

## INTRODUCTION

With the increased tempo of U.S. Navy operations in the Indian Ocean, there has been a matching increase in concern over the environmental support available to the Fleet meteorologists. As part of the NAVENVPREDRSCHFAC effort to improve that support, this Command has reprinted a series of meteorological handbooks -- collectively titled Weather In The Indian Ocean -- that were originally issued by the British Government in the 1940-44 time frame.

These handbooks, published as three volumes in a total of twelve parts, were prepared by the Meteorological Office, Air Ministry, in cooperation with the Naval Meteorological Branch, Admiralty, London. Titles of all volumes/parts in the series are given below.

Because the series has long been out of print, the NAVENVPREDRSCHFAC has obtained permission to reprint and distribute the handbooks to U.S. Navy units. As in the original publication, this new reprinting ultimately will comprise twelve individual books, each marked with volume and part number; the reprint set is distributed as NAVENVPREDRSCHFAC Technical Bulletin 80-02, April 1980. The books are three-hole-punched for collection into ring binders. There has been no editing or changing of the original material.

Users of the series should be alert to the fact that a number of place names used in the original writing have changed over the intervening years.

### Volumes/parts titles in the series are as follows:

- Vol. I ---- Weather In The Indian Ocean - General Information (in one part)
- Vol. II --- Weather In The Indian Ocean to Latitude 30<sup>0</sup>S and Longitude 95<sup>0</sup>E including the Red Sea and Persian Gulf (in nine parts; see parts titles below)
- Vol. III -- Weather In The Indian Ocean - Aids To Forecasting (in two parts:  
1, Indian Ocean; and 2, North Indian Ocean)

### Parts titles, Volume II (local information):

1. Red Sea
2. The Gulf of Aden and West Arabian Sea to Longitude 00<sup>0</sup>E
3. The Persian Gulf and Gulf of Oman
4. The Makran Coast from Gwadar to Karachi and the West Coast of India to Latitude 20<sup>0</sup>N
5. West Coast of India from Latitude 20<sup>0</sup>N to Cape Comorin, with an Appendix on Conditions at Bombay
6. A. East Coast of India from Cape Comorin to the Ganges Delta -- B. Ceylon
7. The Coast of Burma
8. The South Indian Ocean to Latitude 30<sup>0</sup>S.
9. Coast of East Africa from the Equator to Cape Delgado

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Frontispiece]

PART 2  
 THE GULF OF ADEN  
 AND WEST ARABIAN SEA  
 TO LONGITUDE 60° E.

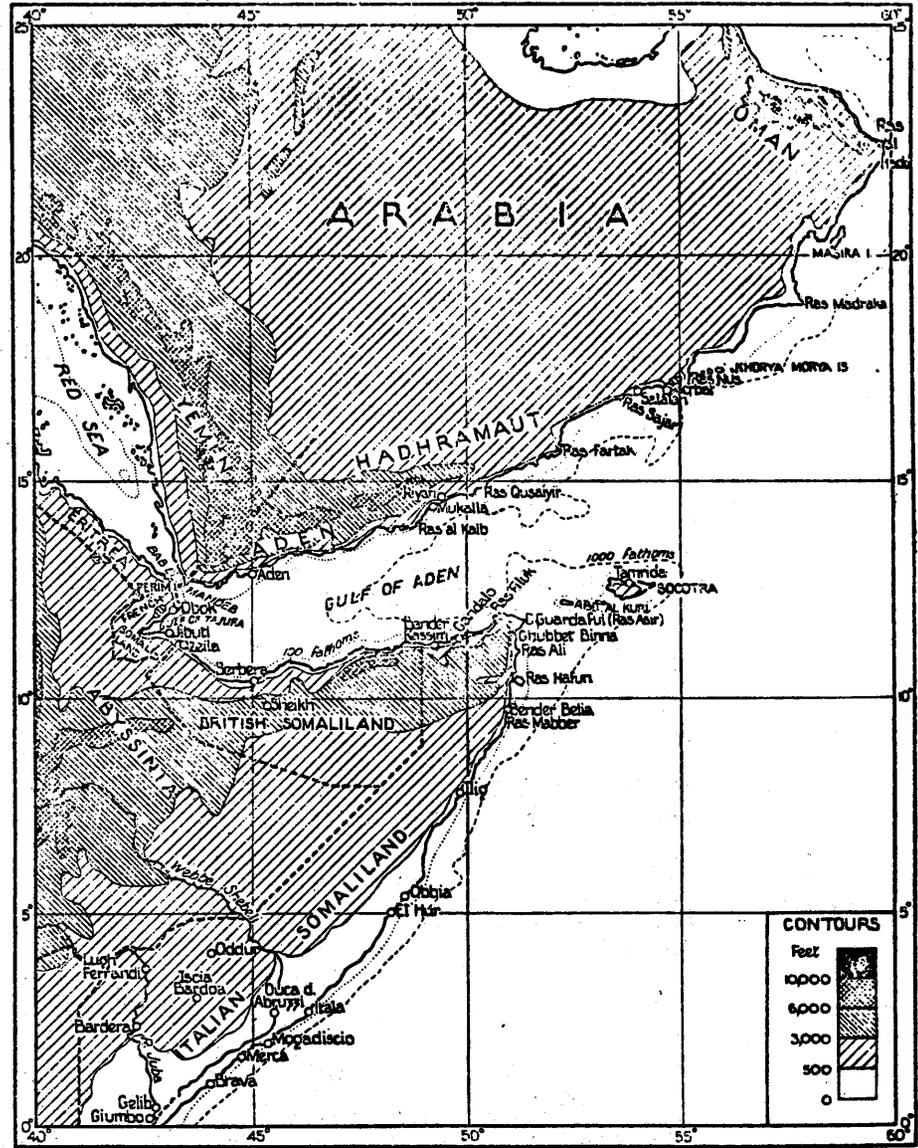


FIG. 1—THE GULF OF ADEN AND WEST ARABIAN SEA

Note.—Giumbo is marked just north of the equator, the correct position is 0° 15' S., 42° 37' E.

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# THE GULF OF ADEN AND WEST ARABIAN SEA TO LONGITUDE 60° E.

INCLUDING

THE COASTS OF THE SOMALILANDS, HADHRAMAUT AND OMAN

## I—GENERAL

### 1.—INTRODUCTION

The area under consideration stretches from the equator to 22° N., and from 43–60° E., and includes the coastal regions of south-east Arabia and the Somalilands.

The Gulf of Aden runs from west-south-west to east-north-east, and is connected in the west with the Red sea by Bab el Mandeb. It lies between the parallels of 10° and 15° N. and the meridians of 43° and 52° E. It is approximately 480 nautical miles in length and its width varies from 13 miles at Bab el Mandeb to about 174 nautical miles at Cape Guardafui (Ras Asir). The Gulf is deep outside the 100-fathom line; there is a depth of 2,347 fathoms about 75 miles south of Ras Fartak (*c* 52° E.), and one of 1,820 fathoms about 83 miles south of Ras al Kalb (*c* 49° E.). West of the latter the depths gradually shoal, and within the Gulf there are no deep soundings south of 12° 15' N. Off the east coast of Italian Somaliland the sea is deep, soundings reaching more than 2,000 fathoms within 200 miles of the coast.

The Gulf is bounded on the north by the mountains of Yemen and Hadhramaut, which are over 6,000 feet high, with peaks rising to 10,000 feet; on the south it is limited by the mountains of the Somalilands, terminating in Cape Guardafui, to the east of which is the island of Socotra.

The Arabian plateau slopes gradually north-eastward until it fades into the coastal plain bordering the Persian gulf. The eastern lowlands are broken only by the mountains of Oman (10,000 feet) in the extreme east. The Khorya Morya islands lie off the coast in longitude 56° E., and Masira island is to the east of the gulf of that name.

At the head of the Gulf in French Somaliland the coastal plain is fairly wide; a valley lying parallel with the coast is separated from it by a ridge. Behind this is the Abyssinian plateau, 6,000–9,000 feet above sea level, with isolated peaks rising to 15,000 feet. In British Somaliland the coastal plain becomes narrower to the east, where it is backed by a precipitous escarpment. The interior plateau, which attains a height of 7,000 feet in the north, slopes south-eastward to the broad coastal plain of Italian Somaliland.

Several rivers enter the Arabian sea along this coast, the most notable being the Juba; the Webbe Shebéli follows the north-east to south-west trend of the coast for some 200 miles and then disappears in a swampy depression before entering the Juba estuary.

Aden is the only important harbour on the north side of the Gulf; farther north-east along the Arabian coast, Masira channel within Masira island affords sheltered anchorage for vessels of moderate draught but the channel is somewhat intricate. Obok, Jibuti, Zeila and Berbera are the only ports on the west and south sides of the Gulf. On the east African coast Kisimayu (Chisimaio) just south of the equator and Baia Sud di Hafun in about 10° N. (during the NE. monsoon season) are the only anchorages which can be considered as harbours for large vessels; the other ports are only open anchorages, and of these the principal ones are Brava, Merca, Mogadiscio, Itala and Obbia.

The year has been divided into the following four seasons:—

- (i) NE. monsoon, December to March.
- (ii) Transition season, April and May.
- (iii) SW. monsoon, June to September.
- (iv) Transition season, October and November.

## 2.—REGIONAL SUMMARIES

### Gulf of Aden

The climate of the Gulf of Aden is exceptionally dry and, especially from May to September, very hot. Average temperatures over the sea range from about 77° F. in January to 87° or 88° F. in June. Even during the cool season from November to March temperatures exceeding 90° F. have been recorded at coastal stations on both sides of the Gulf, while in June, July and August on the African coast the shade temperature regularly exceeds 100° and in some parts even 105° F. during the heat of the day, and at Berbera has been known to rise to 116° F. in all three months.

In spite of the intense heat neither British Somaliland nor the Aden Protectorate is unhealthy for white people, though the climate, especially on the low-lying coastal plain, is very trying in the SW. monsoon season, partly on account of the presence of vast quantities of sand in the air. On the coast itself the atmosphere is moist and steamy; wet-bulb temperatures, especially during the day, are high and in spite of the low relative humidity the air is very oppressive. A few miles inland both relative and absolute humidities are low. The high plateau and hill country of the Aden Protectorate has a temperate and healthy climate; the extreme range of temperature is from about 40° to 102° F. so that there is no real cold and no very severe heat. The diurnal range is often as much as 30° F. or more. On the higher mountains frost often occurs.

Over the Gulf and on the coasts the rainfall is remarkably small, only 50–100 mm. (2–4 in.) on the average, and over limited areas a whole year has been known to pass without any rain at all. The average annual fall on the plateau is about 18 in. but it is heavier on the mountains. On the coasts the only rainfall is a few showers chiefly in the early part of the year; on rare occasions these may be fairly heavy, but on the great majority they are not likely to affect the ground for landing purposes.

On the plateau the rainfall is precarious and usually falls between April and November in violent local thunderstorms, occasionally accompanied by hail.

Normally there is very little cloud. At no time of the year does the average exceed 5 tenths of the sky covered and in most months it is less than 4 tenths.

Visibility is generally good from about October to May but during the SW. monsoon the atmosphere is usually thick and hazy. Glare from the mountains and desert is very trying to the eyes during daylight hours. Twilight is short, seldom more than 20 minutes, and during that time the light is deceptive.

The winds and weather in the Gulf are controlled to a great extent by seasonal changes of pressure distribution, for the Gulf lies well to the southward of the normal tracks of extratropical depressions and thus any effect that these may have on the weather is indirect. From about mid October to mid May E. and NE. winds blow steadily, usually of force 2 or 3 but strengthening slightly in January; they sometimes freshen but only rarely reach gale force; in Bab el Mandeb they are stronger than elsewhere, being about force 4. At the close of the season winds become light and variable; in May, and sometimes in April near the eastern entrance to the Gulf, southerly winds increase in frequency, and from June to September S. and SW. winds prevail. At the eastern entrance they blow strongly with force 4-5 and may reach gale force about four times a month, but their strength falls off towards the west. Except at the western end the average speed of the wind is as great as in the NE. monsoon and in the coastal regions and over the Gulf itself between 46° and 48° E. it is appreciably greater, but its direction is not so steady as in that season. Coastal winds during the SW. monsoon show some remarkable features and frequently reach gale force in the morning near Berbera.

Tropical cyclones very seldom enter the Gulf though three such storms have been known to do so in the past 60 years. Violent squalls and oppressively hot storms from the land are liable to occur on the coasts during the late afternoon and evening during the hot season and may continue into the night. They are usually accompanied by sand, which may drift out over the Gulf. The conditions giving rise to them are not yet understood.

Flying conditions are said to be very bumpy up to at least 6,000 feet over the coastal plain and low-lying valleys and also near the coastal mountains; but conditions are much better over the plateau. The high temperature and resulting low density affects the rate of climb; with heavily laden machines, flying near the ground becomes dangerous except at high speeds and landings have to be made faster than normally.

The following notes supplied by the Meteorological Officer at Aden describe a typical day's weather there in different seasons.

**Local notes on the weather at Aden.**—*NE. monsoon* (about October to April).—Following clear nights with a light N. or NE. wind, small amounts of cloud are frequently seen forming just before dawn. These may thicken a little after sunrise, but soon begin to disperse and by noon the sky is usually cloudless and remains so for the rest of the day. The wind freshens from NE. or E. during the forenoon and as often as not veers to

SE. during the afternoon. Visibility is generally above 20 miles. The air is comparatively cool and pleasant, temperature usually ranging from about 73° to 80° or 85° F. during the 24 hours.

*SW. monsoon* (about June to August).—Wind is light and may blow from either a southerly or a northerly point in the early morning, freshening from SE. or S. two or three hours after sunrise and blowing from this direction until an hour or so before sunset. The sky is cloudless but, owing to the haze, usually has a milky appearance. Visibility is poor, often only 3 or 4 miles. A wind off the land sets in an hour or so before sunset and may blow in rather uncertain fashion until about midnight, after which it is as often as not superseded temporarily by a southerly wind. Temperature is high, ranging on the average from about 83° to 93° F.

*Transition periods* (May and September).—Nights are usually clear and calm with sometimes a land breeze blowing intermittently. Wind freshens from SE. during the late forenoon and sky is still cloudless except for patches of high cloud which often spread over from north-west towards sunset and disperse later in the evening. Visibility is generally good although less consistently so than during the NE. monsoon. Temperature is high and the atmosphere feels damp and oppressive.

#### Western Arabian sea

The weather in the Arabian sea is on the whole slightly cooler than that in the Gulf of Aden, but even so it is hot throughout the year. Average temperatures range from 75° F. in January, the coolest month, to about 84° F. in May, the hottest. The arrival of the SW. monsoon brings an appreciable fall of temperature and August is 5-8° F. cooler than May. There is a slight rise again by October amounting in most parts to about 2° F.

There is very little rain in the north-west but in the extreme south-east near the equator the estimated amount exceeds 1,000 mm. (25 in.). During the cooler season the weather is fine with clear blue skies and fairly low humidity so that the air feels very fresh. The arrival of the SW. monsoon in May or June is accompanied by unsettled weather with cloud and squalls, and this continues until September. In the transition period before the onset of the NE. monsoon the periods of bad weather are shorter and alternate with longer periods of fine clear weather. On the Arabian coast the amount of rain is small and is mostly in the form of drizzle. It is seldom sufficient to make the ground soft or muddy except during the rare occurrence of a tropical cyclone.

Over the open sea skies are comparatively clear throughout the year. Except in the extreme south in no season does the average exceed 5 tenths. During the SW. monsoon the cloud base over the open sea is often as low as 3,000 feet but rarely below 1,000 feet. Information about visibility is scanty but it appears to be good throughout the year except when it is reduced by cloud and rain during the SW. monsoon. Near the coast conditions during the SW. monsoon are worse than over the open sea, and from about mid June until the end of September the weather in the neighbourhood of Salalah on the Arabian coast is exceptionally bad, the sky is almost continuously overcast with low stratus cloud, and intermittent slight drizzle (see p. 92). Near Socotra and off the African

coast, especially to the south of Cape Guardafui, there is a good deal of coastal fog and haze during the SW. monsoon. During the NE. monsoon flying conditions are likely to be extremely good with very little low cloud and excellent visibility apart from occasional duststorms on the coast.

During the cool season NE. winds blow strongly, force 3-4, accompanied by slight or moderate swell. In April winds become light and variable, blowing from SW. near the Arabian coast; they strengthen in May when they blow chiefly from SW. or W. By June the SW. monsoon is fully established over the whole region and blows strongly, especially in the west where its average force is 6, rising to 7 or more to the east of Socotra and reaching force 8 on about half the days of the month in July. Squalls are frequent, especially where the monsoon is strong, and there is heavy swell. The monsoon continues strong until September, when it begins to weaken, and in October winds are light and variable with frequent calms. Near the equator the monsoons blow less strongly and for a shorter period.

Cyclonic storms are liable to occur in the transition periods of late April to June and September to December, but they have never been recorded in this region in other months of the year. They are infrequent and are not experienced every year but when they do occur they may be severe. They approach from the eastern Arabian sea and usually travel towards the west or west-north-west. They rarely if ever travel south of 10° N. and hence do not affect the African coast. They are felt occasionally on the Arabian coast though they often lose their intensity and die away near the Khorya Morya islands.

The following description of a day's weather in the central Arabian sea during the NE. monsoon gives a more vivid idea of the conditions in that season than can be gained from average values. The ship was to the east of the area dealt with in this Part, but the description is probably typical of a fairly wide region.

*February 25, 1935.* Position at 0800: 10° 42' N., 64° 36' E. (about half way between Ceylon and Aden).—At about 0400 broken cumulus was passing over the starlit sky; but towards 0700 patches of altocumulus covered about 3 tenths of the sky and at 0800 a few fine cirrus threads became visible. A light N. wind, which with temporary deviations to NE, had been blowing with surprising uniformity for some days, was force 3 at 0400 and 0800. At 0800 temperature was 78° F., humidity 75 per cent.; it was a fine summer morning of tonic freshness.

About 1000 a few isolated fine-weather cumulus appeared, coalescing in places into small stratocumulus; the amount remained small, varying from hour to hour. Cirrus clouds on the other hand increased, spreading in from the south. They dissipated again by sunset. Air temperature decreased very slowly during the day as the ship travelled WNW., and remained about 3° F. lower than the sea temperature.

Visibility was very good throughout the day and was so exceptional in the evening that the sun sank in a grey-green horizon with no trace of yellow until some time after sunset.

About 2000 small fine-weather cumulus covered about one tenth of the sky. Temperature was 76° F., about 2° F. lower than in the morning and humidity 68 per cent. Zodiacal light was clearly visible in the west until 2100. (Bibliography No. 24.)

#### Italian Somaliland

On the Indian ocean coast of Italian Somaliland the weather is hot and sunny over the greater part of the year, but is said to be not

unhealthy. The average annual temperature is about 80° F. or rather more and ranges some 6° or 7° F. above and below that value during the course of the day. The average monthly temperatures vary only 2° or 3° F. from the annual mean, June to September is the coolest time of the year and the intermonsoon periods, known as Tangam-bili, are said to be the hottest. Temperature rarely rises above 100° F. In the interior the climate is much more extreme, average temperature is several degrees higher than on the coast, the daily range is about 25-30° F., and temperatures exceeding 120° F. have been recorded. On the coast the relative humidity is high, averaging 80-90 per cent. as the mean of the day during most of the year and often rising to 90 or 95 per cent.; inland the air is drier, humidity falling to less than 80 per cent. and at Lugh Ferrandi to less than 50 per cent.

The rainfall is low, though greater than in the Gulf of Aden, the annual fall being for the most part between 350 and 625 mm. (14 and 25 in.). On the coast the rain occurs chiefly between the monsoons or in their early stages. The rainiest period is from April or May to June or July; there is a decrease in August and September followed by a slight increase in October and November. January to March is almost completely dry. In the interior the decrease in August and September becomes more marked and there are two almost rainless seasons, one from January to March, coinciding with that on the coast, and the other from June to September; the rain falls chiefly in April-May and October-November. In most parts the second of these periods is the rainier but in some parts more rain falls in April and May. In general the average fall in the wettest months is about 100-125 mm. (4-5 in.).

The amount of cloud is small in all seasons and decreases towards the north. The cloudiest period, with an average of 4-5 tenths of sky covered, is during the SW. monsoon. There appears to be very little difference between the coast and the interior. Mist and fog are also frequent during the SW. monsoon as far as about 200 miles off shore and may occur as early as March. They are rare from November to February and infrequent in October. Flying is said to be possible at all times, but during the SW. monsoon, when visibility is poor, the horizon is generally misty and it may be necessary to fly low.

From December to March winds are chiefly NE. or E. blowing most steadily in January. In April and May winds are light and their direction becomes more variable; inland there are frequent calms, particularly between midnight and dawn. With the arrival of the monsoon SW. winds gain predominance and blow persistently in July and August, becoming less steady in September. In October and November winds are variable with NE. increasing in frequency.

#### II—PRESSURE

Charts of average isobars over the Indian ocean in representative months of the different seasons are reproduced in Volume I. They show that in the region covered by this Part there is a complete reversal of pressure gradient during the course of the year.

From November to March there is a continuous gradient from north to south, with a high pressure over the Asiatic continent and a low over

the equatorial belt. The isobars run roughly from west-south-west to east-north-east in the early part of the season and from west to east in the latter part, the gradient being steepest in January. In April the distribution becomes very irregular with no well marked pressure differences. By May the isobars again run from west to east but the gradient is reversed compared with the winter months; there is low pressure over northern India from which the pressure rises continuously to the high near the southern tropic. Over the Gulf of Aden the direction of the isobars is from about west-south-west to east-north-east roughly parallel with the Gulf, whereas further south the isobars run from west to east or even west-north-west to east-south-east. The gradient is steep from June to August and then slackens. In October the Gulf of Aden lies in a col with high pressure to north and south and low to east and west.

**Annual variation**

Values of the normal monthly pressure at mean sea level are included in the general climatological tables for Aden, Perim and Berbera; values based on a few months' data are given also for recently established stations. Data for places in Italian Somaliland appear to be unreliable and are not included. In conformity with the distribution of pressure described above the pressure in the Gulf shows a regular annual variation from a maximum of about 1016 mb. in December to a minimum of 1004 mb. in July. Near the equator the variation is reversed with a minimum in December and a maximum in July-August. In this latter region the variation is much less regular and the range is only about one third that in the Gulf, namely from about 1014 mb. to 1010 mb. Between the two, in about 5° N., the range is probably even lower, amounting to only 2 or 3 mb.

The extreme range of pressure in any month is not large compared with temperate latitudes. At Berbera the average highest and lowest pressures recorded at 0800 in each month during the period 1924-34 are shown in the following table:—

AVERAGE HIGHEST AND LOWEST PRESSURES AT MEAN SEA LEVEL

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
<i>millibars</i>													
BERBERA													
Highest ..	1019	1018	1017	1014	1013	1009	1008	1008	1011	1016	1017	1019	1020
Lowest ..	1014	1012	1010	1008	1005	1002	1002	1002	1004	1008	1012	1013	1001
Range ..	5	6	6	6	7	7	6	6	7	7	5	6	19

Authority.—Bibliography No. 94.

Period.—1924-34.

Time of observation.—0800 (Z-3).

Owing to the omission of decimal points the range in some months differs by 1 mb. from the difference between the highest and lowest pressures shown in the table.

Average values of highest and lowest pressure at 1400 would be some 3 mb. lower.

During the same period the absolute extremes recorded, taking into account all three hours of observation, were 1020.6 and 991.1, giving an extreme range of 29.5 mb. At Aden in the period 1891-1910 the corresponding figures were 1022 and 997 mb.

**Diurnal variation**

The regular diurnal variation of pressure is large. Judging from ships' observations distributed over the whole width of the North Indian ocean the difference between the average highest and lowest hourly values is between 2½ and 3 mb. The pressure shows a regular oscillation with two maxima and two minima during the course of the day. The amounts by which the mean hourly values at the times of maximum and minimum differ from the daily mean are shown in the following table:—

Lat. N.	Season	Principal		Secondary					
		Max.	Min.	Max.	Min.				
10-20°	Nov.-Apr. ..	1.7	10	-1.4	16	0.6	22	-0.9	03-04
	May-Oct. ..	1.3	10	-1.3	16-17	0.6	22-23	-0.6	04
	Year ..	1.4	10	-1.3	16-17	0.6	22-23	-0.7	03-04
0-10°	Nov.-Apr. ..	1.5	10	-1.6	16	1.0	22-23	-0.9	04
	May-Oct. ..	1.3	10	-1.5	16	1.0	22	-0.7	04
	Year ..	1.4	10	-1.5	16	1.0	22	-0.9	04

Authority.—Bibliography No. 5 (December).

At coastal stations in the Gulf the range is even higher. Hourly values are not available but average values of pressure at the synoptic hours 0600 and 1200 G.M.T. (approximately 0900 and 1500 local time) show a difference of 3½ mb. over the greater part of the year and of more than 4 mb. in some months. These values probably slightly underestimate the true daily range. The seasonal variation is irregular.

A recent investigation at Aden indicates that the tendencies at the synoptic hours to be expected from the normal diurnal variation are:—

G.M.T.	0000	0600	1200	1800
<i>millibars</i>				
February .. .. .	-1.0	+1.6	-2.1	+1.5
May .. .. .	-0.9	+1.7	-2.3	+1.7
August .. .. .	-0.5	+1.5	-2.4	+1.3
November .. .. .	-1.0	+1.5	-1.9	+1.6

The figures are based on values for only a small number of days so that their absolute accuracy cannot be guaranteed.

Owing to the exceptional character of the diurnal variation of wind in the Gulf of Aden during the SW. monsoon (see pages 50-5) the diurnal variation of pressure in that season is of particular interest. Data for two sea areas, one in the Gulf and one in the Arabian sea, are therefore given in the table below. The figures show that, compared with the Arabian sea farther east, pressure in the Gulf is abnormally high about noon and abnormally low about midnight.

DIURNAL VARIATION OF PRESSURE, JULY-AUGUST  
(departures from mean)

Area	0400	0800	1200	1600	2000	2400
<i>millibars</i>						
12-13° N.						
46-48° E. .. .. .	-0.8	+1.4	+1.4	-1.1	-0.4	-0.5
55-60° E. .. .. .	-0.5	+1.0	+0.6	-1.6	+0.2	+0.3

Authority.—Bibliography No. 58.

## III—TROPICAL CYCLONES

Monthly charts of the tracks of tropical cyclones in the Indian ocean are reproduced in Volume I. They show that of the western half of the Arabian sea the area south of  $10^{\circ}$  N. is almost entirely free from tropical cyclones, whereas north of that parallel storms have been recorded in both the transition periods, namely from the latter part of April to June and from September to December. They are, however, comparatively rare and in the ten years 1928-37, for which tracks are reproduced in Volume I, only one storm entered the area. Over the whole period for which records are available, extending over perhaps 100 years, some 20-25 storms have been traced to the west of  $60^{\circ}$  E. It must be remembered, however, that in early years records are probably incomplete.

Storms are most likely to be encountered in May-June and October-November. In those months most of the storms in the Arabian sea travel towards the west or west-north-west and quite a large proportion penetrate beyond the 60th meridian even as far as the Arabian coast. Not infrequently they appear to dissipate near the Khorya Morya islands. Most of the storms are fully developed when they enter the region, and usually continue to travel towards the west or north-west, though some recurve to north and north-east. A few storms have been known to form within the region and to move north and north-east.

Records from south-east Arabia are scanty but it appears from the charts that storms penetrate farther west in May than in the post-monsoon period so that it is in that month that the Arabian coast is most likely to be visited.

During their passage over the open sea the storms may give rise to winds of hurricane force with squalls and heavy swell. The most recent storm for which detailed records exist is one in the first fortnight of November, 1940. It originated near the Laccadive islands or possibly even farther east and travelled west-north-west, passing north of Socotra; it crossed the Arabian coast to the west of Merbat, where it is said to have recurved and travelled north-eastwards, weakening and dying out rapidly. In the open sea in about latitude  $15\frac{1}{2}^{\circ}$  N., longitude  $58^{\circ}$  E., it gave rise to a wind of whole gale force, estimated as exceeding 87 knots (100 m.p.h.). The storm produced very little effect in the Gulf of Aden except at its eastern end, but it gave heavy rainfall over the whole of the Hadhramaut region of the Arabian coast (3.4 in. on the 13th at Mukalla). Damage is difficult to assess in a sparsely populated area but 50 mud houses collapsed on the coast and coastal roads were cut for several days. Dhows were driven ashore in the gale and one was lost.

As far as is known only three or possibly four tropical cyclones have actually entered the Gulf of Aden in the past fifty years, of which the Aden cyclone of May 30-June 3, 1885, was the most notable. This cyclone passed north of Socotra on a westerly or west-south-westerly course, keeping in the middle of the Gulf. It passed some fifty miles south of Aden, where it gave rise to a wind of 78 knots, then southward of Obok in French Somaliland, finally passing westward out of observation. The forecasting of cyclones in the Gulf of Aden is said to be extremely difficult and in ( ) instance the barometer gave little or no warning of the approach of the storm, though an unusual swell from the east set in to the bay.

Another cyclone entered the Gulf on October 13, 1896. Having travelled westwards across the Arabian sea it moved west by south, following the direction of the Gulf, and probably passed into Abyssinia. A wind of force 11 was experienced by a ship in approximate position  $12^{\circ}$  N.,  $47^{\circ}$  E. on the 14th.

The third cyclone in the Gulf occurred in November, 1906 and the track in this case also passed north of Socotra.

A fourth cyclone which travelled over the Indian peninsula and across the Arabian sea in a west-north-west direction in latitude  $10-12^{\circ}$  N. at the end of November 1922, passed north of Socotra on December 6. It probably passed through the mouth of the Gulf of Aden and crossed the Arabian coast in about  $48^{\circ}$  E.

A severe storm was experienced at Aden on May 1, 1859 but evidence is not sufficient to show whether it was related to the continued activity of a cyclone which had travelled from the Bay of Bengal across India and the Arabian sea during the previous week, or was due to other causes.

## IV—WIND

## 1.—SURFACE WINDS

Wind roses for each of the twelve months are reproduced in Figs. 2-13. For each month the chart on the left-hand page (a) shows the roses for the sea areas, together with those for coastal stations at the morning hour of observation, approximately 0900 local time, and the charts on the right-hand page (b) give supplementary data for the coast in order to illustrate the diurnal variation. The upper chart carries roses for the early morning, 0500 (2000 at Berbera) and represents conditions likely to obtain during the night, and the lower chart carries the roses for 1500 and represents conditions during the hot hours of the day, when the sea breeze is likely to be dominant.

The roses for the sea show the frequency of both the direction and force of the wind; they are based on ships' observations taken throughout the twenty-four hours. The roses at coastal stations represent the frequency of direction only, except at Berbera where force also is shown. For Mogadiscio one rose only is given and represents the mean of observations at three hours of the day.

The data on which the wind roses are based are given for the sea in Table II and for the coastal places in the general climatological tables and in Tables III and IV. More detailed information about the force of the wind irrespective of direction is given for the sea below the charts of Figs. 2-13 and for coastal places in Table V. [While this Part has been passing through the press additional information for recent months has been received from coastal stations. This has been included in the tables and to some extent in the text, but not in the diagrams.]

Over the open sea in the north of the area the NE. monsoon begins in October or November and its boundary progresses southwards during that month; south of  $5^{\circ}$  N. the monsoon is not fully established until December. It continues to blow until the end of March over the whole area, becoming lighter at the end of the season. During April it loses its persistence, and in the north, and to some extent also in the south-west, is replaced by south-westerly winds. By May the winds over

the whole of the open sea are predominantly south-westerly though the SW. monsoon only attains its full force in June, after which it continues with little change into September, when it loses strength. In October the winds are light and variable.

The following table gives some particulars of the wind in the area 5-15° N., 50-60° E.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Beaufort force	3.4	3.1	2.5	1.9	2.8	5.5	5.8	5.4	4.2	2.1	2.9	3.6
Most frequent force	3	3	2-3	2	2-3	6	6	6	4-5	2	3	4
Most frequent wind Direction	NE.	NE.	E.	E.	SW.	SW.	SW.	SW.	SW.	C.NE.	NE.	NE.
Frequency %	56	46	44	25	34	67	72	69	58	17, 16	53	68
Frequency of gales												
Force 7 and over %	1	.5	.2	.2	3	34	40	29	9	.5	.7	1
Force 8 and over %	.2	0	0	<.1	.6	14	16	10	2	.2	.3	.1

Authority.—Bibliography No. 16.

Annual and diurnal variation

NE. monsoon (December to March).—Open sea.—Over the whole of the open sea, north of 5° N., NE. winds prevail throughout the period November to March, further south they do not set in until December. They reach their most southerly limit in January as shown in the following table:—

APPROXIMATE SOUTHERN LIMIT OF THE NE. MONSOON WINDS					
Longitude	Nov.	Dec.	Jan.	Feb.	Mar.
50° E. . . . .	3½° N.	3° S.	5½° S.	3° S.	1° N.
60° E. . . . .	6° N.	1½° N.	2° S.	0°	1° N.

Authority.—Bibliography No. 52.

The charts in Volume I (pages 22-3) show that in February the NE. monsoon winds may extend 2° or 3° further south than is indicated in this table, and that near the African coast they are felt as far south as 10° S. in December and January.

At the beginning of the season over the greater part of the area the direction of the prevailing wind is due NE. In the extreme north, however, and especially to the north of Socotra it is ENE, whereas in the extreme south-east it is NNE. The prevailing direction tends to veer through one or two points as the season advances, becoming ENE. over most of the area in March, when northerly winds are rare.

The force of the wind is constant. From November to February, in the central part of the area, more than 50 per cent. of the winds are of force 3 or 4, and over 80 per cent. are between forces 2 and 5. The winds reach their greatest strength in December and January. By March they have become much lighter and in the north calms are frequent; even in the central area only about half the winds exceed force 2.

Very little information is available about the diurnal variation of wind over the open sea in this season. Observations over the area 5-15° N., 50-60° E. indicate that the maximum speed occurs in the early evening at about 1800; but the difference between the highest and lowest mean speeds at different hours is less than ½ knot, which is so small as to be almost imperceptible.

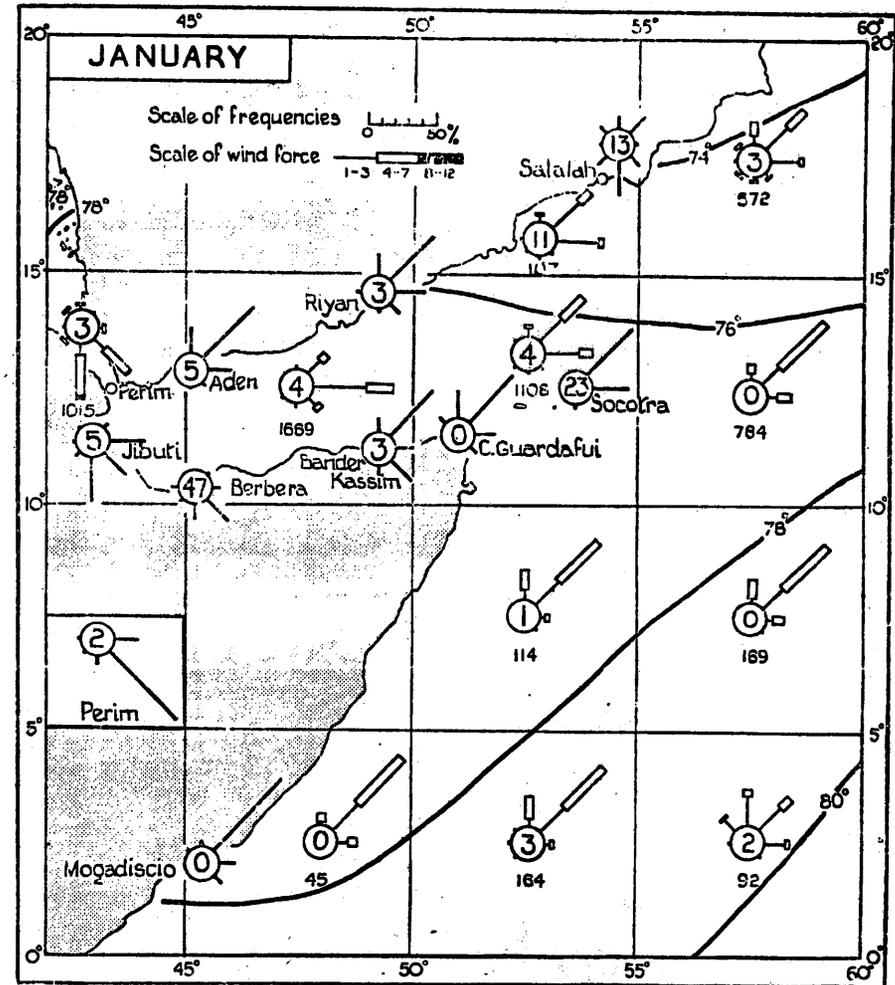


FIG. 2a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—JANUARY

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA												
Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
GULF OF ADEN												
43-44° E. . . . .	1	3	16	17	30	21	11	.7	-	.4	-	273
44-45° E. . . . .	2	5	31	27	25	8	2	-	-	-	-	303
45-46° E. . . . .	5	12	34	23	19	6	.5	.5	-	-	-	594
46-47° E. . . . .	4	10	35	22	20	6	3	-	-	-	-	320
47-48° E. . . . .	4	12	28	23	23	7	3	.3	-	-	-	338
48-49° E. . . . .	2	10	30	25	25	7	1	.3	-	-	-	329
49-50° E. . . . .	4	14	28	27	20	6	.6	-	-	-	-	326
50-51° E. . . . .	6	16	28	26	17	7	-	-	-	-	-	432

Authority.—Bibliography No. 94.

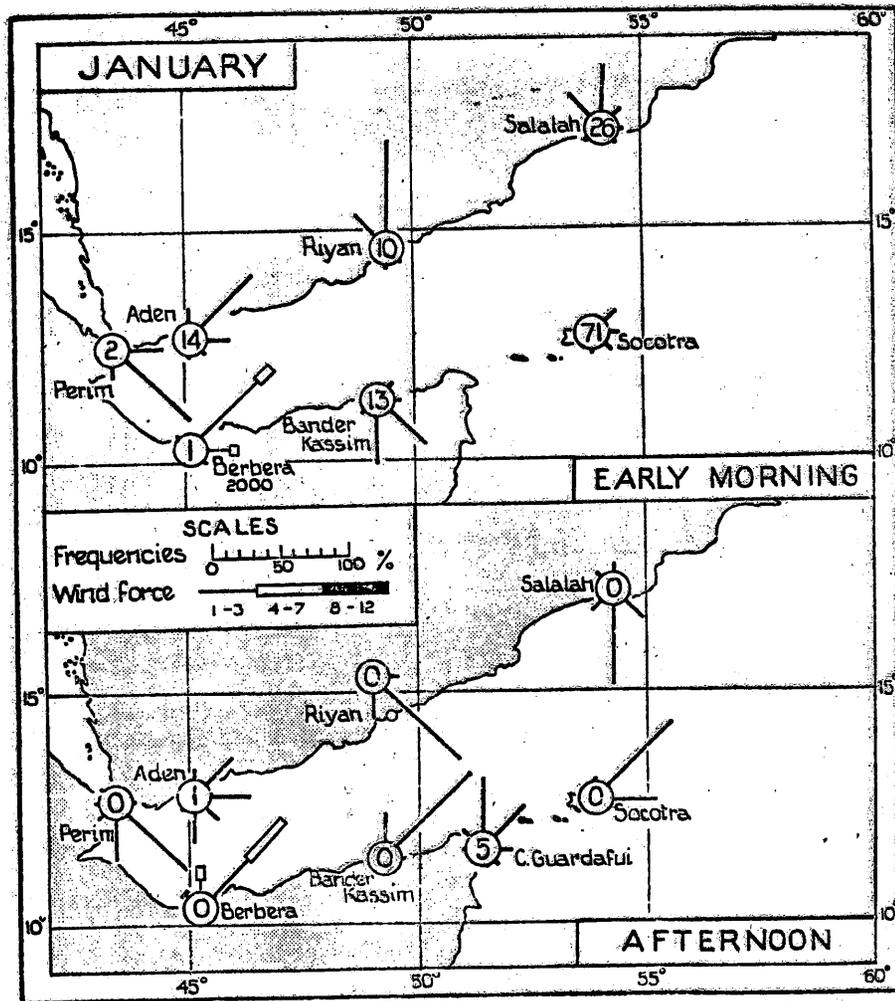


FIG. 2b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 2a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.												
51-52° E. ...	6	12	32	24	19	6	8	-	-	-	-	370
53-54° E. ...	4	9	31	30	16	8	2	-	-	-	-	281
EAST OF SOCOTRA. 12-15° N.												
55-56° E. ...	7	5	15	31	26	13	9	-	-	-	-	145
56-57° E. ...	-	3	12	24	27	22	12	-	-	-	-	90
ARABIAN SEA. 5-15° N.												
50-60° E. ...	3	5	15	29	26	16	5	1	2	<.1	-	?

Authority.—Bibliography Nos. 94, 16.

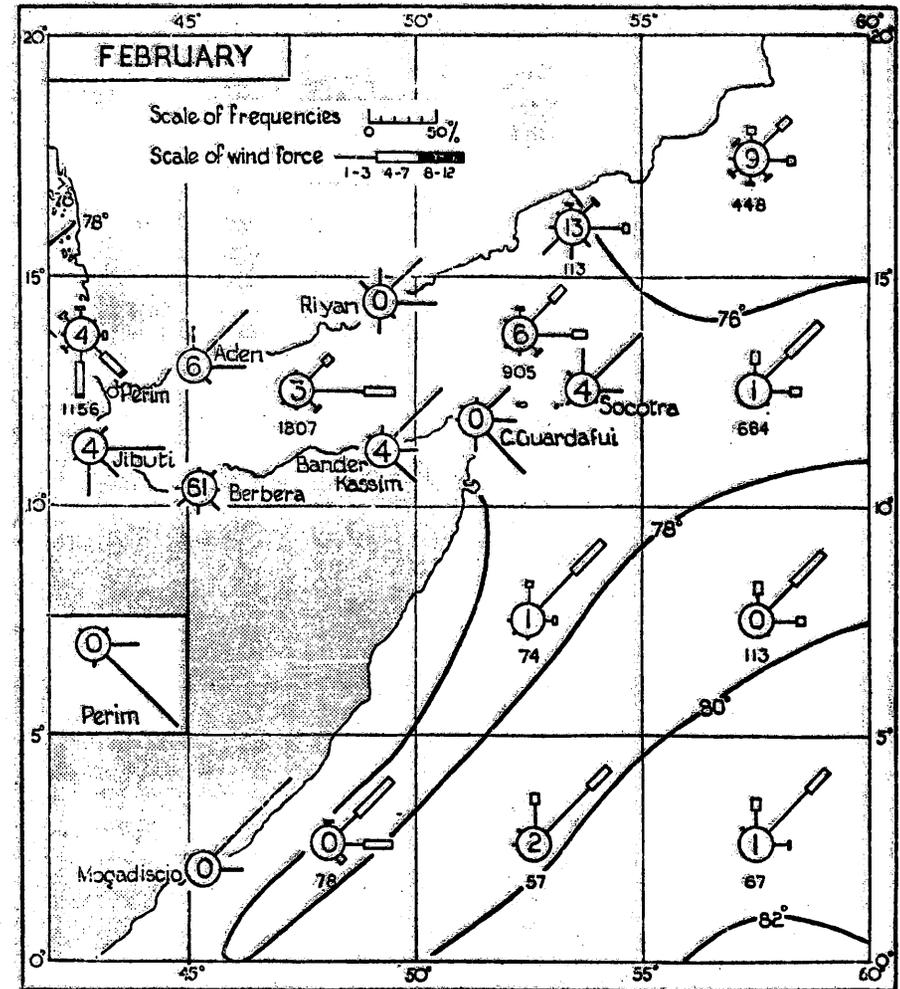


FIG. 3a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—FEBRUARY

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
GULF OF ADEN												
43-44° E. ...	2	6	9	19	30	20	10	3	1	4	-	246
44-45° E. ...	3	10	25	28	22	10	2	4	-	-	-	281
45-46° E. ...	6	11	29	30	16	6	2	-	-	-	-	470
46-47° E. ...	2	9	32	23	24	8	2	-	-	-	-	251
47-48° E. ...	2	8	28	30	22	8	2	-	-	-	-	257
48-49° E. ...	2	11	29	30	17	9	2	-	-	-	-	263
49-50° E. ...	4	10	27	30	22	7	4	-	-	-	-	245
50-51° E. ...	7	13	32	26	17	4	9	3	-	-	-	332

Authority.—Bibliography No. 94.

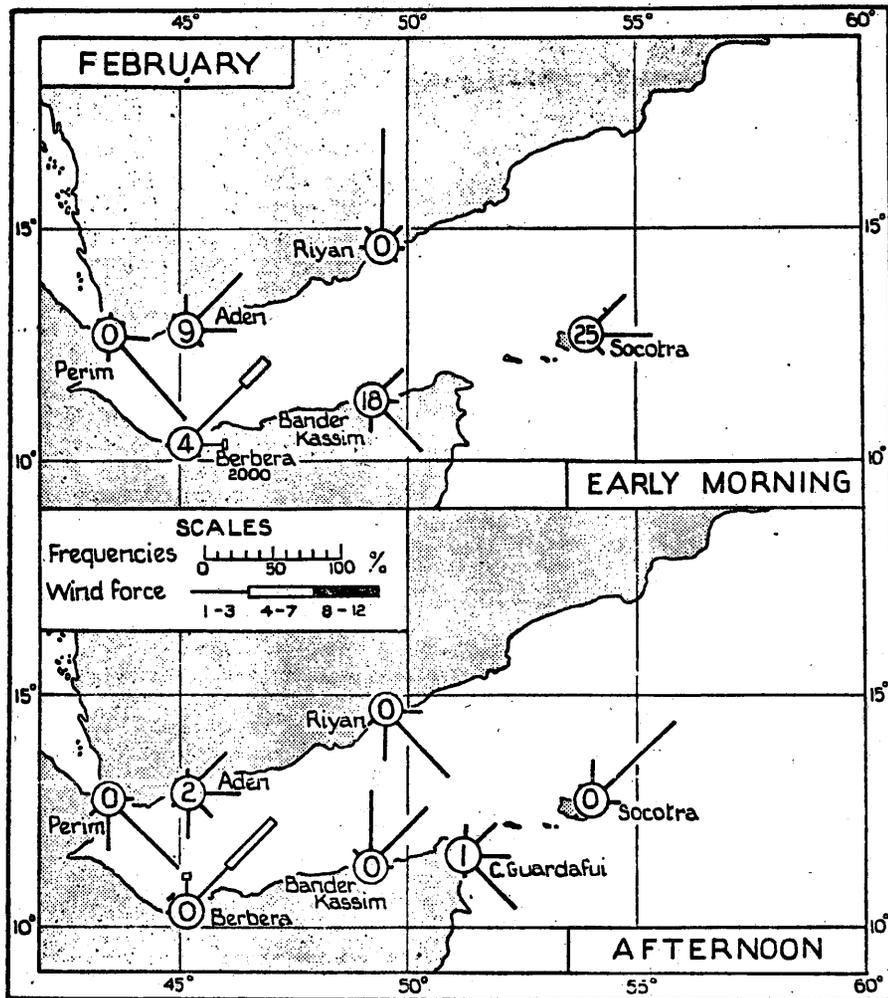


FIG. 3b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 3a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E. ..	10	17	27	25	16	4	7	4	-	-	-	281
53-54° E. ..	8	18	34	19	14	6	1	-	-	-	-	168
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E. ..	5	5	28	28	17	8	7	2	-	-	-	83
56-57° E. ..	-	10	21	31	18	12	8	-	-	-	-	49
<b>ARABIAN SEA. 5-15° N.</b>												
50-60° E. ..	3	8	22	32	20	11	3	5	-	-	-	?

Authorities.—Bibliography Nos. 94, 16.

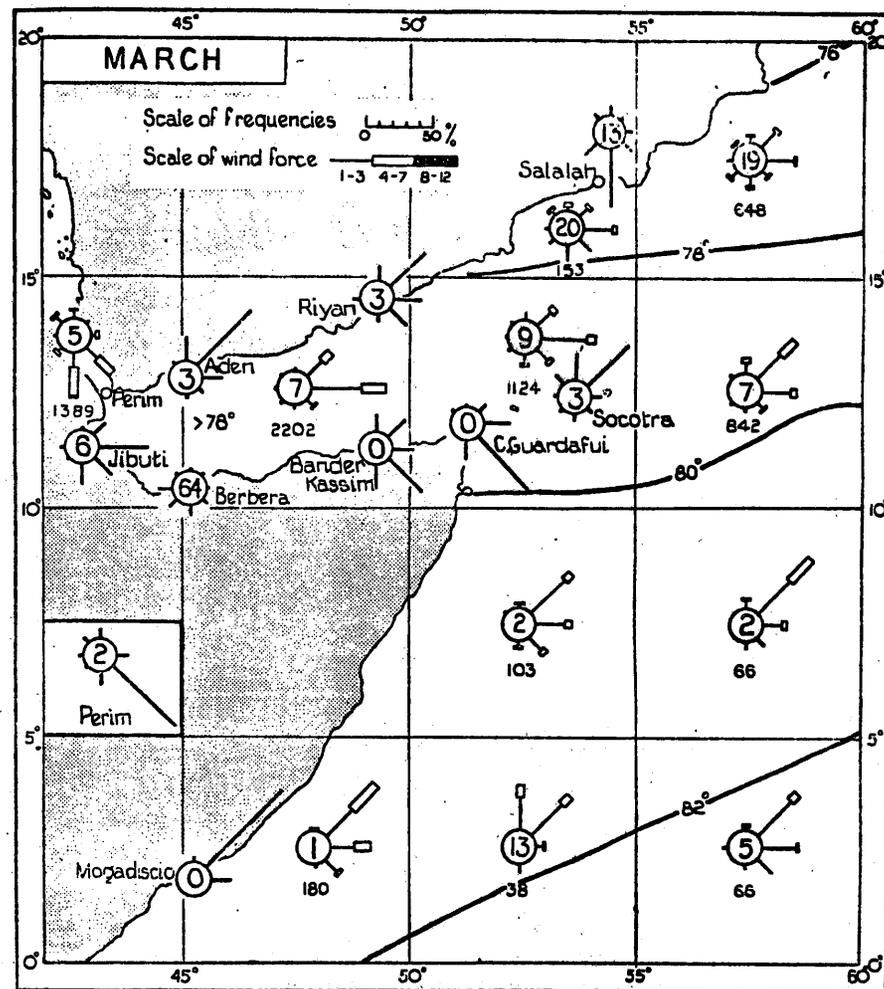


FIG. 4a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—MARCH

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E. ..	5	7	13	22	22	20	10	6	9	-	-	321
44-45° E. ..	6	9	21	30	24	8	2	3	-	-	-	315
45-46° E. ..	8	16	23	27	19	6	6	-	-	-	-	543
46-47° E. ..	6	12	26	27	20	6	3	-	-	-	-	315
47-48° E. ..	5	11	30	24	18	10	2	-	-	-	-	342
48-49° E. ..	6	13	30	26	18	5	2	-	-	-	-	328
49-50° E. ..	7	20	28	27	12	5	1	4	-	-	-	240
50-51° E. ..	8	20	33	23	12	4	5	-	-	-	-	396

Authority.—Bibliography No. 94.

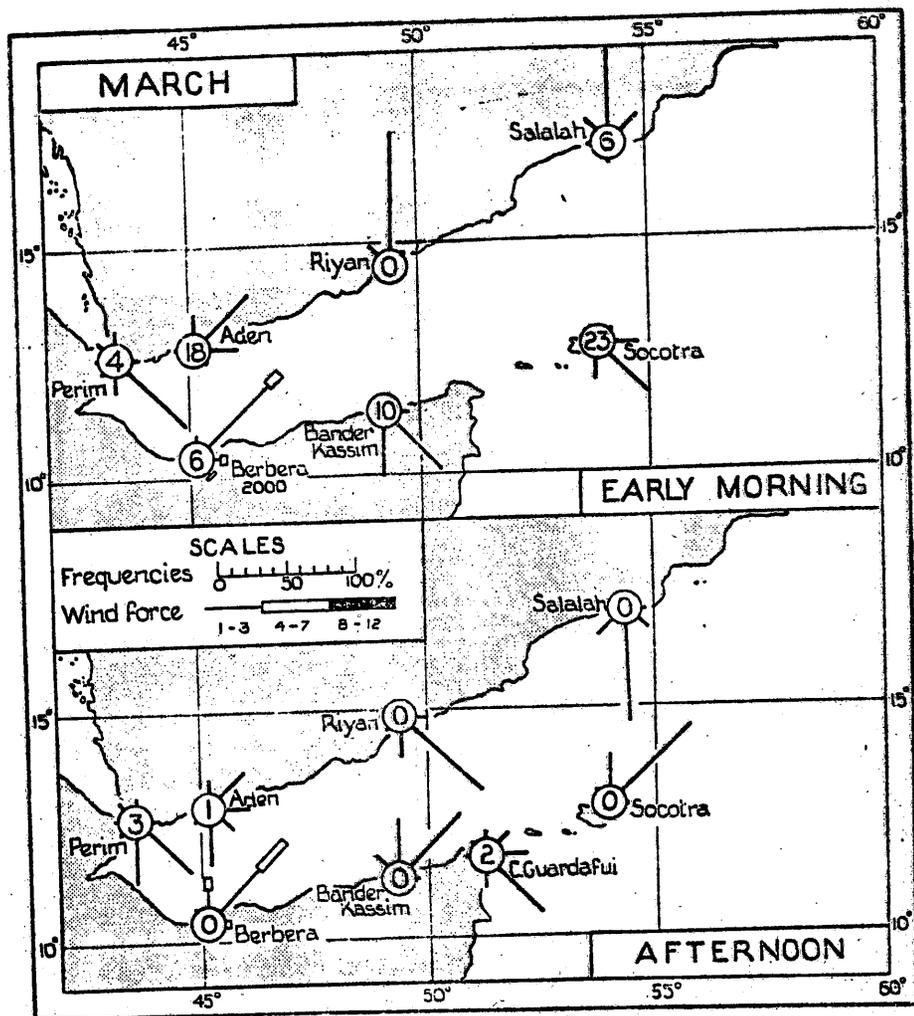


FIG. 4b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 4a. Roses for the early morning 0500 (Z 3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E.	11	22	32	21	11	3	-	-	-	-	-	318
53-54° E.	13	38	31	13	5	-	4	-	-	-	-	254
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E.	7	33	30	20	9	7	-	-	-	-	-	147
56-57° E.	3	29	33	21	14	-	-	-	-	-	-	99
<b>ARABIAN SEA. 5-15° N.</b>												
50-60° E.	8	12	29	29	15	6	1	2	-	-	-	?

Authority.—Bibliography Nos. 94, 16.

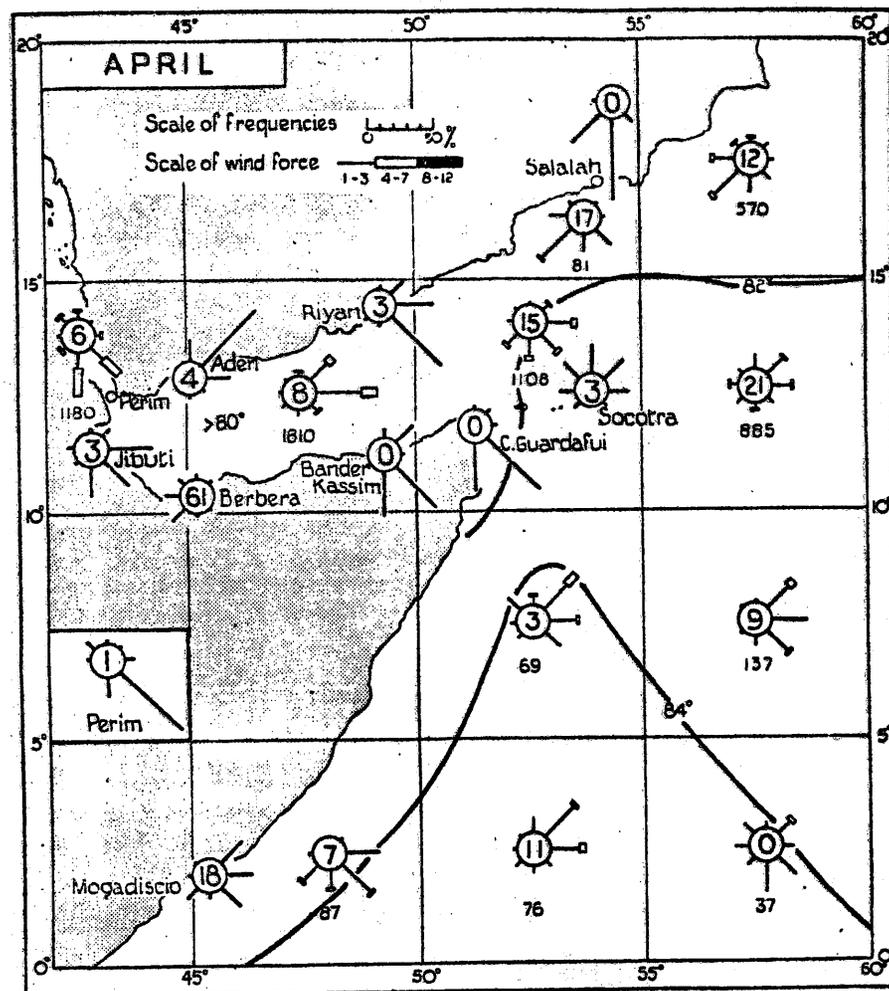


FIG. 5a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—APRIL

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E.	2	9	15	27	24	15	7	1	-	-	-	280
44-45° E.	5	18	32	23	15	7	3	-	-	-	-	302
45-46° E.	9	21	28	25	14	3	4	-	-	-	-	510
46-47° E.	10	17	27	28	14	4	-	4	-	-	-	272
47-48° E.	6	20	24	27	20	3	4	-	-	-	-	241
48-49° E.	8	22	22	25	17	5	1	-	-	-	-	208
49-50° E.	9	27	25	22	14	3	5	-	-	-	-	209
50-51° E.	14	28	28	19	9	2	3	-	-	-	-	383

Authority.—Bibliography No. 94.

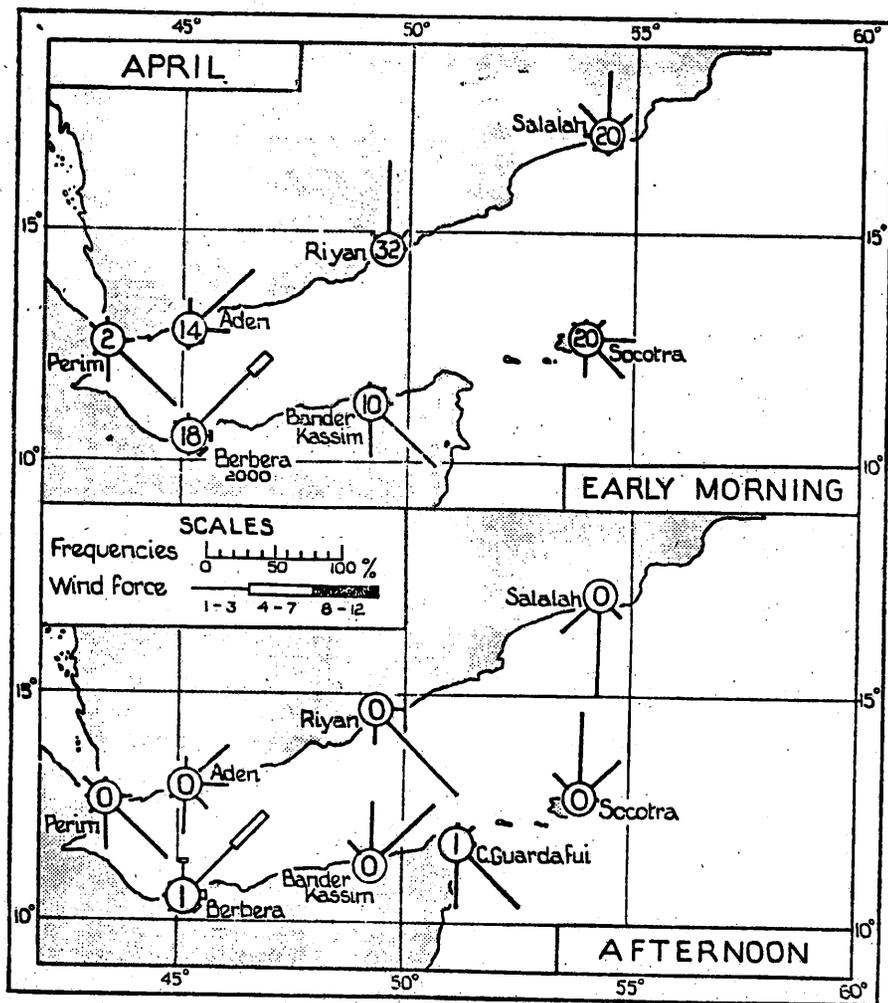


FIG. 5b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 5a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.												
51-52° E. ...	9	23	33	19	13	2	.7	-	-	-	-	300
53-54° E. ...	19	32	34	12	1	.8	.8	-	-	-	-	240
EAST OF SOCOTRA. 12-15° N.												
55-56° E. ...	13	30	36	17	4	-	-	-	-	-	-	166
56-57° E. ...	9	44	33	9	5	-	-	-	-	-	-	99
ARABIAN SEA. 5-15° N.												
50-60° E. ...	19	21	30	21	7	2	.4	.1	<.1	-	-	?

Authorities.—Bibliography Nos. 94, 16.

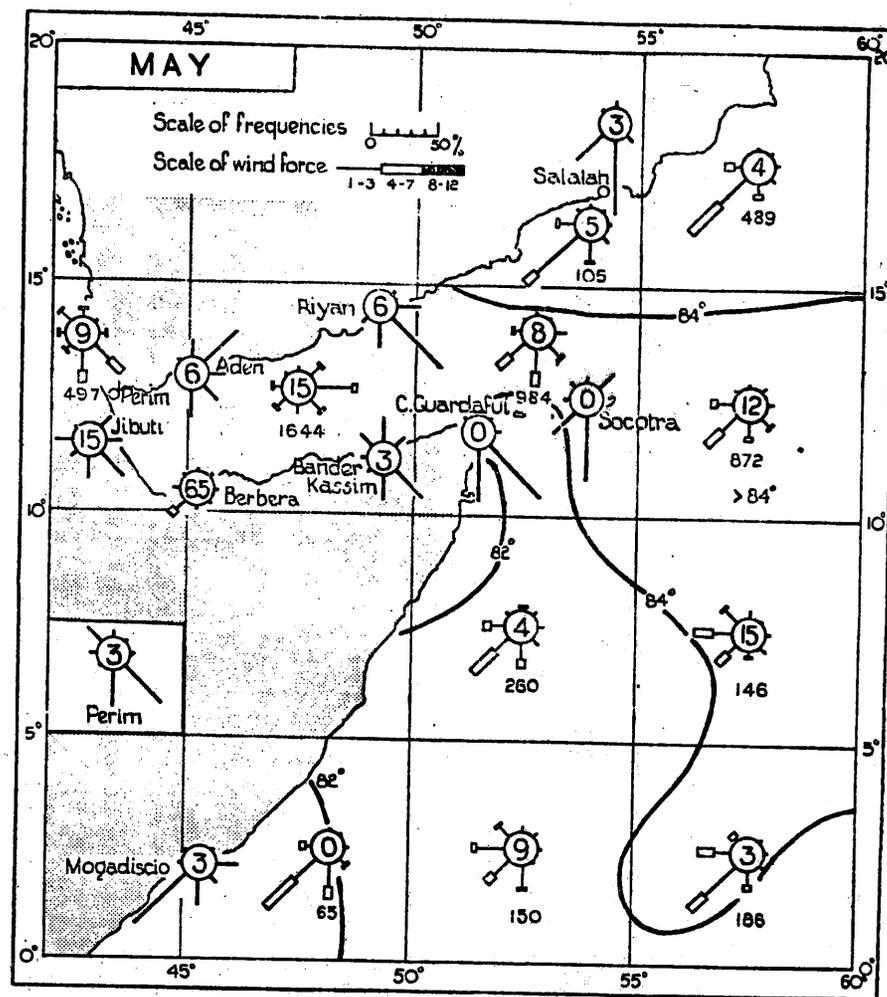


FIG. 6a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—MAY

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours, at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
GULF OF ADEN												
43-44° E. ...	6	16	28	28	18	4	.4	-	-	-	-	248
44-45° E. ...	11	20	38	22	8	1	.4	-	-	-	-	230
45-46° E. ...	15	25	34	19	5	.4	.2	.9	-	-	.2	463
46-47° E. ...	14	26	28	26	5	1	-	-	-	-	-	217
47-48° E. ...	15	30	28	22	5	-	-	-	-	-	-	235
48-49° E. ...	14	28	33	20	4	.8	.4	-	-	-	-	248
49-50° E. ...	21	30	35	9	4	.8	.4	-	-	-	-	256
50-51° E. ...	19	28	34	15	3	1	-	-	-	-	-	282

Authority.—Bibliography No. 94.

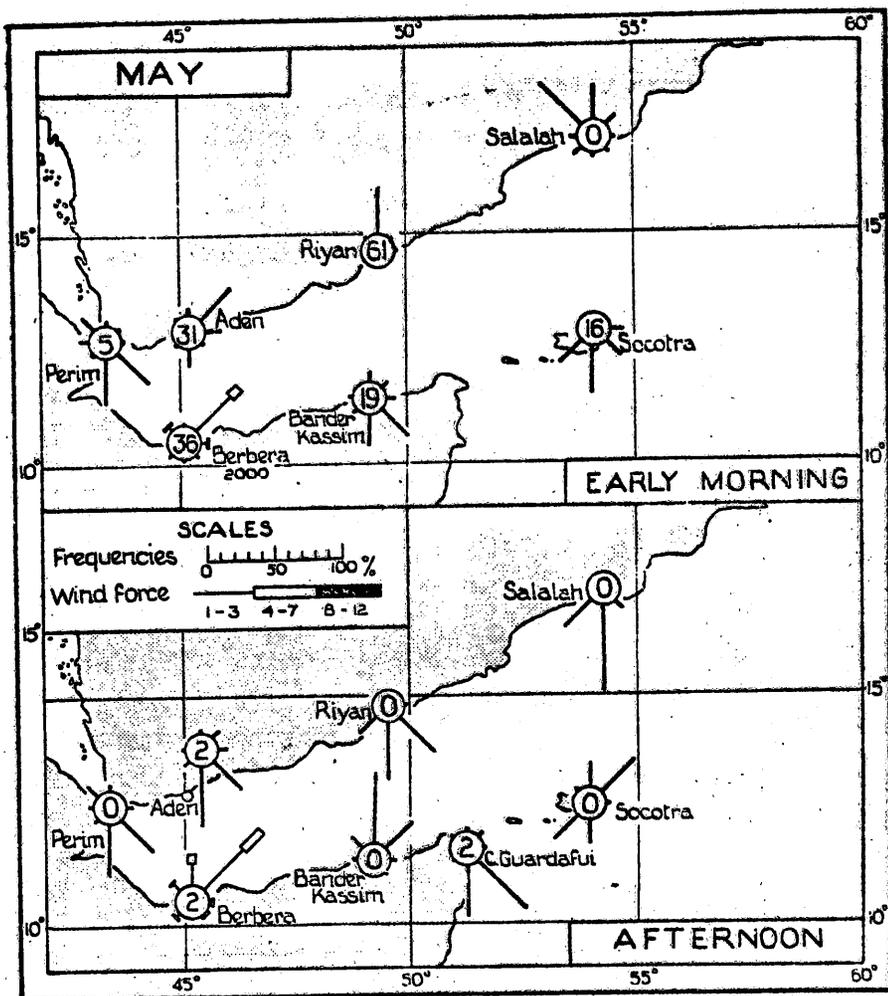


FIG. 6b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 6a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E.	5	21	30	23	13	7	1	-	-	-	-	226
53-54° E.	8	15	15	22	22	9	6	3	-	-	-	153
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E.	7	15	22	26	15	4	5	2	4	-	-	127
56-57° E.	3	18	30	23	13	7	2	3	1	-	-	100
<b>ARABIAN SEA. 5-15° N.</b>												
50-60°	13	21	20	14	10	6	2	<1	<1	<1	<1	?

Authority.—Bibliography Nos. 94, 16.

14

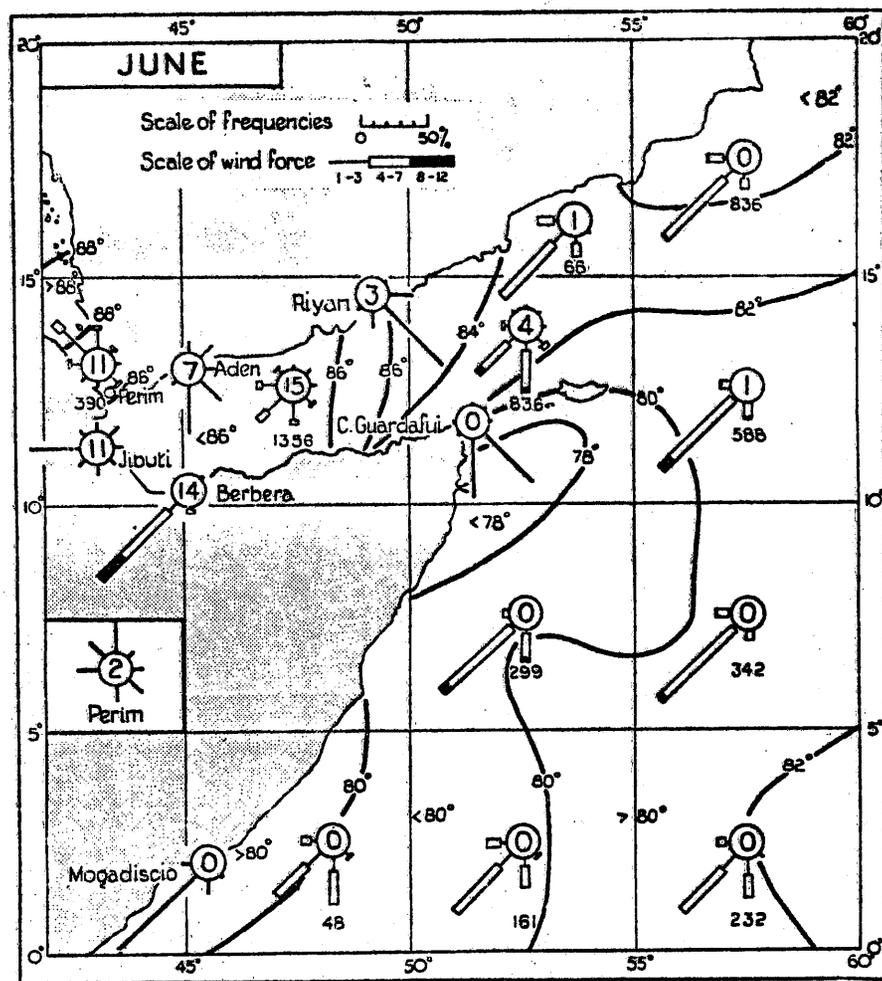


FIG. 7a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—JUNE

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E.	9	26	21	25	11	6	2	-	.5	-	-	214
44-45° E.	12	26	27	16	11	4	4	-	-	-	-	187
45-46° E.	15	20	30	20	7	4	3	.8	-	-	-	384
46-47° E.	8	23	24	18	13	6	7	1	-	-	-	175
47-48° E.	17	17	23	18	16	4	3	2	-	-	-	178
48-49° E.	16	30	21	18	9	4	2	-	-	-	-	170
49-50° E.	12	26	25	16	12	5	4	.5	-	-	-	182
50-51° E.	14	30	28	14	9	3	.5	2	-	-	-	206

Authority.—Bibliography No. 94.

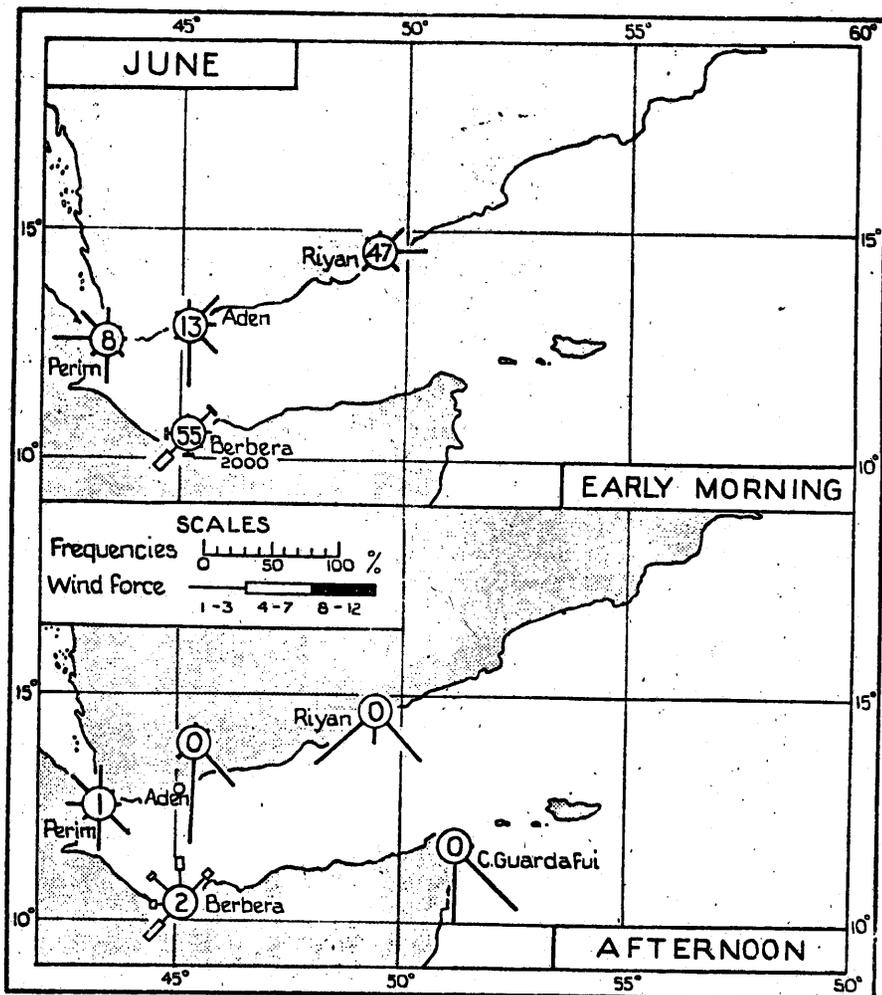


FIG. 7b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 7a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E. ..	3	4	21	21	21	15	8	4	3	-	-	154
53-54° E. ..	-	8	5	3	18	21	18	18	13	3	-	130
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E. ..	-	-	9	3	7	8	28	36	14	2	9	114
56-57° E. ..	-	-	-	-	6	13	28	38	11	3	1	93
<b>ARABIAN SEA. 5-15° N.</b>												
50-60° E. ..	3	2	4	6	10	17	25	19	10	3	9	?

Authorities.—Bibliography Nos. (12 15° N.) 94, (5-15° N.) 16.

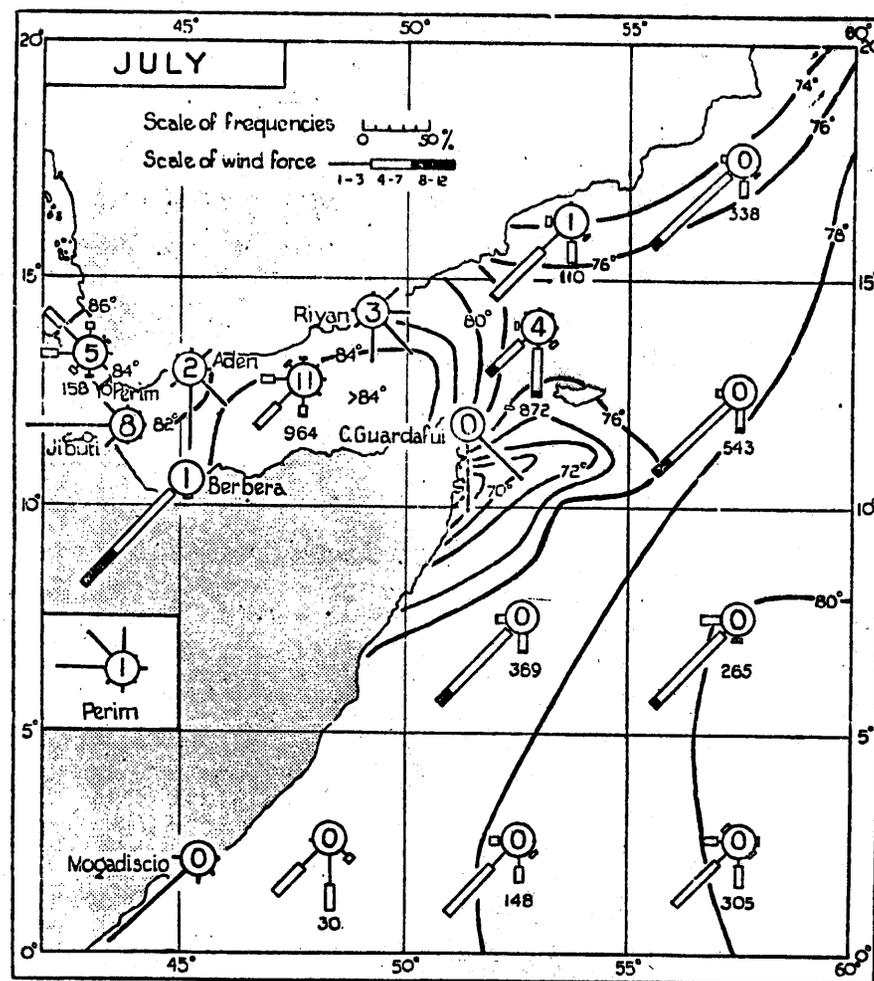


FIG. 8a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—JULY

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines. Note that an isotherm of 82° F., obscured by the wind rose for Perim, runs across Bab el Mandeb.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E. ..	5	8	30	19	22	10	4	4	-	-	-	237
44-45° E. ..	8	10	26	16	26	11	3	-	-	-	-	235
45-46° E. ..	11	12	29	15	16	10	5	2	4	-	2	480
46-47° E. ..	5	11	21	14	22	18	6	1	2	-	-	216
47-48° E. ..	8	7	18	12	26	16	8	4	4	-	4	225
48-49° E. ..	9	13	23	20	20	9	4	9	1	-	-	220
49-50° E. ..	8	11	27	14	23	9	5	2	1	-	-	206
50-51° E. ..	11	19	22	23	16	5	3	1	-	-	-	291

Authority.—Bibliography No. 94.

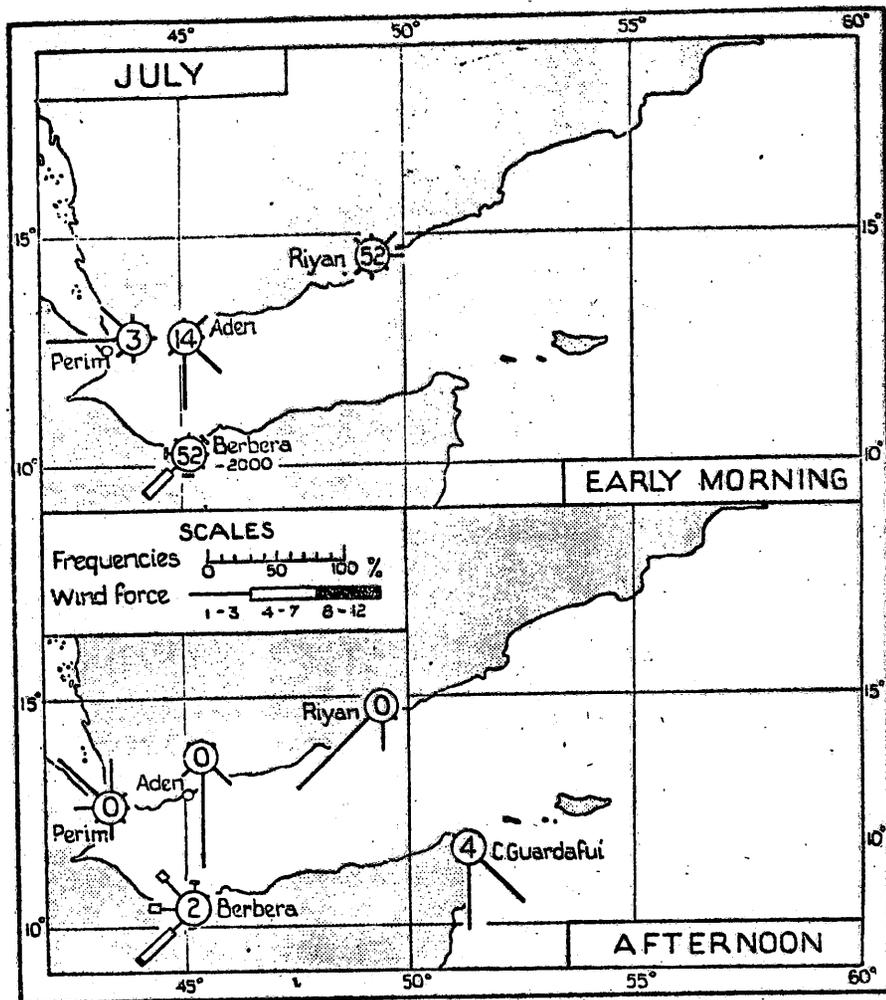


FIG. 80—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 8a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E.	1	4	11	17	30	21	10	3	3	-	-	160
53-54° E.	-	-	1	2	10	14	34	22	14	3	-	181
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E.	-	-	7	-	7	13	29	27	18	5	7	150
56-57° E.	-	-	-	-	6	10	31	29	17	6	9	111
<b>ARABIAN SEA. 5-15° N.</b>												
50-60°	2	2	3	4	8	15	26	23	12	4	1	?

Authority.—Bibliography Nos. 94, 16.

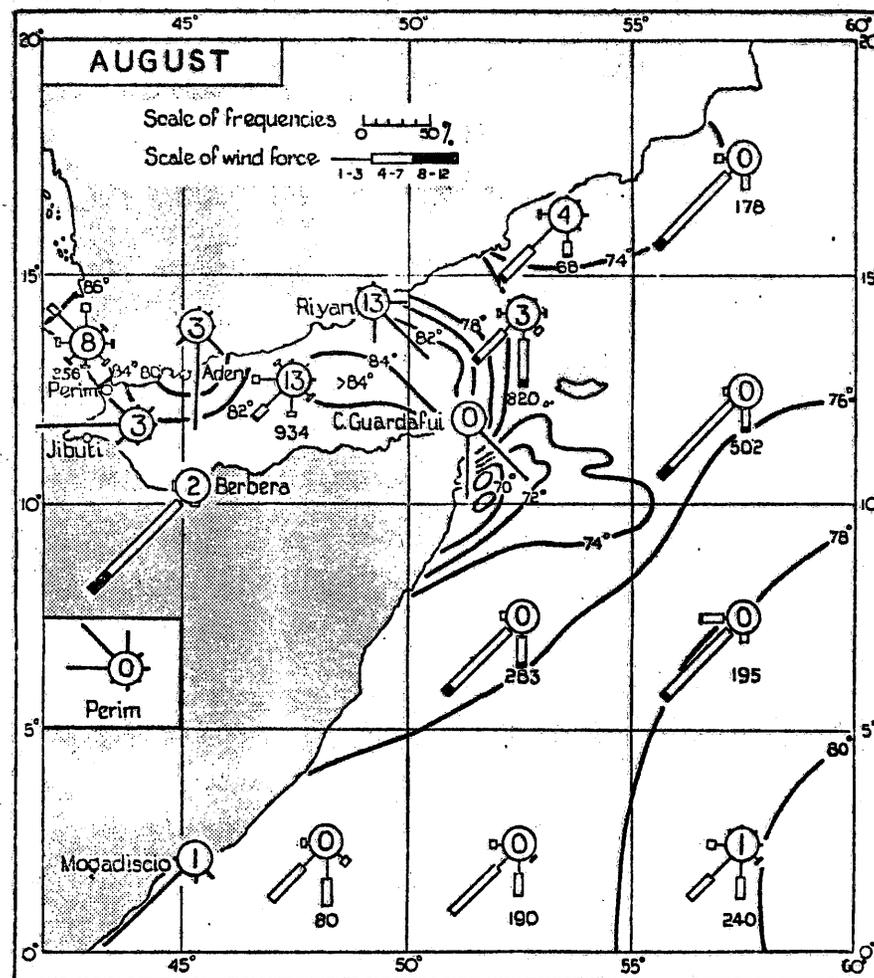


FIG. 9a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—AUGUST

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E.	6	14	31	24	16	4	4	8	-	-	-	131
44-45° E.	11	18	19	22	18	8	1	6	2	-	-	166
45-46° E.	14	14	28	20	13	7	1	8	2	-	-	263
46-47° E.	8	15	30	14	14	13	4	8	8	-	-	124
47-48° E.	11	15	25	18	13	12	4	9	9	-	-	112
48-49° E.	8	23	38	16	8	4	2	-	-	8	-	119
49-50° E.	15	22	33	14	9	3	2	8	2	-	-	133
50-51° E.	10	28	34	16	8	2	2	-	5	-	-	196

Authority.—Bibliography No. 94.

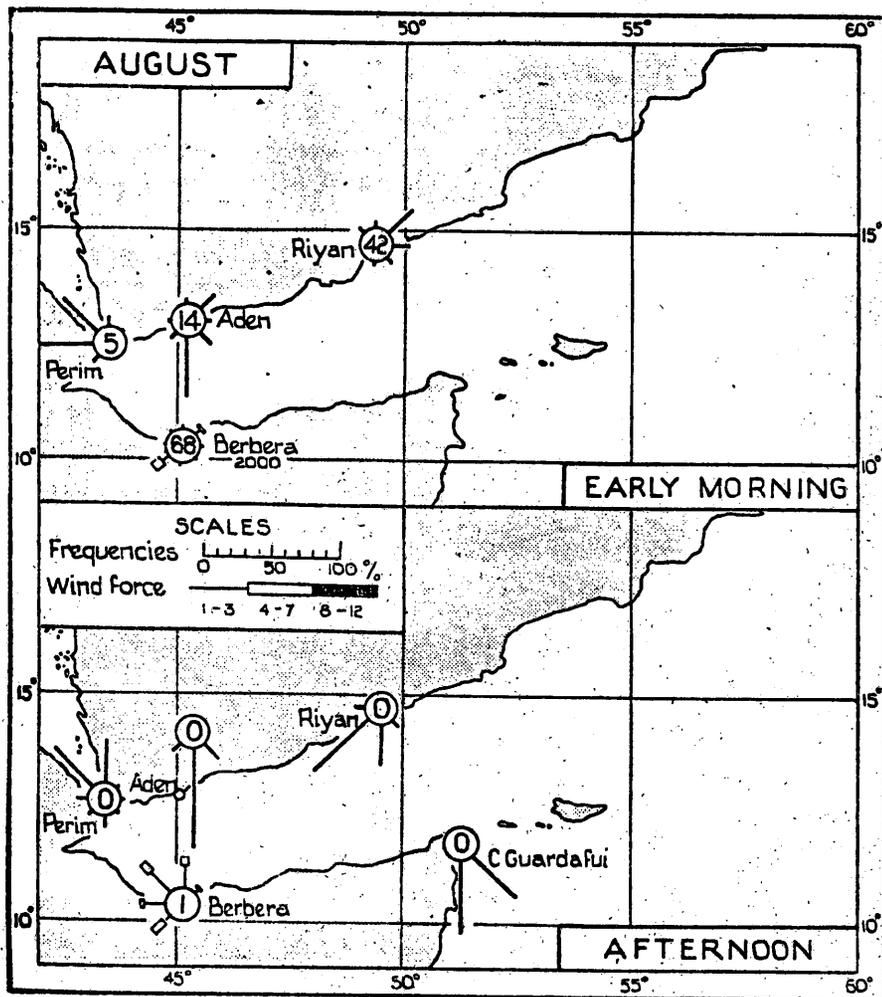


FIG. 9b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 9a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E. . .	-	8	13	16	30	13	17	3	6	-	-	157
53-54° E. . .	9	-	9	5	13	24	26	21	8	9	-	114
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E. . .	-	-	1	1	11	16	29	28	13	2	1	89
56-57° E. . .	-	-	-	-	8	23	26	23	14	6	-	78
<b>ARABIAN SEA. 5-15° N.</b>												
50-60° E. . .	3	2	4	5	12	19	27	19	7	2	5	?

Authorities.—Bibliography Nos. 94, 16.

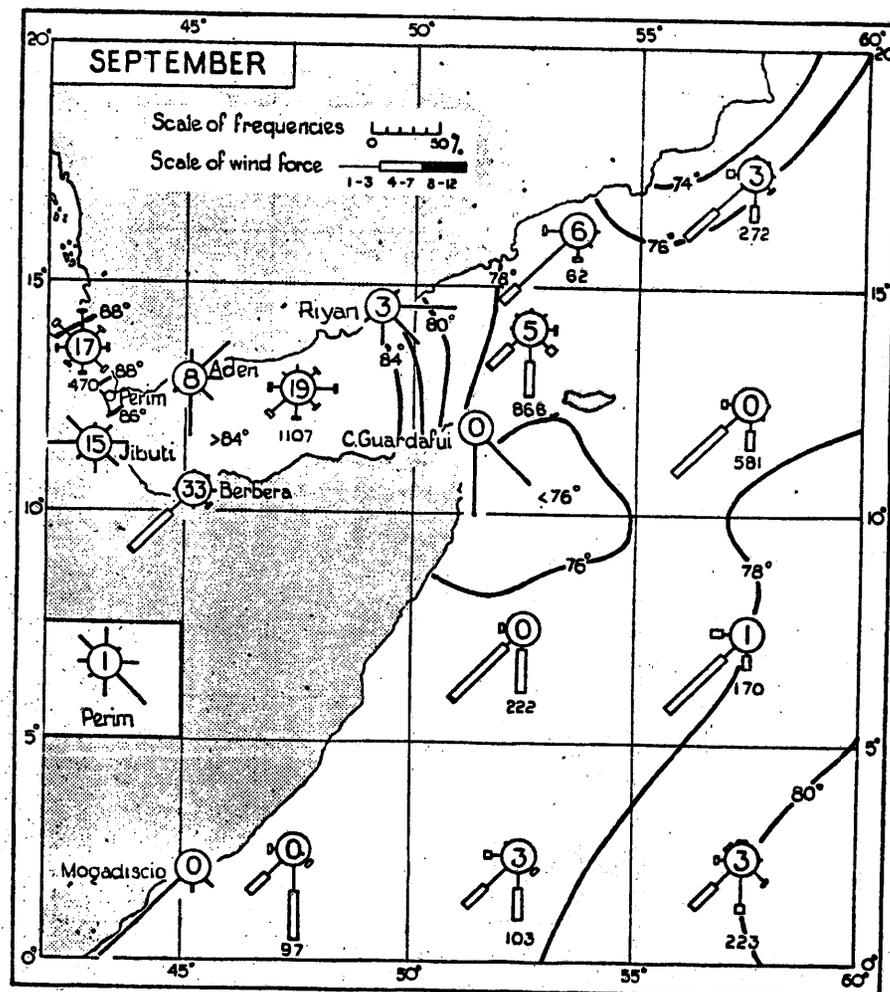


FIG. 10a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—SEPTEMBER

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E. . .	22	15	20	29	12	2	-	-	-	-	-	91
44-45° E. . .	19	23	26	25	6	5	-	1	-	-	-	210
45-46° E. . .	19	21	28	22	9	1	-	-	-	-	-	316
46-47° E. . .	12	28	28	21	9	2	-	-	-	-	-	166
47-48° E. . .	20	29	31	16	3	1	-	-	-	-	-	147
48-49° E. . .	20	26	29	19	5	7	-	-	-	-	-	150
49-50° E. . .	22	29	31	15	3	-	-	-	-	-	-	162
50-51° E. . .	12	30	36	16	5	9	-	-	-	-	-	211

Authority.—Bibliography No. 94.

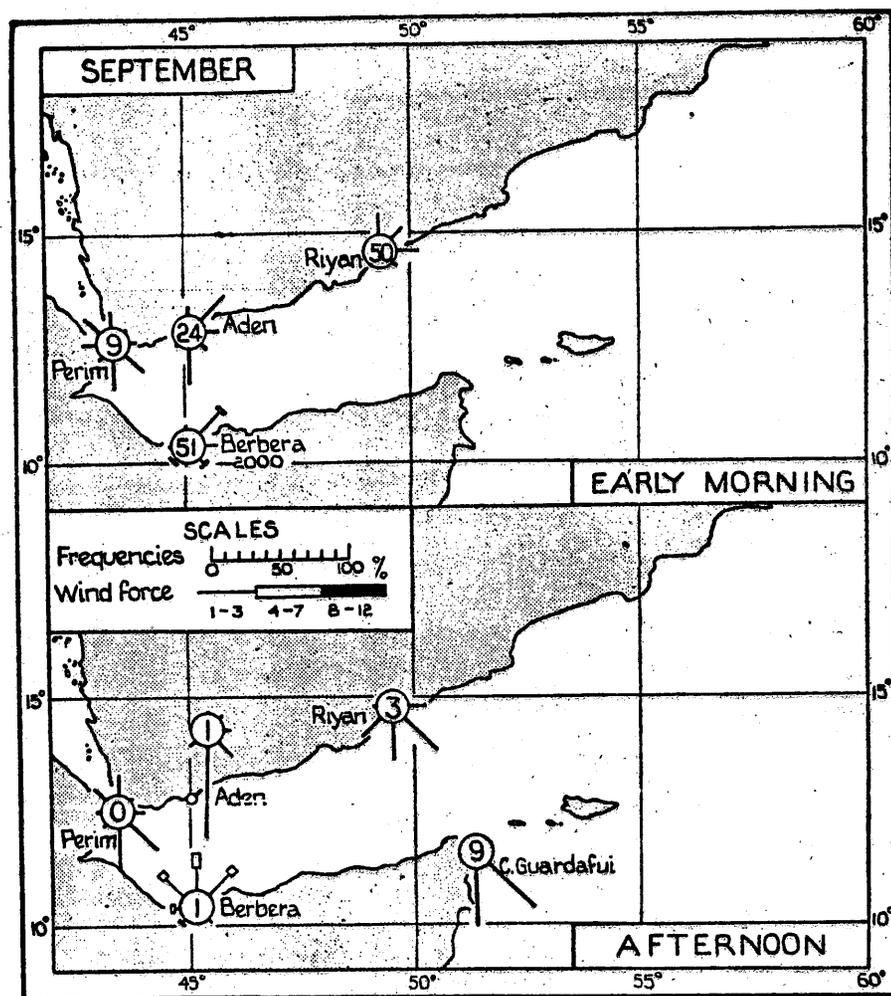


FIG. 10b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 10a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

## PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E. . .	3	9	28	19	21	15	3	1	.6	-	-	164
53-54° E. . .	3	7	14	18	19	21	11	6	.8	-	-	123
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E. . .	-	5	8	19	18	28	13	8	-	1	-	187
56-57° E. . .	-	1	9	18	29	15	15	12	1	-	-	84
<b>ARABIAN SEA. 5-15° N.</b>												
50-60° E. . .	4	5	8	14	21	22	17	7	2	.3	<.1	?

Authority.—Bibliography Nos. 94, 16.

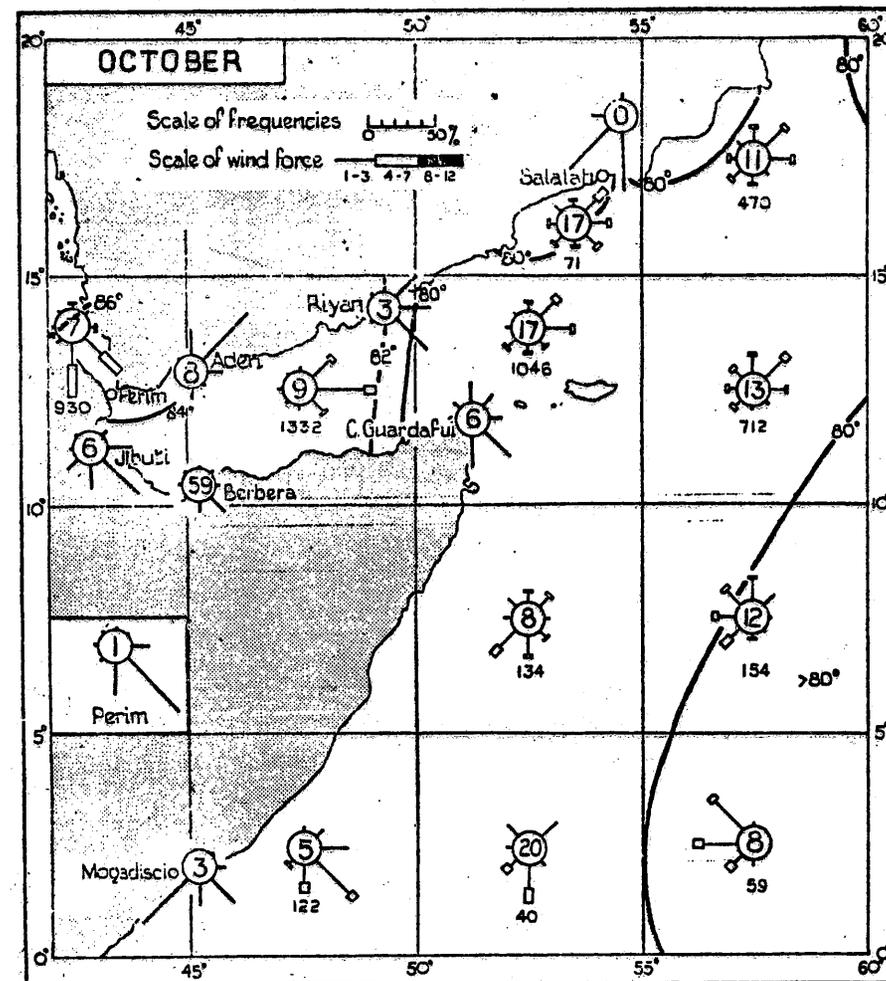


FIG. 11a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—OCTOBER

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

## PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E. . .	2	6	16	25	26	19	5	.5	.5	-	-	199
44-45° E. . .	5	17	31	27	16	4	-	-	-	-	-	231
45-46° E. . .	5	21	40	21	11	1	.6	-	-	-	-	358
46-47° E. . .	7	23	30	25	13	2	-	-	-	-	-	184
47-48° E. . .	6	18	35	25	12	3	.5	.5	-	-	-	186
48-49° E. . .	12	17	35	21	12	3	-	-	-	-	-	181
49-50° E. . .	19	29	25	20	7	.5	-	-	-	-	-	181
50-51° E. . .	15	34	30	14	5	2	-	.3	-	-	-	295

Authority.—Bibliography No. 94.

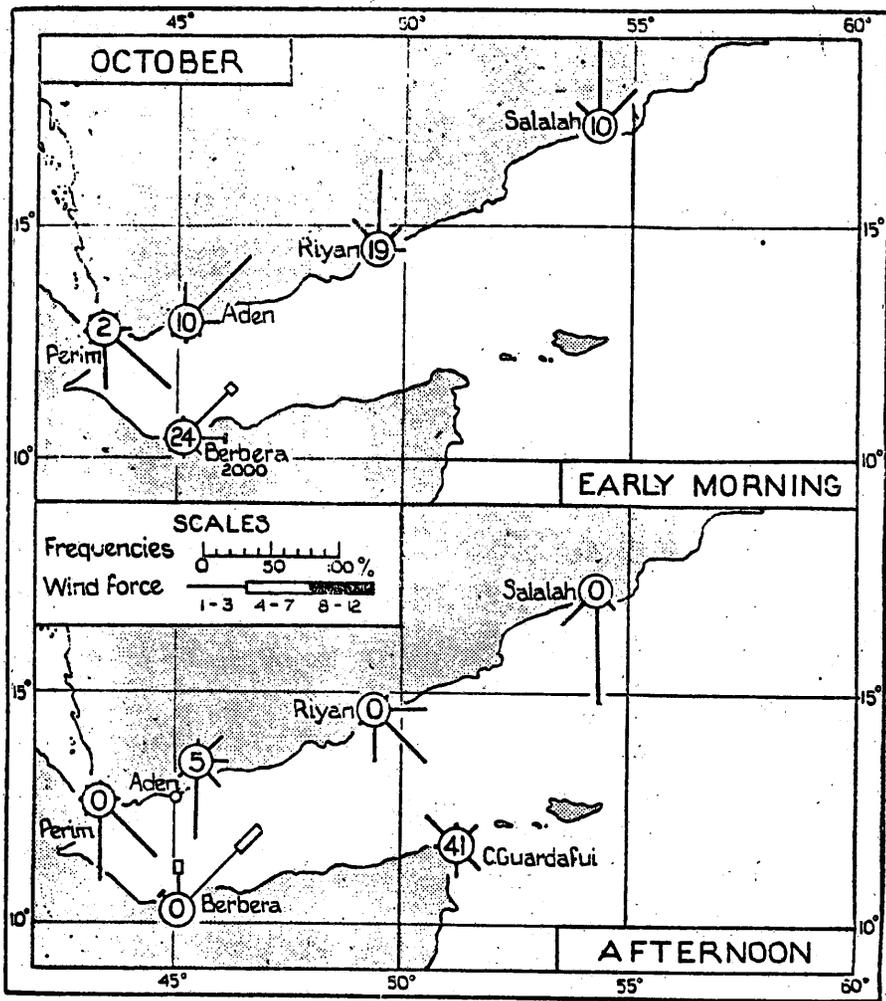


FIG. 11b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 11a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.												
51-52° E. . .	17	24	29	19	8	3	.4	-	-	-	-	270
53-54° E. . .	16	27	28	18	6	2	2	1	-	-	-	161
EAST OF SOCOTRA. 12-15° N.												
55-56° E. . .	12	22	30	20	13	3	-	-	-	-	-	91
56-57° E. . .	2	30	27	24	12	5	-	-	-	-	-	59
ARABIAN SEA. 5-15° N.												
50-60° E. . .	17	19	27	21	11	4	.6	.3	.1	-	<.1	?

Authorities.—Bibliography Nos. 94, 16.

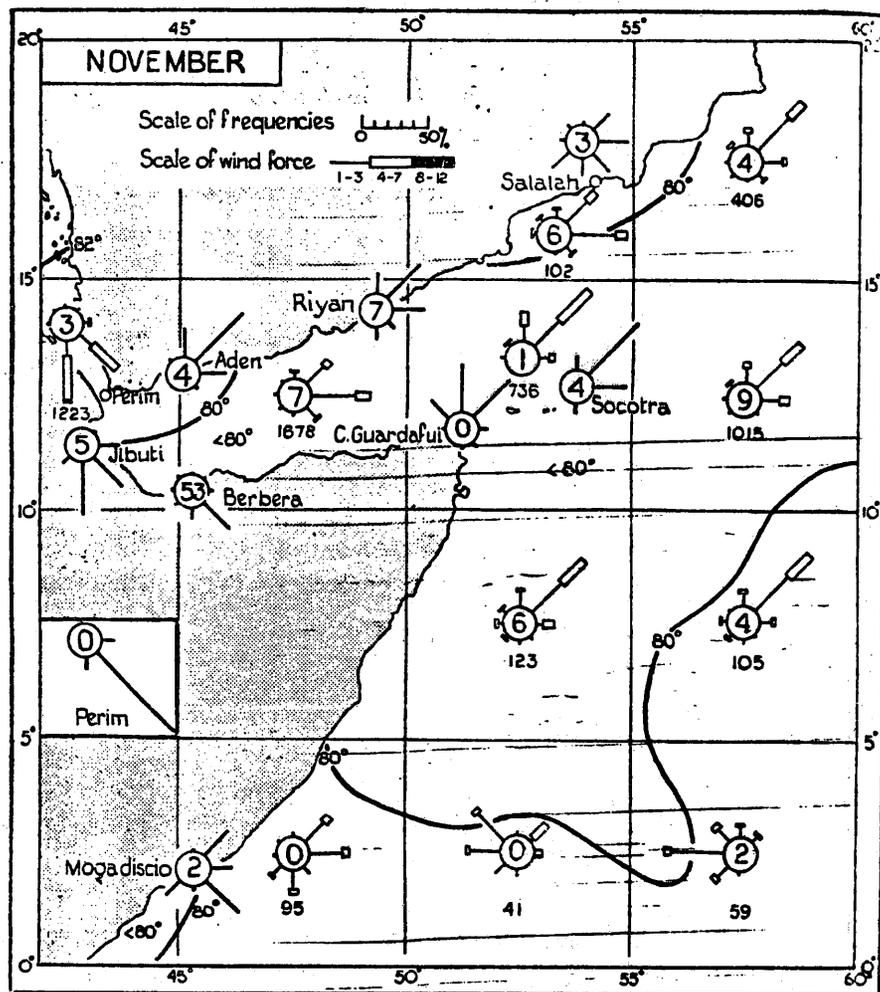


FIG. 12a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—NOVEMBER

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
GULF OF ADEN												
43-44° E. . .	2	2	15	25	30	16	10	.5	-	-	-	219
44-45° E. . .	4	18	27	30	14	6	1	-	-	-	-	232
45-46° E. . .	8	22	25	27	13	4	1	-	-	-	-	364
46-47° E. . .	4	17	32	27	16	2	2	-	-	-	-	241
47-48° E. . .	5	20	25	29	16	3	2	-	-	-	-	257
48-49° E. . .	7	22	27	28	10	5	.4	-	.4	-	-	263
49-50° E. . .	9	27	27	22	12	3	-	-	-	-	-	234
50-51° E. . .	12	22	32	15	13	6	.4	-	-	-	-	268

Authority.—Bibliography No. 94

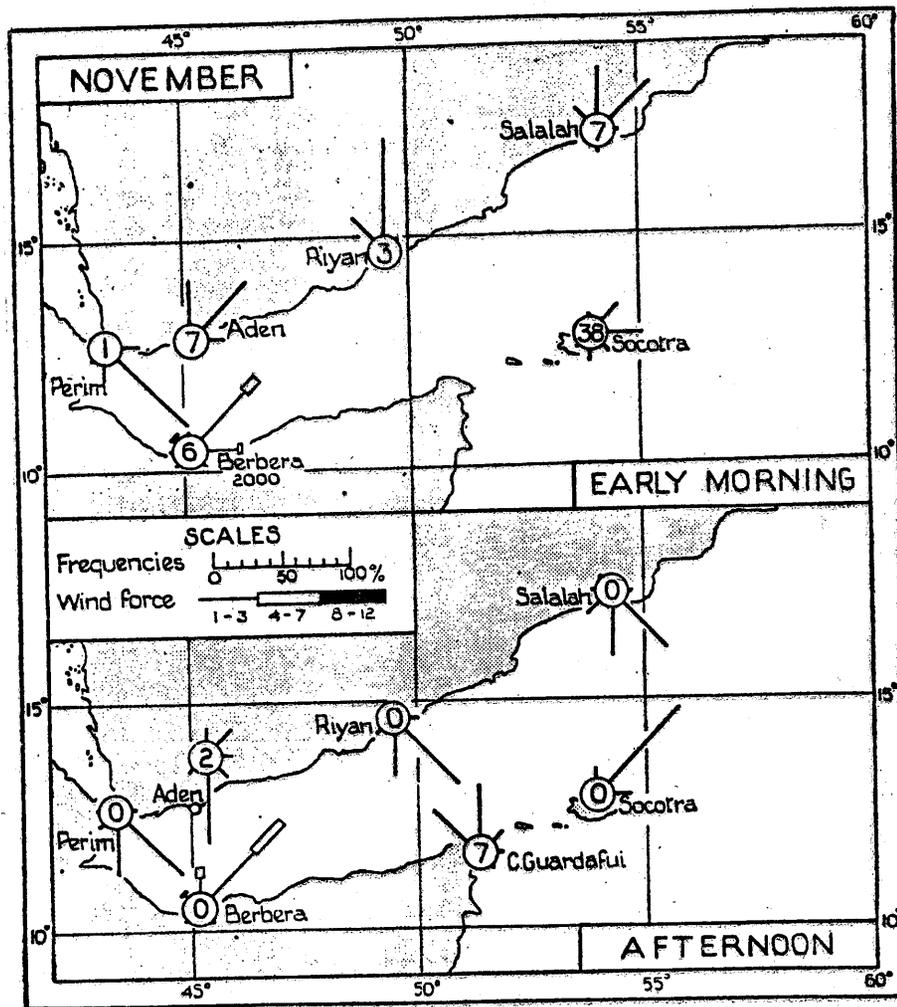


FIG. 12b—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 12a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.</b>												
51-52° E. . . .	10	21	23	24	17	4	3	3	-	-	-	309
53-54° E. . . .	5	20	27	24	18	4	1	4	4	-	-	232
<b>EAST OF SOCOTRA. 12-15° N.</b>												
55-56° E. . . .	3	12	19	25	22	10	5	3	1	-	-	94
56-57° E. . . .	-	2	16	21	47	8	2	4	-	-	-	68
<b>ARABIAN SEA. 5-15° N.</b>												
50-60° E. . . .	6	9	21	31	21	9	2	4	1	1	-	?

Authority.—Bibliography Nos. 94, 16.

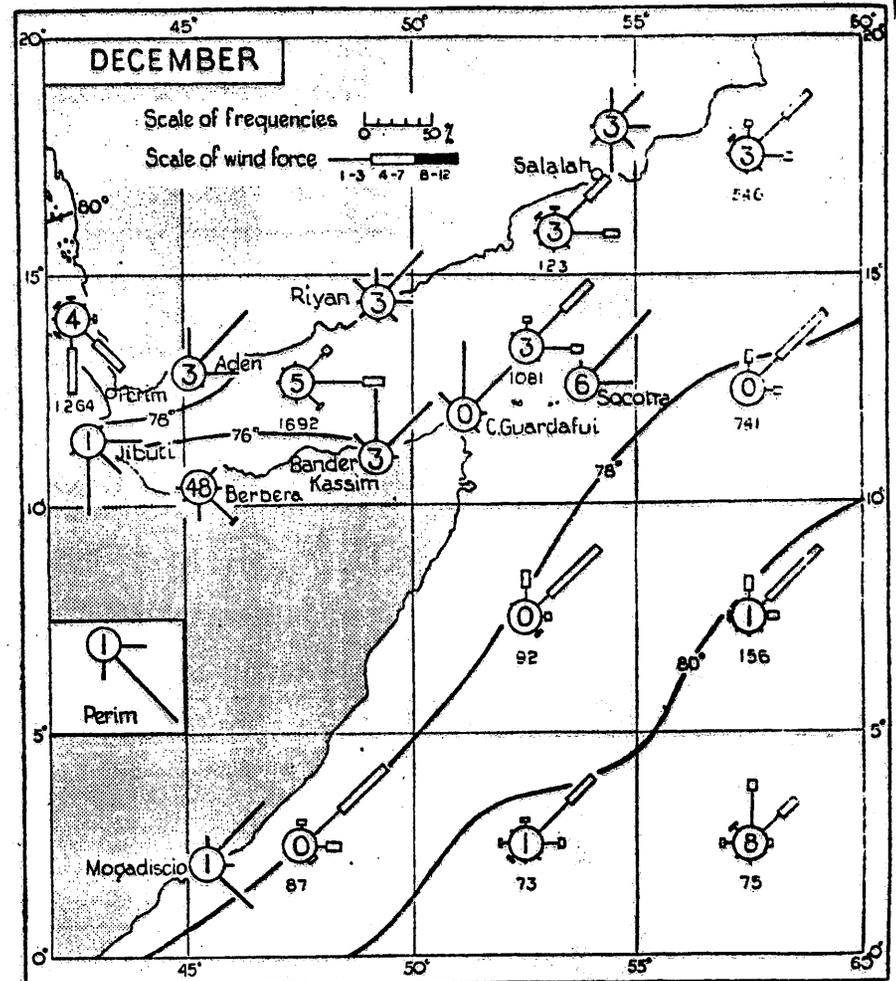


FIG. 13a—SURFACE WINDS AND TEMPERATURE OF THE SEA SURFACE—DECEMBER

The figures inside the circles indicate the percentage frequency of calms; the small figures below the roses for the sea areas give the number of observations. Except at Berbera the wind force is not shown on the roses for land stations. At Mogadiscio the roses are based on the mean of observations at three hours; at all other stations they are for the morning hour, approximately 0900 (Z-3).

Isotherms of sea temperature are indicated by thick lines.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
<b>GULF OF ADEN</b>												
43-44° E. . . .	3	6	12	17	30	19	9	3	8	-	-	236
44-45° E. . . .	3	10	25	40	17	5	-	4	-	-	-	253
45-46° E. . . .	6	15	31	30	15	3	2	-	-	-	-	447
46-47° E. . . .	6	12	27	33	17	2	3	-	-	-	-	247
47-48° E. . . .	3	13	32	32	16	3	8	-	-	-	-	240
48-49° E. . . .	3	10	33	36	15	1	2	-	-	-	-	231
49-50° E. . . .	5	13	32	30	15	4	8	-	-	-	-	237
50-51° E. . . .	5	9	32	32	19	3	-	-	-	-	-	324

Authority.—Bibliography No. 94.

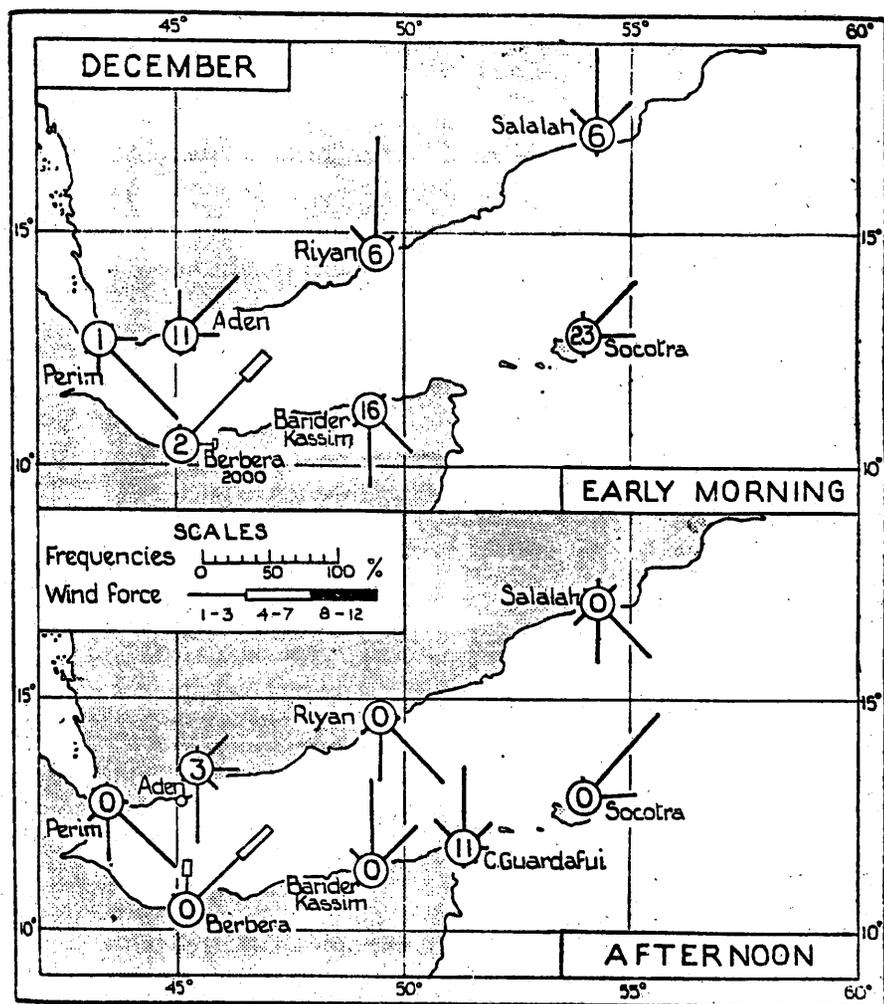


FIG. 13b.—SURFACE WINDS AT COASTAL STATIONS

The wind roses are similar in form to those for 0900 in Fig. 13a. Roses for the early morning 0500 (Z-3) are shown in the upper chart and for the afternoon 1500 (Z-3) in the lower chart, except at Berbera where the times are 2000 and 1400. Except at Berbera the wind force is not shown.

PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE AT SEA

Beaufort force	0	1	2	3	4	5	6	7	8	9	10	No. of obs.
EASTERN ENTRANCE TO GULF OF ADEN. 12-15° N.												
51-52° E. . .	4	10	25	31	21	8	1	-	-	-	-	276
53-54° E. . .	3	4	21	32	27	12	1	5	-	-	-	
EAST OF SOCOTRA. 12-15° N.												
55-56° E. . .	-	3	17	33	28	16	2	9	-	-	-	114
56-57° E. . .	-	4	14	40	23	9	10	-	-	-	-	
ARABIAN SEA. 5-15° N.												
50-60° E. . .	1	5	13	27	30	17	6	1	<.1	-	-	?

Authorities.—Bibliography Nos. 94, 16.

*Gulf of Aden.*—Over the greater part of the Gulf the NE. monsoon is generally fully established by the middle of October, but near the eastern entrance the variable winds and calms associated with the transition period between the monsoons continue throughout October and the NE. monsoon does not usually set in until November. The wind is deflected by the high land on the borders and tends to blow from ENE. or E. along the general direction of the Gulf. From December to March it blows very steadily, some 80 per cent. of the winds being included within the quadrant NE.-E.

Except at the western end it is light or moderate in force, and even in January and February, when it is strongest, only about 30 per cent. of the winds exceed force 3. It rarely reaches even a moderate gale. The weather in the late winter and early spring is less uncertain than at any time of the year and most of the coastal trade is done during this period. Northerly squalls occur at times near the Arabian coast but are comparatively rare.

Towards the narrow western end of the Gulf the wind blows more strongly. In Bab el Mandeb its general direction is along the straits, from SE. or S., and over the period November to March about 60 per cent. of the winds exceed force 3 and occasionally even exceed force 8 (see page 59). Sometimes the change from NNW. winds in the Red sea to E. winds in the straits takes place abruptly (Bibliography No. 23).

Winds from ENE. and E. are said often to blow strongly into the Gulf of Tajura, strengthening towards midday and dropping at night.

*Coastal regions.*—In coastal regions the diurnal variation is evident in speed as well as in direction, depending to some extent on whether the sea winds reinforce or counteract the prevailing monsoon winds. In most places, but with the notable exception of Aden, the wind blows most strongly in the afternoon. On the Arabian coast between Ras al Hadd and Masira island land and sea breezes are likely in the season of light winds before the monsoon. From December to about the middle of March the NE. monsoon blows all along the coast, its direction varying with the direction of the coastline. At Ras al Hadd light or moderate N. winds blow in the afternoon; not infrequently they persist through the night but more often the wind then is SW. and light. During this period a strong land wind from about NNW. is not infrequent between Masira island and Ras Sajar. SE. winds are said to be frequent in the neighbourhood of the Gulf of Masira early in the year, and S. winds also occasionally blow there for two or three days at a time, but reliable information is lacking. Khorya Morya bay also has a bad reputation on account of stormy and variable winds both from land and sea. From mid March the winds along the coast become light and variable with land and sea breezes again prevalent.

At Salah, which is sheltered to some extent from the NE. monsoon, the alternation of northerly winds at night with SE. or S. winds in the afternoon seems to be a regular phenomenon all through the season. Even in December and January the southerly sea breeze frequently sets in as early as 1000 and by March it is definitely established at that hour. In the early part of the season some 90 per cent. of the winds are light, but by March the sea breeze exceeds force 3 on nearly 40 per cent. of occasions in the afternoon.

Off the north coast of Socotra gusty NE. winds blow during this season and may persist for several days so that it is advisable to keep some

distance from the coast. Observations in 1942-3 indicate that NE. and E. winds prevail throughout most of the day and night in December and January, but that in February N. winds increase slightly in frequency during the day-time. In March, when the NE. monsoon is dying, land and sea breezes prevail, calms and SE. winds in the early morning being replaced by NE. and N. winds in the afternoon. Throughout the season the winds show a well-marked strengthening in the afternoon, when some 60 per cent. exceed force 4.

On the coasts of the Gulf of Aden the diurnal variation is large and the direction of the wind depends upon the locality and the time of day. A brief summary of conditions at individual places is given below.

At Riyan N. winds in the early morning become variable but chiefly north-easterly at 0900 and in the afternoon they blow almost continuously from SE. or S. In the late evening calms are fairly frequent, and winds continue to be light in the early morning; in the afternoon they strengthen and exceed force 3 on over 60 per cent. of occasions in all months but January, when the frequency is only about three quarters of that figure.

At Aden the diurnal variation in the winter months, October to February, is illustrated in the upper panel of Fig. 14, which is based on observations taken many years ago when the meteorological station was situated on the crest of a small ridge 94 feet above M.S.L. fronting the harbour. The site was freely exposed to east, south and west, but sheltered on the north by distant hills. The information in the text takes account also of more recent data, which to a large extent confirm the earlier observations.

At night and in the early morning the wind is north-easterly, it is comparatively light and calms are frequent. It increases slightly during the morning and reaches its greatest strength at about 1000. Towards noon the sea breeze begins to make itself felt and the wind frequently veers to SE. and decreases in force, reaching its lowest speed in the late afternoon. At about 1700 the land breeze sets in, sometimes with great suddenness and with gusts of 15-25 knots or more. Sometimes during this season the land breeze continues to blow in this way until about midnight and may do so on 3 or 4 consecutive days. It is usually much less vigorous after midnight. The depth of the land breeze is said to be about 1,000 feet.

At Jibuti on the coast of French Somaliland during this season a light land breeze blows from S. in the night and early morning; the sea breeze from NE. or E. sets in between 0800 and 1000 and strengthens in the early afternoon, it becomes lighter at 1700 and drops altogether at night.

At Berbera the average diurnal variation in January is illustrated in the lower panel of Fig. 14. Similar conditions prevail throughout the period October to April (Table VI). From about 2300 to 0900 calms and light winds prevail; in the early part of the night the average speed is only about 4 knots or even less but, especially at the beginning of the season, it increases slightly after 0400 and tends to blow from S., i.e. off shore, reaching a maximum between 0600 and 0800 and then falling calm again. At about 1100 the sea breeze sets in rather suddenly from N. with speed of 7-9 knots. It increases in speed and veers gradually

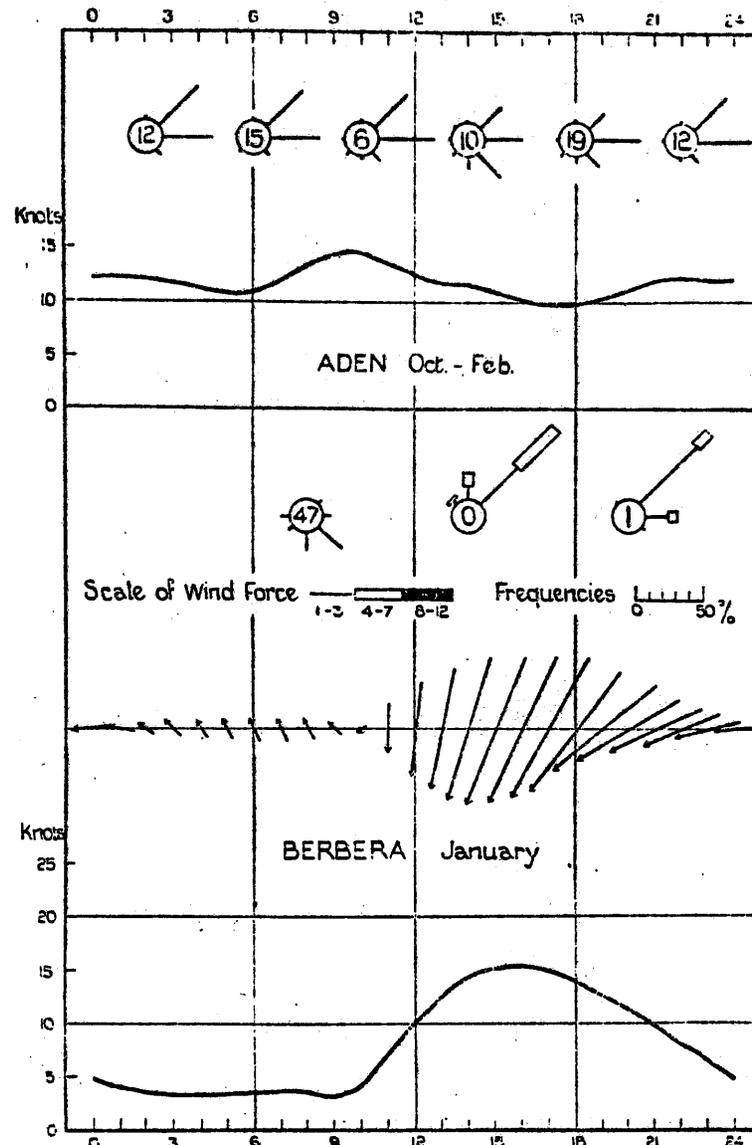


FIG. 14—DIURNAL VARIATION OF WIND AT ADEN AND BERBERA DURING THE NE. MONSOON

In the upper panel, for Aden, the frequencies of winds from the eight principal directions, without regard to force, are shown by wind roses, which represent the mean of hourly values over the four-hourly intervals in which the roses are centred. The average speed of the wind, without regard to direction, is represented by the curve immediately below.

In the lower panel, for Berbera, the frequencies of both the direction and force of the wind are shown on roses for the standard hours 0800, 1400 and 2000 (Z-3). The direction of the resultant wind at hourly intervals is represented by arrows, the length of which shows the speed according to the vertical scales on the left. The average speed, without regard to direction, is shown by the curve at the foot of the diagram.

The scale of frequencies refers to both sets of roses and the figures inside the circles give the percentage frequency of calms.

The roses for Aden are from observations made in 1881-90 and differ slightly from the modern observations used for Figs. 2-13.

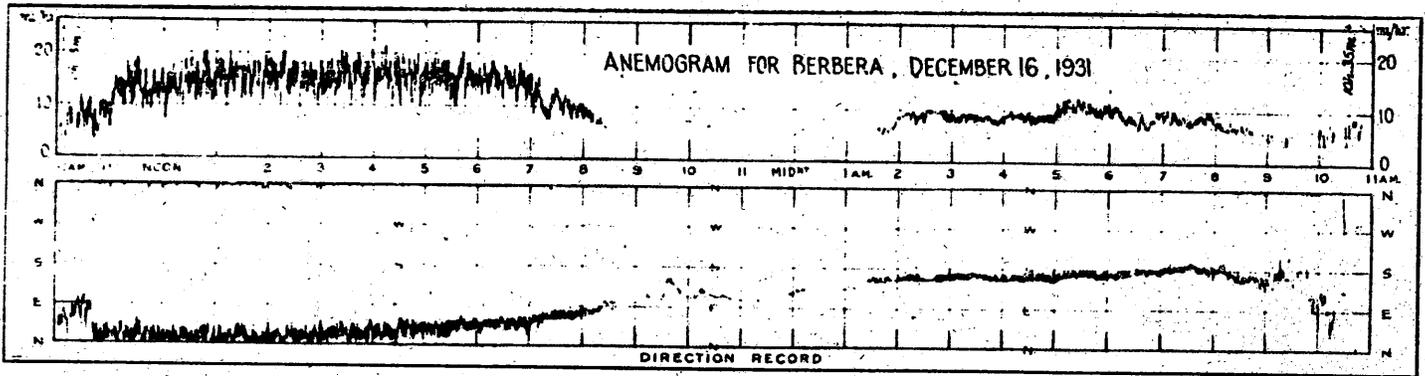


FIG. 15—ANEMOGRAM SHOWING THE DIURNAL VARIATION OF WIND AT BERBERA ON A TYPICAL DAY DURING THE NE. MONSOON, DECEMBER 16-17, 1931

The anemometer head was 88 feet above ground level and 30 feet above the surrounding buildings. It was situated about 40 yards from the sea shore.

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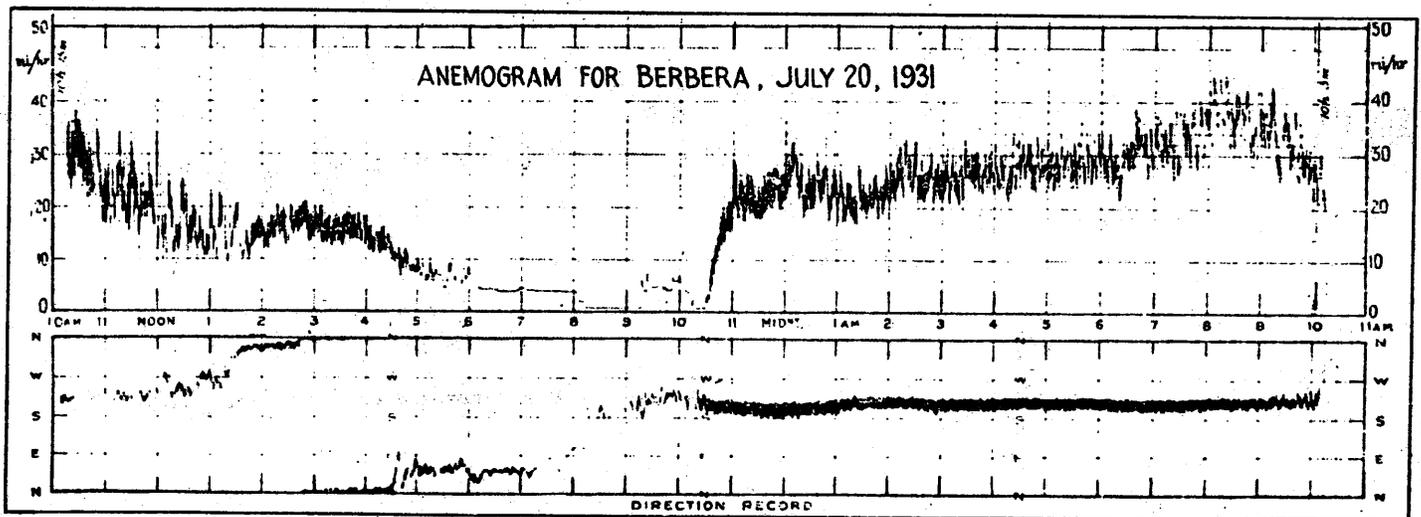


FIG. 16—ANEMOGRAM SHOWING THE DIURNAL VARIATION OF WIND AT BERBERA ON A TYPICAL DAY DURING THE SW. MONSOON, JULY 20-21, 1931

to NE., reaching a maximum of about 15 knots between 1400 and 1700, after which it gradually falls off, slowly at first but rather more rapidly after 2000, and veers still further. The diurnal variation is noticeable up to between 3,000 and 4,000 feet (see page 73). The anemogram of a typical day in this season is reproduced in Fig. 15. The record runs from 1000 on December 16 to 1100 on the 17th. It shows that the wind backed to N. at about 1100 when the sea breeze set in and continued to blow at about 15 knots with considerable instability until 1800. The height of this unstable layer is probably 1,500-2,500 feet. After 1800 instability gradually ceased and there was a period of light winds from 2000 until about 0200 during which time the direction veered to S. By 0200 the southerly land breeze was established and continued until about 0800, after which it gradually died down as convection set in.

East of Berbera where the escarpment is nearer the coast the land breeze from SE.-SW. sets in during this season between 2100 and 2400, and persists until 0200 and sometimes until 0500 or 0600 followed by a period of calm; between 0900 and 1000 N.-NE. sea winds set in. During periods of bad weather, which may persist for 3 to 7 days, stronger winds from E. blow during the day, backing to NE. and weakening before sunset.

At Bander Kassim SE. and S. winds prevail in the morning, they tend to back during the day becoming NE. and N. by the afternoon. Winds are light in the early morning but tend to strengthen as early as 0900, and from January to March at 1500 some 20 per cent. exceed force 3.

Near the east coast of Africa the NE. monsoon blows roughly parallel with the coast and is not so steady as over the open sea. The wind dies down at night, gets up from N. about sunrise and gradually veers during the day, reaching its greatest speed in the afternoon, when it blows from E., falling calm in the evening. This variation is, however, not likely to extend more than about 15 miles from the coast. At Cape Guardafui the direction of the winds shows a gradual veer during the season; from November to January it blows from between NW. and NNE.; it is more variable but chiefly from some easterly direction in February, and veers still further to become south-easterly in March.

In Ghubbet Binna, some 30 to 40 miles south of Cape Guardafui, the NE. monsoon blows strongly during the day from 0900 until about 2200. At night a light wind blows from W. and in the early morning from NNW., the cycle from NE. being resumed at about 0900.

South of Ras Hafun the NE. winds are said to be weak and variable in December; they blow more regularly in January, when they may occasionally exceed force 7, but become weaker again in February and March.

At Mogadiscio NE. winds blow from January to March.

Transition season (April and May).—*Open sea.*—The change from the NE. to the SW. monsoon does not occur simultaneously over the whole area nor even progress steadily from one part to another. It is first evident in about mid April, when light south-westerly winds set in along the Arabian coast and light southerly winds off the southern coast of Italian Somaliland. Elsewhere light winds, mainly from some easterly

direction, continue to prevail in April; but only about 10 per cent. of the winds exceed force 3, and off the entrance of the Gulf of Aden calms are frequent.

By May south-westerlies predominate over the whole of the open sea. They are strongest on the western side, particularly in the south, where some 40 per cent. exceed force 3, compared with only 30 per cent. farther east; they blow strongly also off the eastern part of the Arabian coast. Occasionally, but very rarely, the wind strengthens to gale force.

No information about diurnal variation is available.

*Gulf of Aden.*—Near the eastern entrance to the Gulf the winds become light and variable as early as April and by May they are chiefly from S. or SW. It appears probable that in a year when the SW. monsoon happens to set in early fresh S. to SW. winds may be experienced in the extreme eastern part of the Gulf quite early in May. Within the Gulf of Aden the winds in April are similar in direction to those during the NE. monsoon, namely E. and NE., but they are somewhat lighter in force, about 20 per cent. exceeding force 3. Squalls are rare but not unknown. A brief squall of force 5 from S. with heavy roll cumulus and violent rain was recorded on May 10, 1938 in 12° 29' N., 46° 12' E. The wind before the squall was NNE. 3. In May calms are frequent and though the general direction continues to be mainly from some easterly point the winds are very light and except in the extreme west only about 5 per cent. exceed force 3.

In Bab el Mandeb the winds continue to blow with moderate strength from S. to SE. in April, over 40 per cent. exceeding force 3. By May, though their general direction is unchanged, they are much lighter in force; only 25 per cent. exceed force 3 and gales are rarely if ever recorded.

In April and early May easterly breezes continue to blow by day into the Gulf of Tajura.

*Coastal regions.*—On the south-east coast of Arabia the winds in April are light and variable with frequent calms. Close inshore near the Gulf of Masira land and sea breezes alternate from mid March to the end of April and this is probably true also in other parts of the coast.

At Ras al Hadd winds in both April and May are light S.-SW. in the morning, becoming N.-NW. at 1000 and SE. in the afternoon, when they sometimes blow strongly. At Masira island the diurnal change is less and SW. winds are frequent at all hours of the day, backing somewhat in the afternoon. In April winds are usually light at night with frequent calms in the early morning, but they become stronger in May, and in both months they strengthen also in the afternoon.

At Salalah, winds are light N. or NW. in the early morning but change to S. and SW. by 1000 and continue to blow from that direction also in the afternoon, when they strengthen to force 4-5. In April light SW. winds begin to predominate off shore, but it is not until May that the SW. monsoon sets in strongly; near Khorya Morya bay its onset is said to be accompanied by heavy squalls, rain and thunderstorms.

On the north coast of Socotra, judging from observations in 1943, in April winds in the early morning are light and chiefly SE., becoming northerly by 1000; in the afternoon they blow almost entirely from N.

and NE. and are stronger, about 25 per cent. exceeding force 3. In May winds in the morning are chiefly from S. and they continue to blow from that direction at 1000. A light sea breeze from NE. or N. blows in the afternoon in the early part of the month and may continue until the late evening, but in the latter part of the month S. or SW. winds are likely to continue throughout the day and may blow strongly.

On the coast of the Gulf of Aden land and sea breezes remain the important factor.

At Riyan calms or light N. winds prevail in the early morning in both April and May; the wind veers to become south-easterly at 0900 and by the afternoon (1500) blows from SE. in April and SE. or S. in May, increasing in strength. Even in the afternoon, however, only some 30 per cent. of the observations in April and 10 per cent. in May exceed force 3.

At Aden the diurnal variation in April is similar to that during the NE. monsoon. In general light NE. winds prevail in the early morning and at 0900, but S. and SE. winds become more frequent in the afternoon. In May winds continue to be light and chiefly from NE. in the early morning, but southerly winds show a very definite prevalence in the afternoon and may set in as early as 0900. In April the speed of the wind is not very different from that during the NE. monsoon, but in May the afternoon winds are stronger, nearly 20 per cent. exceeding force 3.

In French Somaliland conditions resemble those during the NE. monsoon. At Berbera also conditions in April and May (Fig. 17) do not differ much from those at the height of the NE. monsoon, except that there is no land breeze. From 2300 until about 0900 there is a period of calm; after 0900 a sea breeze sets in from NNW., it veers and increases in strength until about 1600, when it blows from NE., after which it continues to veer but decreases slightly in speed until 2000, when its direction is slightly N. of E.; from then until 2400 it gradually falls calm.

At Bander Kassim winds in the early morning in both April and May are from SE. or S. and are mostly light with frequent calms; in the afternoon N. and NE. winds predominate, and these northerly winds are sometimes apparent as early as 0900. The few observations available indicate that the wind at 0900 is stronger than at other times of the day.

Near Cape Guardafui the SE. and S. winds which set in in March become even more prevalent in April and May. In May they frequently come in violent gusts with an overcast sky and rain. Land and sea breezes are said to blow sometimes in this vicinity.

On the east coast of Africa the SW. monsoon is said to set in at Zanzibar, just south of the equator, in March and to spread north-eastwards, reaching Guardafui at the end of April. At Mogadiscio winds are light and variable in April. It is not until May that SSW. winds begin to blow strongly, first in the south and later in the north, accompanied by squalls and rain. Before the onset of the monsoon land and sea breezes are likely to be prevalent, but no details are available.

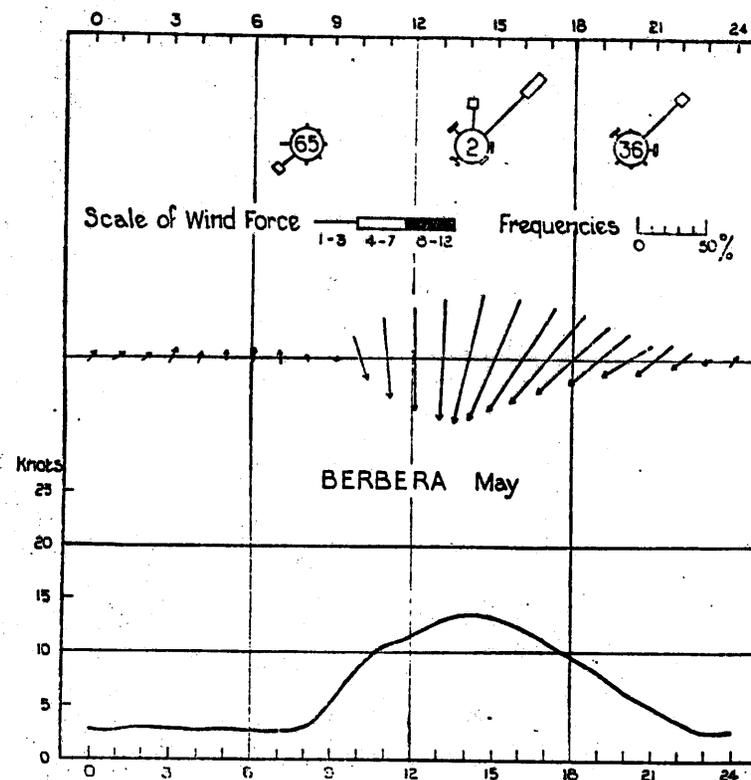


FIG. 17.—DIURNAL VARIATION OF WIND AT BERBERA IN MAY

The frequencies of both the direction and force of the wind are shown on roses for the standard hours 0800, 1400 and 2000 (2-3). Figures inside the circles give the percentage frequency of calms. The direction of the resultant wind at hourly intervals is represented by arrows the length of which shows the speed according to the vertical scale on the left. The average speed, without regard to direction, is shown by the curve at the foot of the diagram.

SW. monsoon (June to September).—*Open sea.*—By June moderate to strong SW. winds prevail over the whole area. They remain strong in July and August and though they weaken in September the general direction of the wind in that month is still predominantly the same.

Near the equator (0-5° N.) southerly winds are comparable in frequency with the south-westerlies, but further north, and especially in the east, south-westerlies account for nearly 80 per cent. of the observations. In the area 5-15° N., 55-60° E. the percentage frequencies of SW. winds in the four months June to September are: 78, 78, 75 and 68. By September S. winds become more frequent, especially in the west.

The region in which the monsoon blows strongest is a belt running north-eastwards from about 7° N. on the African coast, passing close to the eastward of Ras Hafun and Socotra and thence to about 16-18° N. in longitude 60° E. In this region in July and August the wind usually blows with force 6 or 7 (see volume I, page 13) and exceeds force 8 for some 20 per cent. of the time in July, with frequent squalls; it rarely falls below force 4. In September the average force is 4 or 5.

The direction is remarkably uniform over the greater part of this area but it becomes more southerly near the African coast, and in the channel between Cape Guardafui and Socotra, where it is slightly less strong, the wind blows from SSW. The force exceeds 6 immediately to the north of Socotra but falls off near the Arabian coast.

For the central region as a whole (5-15° N., 50-60° E.) the frequencies of winds of different force are given below the monthly charts of surface winds (Figs. 2b-13b). They show that in the four months June to September winds are of force 7 or over on 33, 40, 29 and 9 per cent. of occasions respectively.

Over the open waters of the south-west Arabian sea as a whole the diurnal variation of speed is very small. In the area referred to above, the wind blows strongest on the average at about 1000 but the range between the highest and lowest hourly values during the day is less than 1 knot. Opposite the mouth of the Gulf of Aden, however, conditions are different and the range is appreciable. For July-August the averages for 3 areas, expressed as differences from the daily mean, are shown in the following table. For the second area similar information for July only is given in Fig. 18.

Area	Mean	2400	0400	0800	1200	1600	2000	Range
12-13° N. 50-55° E. ..	18.9	+0.7	+0.6	+0.6	-1.0	-0.5	-0.2	1.7
55-60° E. ..	27.2	-1.6	-1.7	-0.3	+1.9	+1.7	0.0	3.7
10-12° N. 53-57° E. ..	27.8	-1.5	-2.6	-0.1	+1.9	+1.9	+0.5	4.5

Authority.—Bibliography No. 58.

In the first area, which lies north of Cape Guardafui and includes Socotra, the maximum is at midnight and the minimum in the early afternoon; but in the other areas, which lie to the east and south of Socotra respectively, the variation is reversed and shows a maximum in the early afternoon and a minimum in the early morning. Here the range is about 4 knots, which is large for a sea area, especially where the speed of the wind is high. Detailed information about the variation of direction is lacking but apparently the change from SW. is very slight.

*The Gulf of Aden.*—The SW. monsoon usually sets in towards the end of May or early in June, shortly after it has become fully established over the western portion of the Arabian sea. It reaches its maximum strength in July. In contrast with India this is a dry season in the Gulf, the air is generally heavily laden with dust and the weather though fine is usually very hazy.

Near the eastern entrance to the Gulf SSW. winds prevail throughout June, July and August. The speed of the wind increases very rapidly as the entrance is approached from the west; in July the most frequent forces in long. 50-51° E. are 2 and 3, in long. 51-52° E. force 4 and in long. 53-54° E. force 6. Gales of force 8 and over show a corresponding increase, being infrequent in the Gulf but occurring on about 11 days a month in long. 53-54° E.

In the Gulf, June is an unsettled month with variable winds and uncertain weather; the winds are mainly light, only about 20 per cent. exceeding force 3, and calms are frequent. In July and August the winds blow chiefly from between S. and W. but they are not as steady in direction as during the NE. monsoon. In these months winds are stronger than in June; in July some 40 per cent. exceed force 3 and in August 25 per cent. The wind appears to be slightly stronger between long. 46° and 48° E. than elsewhere, the corresponding values there being about 50 and 30 per cent. There is said also to be usually more wind in the northern part of the Gulf than under the weather shore. Over the sea the wind freshens to gale force (Beaufort 8) on less than one day a month, and even in the areas where it blows strongest it reaches force 7 on only about 3 days. On the south coast gales are much more frequent (see page 59).

Ras Rahmat (14° 08' N., 48° 47' E.) takes its name "lull of the wind" from a term frequently used by the Arabs when it falls calm. It is said that dhows running up the coast during the early part of the SW. monsoon lose the violence of the wind when they round this cape. This, however, may be due simply to the protection afforded by the cape itself. There is some suggestion that the air in the western part of the Gulf is derived from the north-westerly winds of the Red sea, whereas in the east it belongs to the true SW. monsoon circulation.

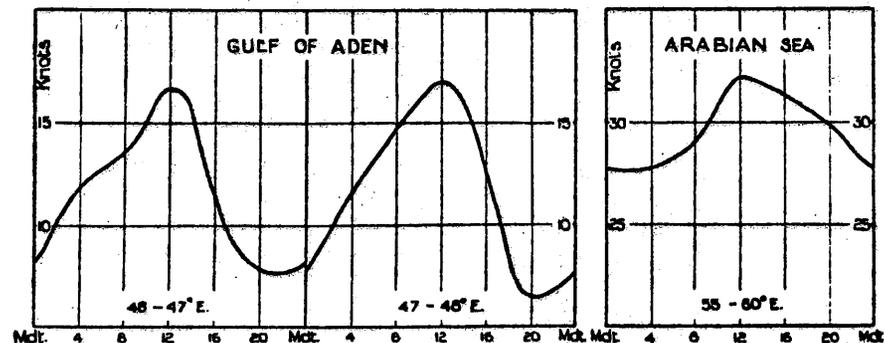


FIG. 18—DIURNAL VARIATION OF WIND SPEED OVER THE SEA IN JULY IN LATITUDE 12-13° N.

The diurnal variation of wind speed is similar to that over the Arabian sea east of Socotra, but the range is larger and is comparable with that at land stations; the variation is appreciable in direction as well as in speed. The results for July in two areas in latitude 12-13° N. are illustrated in Fig. 18 and for comparison data in the same latitude farther east (55-60° E.) are also shown. The diagrams indicate that in the Gulf the speed more than doubles between night and day, varying from about 7 knots at 2000 to 16½ knots at midday. It is noteworthy that the time of maximum speed lags 3 hours behind that at Berbera (see Fig. 19). In 46-47° E. in July the direction veers from 190° at midnight to about SW. (225°) at 1200; it remains SW. until about 2000 and then backs.

In Bab el Mandeb the wind during July and August blows chiefly from NW., about a third of the winds coming from that direction. There

is a tendency for it to be WNW. in July but NW. or NW.'N. in August. In this season its strength is little, if at all, greater than that in the Gulf and gales are rare. In the Gulf of Tajura the direction is chiefly from W.

Near the eastern end of the Gulf of Aden the SW. monsoon continues until October when winds become light and variable with NE. increasing in frequency towards the end of the month. Over the rest of the Gulf winds become lighter and more variable in September with frequent calms, light E. and NE. winds increasing as October draws near. Over Bab el Mandeb also, southerly winds (chiefly SE. and S.) show a well marked increase between September and October and become stronger.

*Coastal regions.*—On the south-east coast of Arabia from Ras Qusaiyir (Kusai'ir) to Ras al Hadd the SW. monsoon begins in May, sometimes with heavy squalls, rain and thunderstorms. It blows with full force from June to the end of August. The region of strongest wind and heaviest seas on the coast is between Ras Merbat and Masira island but in general the wind is not so strong as in the other zones of the Arabian sea. In September its strength abates and the monsoon blows as a moderate breeze from between S. and W. Very little information is available about land and sea breezes, but as the SW. monsoon blows strongly almost parallel to the coast they are not likely to be well marked; near the coast the monsoon may show a slight deflection off shore at night and on shore during the day.

At Ras al Hadd, for example, winds at night are light and blow almost exclusively from SW. or S. whereas in the afternoon they are from S. or SE. usually moderate in force and sometimes strong. At Masira island at the height of the monsoon there is little diurnal variation in direction but in June and September the wind sometimes backs to SE. in the afternoon. At this station the wind in July and August appears to blow more strongly at night than during the day.

At Salalah winds at night are mostly from SE. and S., they veer to S. and SW. as early as 1000 and blow almost continuously from those directions in the afternoon. They are usually light except in the afternoon in June when 90 per cent. are force 4 or 5.

At Socotra the SW. monsoon blows strongly from June to August. On the north coast it is said to blow incessantly in hard, violent gusts; on the low southern coast it is steadier and less violent, but there is tremendous surf on the shore. Observations in 1943 indicate that about 75 per cent. of the winds during daylight are force 6 and over.

On both the Arabian and African coasts of the Gulf of Aden squalls from the land are liable to occur (see pages 59-60). On the Arabian coast they come from N. and on the African from SW. Even though they occur chiefly at night they are often oppressively hot. Those on the African coast are said to last about an hour and to occur most often between midnight and 0400. Towards the end of the season northerly squalls of slightly different character occur near Aden; though they are accompanied by thick weather they carry no sand, are less violent and are not associated with a rise of the barometer.

The diurnal variation of wind is large on both the northern and southern shores and has some important features. Particulars for individual places are given below.

At Riyan winds at night are light and variable, at 0900 they blow chiefly from the SE. quadrant and in the afternoon from SW. (June and September SE.-SW.). In the early morning calms occur on about 50 per cent. of occasions and winds of over force 3 are rare, but in the afternoon calms are non-existent and more often than not the wind is of force 4 or more, not infrequently rising to force 6. The wind becomes lighter in September.

At Aden land and sea breezes are very well marked (Fig. 19). In the early morning the wind is light, averaging about 7 knots, calms are frequent and the direction may be anything between NE. through SE. to S.; as the day advances the speed of the wind increases and in the early afternoon it averages about 11-12 knots, exceeding force 3 on 30-35 per cent. of occasions from June to August, and blowing almost entirely from between SE. and S. (Earlier data showed more frequent winds from SW. probably owing to difference of exposure.). There seems to be a tendency for the NE. upper current to descend to lower levels in the late afternoon and evening, and it may be strong enough to overcome the monsoon so that a land breeze sets in at about 1700 and NE. winds predominate in the evening with frequent calms. The onset of the land wind is often sudden with gusts of 15-25 knots, though this feature is more common during the NE. monsoon. The land wind blows most strongly before midnight and frequently does not persist until dawn. Its depth is usually about 1,000 feet but sometimes it extends to 2,000 feet. The change to southerly wind may take place before dawn and is sometimes accompanied by a heavy gust from S. followed by a moderate to strong southerly wind lasting 10-20 minutes. The change in speed during the day is not limited to a shallow surface layer (see page 78), sometimes it is appreciable even up to 10,000 feet. In August 1940 the speed averaged over a layer 2,000 feet thick, showed a vector change of 35 knots on several occasions.

At Jibuti a light land breeze blows from S. in the night and early morning; from about 1000 a strong SW. wind is prevalent which reaches its greatest force between 1200 and 1400. There appears to be no sea breeze in this season.

At Berbera the diurnal variation is very striking, strong winds, known as kharif (see page 59), blowing persistently at night. Average conditions in July are illustrated in Fig. 19, and these are typical also of June and August (Table VI) though the speed, especially in June, is lower. On the average, the speed of the wind is greatest at about 0900, when its average is 22 knots in June, 30 knots in July and 27 knots in August. During the morning the wind decreases and veers rapidly. Between 1300 and 1500 the sea breeze sets in rather suddenly from NW. and blows with a speed of 7 to 12 knots for an hour or so, falling rapidly after about 1600. At sundown the wind is light and remains so until about 2100, when a land breeze from between SSW. and SW. sets in and persists with gradually increasing force, reaching its maximum speed about 12 hours after its onset, namely at 0900.

The anemogram of a typical day in July is reproduced in Fig. 16. It shows a gusty SW. wind at 1000 dying down gradually until 1330 but showing an increasing tendency towards instability. This wind had been blowing all night, reaching a speed of 35 knots with gusts of nearly

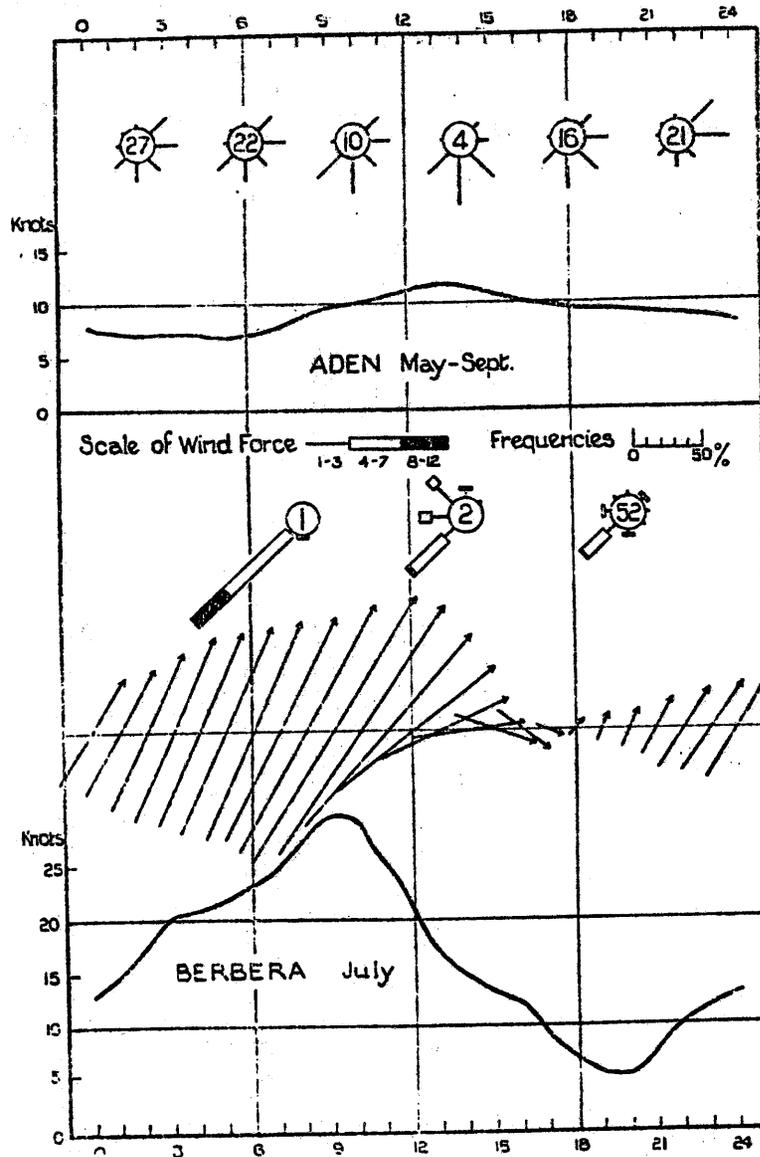


FIG. 19—DIURNAL VARIATION OF WIND AT ADEN AND BERBERA DURING THE SW. MONSOON

In the upper panel, for Aden, the frequencies of winds from the eight principal directions, without regard to force, are shown by wind roses, which represent the mean of hourly values over the four-hourly intervals in which the roses are centred. The average speed of the wind, without regard to direction, is represented by the curve immediately below.

In the lower panel, for Berbera, the frequencies of both the direction and force of the wind are shown on roses for the standard hours 0800, 1400 and 2000 (Z-3). The direction of the resultant wind at hourly intervals is represented by arrows the length of which shows the speed according to the vertical scales on the left. The average speed, without regard to direction, is shown by the curve at the foot of the diagram.

The scale of frequencies refers to both sets of roses and the figures inside the circles give the percentage frequency of calms.

The roses for Aden are from observations made in 1881-90 and differ slightly from the modern observations used for Figs. 2-13.

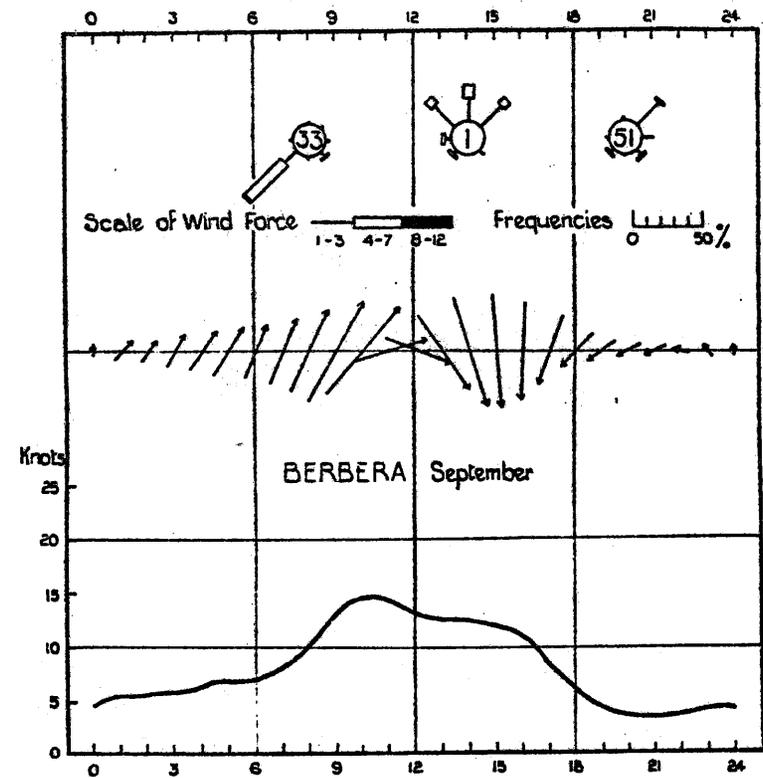


FIG. 20—DIURNAL VARIATION OF WIND AT BERBERA IN SEPTEMBER

The frequencies of both the direction and force of the wind are shown on roses for the standard hours 0800, 1400 and 2000 (Z-3). The figures inside the circles give the percentage frequency of calms. The direction of the resultant wind at hourly intervals is represented by arrows the length of which shows the speed according to the vertical scale on the left. The average speed, without regard to direction, is shown by the curve at the foot of the diagram.

50 knots at 0830. Suddenly between 1315 and 1330 the sea breeze set in and simultaneously convection ceased at the surface. The contrast of the gustiness of the SW. land wind compared with the stability of the on-shore sea breeze is noteworthy. The anemogram indicates a succession of about 8-12 gusts an hour with intervening lulls, with a free wind of 39 knots. This is compatible with a distance of  $4\frac{1}{2}$  miles between successive gusts and indicates that convection extends to some 4,000-7,000 feet. Aircraft are likely to encounter very bumpy conditions up to this level. The afternoon wind is characterised by absence of convection and stable air free from eddy motion. At sundown the wind fell calm and at 2230 the SW. wind reasserted its sway and continued throughout the night. Convection increased from 0920 onwards and became very great; at 1145 (not shown on the anemogram) the sea breeze arrived with a discontinuity of wind direction as abrupt as a sharp front. On some days at the height of the monsoon, strong SW. winds persist all through the day and these conditions sometimes last for 3 or 4 da

The outstanding feature of the table is the very high frequency of gales in July and August when the SW. monsoon is at its height, especially in the areas to the east and south of Socotra. The occurrence of occasional gales in the vicinity of Bab el Mandeb during the winter is also worthy of note. Their frequency is even greater further west over the southern Red sea (see Table II, page 136). In the strait strong southerly winds may blow for three or four days at a time in the early months of the year, causing poor visibility in the southern Red sea.

At Aden gales are seldom experienced though they are not entirely unknown. In the year 1940 there were none and even winds of force 6 were recorded only four times, once in March, twice in June and once in July; in 1941 there was 1 gale in July; in 1942, 1 in February and 1 in July.

At Perim gales occur chiefly during the months from October to March, but there is great variability from year to year. In 1941-2, for example, there were 33 in the six months—10 in October, 4 in December, 14 in January, 3 in February and 2 in March, whereas in 1940-1 there were none. The 10 gales in October occurred on consecutive days (19th-28th); they blew chiefly from SE. and rose to 45 knots. In January in the period from 8th-20th the wind reached gale force on all days except the 13th and 14th. Its direction was mainly from between E. and S., but on the 15th it blew with force 9 from SSW. Gales have been recorded at Perim during the months from June to August also, but not more than once or twice a year; the direction of the few that have been recorded is between N. and W.

At Berbera the kharif (see below) frequently reaches gale force from June to August and less frequently in September, almost always in the night or early morning. Gales have been recorded in all seasons, but of the average of 49 gale days in the year no less than 46 are recorded between June and September. The direction is almost invariably SW. During that period the speed may exceed 50 knots in gusts. The following table shows the highest gusts registered by the anemometer during the period June 1932 to December 1936:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
knots	37	32	31	33	40	55	54	54	49	29	31	36

Authority.—Bibliography No. 94.

#### Local winds

(i) Kharif is the name given to the strong south-westerly wind which blows on the African coast of the Gulf of Aden during the SW. monsoon.

It is not known exactly in what parts of the coast the kharif is experienced. It is felt at Berbera and probably for some distance to the east; but it is less likely to occur to the westward where the high land recedes from the coast, and in fact no mention is made of it in the information which exists for Jibuti and Zeila.

Particulars for Berbera, the only place for which detailed information is available, are given on pages 52-4; the wind blows persistently from June until the middle or end of August, being strongest from mid July to mid August; it is less frequent and lighter in September. Its force is 3 to 5 on the Beaufort scale, but not infrequently it reaches force

8 or 9. On the average at Berbera it reaches gale force on 19 days in July, on 11 and 13 days in June and August respectively, but on only 3 days in September. Over the sea the force decreases fairly rapidly with increasing distance from the coast but it sometimes blows as a fresh breeze about 30 miles off shore.

The kharif blows chiefly at night. It usually sets in rather suddenly about 2100 and gradually increases in force reaching its maximum about 0900. In general it decreases during the forenoon and in the afternoon is replaced by a sea breeze which lasts until sunset; at times, however, it continues all day and may blow incessantly for three or four days.

While the kharif is blowing the air is extremely dry, with a temperature varying between 105° and 115° F. in the day-time, and sometimes remaining as high as 100° F. even at night. The wind generally raises a great deal of sand which may reduce the visibility to less than  $\frac{1}{2}$  mile.

(ii) Hot dry winds from between NW. and NE. sometimes blow at places along the Arabian coast, in Bab el Mandeb and in French Somaliland. Winds of this type are known as khamisin in Egypt but this name is not in common use at Aden. They are more likely to occur during the period from May to September than at other times of the year; at Aden they are said to occur only 3 or 4 times a year. They may blow hard for 3 or 4 hours and sometimes longer. They generally spring up without warning either from the appearance of the weather or the behaviour of the barometer. As the wind sets in the pressure usually rises rapidly and there may be much lightning while it lasts. The air is very dry and the temperature sometimes rises 15-20° F., making the weather unbearably hot; sand adds to the general discomfort. The visibility, both vertical and horizontal, is considerably reduced, sometimes almost to nil. On the Arabian coast the monsoon sometimes drops to calm before the NW.-NE. winds set in, and the wind may later veer to E.

In French Somaliland the direction of these desert winds is from NW.-N. They are experienced at Obok where in June 1892 they are reputed to have blown incessantly for 7 days; they are less frequent at Jibuti, 30 miles or so to the south. They usually set in about 1300 and cease between 2000 and midnight, but they may start again next morning with renewed violence and may blow on 3 or 4 consecutive days. If they set in before midday with squalls they are likely to last longer and be more violent than if they start in the late afternoon. A local prognostic is the appearance of thunder cumulus on the tops of the Mabila hills. The sea is calm and leaden, and a bank of cloud appears along the horizon. Whirlwinds of sand appear on the Obok plateau moving from west to east along the edge of the highlands and soon the wind increases suddenly and the sea gets up.

These winds are dangerous to shipping; they are always squally, their speed is variable but may reach over 50 knots, and they may raise a layer of dust several hundred feet thick. They have been known to break down masts and yards and to raise such large waves in the Gulf of Tajura that traffic is suspended even for large ships.

(iii) On the south-east coast of Arabia strong winds from the land with direction about NNW. sometimes blow during the cool season from

mid December to mid March. They are said to occur usually between Ras Sajar and Masira island, but a wind of similar characteristics has been observed early in December in  $14^{\circ}$  N.,  $50^{\circ}$  E. They blow very strongly in Khorya Morya bay.

They usually set in between midnight and 4 a.m. as a light breeze and may increase to a moderate gale in about an hour, ceasing about noon as suddenly as they began. They sometimes blow for several consecutive days and are often succeeded by strong SE. winds accompanied by swell.

These winds are liable to be dangerous to sailing vessels close inshore owing to violent squalls which may set in without warning, blowing from the mountains at intervals of a few minutes and sometimes continuing to do so for several hours.

The atmosphere is always hazy when these winds are blowing and they are frequently associated with a dense sandstorm, especially near the land. Their onset is indicated by a faint hazy arch over the land on the previous evening, or by the wind shifting towards a landward direction, sometimes in sudden gusts, early in the night. Winds of this character are sometimes called Belat but the name is not in regular use.

(iv) On the coast of French Somaliland a wind from due W. sometimes blows in the morning in summer; it begins and ends abruptly and is confined to the hours between 0800 and 1100. It is always very violent and gusty and makes a characteristic roar as it rushes through the Ghubbet Kharab pass. It is always fresh and is often accompanied by drops of rain. Its onset is usually preceded by the heaping up of cloud on the summit and western slopes of the Gouda mountains and by lightning flashes. It has been called locally the wind of Saba.

## 2.—UPPER WINDS

Observations of upper winds are available for Socotra, Salalah, Riyan, Aden, Perim, Berbera, Bander Kassim and Cape Guardafui. Seasonal wind roses for these places are reproduced in Figs. 22-32, except at Cape Guardafui for which monthly roses are given. The data on which the roses are based are given in Tables VII and VIII, pages 151-60. Some 1,200 ascents were made at Mogadiscio in 1932-3, but are not in a form suitable for wind roses; a few data from H.M. ships have also been used in writing the text but are not reproduced in detail.

[While this Part has been passing through the press additional data for recent months have been received for several of the above coastal stations, as well as 13 months' observations for Masira island. These data have been incorporated in the tables but not in the diagrams.]

The diurnal variation of the wind at levels below 5,000-6,000 feet at Aden in March-May and at Berbera in the NE. and SW. monsoons is illustrated in Figs. 33-4. The corresponding data are given in Table IX. In compiling these roses only those days were used when observations were available for both the morning and afternoon of the same day. Although they are based on very few observations they are sufficient to give a general idea of the major diurnal changes in the seasons represented. [Further details for Aden are included in a summary of a note recently received from the Meteorological Officer there, see page 78.] At Cape

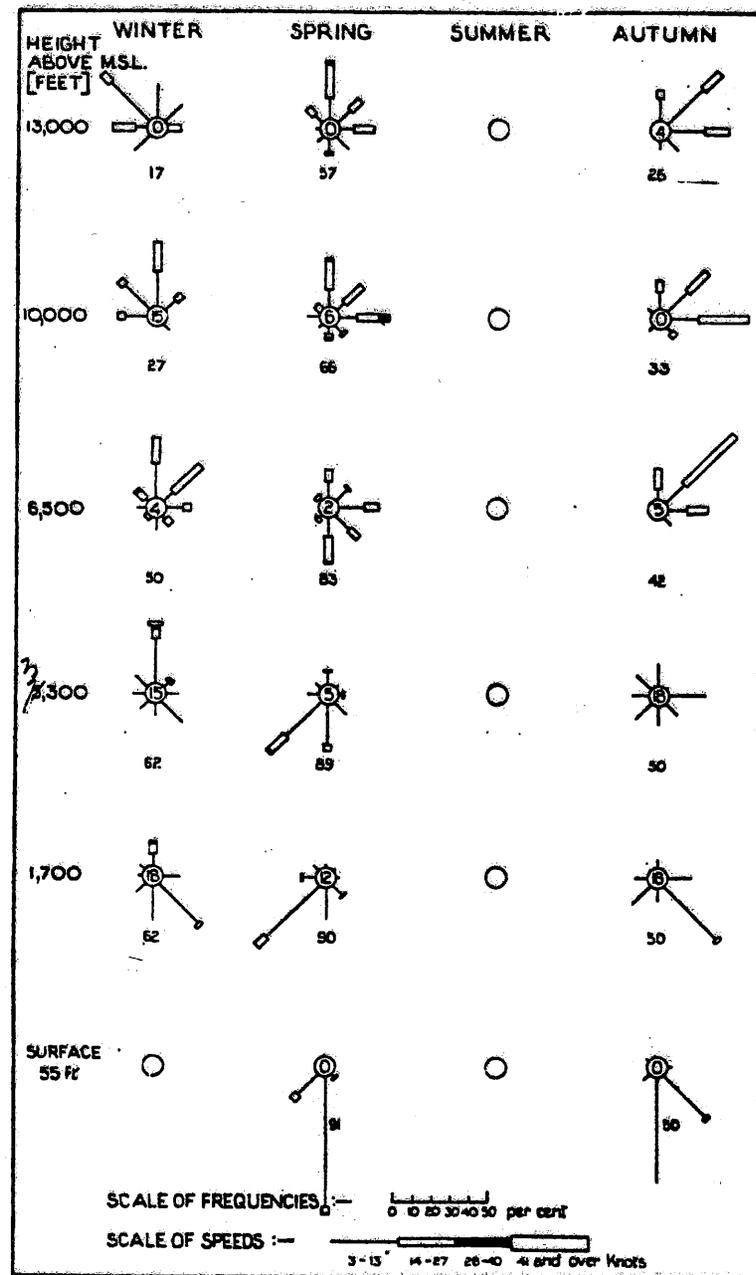


FIG. 22—UPPER WINDS—SEASONAL  
Time of observation: 1400-1600 (Z-4).

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

The roses are for the period October 1942-May 1943. Data for a longer period, including the SW. monsoon, are given in Table VII.

Erratum.—For 5,300 feet read 3,300 feet.

This diurnal variation is not merely a local phenomenon confined to the coasts but extends also over the sea (see page 50) and is felt up to a height of some 3,000–4,000 feet (see page 73).

At Berbera conditions in September (Fig. 20) are transitional. The most notable difference from the earlier months is that the land wind is much weaker and reaches its greatest speed of about 15 knots between 1000 and 1100, an hour or so later than in June–August. The sea breeze, on the other hand, is steadier. It sets in about noon, after which its direction veers, becoming N. at 1500 and NE. at 1800. It dies down rapidly at sundown.

East of Berbera the diurnal variation is similar to that at Berbera itself with a strong SW. wind setting in suddenly about 2200 and continuing until about 1200 on the following day. Particulars of the time when it reaches its greatest strength in different parts are not available but where the coast is steeper it is possible that the highest speeds may occur earlier than at Berbera.

At Bander Kassim in July and August over 90 per cent. of the winds at 0500 and 0900 blow from SE. (S. or SE. in June) whereas at 1500 over 80 per cent. are from W. or NW. (NW. or N. in June). At the morning hours in July and August over 80 per cent. are of force 4 or over and in the afternoon less than 15 per cent.

Near Cape Guardafui the winds blow steadily from SSE., reaching their greatest force in July. The direction is probably due to the configuration of the coast. Southwards to 4° N. the monsoon blows from SSW. Near the coast light SW. winds blow at night, backing to SSE. and strengthening during the afternoon, but this variation does not extend more than about fifteen miles from the coast. Twenty or thirty miles off shore the monsoon frequently reaches gale force, especially in July and August. Between 4° N. and the equator winds are SE.–SSW. from May to July, light or moderate SSW. in August and light S. or SSE. in September. At Mogadiscio S. and SW. winds prevail from June to August and calms reach their lowest frequency.

**Transition season (October and November).—Open sea.**—The greater part of the transition from the SW. to the NE. monsoon takes place in October, during which month the winds over the western Arabian sea are very light and variable. The NE. monsoon sets in off the south-east coast of Arabia about mid October and gradually increases in strength and spreads southwards during November without, however, reaching the equator in long. 55–60° E. until the close of that month.

In October north of 10° N. the winds are chiefly from the NE. quadrant, light in force and with frequent calms. South of 10° N. the winds are light, blowing chiefly from some southerly direction in the west, and from between SW. and N. in the east. Over the whole area more than 80 per cent. of the winds are of force 3 or less.

By November the NE. monsoon is well established except in the extreme south, and some 50 per cent. of the winds blow from NE. They are still comparatively light and except near the mouth of the Gulf of Aden and in the area immediately to the south some 70 or 75 per cent. are of force 3 or less.

**Gulf of Aden.**—Near the eastern entrance to the Gulf, where the SW. monsoon continues to blow with moderate strength throughout September, there is a well marked change in October, when winds become light and variable but chiefly NE. and E. By November they strengthen again and blow persistently from NE. The frequency of winds of force 4 and over in September, October and November in long. 51–52° E. is 41, 11 and 22 and in long. 53–54° E. 58, 11 and 24.

Within the Gulf the light variable winds of September are succeeded by light E. or NE. winds in October and these strengthen slightly in November. In October some 15 per cent. and in November 18 per cent. exceed force 3. In October the winds at the eastern end, 49–51° E., are lighter than elsewhere. In Bab el Mandeb the light winds of September are replaced by light to moderate SE. or S. winds in October and these strengthen still further in November. The wind in the strait is much stronger than in the Gulf. Between long. 43° and 44° E. 51 per cent. of the winds in October and 57 per cent. in November exceed force 3.

**Coastal regions.**—Off the south-east coast of Arabia the winds in October are light and variable with frequent calms. Land and sea breezes become prominent again during this period of light winds. They begin to be noticeable in October and increase in frequency in November. The direction of the sea breeze is SE.–SSE. Between Ras al Hadd and Masira island the land breeze is usually light and of short duration; westward of Masira island land breezes are rare. About this time of year a strong NE. wind is not unusual and gives rise to short choppy seas.

In October winds at night at both Ras al Hadd and Masira island are light and somewhat variable but chiefly from the west, they strengthen in the afternoon and become northerly at Ras al Hadd and easterly or south-easterly at Masira island. In November conditions at Ras al Hadd are similar to those in October, except that winds at all times are rather stronger; at Masira island winds between N. and E. prevail at all hours of the day.

At Salalah in October winds in the early morning are chiefly northerly, becoming SE.–SW. by 1000. In November the sea breeze does not set in so early and at 1000 winds are variable, though they become SE. or S. in the afternoon. On October mornings until at least as late as 1000 the wind rarely exceeds force 3, but by 1600 about 40 per cent. of the winds are of force 4 and over; they fall light again by 2200.

At Socotra light land and sea breezes are experienced from September to mid November. Judging by observations on the north of the island the wind falls calm at night and blows with light or moderate strength from NE. during the day.

Very little information is available for the shores of the Gulf of Aden.

At Riyan winds at night are northerly, veering to easterly at 0900 and south-easterly in the afternoon, when about 20 per cent. in October and 35 per cent. in November exceed force 3.

At Aden winds at night and in the morning are chiefly from NE. and N., becoming southerly in the afternoon; the strengthening during the day is less noticeable than at Riyan, only about 13 per cent. exceeding force 3.

At Berbera conditions in October and November differ little from those during the NE. monsoon. Light SE.-S. winds prevail during the night from about 2200, strengthening to 6 knots at 0700 and then falling calm. A sea breeze from N. sets in somewhat abruptly about 1100 with a speed of 7 knots, increasing to 15 knots by 1500. It veers gradually during the day, becoming ENE. by 2100. Conditions along the coast to the east of Berbera are probably similar.

A single year's observations at Bander Kassim indicate that there the northerly sea winds are apparent as early as 0900, and in the afternoon winds blow almost entirely from between NW. and NE. some 30 per cent. exceeding force 3.

At Cape Guardafui SSE. winds prevail in October but the direction is probably due to local configuration; the wind is very light and there are frequent calms; N. winds predominate in November. In October between Cape Guardafui and Ras Hafun the direction is NE.-E.; southwards to 4° N. there is a tendency to NE.-E. winds, but there are frequent calms; south of 4° N. light southerly winds prevail. Near Ras Hafun the NE. monsoon does not set in in strength until the beginning of November; in latitude 5° N. the change occurs in about the middle of that month and near the equator it is somewhat later. The period of change lasts about a fortnight during which time winds are variable with calms, overcast sky and showers of rain.

Near the equator calms reach their highest frequency in October and November.

Wind speed over the sea

The annual variation of wind speed in different longitudes along the Gulf of Aden and in the same latitude of the Arabian sea further east is

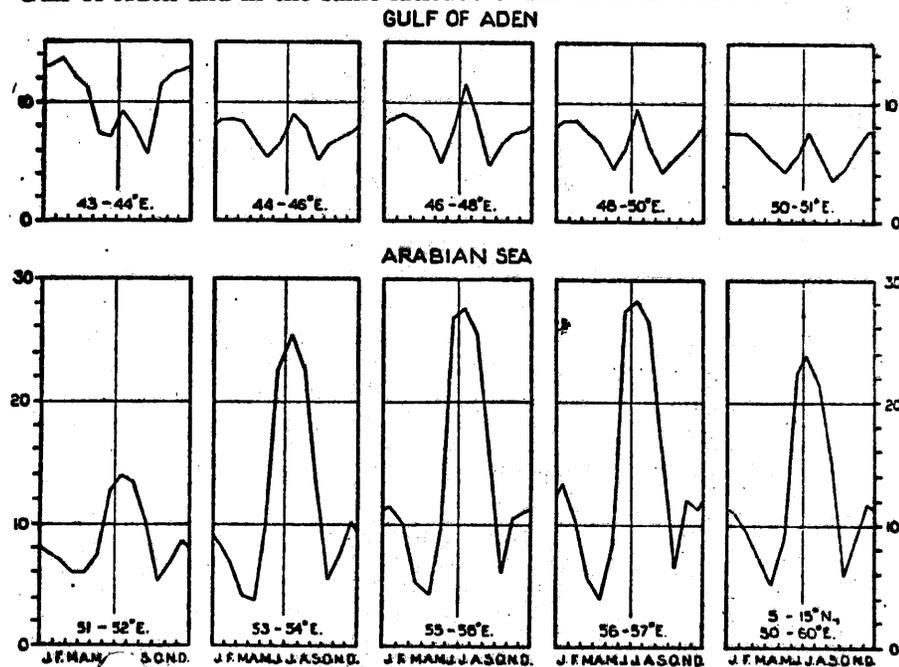


FIG. 21.—ANNUAL VARIATION OF WIND SPEED OVER THE SEA. The speeds in knots have been computed from the tables below Figs. 2-13.

illustrated in Fig. 21 and similar information for a ten-degree area of the Arabian sea is added for comparison. The speeds have been computed from the frequencies of different forces given in the tables on pages 18-41.

Everywhere the winds are strongest during the monsoons. During the intervening periods, May and September in the Gulf and April and October over the open sea, winds are light of about force 2. Except in the west of the Gulf near Bab el Mandeb the SW. monsoon is stronger than the NE. Within the Gulf of Aden the average difference is less than 3 knots, but over the open sea near the east entrance to the Gulf the difference amounts to as much as 17 knots, the speed in July exceeding 25 knots compared with 9 knots in January.

The gradual increase in speed from west to east along the Gulf in July as far as 48° E. is noteworthy, farther east there is a slight weakening followed by a very well marked strengthening over the open sea, where the shelter of the African coast is lost.

Another feature of interest is the local strengthening of the wind in the strait at the western end of the Gulf. Except during the SW. monsoon the speed in the strait is at least 4 knots higher than elsewhere in the Gulf.

Gales

The percentage frequency of gales, Beaufort force 8 and over, in each month is included in Table II in the columns headed III, and in more detail for the Gulf of Aden in the tables on pages 18-41. For convenience the figures are collected together in the table below:—

PERCENTAGE FREQUENCY OF GALES (Beaufort force 8 and over)

Area	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>per cent.</i>												
GULF OF ADEN												
43-44° E.	..	.4	1	.9	-	-	.5	-	-	.5	-	.8
44-45° E.	..	-	-	-	-	-	-	2	-	-	-	-
45-46° E.	..	-	-	-	.2	-	.6	2	-	-	-	-
46-47° E.	..	-	-	-	-	-	2	.8	-	-	-	-
47-48° E.	..	-	-	-	-	-	.8	.9	-	-	-	-
48-49° E.	..	-	-	-	-	-	1	.8	-	-	.4	-
49-50° E.	..	-	-	-	-	-	1	2	-	-	-	-
50-51° E.	..	-	-	-	-	-	-	.5	-	-	-	-
EASTERN ENTRANCE TO GULF OF ADEN												
51-52° E.	..	-	-	-	-	3	3	.6	.6	-	.4	-
53-54° E.	..	-	-	-	-	16	17	9	.8	-	.4	-
EAST OF SOCOTRA												
55-56° E.	..	-	-	-	4	17	24	16	1	-	1	-
56-57° E.	..	-	-	-	1	15	24	20	1	-	-	-
ARABIAN SEA												
15-20° N.												
50°-55° E.*	..	-	-	1	-	-	2	6	-	-	-	-
55-60° E.	..	-	-	-	-	3	8	8	-	-	.3	-
10-15° N.												
50-55° E.	..	-	.1	-	-	.5	10	12	9	2	.2	.3
55-60° E.	..	-	-	-	-	.7	14	20	13	.6	-	.8
5-10° N.												
50-55° E.*	..	-	-	-	-	11	14	10	2	-	-	-
55-60° E.*	..	-	-	-	-	5	5	6	-	-	-	-
0-5° N.												
45-50° E.*	..	-	-	-	-	-	-	-	-	-	-	-
50-55° E.*	..	-	-	-	.6	-	-	-	-	-	-	-
55-60° E.*	..	-	-	-	-	.9	-	-	-	-	-	-

Authority.—Bibliography No. 94.

\* In many months the number of observations in these areas is too small to give a reliable normal (see Table II).

A frequency of 5 per cent. represents about 4 days/month, 10 per cent. 8 days/month, 20 per cent. 13 days/month, 25 per cent. 16 days/month.

This diurnal variation is not merely a local phenomenon confined to the coasts but extends also over the sea (see page 50) and is felt up to a height of some 3,000–4,000 feet (see page 73).

At Berbera conditions in September (Fig. 20) are transitional. The most notable difference from the earlier months is that the land wind is much weaker and reaches its greatest speed of about 15 knots between 1000 and 1100, an hour or so later than in June–August. The sea breeze, on the other hand, is steadier. It sets in about noon, after which its direction veers, becoming N. at 1500 and NE. at 1800. It dies down rapidly at sundown.

East of Berbera the diurnal variation is similar to that at Berbera itself with a strong SW. wind setting in suddenly about 2200 and continuing until about 1200 on the following day. Particulars of the time when it reaches its greatest strength in different parts are not available but where the coast is steeper it is possible that the highest speeds may occur earlier than at Berbera.

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Near Cape Guardafui the winds blow steadily from SSE., reaching their greatest force in July. The direction is probably due to the configuration of the coast. Southwards to 4° N. the monsoon blows from SSW. Near the coast light SW. winds blow at night, backing to SSE. and strengthening during the afternoon, but this variation does not extend more than about fifteen miles from the coast. Twenty or thirty miles off shore the monsoon frequently reaches gale force, especially in July and August. Between 4° N. and the equator winds are SE.–SSW. from May to July, light or moderate SSW. in August and light S. or SSE. in September. At Mogadiscio S. and SW. winds prevail from June to August and calms reach their lowest frequency.

**Transition season (October and November).—Open sea.**—The greater part of the transition from the SW. to the NE. monsoon takes place in October, during which month the winds over the western Arabian sea are very light and variable. The NE. monsoon sets in off the south-east coast of Arabia about mid October and gradually increases in strength and spreads southwards during November without, however, reaching the equator in long. 55–60° E. until the close of that month.

In October north of 10° N. the winds are chiefly from the NE. quadrant, light in force and with frequent calms. South of 10° N. the winds are light, blowing chiefly from some southerly direction in the west, and from between SW. and N. in the east. Over the whole area more than 80 per cent. of the winds are of force 3 or less.

By November the NE. monsoon is well established except in the extreme south, and some 50 per cent. of the winds blow from NE. They are still comparatively light and except near the mouth of the Gulf of Aden and in the area immediately to the south some 70 or 75 per cent. are of force 3 or less.

**Gulf of Aden.**—Near the eastern entrance to the Gulf, where the SW. monsoon continues to blow with moderate strength throughout September, there is a well marked change in October, when winds become light and variable but chiefly NE. and E. By November they strengthen again and blow persistently from NE. The frequency of winds of force 4 and over in September, October and November in long. 51–52° E. is 41, 11 and 22 and in long. 53–54° E. 58, 11 and 24.

Within the Gulf the light variable winds of September are succeeded by light E. or NE. winds in October and these strengthen slightly in November. In October some 15 per cent. and in November 18 per cent. exceed force 3. In October the winds at the eastern end, 49–51° E., are lighter than elsewhere. In Bab el Mandeb the light winds of September are replaced by light to moderate SE. or S. winds in October and these strengthen still further in November. The wind in the strait is much stronger than in the Gulf. Between long. 43° and 44° E. 51 per cent. of the winds in October and 57 per cent. in November exceed force 3.

**Coastal regions.**—Off the south-east coast of Arabia the winds in October are light and variable with frequent calms. Land and sea breezes become prominent again during this period of light winds. They begin to be noticeable in October and increase in frequency in November. The direction of the sea breeze is SE.–SSE. Between Ras al Hadd and Masira island the land breeze is usually light and of short duration; westward of Masira island land breezes are rare. About this time of year a strong NE. wind is not unusual and gives rise to short choppy seas.

In October winds at night at both Ras al Hadd and Masira island are light and somewhat variable but chiefly from the west, they strengthen in the afternoon and become northerly at Ras al Hadd and easterly or south-easterly at Masira island. In November conditions at Ras al Hadd are similar to those in October, except that winds at all times are rather stronger; at Masira island winds between N. and E. prevail at all hours of the day.

At Salalah in October winds in the early morning are chiefly northerly, becoming SE.–SW. by 1000. In November the sea breeze does not set in so early and at 1000 winds are variable, though they become SE. or S. in the afternoon. On October mornings until at least as late as 1000 the wind rarely exceeds force 3, but by 1600 about 40 per cent. of the winds are of force 4 and over; they fall light again by 2200.

At Socotra light land and sea breezes are experienced from September to mid November. Judging by observations on the north of the island the wind falls calm at night and blows with light or moderate strength from NE. during the day.

Very little information is available for the shores of the Gulf of Aden.

At Riyan winds at night are northerly, veering to easterly at 0900 and south-easterly in the afternoon, when about 20 per cent. in October and 35 per cent. in November exceed force 3.

At Aden winds at night and in the morning are chiefly from NE. and N., becoming southerly in the afternoon; the strengthening during the day is less noticeable than at Riyan, only about 13 per cent. exceeding force 3.

At Berbera conditions in October and November differ little from those during the NE. monsoon. Light SE.-S. winds prevail during the night from about 2200, strengthening to 6 knots at 0700 and then falling calm. A sea breeze from N. sets in somewhat abruptly about 1100 with a speed of 7 knots, increasing to 15 knots by 1500. It veers gradually during the day, becoming ENE. by 2100. Conditions along the coast to the east of Berbera are probably similar.

A single year's observations at Bander Kassim indicate that there the northerly sea winds are apparent as early as 0900, and in the afternoon winds blow almost entirely from between NW. and NE. some 30 per cent. exceeding force 3.

At Cape Guardafui SSE. winds prevail in October but the direction is probably due to local configuration; the wind is very light and there are frequent calms; N. winds predominate in November. In October between Cape Guardafui and Ras Hafun the direction is NE.-E.; southwards to 4° N. there is a tendency to NE.-E. winds, but there are frequent calms; south of 4° N. light southerly winds prevail. Near Ras Hafun the NE. monsoon does not set in in strength until the beginning of November; in latitude 5° N. the change occurs in about the middle of that month and near the equator it is somewhat later. The period of change lasts about a fortnight during which time winds are variable with calms, overcast sky and showers of rain.

Near the equator calms reach their highest frequency in October and November.

Wind speed over the sea

The annual variation of wind speed in different longitudes along the Gulf of Aden and in the same latitude of the Arabian sea further east is

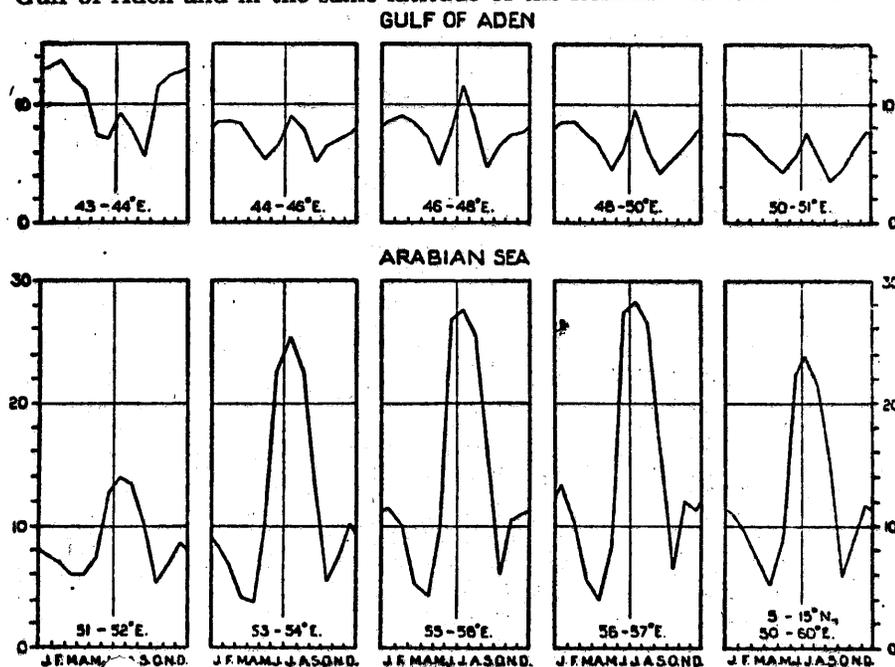


FIG. 21.—ANNUAL VARIATION OF WIND SPEED OVER THE SEA  
The speeds in knots have been computed from the tables below Figs. 2-13.

illustrated in Fig. 21 and similar information for a ten-degree area of the Arabian sea is added for comparison. The speeds have been computed from the frequencies of different forces given in the tables on pages 18-41.

Everywhere the winds are strongest during the monsoons. During the intervening periods, May and September in the Gulf and April and October over the open sea, winds are light of about force 2. Except in the west of the Gulf near Bab el Mandeb the SW. monsoon is stronger than the NE. Within the Gulf of Aden the average difference is less than 3 knots, but over the open sea near the east entrance to the Gulf the difference amounts to as much as 17 knots, the speed in July exceeding 25 knots compared with 9 knots in January.

The gradual increase in speed from west to east along the Gulf in July as far as 48° E. is noteworthy, farther east there is a slight weakening followed by a very well marked strengthening over the open sea, where the shelter of the African coast is lost.

Another feature of interest is the local strengthening of the wind in the strait at the western end of the Gulf. Except during the SW. monsoon the speed in the strait is at least 4 knots higher than elsewhere in the Gulf.

Gales

The percentage frequency of gales, Beaufort force 8 and over, in each month is included in Table II in the columns headed III, and in more detail for the Gulf of Aden in the tables on pages 18-41. For convenience the figures are collected together in the table below:—

Area	PERCENTAGE FREQUENCY OF GALES (Beaufort force 8 and over)											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>per cent.</i>												
GULF OF ADEN												
43-44° E.	..	.4	1	.9	-	-	.5	-	-	.5	-	.8
44-45° E.	..	-	-	-	-	-	-	2	-	-	-	-
45-46° E.	..	-	-	-	.2	-	.6	2	-	-	-	-
46-47° E.	..	-	-	-	-	2	.8	-	-	-	-	-
47-48° E.	..	-	-	-	-	-	.8	-	-	-	-	-
48-49° E.	..	-	-	-	-	1	.8	-	-	-	.4	-
49-50° E.	..	-	-	-	-	1	2	-	-	-	-	-
50-51° E.	..	-	-	-	-	-	.5	-	-	-	-	-
EASTERN ENTRANCE TO GULF OF ADEN												
51-52° E.	..	-	-	-	-	3	3	.6	.6	-	-	-
53-54° E.	..	-	-	-	-	16	17	9	.8	-	.4	-
EAST OF SOCOTRA												
55-56° E.	..	-	-	-	4	17	24	16	1	-	1	-
56-57° E.	..	-	-	-	1	15	24	20	1	-	-	-
ARABIAN SEA												
15-20° N.												
50-55° E.*	..	-	-	1	-	-	2	6	-	-	-	-
55-60° E.	..	-	-	-	-	3	8	8	-	-	.3	-
10-15° N.												
50-55° E.	..	-	.1	-	.5	10	12	9	2	.2	.3	-
55-60° E.	..	-	-	-	.7	14	20	13	.6	-	-	.8
5-10° N.												
50-55° E.*	..	-	-	-	-	11	14	10	2	-	-	-
55-60° E.*	..	-	-	-	-	5	5	6	-	-	-	-
0-5° N.												
45-50° E.*	..	-	-	-	-	-	-	-	-	-	-	-
50-55° E.*	..	-	-	-	.6	-	-	-	-	-	-	-
55-60° E.*	..	-	-	-	-	.9	-	-	-	-	-	-

30

Authority.—Bibliography No. 94.

\* In many months the number of observations in these areas is too small to give a reliable normal (see Table II).

A frequency of 5 per cent. represents about 4 days/month, 10 per cent. 8 days/month, 20 per cent. 13 days/month, 25 per cent. 16 days/month.

Upper winds

2 63

RIYAN : 14° 39' N., 49° 23' E.

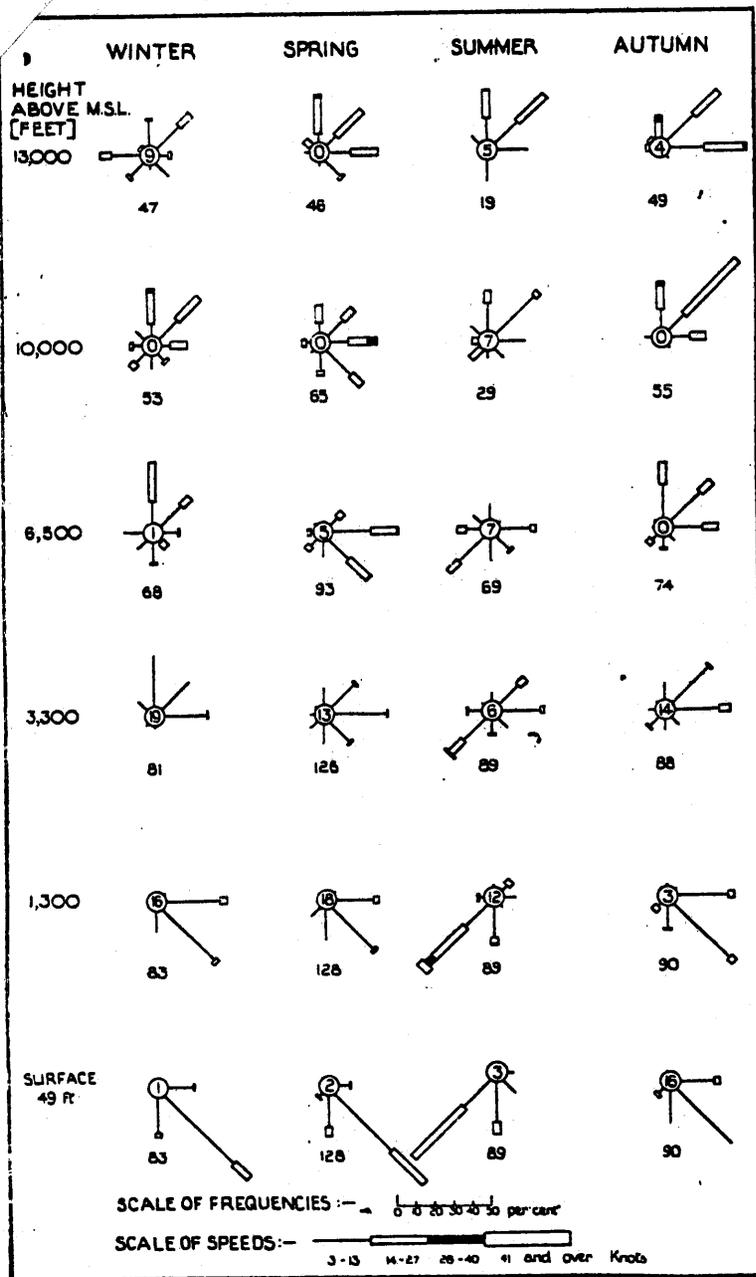


FIG. 23—UPPER WINDS—SEASONAL  
Time of observation : 1330-1700 (Z-3).

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.  
The roses are for the period April 1942-May 1943. Data for a longer period are given in Table VII.

2 64

The Gulf of Aden

ADEN : 12° 47' N., 44° 59' E.

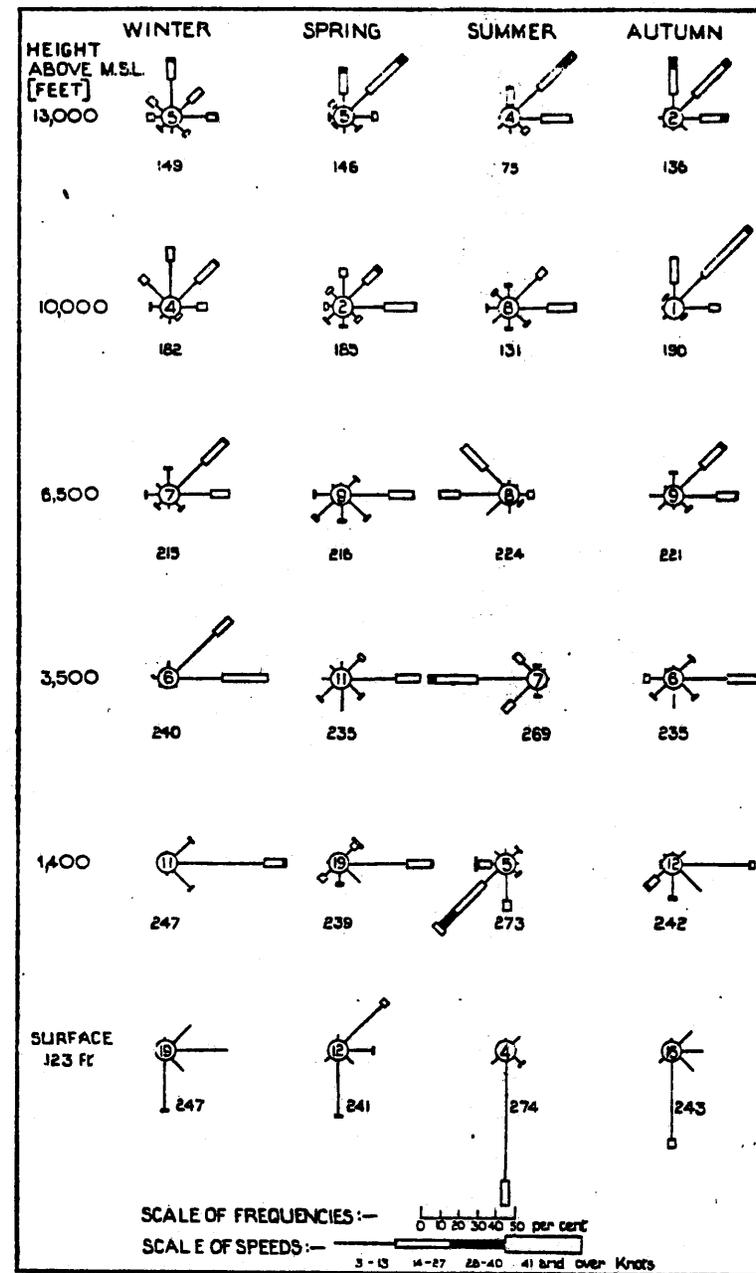


FIG. 24—UPPER WINDS—SEASONAL  
Time of observation : 1500-1600 (Z-3).

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

Upper winds

2 65

PERIM : 12° 39' N., 43° 24' E.

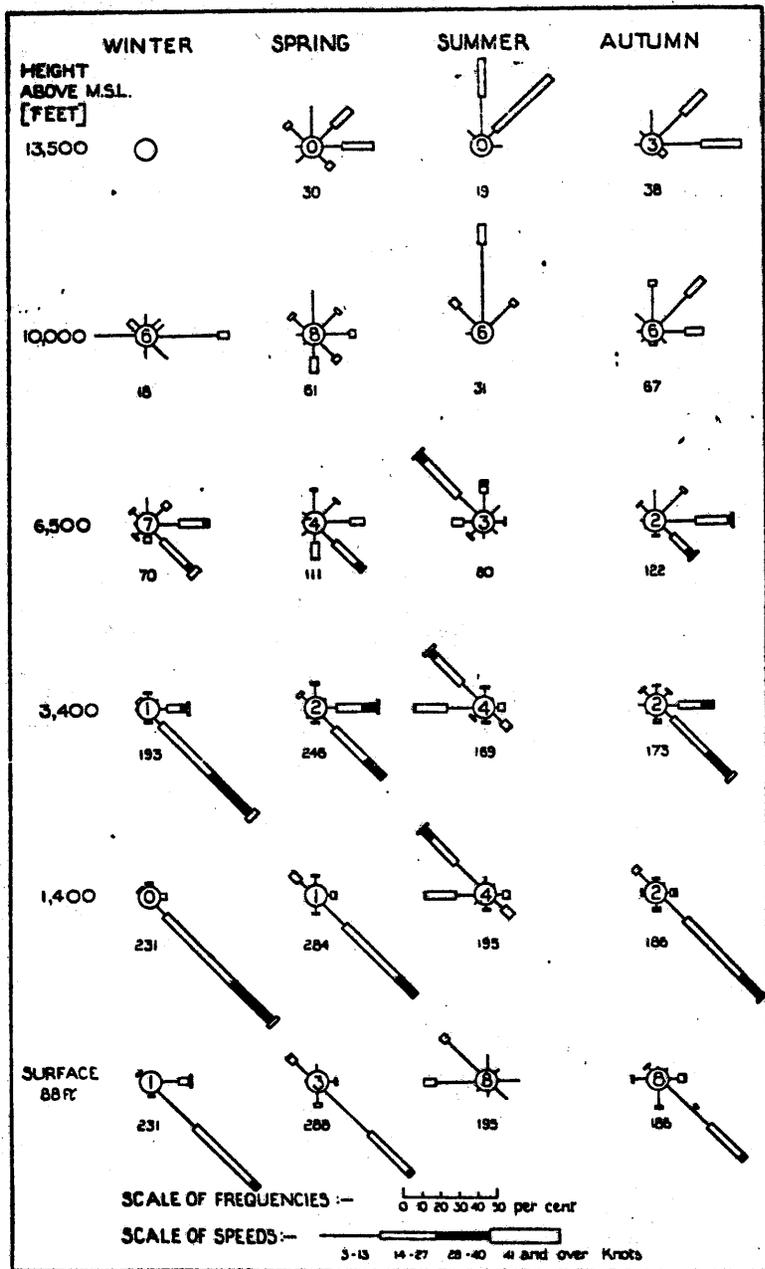


FIG. 25—UPPER WINDS—SEASONAL

Time of observation : 0600-0900 (Z-3).

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

2 66

The Gulf of Aden

BERBERA : 10° 22' N., 45° 02' E.

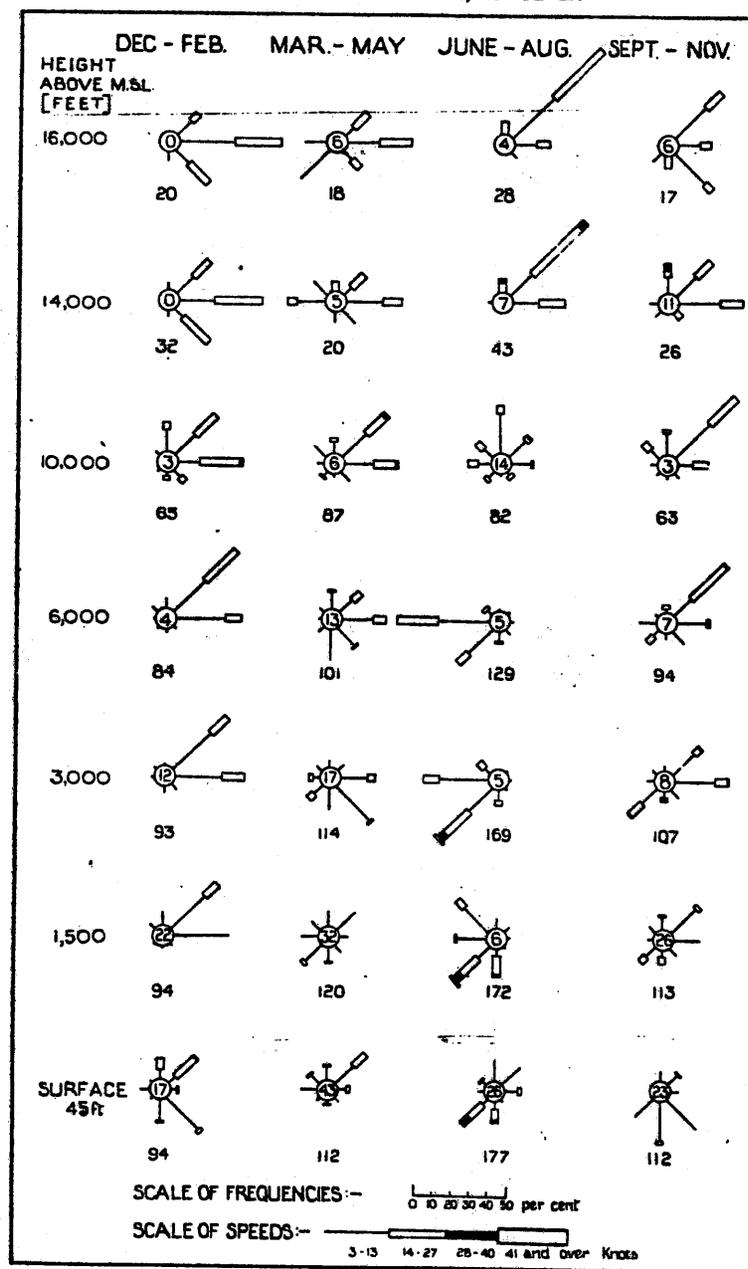


FIG. 26—UPPER WINDS—SEASONAL

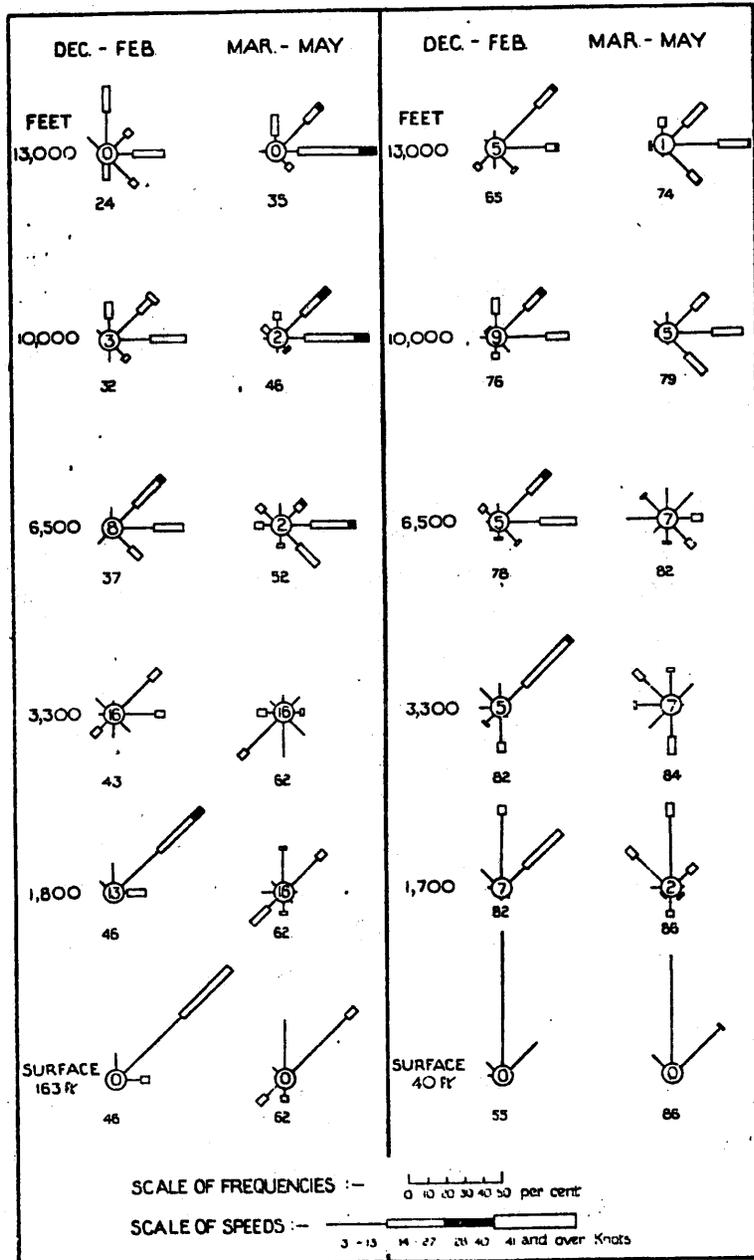
Time of observation : morning and afternoon.

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. Observations at 20,000 ft. for June-August are included in Table VII.

SOCOTRA  
12° 38' N., 53° 53' E.

BANDER KASSIM  
11° 17' N., 49° 10' E.

CAPE GUARDAFUI: 11° 44' N., 51° 15' E.



FIGS. 27-8—UPPER WINDS—SEASONAL

Times of observation: Socotra, 1300 (Z-3); Bander Kassim, 1300-1700 (Z-3).

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

The roses at Socotra are for the period November 1942-May 1943 and at Bander Kassim for December 1942-May 1943. Data for a longer period, including the other seasons, are given in Table VII.

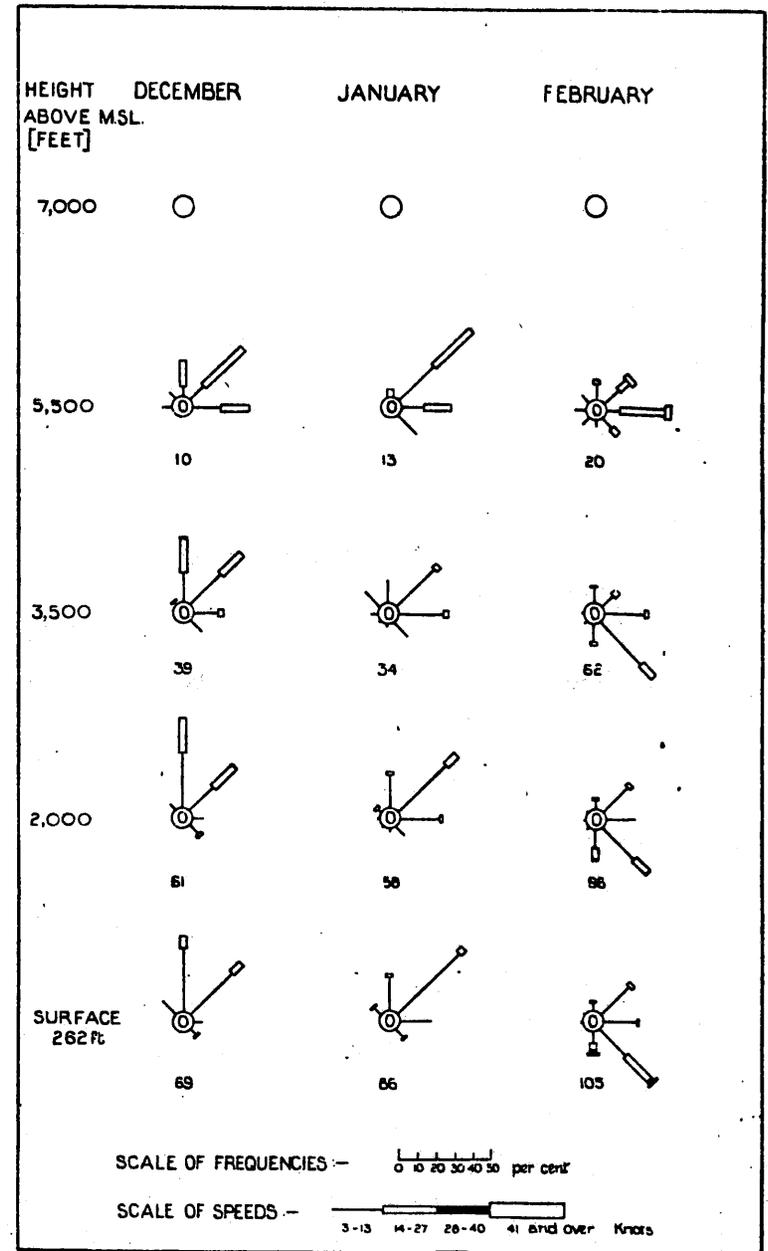


FIG. 29—UPPER WINDS—MONTHLY

Time of observation: morning.

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

CAPE GUARDAFUI: 11° 44' N., 51° 15' E.

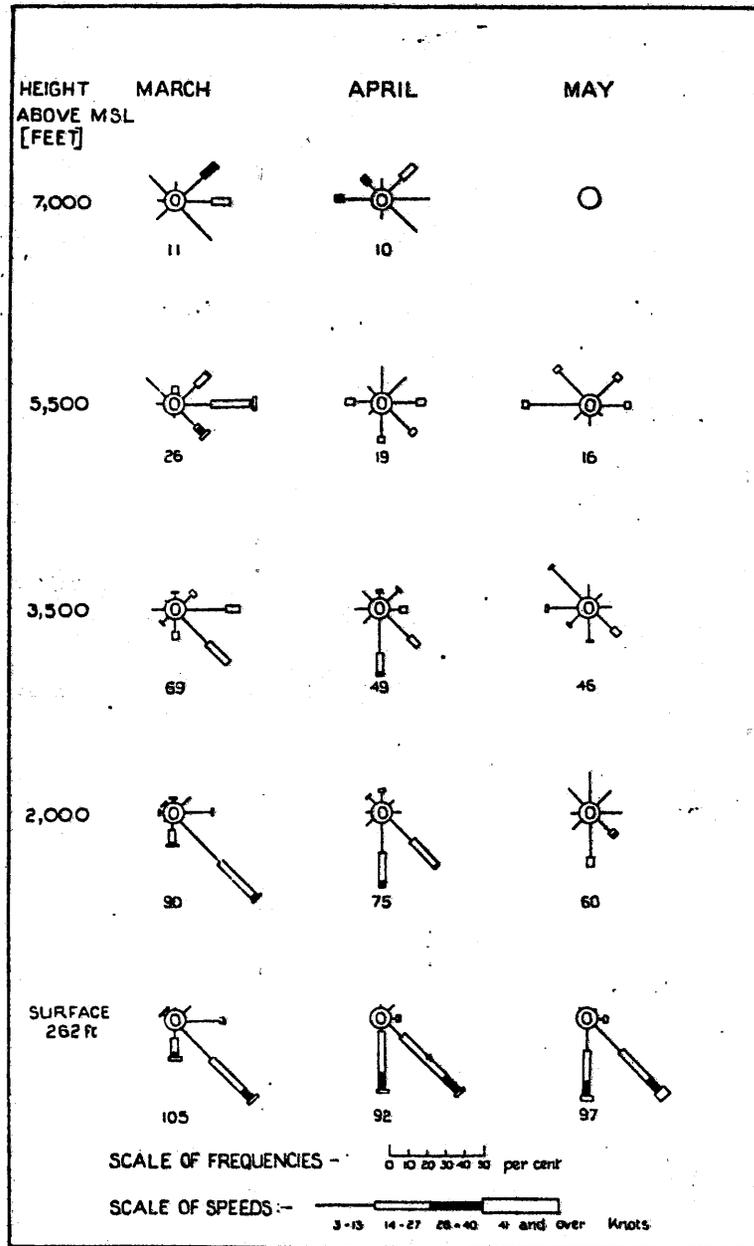


FIG. 30—UPPER WINDS—MONTHLY

Time of observation : morning.

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

(66887)

C 3

CAPE GUARDAFUI: 11° 44' N., 51° 15' E.

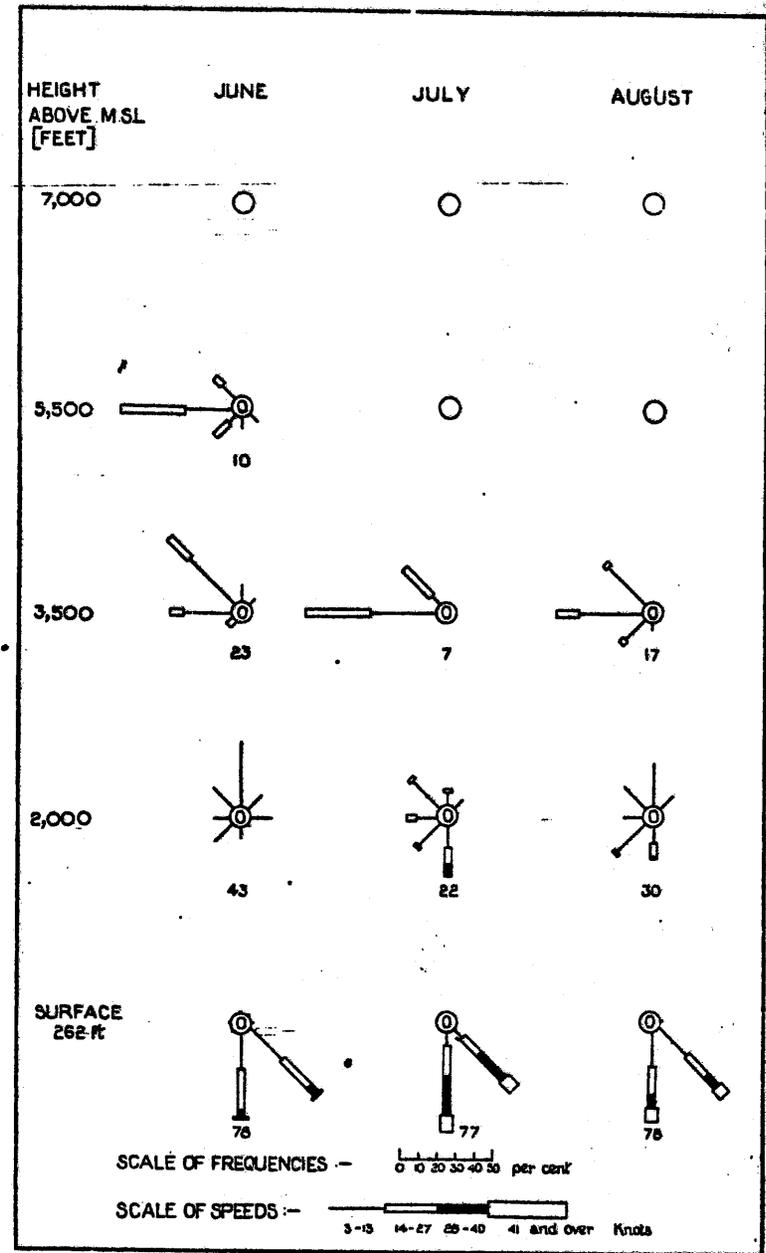


FIG. 31—UPPER WINDS—MONTHLY

Time of observation : morning.

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

Upper winds

2 71

CAPE GUARDAFUI: 11° 44' N., 51° 15' E.

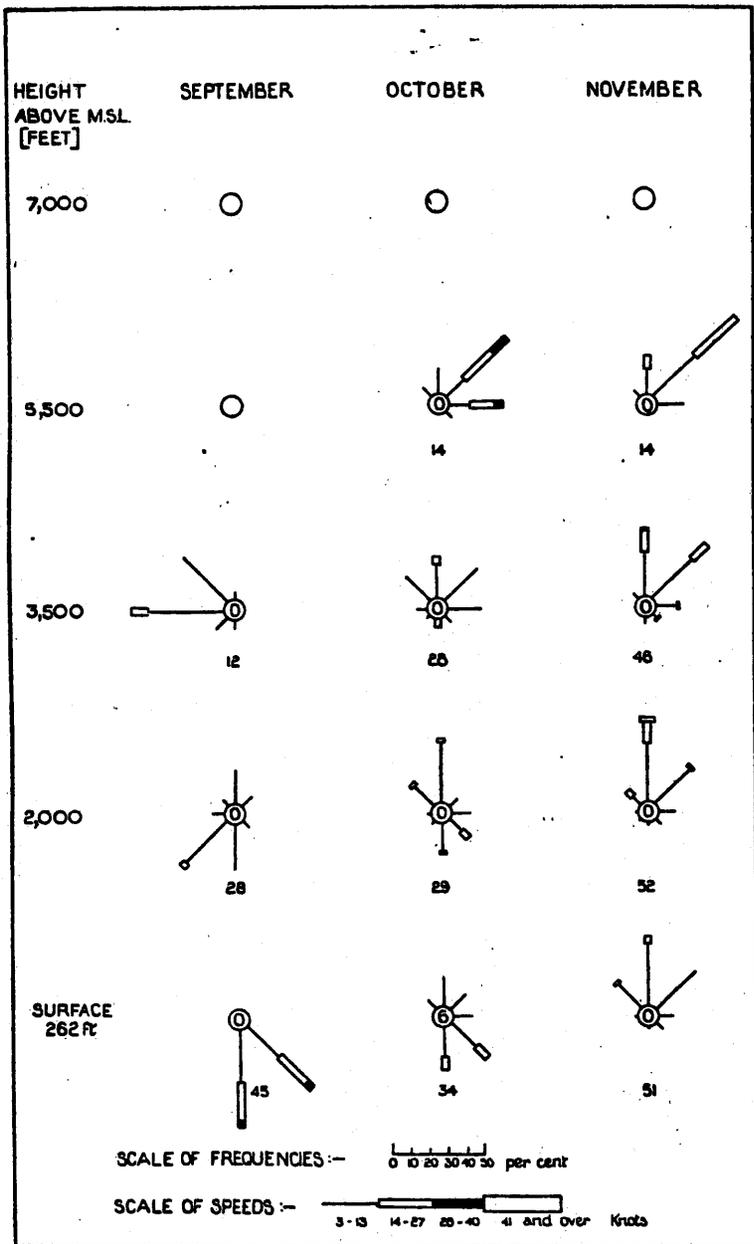


FIG. 32—UPPER WINDS—MONTHLY

Time of observation : morning

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

2 72

The Gulf of Aden

ADEN: 12° 47' N., 44° 59' E.

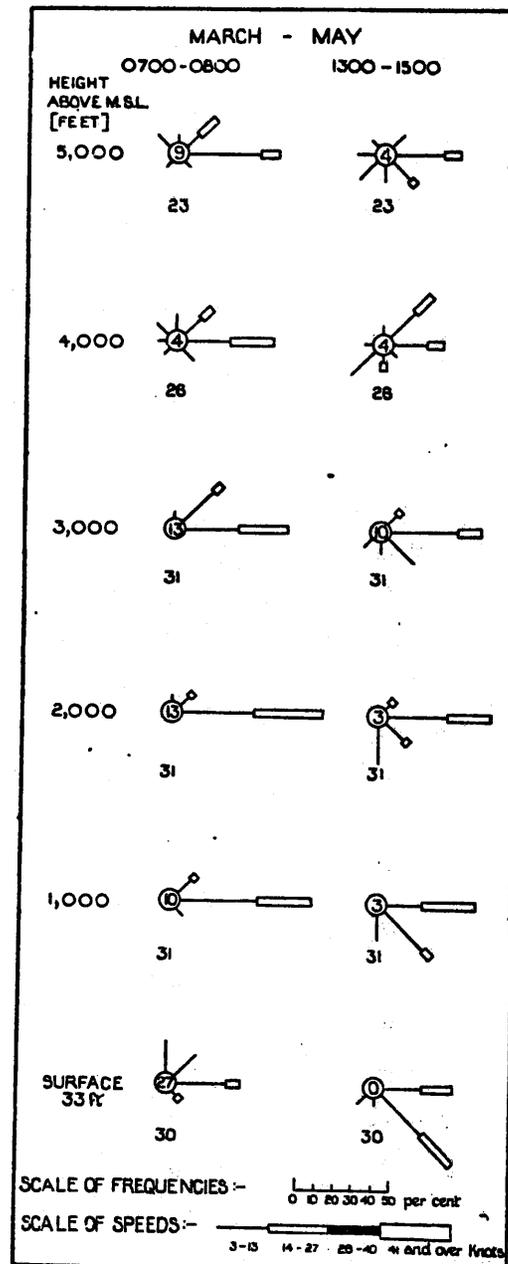


FIG. 33—DIURNAL VARIATION OF UPPER WIND

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses give the number of observations.

BERBERA: 10° 22' N., 45° 02' E.

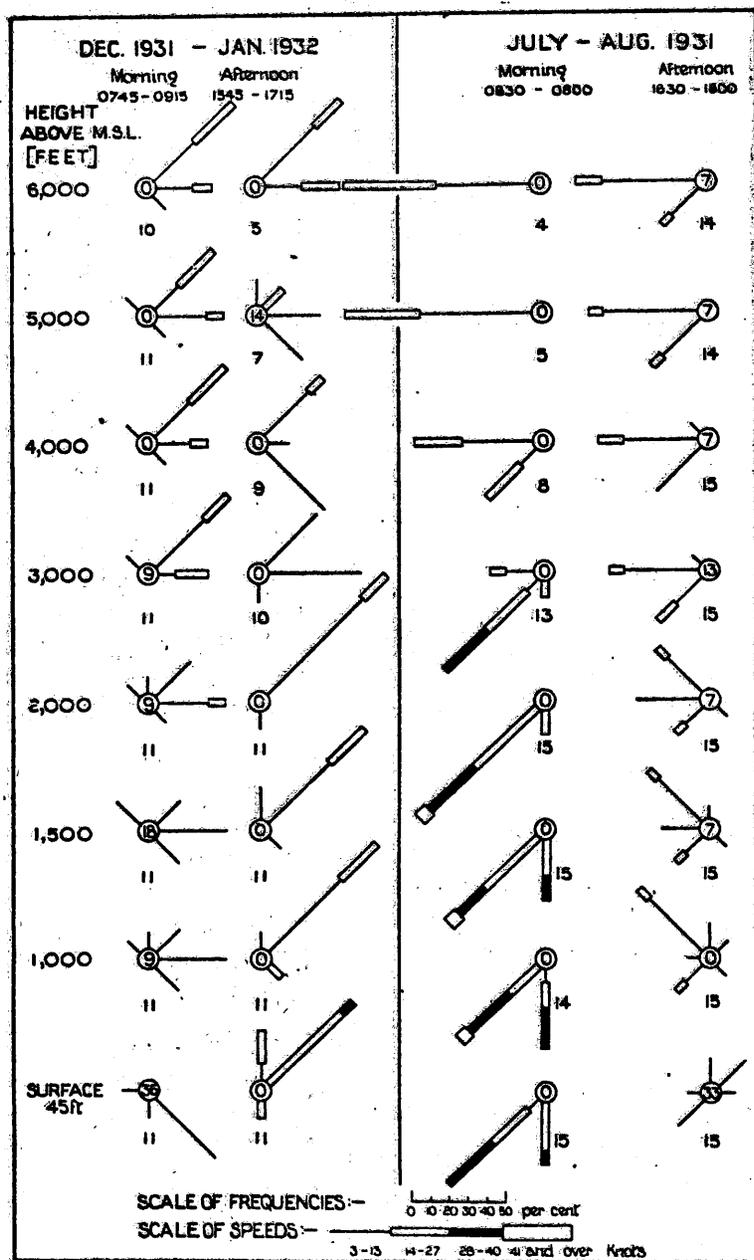


FIG. 34—DIURNAL VARIATION OF UPPER WIND AT BERBERA DURING THE NE. AND SW. MONSOONS

Figures in the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

Guardafui no regular diurnal change was discernible, but this may be partly due to changes and uncertainties about the hours of observation. The results for the afternoon at this station are not reproduced.

[Data recently received for Riyan and Bander Kassim at the morning and afternoon hours separately for December-February and June-August have also been added at the end of Table IX.]

### General

The NE. and SW. monsoon circulations, which are the dominating features at the surface, are comparatively shallow over the western Arabian sea and extend only to a height of some 6,000 or 10,000 feet, the exact height varying with latitude and season, and changing over comparatively wide limits from day to day. Above the monsoons is a region of variable winds with easterlies or westerlies at high levels (see volume I).

The northern part of the western Arabian sea lies within the domain of the upper westerlies in winter though even there they are not likely to be encountered below about 15,000-20,000 feet, and farther south they lie still higher. In summer, above the SW. monsoon, easterly or north-easterly winds extend to great heights over the whole area.

### Annual and diurnal variation

**NE. monsoon (December to March).**—In this season the prevailing winds below about 6,000 feet over the whole area except Bab el Mandeb are north-easterly; in the neighbourhood of high ground they are deflected by local topography and near the coasts are subject to diurnal variation. In the Gulf of Aden the effect of topography is well marked, winds at Perim (Fig. 25), for example, being mainly from SE. and strong, whereas elsewhere in the Gulf they are chiefly from E. or NE. At some of the stations the pilot-balloon observations on which the upper wind roses are based were made mostly in the early afternoon so that the surface winds shown in the diagrams represent the sea breeze rather than the general circulation. Details of diurnal variation have not yet been studied, except at Berbera where a comparison of ascents in the morning and afternoon on 11 days in December and January (Fig. 34) shows that the effect was conspicuous up to about 2,000-3,000 feet, light and variable winds in the morning being replaced by light to moderate north-easterlies in the afternoon when the sea breeze reinforces the prevailing NE. monsoon.

Above 6,000 feet local effects are less and there is a tendency for the winds to become easterly in the south, though they remain north-easterly in the north.

Information above 10,000 feet is scanty and is liable to be affected by the usual limitations of pilot-balloon ascents, but it is probable that in the north above the easterlies there is a layer of variable winds possibly some 10,000 feet thick with westerly winds at higher levels. At Aden W. winds are sometimes experienced as low as 10,000 feet in January and February, but in other months they do not usually descend as low as 13,000 feet and it is probable that they do not show any very definite predominance below 20,000 feet. The level at which the westerlies prevail is lower in the north than in the south. Their strength probably

increases with height. At Salalah (17° N.) light westerly winds begin to make their appearance at 10,000 feet, they are slightly less frequent at Riyan (14½° N.) but much more frequent at Masira island, (20½° N.) where the winds are also stronger.

Apart from the frequencies shown in the upper wind roses little further information is available. At Aden the movement of low clouds is on the average from due east. It is of interest, however, that in February to April, 1941, although the winds between 10,000 and 14,000 feet were chiefly from directions between NW. and E., 10–20 knots, periods with SW. winds at these levels did occur and were without exception unusually wet and cloudy in the western part of the Gulf. A return to clear conditions in all cases coincided with the return of winds to some northerly direction.

South of about 10° N. easterly winds probably persist up to very high levels, their vertical extent increasing as the equator is approached. At great heights they are probably not as strong as the upper westerlies.

At Mogadiscio near the equator the thickness of the NE. monsoon varies from 5,000 to 7,500 feet. In January, when it is most strongly developed the speed within the monsoon current increases from about 21 knots at the surface to 26 knots at 1,200 feet. In December and February the speeds are 3 or 4 knots lower. Above the monsoon are the upper easterlies, which in this region blow with little change of direction up to heights of 30,000 or even 40,000 feet. It is probable that in the lower part of this current the speed increases slightly with height. It is said that westerly winds are encountered above about 40,000 feet and that the boundary between the easterlies and westerlies is subject to non-periodic variations.

**Transition season (April and May).—**During this season barometric gradients at the surface are weak and there is a change from a north-south gradient in April to a south-north gradient in May. In accordance with these changes winds over the whole area are light and rather variable in April becoming S. or SW. in May.

In April in the lower layers the winds over the Gulf of Aden are in the main easterly, similar in direction to those in winter but lighter. Diurnal variation is likely to be conspicuous in the lowest 2,000–3,000 feet and ascents at Aden (Fig. 33) show that in March–May the change from easterly winds in the morning to SE. in the afternoon is evident even up to 3,000 feet. Over the western Arabian sea winds are light and variable, possibly becoming SW. near the coast. At levels above about 3,000 feet winds tend to become NE. or E. over the whole area. In the south these easterly winds probably persist up to very high levels, but north of 10° N. the direction probably becomes variable at about 20,000 feet with light westerlies at higher levels.

In May light south-westerlies begin to make their appearance in all parts of the area, but everywhere they are only shallow and in the Gulf of Aden do not usually extend above about 3,000 feet. At Cape Guardafui owing to local topography winds are S. or SE. near the surface and the arrival of the monsoon in May is marked by an increase of westerly winds between 2,000 and 6,000 feet.

Above about 3,000 feet winds become easterly and these winds probably persist up to at least 20,000 feet in all parts of the region, and to still higher levels in the south (see volume I, page 32).

The northern part of the region lies near the limit of the NW. winds of the Persian gulf, and it is possible that there W. and NW. winds alternate with the easterlies, but observations are lacking. Muscat (Part 3, page 65) shows W. and NW. winds up to at least 10,000 feet. In Bab el Mandeb also there is a slight increase of NW. winds in this season at levels below 3,000 feet.

At Mogadiscio the surface winds are SSE. in April, increasing to about 12 knots at 2,500 feet and then decreasing to 8 knots at 4,000 feet. In May winds are SW., increasing to 20 knots at 2,500 feet and falling to 10 knots at 8,000 feet. Above these levels, which probably give a rough indication of the upper limit of the southerly winds, the speed increases again and at 15,000 feet easterly winds blow strongly.

**SW. monsoon (June to August).—**South-westerly winds predominate over the whole area in the lowest layers, though in the Gulf of Aden and near the coasts elsewhere they are modified to some extent by topography and by diurnal variation. The only place for which details of the diurnal variation are available is Berbera, and owing to the exceptional winds in that locality (see page 52) the results cannot be regarded as typical, though similar conditions may prevail along the coast to the east. The data (Fig. 34) indicate that the diurnal change is evident up to at least 3,000 feet in this season, strong SW. winds in the morning being replaced by light NW. winds in the afternoon. Recent data for Bander Kassim show somewhat similar results (see Table ix).

Over the Gulf the wind shows little change of direction with height in the lowest 3,000 feet except for a tendency to veer slightly; at Aden, for example, the wind at 3,500 feet becomes W. by S. and at Berbera, WSW. Both in the Gulf of Aden and off the south-east coast of Arabia the SW. monsoon is only a shallow current even at the height of the season; the wind becomes much lighter at 10,000 feet and blows almost entirely from some northerly direction. At 6,500 feet the prevailing direction at the western end of the Gulf is W.–NW. and at 10,000 feet N., NE. or E.; at 13,000 feet NE. winds show a well marked predominance. At still higher levels the wind becomes easterly.

It appears that the NW. winds which predominate in this season over the whole of the eastern Mediterranean extend southwards over Egypt and Arabia until they reach the strong south-westerly monsoon current over which they rise. Between the two currents there is a well-marked almost stationary front which at the surface runs from the southern end of the Red sea north-eastwards along the coast of Arabia to near Ras al Hadd. In Bab el Mandeb (Perim) the winds are NW. even in the lowest layers. It is probable therefore that it is only in the lowest 5,000 or 6,000 feet, and possibly only in the eastern part of the Gulf, that the air comes from the southern hemisphere, and that at higher levels it is of northerly origin.

In the Gulf of Aden the SW. monsoon current appears to increase slightly in thickness as the season advances and to become stronger—in June it is not much more than 6,000 feet thick, whereas in August it may

extend nearly to 10,000 feet. It is liable to vary considerably in depth from day to day. The speed increases up to 2,000 or 3,000 feet, then remains fairly steady at about 15-20 knots within the monsoon current, slackening at the upper limit. Within the NE. upper current there is an appreciable increase for a few thousand feet but this probably does not continue up to greater heights.

On the south-east coast of Arabia the SW. monsoon winds are shallow. In view of the predominance of low cloud at Masira and Salalah (see page 92) the upper winds as measured by pilot balloons cannot be regarded as representative of normal conditions in this season, but the results show that at any rate on days when the sky is clear the SW. winds are limited to the lower 2,000 or 3,000 feet with N. winds predominating at 6,000 feet and N.-E. winds at 13,000. At Riyan conditions are somewhat similar, except that in the transition layer between the surface south-westerlies and the upper north-easterlies, winds are more variable.

Over the open Arabian sea to the east the SW. monsoon blows much more strongly and is of greater depth. Its speed probably increases up to about 3,000 feet. SW. winds persist probably up to a height of about 15,000 feet or slightly more, the exact limit varying from day to day. There is a layer of light variable winds above the monsoon and easterly winds at still higher levels.

At Cape Guardafui, owing presumably to the effect of topography, strong SE. and S. winds prevail in the lowest 1,000 feet. Their speed is very high especially in the morning; in the afternoon and evening it is said to increase with height in the lowest 200 or 300 feet but above that the speed falls off rapidly. From 1,000 feet upwards westerly winds increase and above 2,000 feet they show a very definite predominance; they probably continue to prevail up to about 10,000 feet, and that is confirmed by cloud movement over Italian Somaliland. At higher levels the wind is variable, becoming NE. and E. at greater heights. There is some evidence that N. and NE. winds are frequent from 1,000 to 2,000 feet above the surface south-easterlies, and that winds with an easterly component extend to a greater height in the latter part of the day than in the morning.

At Mogadiscio in the extreme south the SW. monsoon usually sets in in May and lasts until September, reaching its greatest development in July and August. In these two months its depth may exceed 8,000 feet. At the surface SW. and W. winds blow at 20 knots, increase to 25 knots at 4,000 feet and decrease fairly rapidly above 6,000 feet. Above the westerly monsoon the winds are variable up to about 13,000 feet, with easterlies above which become stronger in the higher levels. These easterlies probably persist up to at least 30,000 feet. Conditions in September and possibly also at the end of August are somewhat anomalous for above the monsoon, from about 10,000 to 20,000 feet, there is said to be a weak counter monsoon, and from 20,000 to 35,000 feet a westerly flow. Further observations in this region would be of interest.

**Transition season** (October and November).—In the Gulf of Aden the winds in the lowest 3,000 feet in October and November are light. They blow chiefly along the Gulf from E. and NE. but at the western end in Bab el Mandeb from SE. and S. and in this region they are stronger, most

of the winds at 1,400 feet exceeding 14 knots and some exceeding 40. Above the level of the high ground the wind backs to NE., and at 10,000 feet NE. winds prevail over the whole of the Gulf. At levels above 15,000 feet winds are likely to be easterly. In October these easterly winds extend up to at least 25,000 feet, but in November there is probably a tendency for winds to become westerly at that height, particularly in the north of the Gulf.

Over the western Arabian sea north of 10° N. light NE. winds prevail in the lower layers in October, strengthening in November; south of 10° N. the winds in October are light and variable but in November the NE. monsoon has penetrated to 5° N. and near the coast almost to the equator, with NW. and W. winds in equatorial regions further east. It is probable that in the north the direction remains NE. up to some 20,000 feet with little variation in direction. Above that level winds in the extreme north probably become light and variable with a tendency for westerly winds at higher levels. The westerlies are likely to be encountered at a slightly lower level in November than in October and to penetrate to more southerly latitudes. Further south the NE. wind gradually veers to E. with increasing height and persists from that direction up to very high levels. The westerly surface winds in the extreme south are very shallow, they probably veer to north and then to east.

The surface winds at Cape Guardafui continue to be somewhat anomalous in October (see Fig. 32), but in both October and November N. and NE. winds prevail above about 3,500 feet and probably veer to E. at higher levels.

At Mogadiscio the winds in the lowest 3,000 or 4,000 feet are from S. or SE., reaching a maximum speed of 14 knots on the average at 1,500 feet. Above that they decrease in speed to less than 10 knots and back, becoming northerly between 4,000 and 8,000 feet. At higher levels they become variable, with easterlies prevailing from 13,000 feet upwards to very high levels.

#### Upper winds at Aden

The following notes are based on an unpublished paper by F/Lt. G. R. Mason received while this Part has been passing through the press. The information is based on ascents from June 1940 to April 1941 made at five separate hours 0300, 0600, 1200, 1600 and 2100 local time. In most months the observations extend up to about 14,000 feet.

From October to February winds below 8,000 feet blow from almost due E., backing to NE. at higher levels and to N. above 10,000 feet in February. In March and April winds are easterly up to 4,000 feet, and above that height they veer to SE. and S. becoming very light at 10,000 feet. From June to August the general direction in the lower layers is SW. and W. with NE. winds above; in June the westerly winds are comparatively light and extend only to about 6,000-8,000 feet, but in July and August they are stronger and reach to 10,000 feet. In all three months the speed of the westerly winds decreases with height while that of the north-easterlies increases. In September winds below 8,000 feet are light and variable with north-easterly winds above.

Diurnal variation is well marked in July and August, and is evident even up to 12,000 or 14,000 feet, the effect in the upper layers being in

general the reverse of that at the surface. During the day the general wind is modified by the addition of a component from approximately SW. in the layer 0-4,000 feet, from NW. in the layer 4,000 to 8,000 feet and from NE. above that height, and during the night by components from roughly the reverse direction, i.e. NE. in the lowest layers and SW. in the higher. The net result is that in the layer from 0-2,000 feet the prevailing SW. winds increase from less than 10 knots at 0600 to about 17 knots at noon, with little change in direction, they weaken slightly by 1600 and thence more rapidly, falling almost calm in the early evening. By 2100 a light land wind of about 5 knots from NNE. has set in, but it is shortlived and as early as 0300 the wind is again from SW. From 2,000 to 10,000 feet the diurnal effect is not sufficient to reverse the prevailing wind; it is shown as an increase in the speed to a maximum between 1200 and 1600, accompanied by a gradual veer which continues until evening. From 10,000 to 12,000 feet observations are fewer, but they indicate that the prevailing north-easterly wind at that level is strengthened during the day and shows a gradual veer from N.E. at 0600 to about E.N. at 1600. It becomes light at night and may even be reversed in direction. A preliminary analysis of winds at 2,000 feet in the afternoon showed that, whatever the wind at that level in the morning, the afternoon wind was from SW. but, as would be expected, its speed was less when the morning wind was NE. than when it was SW.

The diurnal components in the other seasons were similar to those in July and August but of less magnitude; and from October to April they were only about one third of those in July-August.

The relatively strong NE. winds which occur in the early part of the night in the lower layers in July and August are felt also in the months from February to October. From February to April there is a secondary maximum also about dawn. From November to January however the prevailing north-easterlies reach a maximum in the latter part of the night.

#### V—VISIBILITY

Tables of the percentage frequency of different degrees of visibility from ships' observations in three sea areas, one in the Gulf of Aden and two in the Arabian sea, are given in Table X. The number of observations on which the monthly figures are based is very small, sometimes only 20 and never exceeding 100, so that though they give a general idea of the conditions not much reliance can be placed on the details.

A much larger volume of data is available of the frequency of mist, m, and haze, z, over the sea, but, in summarised form, this also is limited to areas north of 10° N. The percentage frequencies are given in the table below, together with those of exceptional visibility, v. No definite limits of visibility can be assigned to m and z; the entry "v" in ships' logs denotes abnormal clearness and transparency of the atmosphere, so that distant objects stand out from their background with great distinctness and show more sharply-defined detail than usual. Fog, f, was not recorded in any of the four areas in any month of the year except August when it was noted in 0.3 per cent. of the observations in the area 10-17° N., 50-55° E. (around Socotra).

#### PERCENTAGE FREQUENCY OF MIST, HAZE AND EXCEPTIONAL VISIBILITY AT SEA

Area	per cent.											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<b>MIST (m)</b>												
15-22°, 55-60° ..	0	0	0	0	0	0	3	3	0	<1	0	0
10-15°, 44-50° ..	<1	<1	0	0	<1	<1	<1	0	<1	0	<1	0
10-17°, 50-55° ..	0	0	0	<1	<1	<1	3	2*	1	<1	<1	0
10-15°, 55-60° ..	0	0	0	0	0	<1	6	<1	1	0	<1	0
<b>HAZE (z)</b>												
15-22°, 55-60° ..	0	0	8	<1	2	13	37	20	1	0	<1	2
10-15°, 44-50° ..	1	3	2	4	6	14	30	19	5	1	<1	1
10-17°, 50-55° ..	<1	2	2	2	7	16	26	24	16	2	<1	2
10-15°, 55-60° ..	<1	1	<1	1	<1	12	18	23	9	<1	0	<1
<b>EXCEPTIONAL VISIBILITY (v)</b>												
15-22°, 55-60° ..	21	17	15	12	21	0	5	2	0	1	5	1
10-15°, 44-50° ..	17	15	14	16	16	11	3	5	11	16	21	18
10-17°, 50-55° ..	18	20	22	25	17	4	3	3	3	15	20	17
10-15°, 55-60° ..	12	15	14	20	13	2	<1	<1	2	11	13	11

Authority.—Bibliography No. 94.

Note.—The average number of observations per month in the four areas is roughly 100, 800, 700, 500.

\* Includes 0.3 per cent. of fog.

Visibility frequencies at Ras al Hadd, Masira island, Socotra, Salalah, Riyan, Aden, Perim, Berbera and Bander Kassim at the four synoptic hours of observation, approximately 0500, 0900, 1500 and 2100 local time, are given in Table XI. The table for Aden is based on observations over 4 years; tables for the other stations are for even shorter periods, in some cases for a few months only. [Some of these data were received while this Part was passing through the press. These have been taken account of in the tables and text but not in the diagrams.]

#### Annual variation

A chart showing the annual variation in the frequency of visibilities of less than 5 nautical miles at coastal stations and over the open sea is reproduced in Fig. 35.

NE. monsoon (December to March).—During these months, particularly from January to March, the visibility over the Arabian sea is good, it is rarely less than 5 miles and usually exceeds 10. Fog is practically unknown and mist and haze are rare.

Little information is available for the south-east coast of Arabia. It is probable that visibility is mainly good but that near the coast the weather is sometimes hazy, especially during sandstorms. At Salalah, apart from occasional duststorms, visibility is excellent at the beginning of the season, almost always exceeding 10 miles; by March it has deteriorated slightly and this deterioration is well-marked also at Masira island. In Masira bay fog is said to be frequently experienced, though records on the island for 6 months in 1943-4 during this season gave only two occasions with visibility less than  $\frac{1}{2}$  nautical mile, both in February. On one the visibility fell to 260 yards during a duststorm followed by showers and light rain about midday, on the other there was fog between 0100 and 0400 which reduced visibility to 50 yards for a short time.

In the Gulf of Aden, away from the coast, visibility is usually very good, nearly always exceeding 5 miles and exceeding 10 miles 9 times out of 10. Frequently the air is brilliantly clear. Any deterioration is usually due to haze and is confined to the surface layers. On rare occasions visibility may be reduced to below 2 miles during a shower of rain.

At Riyan visibility usually exceeds 10 miles in December and January, though it occasionally falls below 5 miles. It deteriorates somewhat in March but even then it exceeds 10 miles for four fifths of the time and rarely falls below 5 miles.

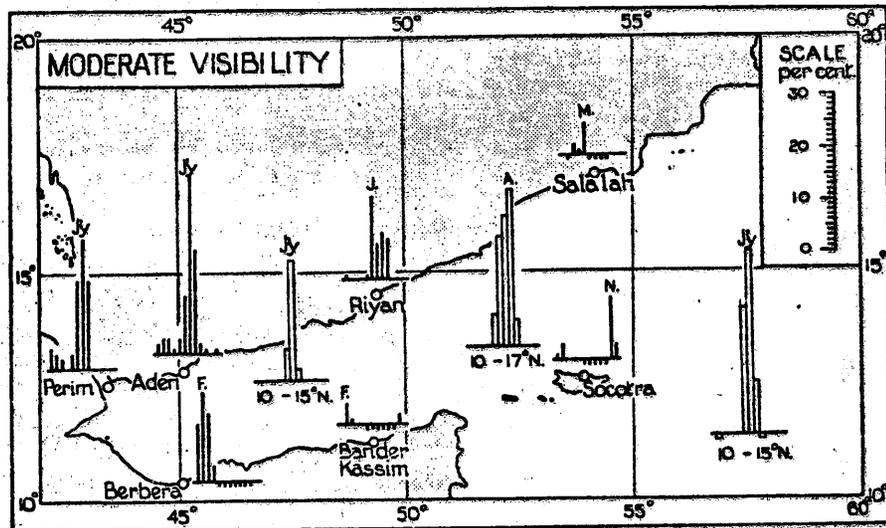


FIG. 35—ANNUAL VARIATION OF THE FREQUENCY OF VISIBILITY LESS THAN 5 NAUTICAL MILES

The diagrams for the land are based on the mean of three observations a day: 0500, 0900, 1500 (Z-3). The diagrams for the sea (shown in slightly different form) are from observations during daylight hours.

The month of greatest frequency is marked by its initial letter: J = June, Jy = July.

When data for any month are not available for the land stations a short vertical line is drawn below the horizontal and a short column for the sea.

[Additional data for land stations, received while this Part has been passing through the press, have been included in Table XI but have not been used in the construction of this diagram.]

At Aden it is said that visibility generally exceeds 15-20 miles, and is very often of the order of 100 miles, mountains some 80 miles to the north being usually visible in the morning in winter. Observations show that, though fog is never recorded, poor visibility may be experienced about once during the season.

In general visibility deteriorates slightly as the season progresses, but even in March it exceeds 10 miles on about 70 per cent. of occasions at night and on 80 per cent. during the day, and falls below 5 miles at any hour only once or twice during the month. Conditions at Perim are not very different except that visibility does not show the same improvement during the day that it does at Aden.

On the southern shores of the Gulf visibility is definitely better than during the SW. monsoon, though fog or mist may occur in the early morning. Haze is likely to occur over and near the land. In French Somaliland small sand whirls or "sand devils" sometimes occur in the interior and cause a deterioration of visibility at the surface.

On the coast at Jibuti fog is rare, but it appears to be more frequent in the mountainous region south-west of the colony. It is formed of relatively large drops and usually only occurs in the early morning and disappears by 0900 when the sun gets high enough to disperse it. It is said to be more frequent in the rainy season than in summer. This fog seems to be low cloud, it makes the tops of the mountains completely invisible, and within the cloud visibility may be reduced to 30 feet. The cloud masses are, however, visible by aircraft at a distance and can be avoided. These clouds are on the windward coasts and further inland the atmosphere is generally very clear.

At Berbera visibility nearly always exceeds 5 miles except in the early morning in January and February when it is often poor owing to mist and haze.

At Bander Kassim visibility usually exceeds 5 miles at all hours. During daylight it is over 10 miles on about 9 days out of 10, but in February and March on 6 or 7 days in 10 it falls to between 5 and 10 miles at night.

On the high plateau in the interior of both British Somaliland and the Aden Protectorate the atmosphere is generally very clear from November to March.

On the east coast of Italian Somaliland fog, mist and haze are rare in December and January. Fog and mist occur occasionally in February north of 5° N. in a region extending about 150 miles from the coast and are more frequent in March, especially near the coast. Inland mist is rather frequent in the hills in the west and sometimes persists all day.

Transition season (April and May).—Over the open sea visibility remains good in April but in May it deteriorates slightly over the Gulf of Aden and over the sea area immediately to the east, haze being recorded on some 6 per cent. of the observations in May. Near Cape Guardafui the frequency rises to about 15 per cent.

On the south-east coast of Arabia the few observations available show that visibility improves slightly in April, but tends to deteriorate in May, the deterioration being more marked at Masira island and Salalah than at Ras al Hadd and Riyan.

At the western end of the Gulf conditions are similar to those during the NE. monsoon. Visibility is generally good, though in May it is said to be less consistently so than during the NE. monsoon. On the north coast of Somaliland visibility, except during the early part of the night, is nearly always over 5 miles and at Bander Kassim it usually exceeds 10 miles.

On the east coast of Italian Somaliland mist and fog occur with increasing frequency in April, especially near the coast. In May fog occurs occasionally as far south as 3° N.

SW. monsoon (June to September).—During the period June to August visibility deteriorates especially near the coasts. The records of worst

visibility over the sea in the period June-August are indicated in Fig. 36. Information in greater detail for the foggy region south of Cape Guardafui in July-August is given in Fig. 37.

Observations on Socotra (Table XI) indicate that visibility over the island is almost always over 10 miles in the afternoon and that although, more often than not, it deteriorates below 10 miles in the morning in July and August, it rarely falls below 5.

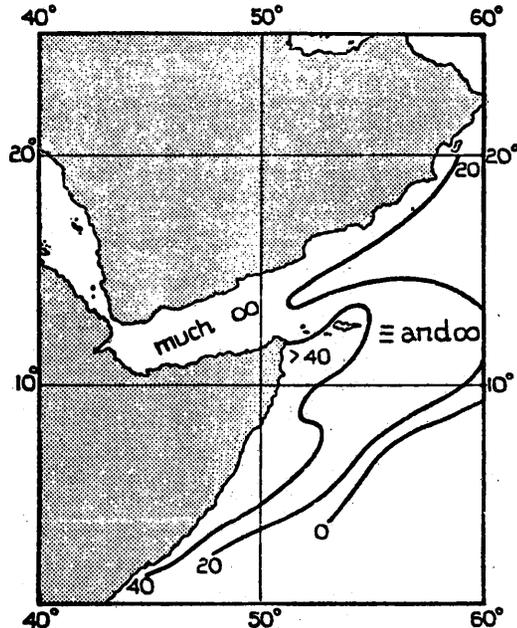


FIG. 36—FREQUENCY OF MIST AND HAZE IN THE WESTERN ARABIAN SEA JUNE-AUGUST (after Schott)

The exact limit of visibility denoted by mist and haze is not known.

In the neighbourhood of Cape Guardafui the percentage frequency of mist or haze in July and August is about 50, and in June and September about 25. The deterioration of visibility in this region has been attributed to desert dust but it may be ordinary sea fog caused by warm air over the areas of low sea temperature which are found off this coast. Further east, visibility improves considerably. The region of high frequency of thick weather extends southwards along the whole coast of Italian Somaliland almost to the equator. The belt stretches some 200 miles from the coast and frequently the land is entirely obscured. The neighbourhood of Ras Hafun is said to be the worst, especially in the early part of the season when visibility is deteriorating. In September the weather is still very hazy but fog becomes less frequent and less dense. There is some indication that in this month conditions are worse about 100 miles out to sea than on the coast itself, and that the worst area of the coast is now near Cape Guardafui where the frequency of thick weather is about 25-30 per cent.

Off the south-east coast of Arabia mist or haze is reported on more than one fifth of the observations from June to August, being most frequent in July, and fog is liable to occur over the regions of cold water (see page 109).

At both Ras al Hadd and Masira island there is a marked deterioration of visibility during the SW. monsoon, and in July and August visibility of over 10 miles is infrequent. Conditions at Masira island are much worse than at Ras al Hadd, visibility there being less than 5 miles on some 40 per cent. of occasions in June, 65 in July, 75 in August and 25 in September compared with about 25, 25, 30 and 10 at Ras al Hadd. At both places conditions are at their worst after noon. Fog sometimes extends over a wide area. On September 8, 1936, a ship after rounding

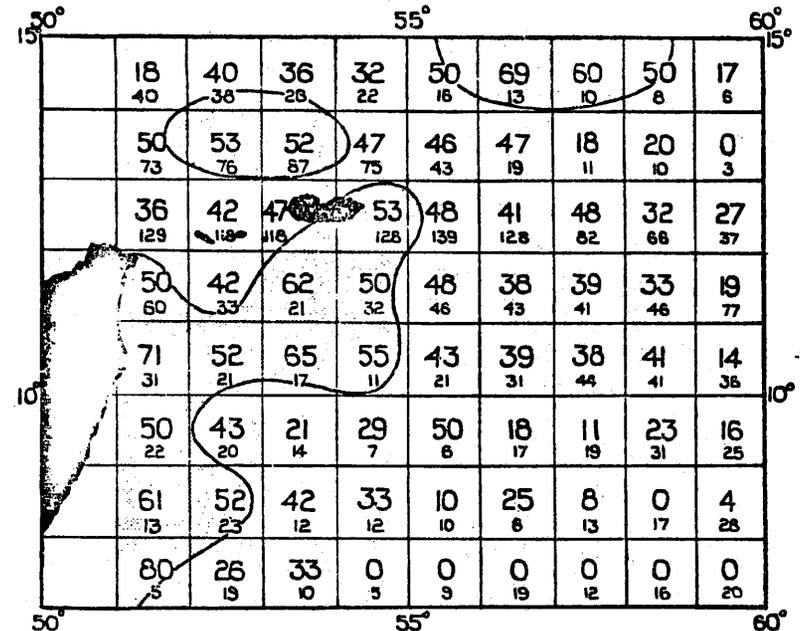


FIG. 37—PERCENTAGE FREQUENCY OF MIST AND HAZE OFF CAPE GUARDAFUI JULY-AUGUST

The larger figures show the percentage frequency of occurrence of mist and haze and the smaller figures give the number of observations. Areas of over 50 per cent. are shaded.

Ras al Hadd recorded a fall of air temperature of 10° F. and shortly afterwards entered a moderate fog. The fog continued for 36 hours and did not lift until midnight on the 9th, when the ship was in the neighbourhood of the Khorya Morya islands. A continuous belt extending as far south as this is almost unheard of.

At Salalah during the period from mid June until the end of September visibility is frequently only 500-1,000 yards in the morning, improving to 1,000-2,000 yards in the afternoon and deteriorating again in the evening; the number of occasions when visibility improves beyond 2,000 yards and the cloud base lifts above 1,500-2,000 feet is extremely small. In July and August some 60 per cent. of the observations show

visibilities of less than 2 miles. Further west at Riyan conditions are much better, haze is frequent but visibility rarely falls below 2 nautical miles; even in June and July, the worst months, it exceeds 10 miles more than 50 per cent. of the time, and is less than 2 miles for only 1 per cent.

In the Gulf of Aden the atmosphere is generally thick and hazy though there are occasional clear days. July is the worst month, the percentage frequencies of mist and haze in the four months June to September being 14, 30, 19 and 5. In the west of the Gulf visibility tends to improve in September, but near the eastern end, where the NE. monsoon sets in later, haze is frequent even in September.

At Aden itself from June to August visibility is often only 3-4 miles and occasionally falls below 2 miles; the haziness of the sky gives it a milky appearance. Even in July, the worst month, visibility exceeds 5 miles over the greater part of the day on 60 per cent. of occasions. In September visibility is generally good especially during daylight but less consistently so than during the NE. monsoon. During sandstorms which are liable to occur during any of the months from May to September visibility may be reduced to 50 yards or even less. Glare caused by reflected sunlight from dust particles reduces the effective downward visibility to less than half the horizontal. Sheikh Othman (50 ft.) is very subject to blown sand and almost every day during the SW. monsoon the visibility ranges from 3,000 yards to nil from about 1100 until the late afternoon.

Over the plains of French Somaliland and over the Gulf of Tajura and a fairly wide area of the Gulf of Aden NW.-NE. winds (see page 60), which are frequent during this season, raise clouds of dust several hundred feet high and reduce visibility almost to nil. Deformation of objects by refraction is also very common during the day-time, especially where the soil is bare.

At Berbera visibility seaward is at its worst from June to August and particularly in July. Visibility is generally poorest in the forenoon on account of the sand carried by the kharif; it improves slightly after midday when the sea breeze sets in. Inland visibility is said to be worse. During sandstorms, which are most frequent from June to August but may also occur in other months, visibility may be reduced to 30-40 yards. Conditions improve greatly in September. Morning mists are frequent in the hilly interior of British Somaliland and may persist all day.

At Bander Kassim in July and August visibility is worse than at Berbera; it falls below 5 miles on some 30 per cent. of the observations in the morning, owing to haze, but improves slightly in the afternoon.

Conditions off the coast of Italian Somaliland have already been referred to. Inland, morning mist is frequent in the valleys during the rainy season but dissipates during the day.

Transition season (October and November).—During this period visibility improves almost everywhere and conditions are comparable with those during the NE. monsoon.

At Ras al Hadd visibility is almost always over 10 miles at all times of the day; at Masira island this is true in November and in the day-time in October, but in that month fog is sometimes observed in the early morning and visibility of less than 5 miles occurs on about 1 morning in 4.

At Aden visibility is almost always good and frequently very good though in the early morning it occasionally falls below 5 miles.

On the north coast of Somaliland visibility is better than during the SW. monsoon; it nearly always exceeds 5 nautical miles and exceeds 10 for 95 per cent. of the time during daylight. In the high interior of British Somaliland good visibility may generally be counted upon.

Off the east coast of Italian Somaliland visibility continues to be rather poor in October with occasional fog near Cape Guardafui, where visibility seems to be slightly worse than farther south; by November fog is rare. Haze is sometimes recorded in both months.

VI—CLOUD

Monthly averages of cloud amount for sea areas are given in the table below which is based on observations from ships taken at four-hourly intervals. The averages at land stations taken as the mean of three observations a day are added for comparison. Step diagrams illustrating these data are reproduced in Fig. 38. It should be noted that at several stations the figures are from observations extending over a few months only so that the details cannot be relied upon. [Additional data received after the diagram was drawn have been incorporated in the tables.]

MEAN CLOUD AMOUNT  
(mean of 3 hours)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
<i>fenths</i>													
<b>GULF OF ADEN</b>													
N. E.													
10-14°, 43-47°	2.5	2.8	2.8	2.5	2.1	2.5	3.6	3.1	2.7	1.5	1.9	2.2	2.5
10-15°, 47-50°	2.5	2.6	2.6	2.1	1.6	1.6	2.3	1.8	1.6	1.4	2.1	2.6	2.1
<b>ARABIAN SEA</b>													
N. E.													
15-22°, 55-60°	3.6	2.5	1.5	1.9	3.0	4.8	5.2	4.2	5.4	2.4	2.1	3.8	3.4
10-15°, 50-55°	3.3	3.1	2.6	2.2	2.6	2.4	2.6	1.8	2.0	2.6	3.2	3.7	2.7
10-15°, 55-60°	4.1	3.8	3.0	2.6	3.6	4.9	4.1	3.5	4.3	3.8	4.3	4.3	3.9
5-10°, 50-55°	4.3	3.6	3.0	2.7	4.2	3.8	4.0	3.4	3.6	3.4	4.2	4.0	3.7
5-10°, 55-60°	4.6	3.9	3.5	3.5	4.8	4.8	4.8	4.2	4.0	4.1	4.7	5.0	4.3
0-5°, 50-55°	—	—	—	—	5.1	—	—	—	4.3	4.3	3.9	—	—
0-5°, 55-60°	4.9	3.7	2.9	4.2	5.0	—	—	—	4.2	3.9	3.7	4.5	—
<b>COASTAL STATIONS</b>													
Ras al Hadd	3.1	2.1	1.2	1.7	1.2	1.0	2.4	2.7	1.1	0.9	1.6	3.5	1.9
Masira island	3.0	1.6	0.9	1.7	2.0	2.4	4.0	5.4	4.8	1.9	1.3	3.8	2.7
Socotra	3.7	3.4	1.6	2.0	2.6	3.7	3.1	2.9	2.6	3.4	3.7	5.2	3.3
Salalah	2.5	1.7	1.5	1.9	2.1	5.1	9.7	9.7	7.7	2.5	1.8	2.6	4.1
Riyan	4.0	3.3	2.4	4.1	3.6	3.5	3.1	3.7	4.4	3.1	1.6	2.2	3.3
Aden	4.6	4.8	4.2	4.2	3.6	3.0	3.5	3.2	3.0	2.2	2.2	3.8	3.6
Perim	4.3	5.1	4.6	5.0	3.4	3.6	4.7	4.1	4.0	2.8	2.7	3.5	4.0
Berbera	2.6	2.4	2.1	2.2	2.0	1.2	2.1	1.9	1.6	1.4	1.7	1.8	1.9
Bander Kassim	2.6	2.9	1.4	1.2	1.5	1.7	3.0	2.8	2.8	2.1	3.0	3.0	2.3
C. Guardafui	6.8	5.0	4.8	3.9	2.5	3.6	4.4	2.9	2.9	2.6	4.8	6.3	4.2
Mogadiscio	2.4	2.7	2.7	3.3	3.2	4.6	4.9	4.3	3.6	3.6	3.3	3.3	3.5
Jumbo	3.5	4.0	3.8	4.1	4.3	4.7	4.1	4.5	3.3	3.0	4.0	3.7	3.9

Periods and authorities.—Sea: 15-22° N., 55-60° E., 1921-38; Bibliography No. 94. Other areas, 1856-1908; Bibliography No. 14. Coastal stations, see Table I.

Information regarding the frequency of skies with different amounts of cloud cover is given in Table XII and for coastal stations at different hours of observation in Table XIII.

The diurnal variation of cloud amount in the Gulf of Aden is large, especially during the NE. monsoon. Detailed hourly observations are

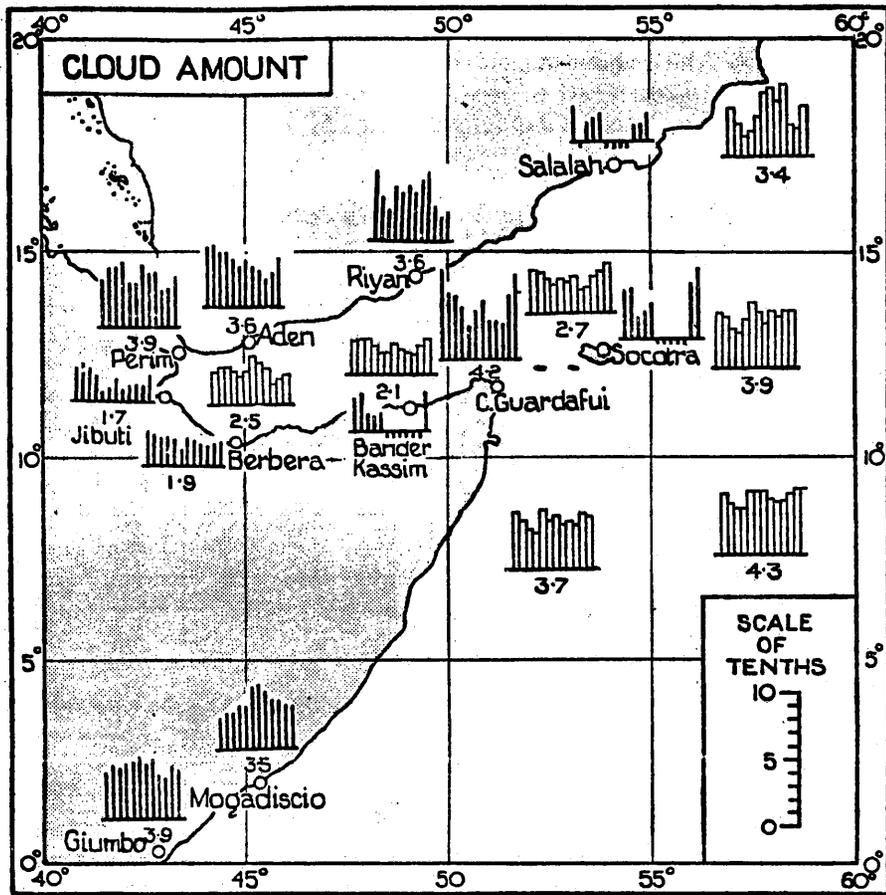


FIG. 38—ANNUAL VARIATION OF MEAN CLOUD AMOUNT

The figures below the step diagrams indicate the mean annual cloud amount.

Diagrams for sea areas are drawn in open column and represent observations throughout the 24 hours.

Diagrams for coastal stations are the mean of 3 or more observations a day except at Jibuti, where it is for 0800 local time.

When data for any month are not available a short vertical line is drawn below the horizontal.

[Additional data received after this chart was prepared are given on p. 86.]

available only for Aden, taken some fifty years ago. These are illustrated in Fig. 39; averages at the four standard hours of observation at the recently established station are shown for comparison.

Monthly values at the four hours of observation separately at Aden and other coastal places are set out in the table on page 89. For Aden the information is given also for low cloud, i.e. cloud with base below 8,000 feet, as for many practical purposes this is of more importance than total cloud.

In general the difference between the amount of low cloud and total cloud in other parts of the Gulf is not very different from that at Aden,

the average values of the difference being less than 1 tenth during the NE. monsoon and rising to a maximum of about 3 tenths in July except at Berbera where the amount of cloud of any sort in that season is very small.

On the south-east coast of Arabia the difference is about 1 tenth or less except during the SW. monsoon when it exceeds 2 tenths in the extreme east, is 1½ tenths at Masira island and is zero at Salalah.

The charts of the average cloud amount in representative months of the four seasons reproduced in Volume I indicate that in general the distribution over the region as a whole shows very little seasonal change. At all times of the year the amount increases from 3 tenths or less in the north to 4-5 tenths in the south, although skies are about half covered in the north-east of the region during the SW. monsoon.

In most regions the amount of cloud is greater during the two monsoons than in the transition seasons. Near the mouth and on the coasts of the Gulf of Aden the NE. monsoon is somewhat cloudier than the SW., but elsewhere the SW. monsoon is the cloudiest season.

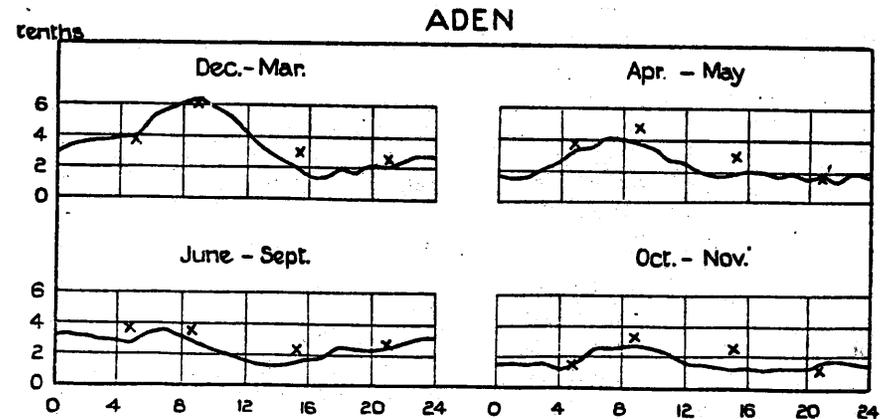


FIG. 39—DIURNAL VARIATION OF CLOUD AMOUNT AT ADEN

For comparison, averages at the four standard hours of observation at the recently established station are shown by crosses.

Period.—January 1940-May 1943.

Annual and diurnal variation

NE. monsoon (December to March).—Over the open sea the average amount of cloud increases slightly from north to south. It is about 3 tenths in the north, between 3 and 4 tenths off the coast of Italian Somaliland and over the open sea to the east, and it exceeds 4 tenths only in the extreme south-east. In the Gulf of Aden the average is only 2-3 tenths. The general distribution does not show any very well marked difference during the four months and the changes are not identical from one region to another. Over the sea north of 15° N. the few data available indicate a progressive clearing of the sky between December and March, the latter month being the clearest of the year. The cloud is probably fine weather cumulus with possibly a veil of high cirrus. A somewhat similar variation is found farther south between 10° and 15° N.; overcast skies are infrequent and for about half to one third of the time

DIURNAL VARIATION OF CLOUD

Time (Z-3)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
<b>RAS AL HADD</b>													
0600 ..	3.0	2.3	1.2	1.9	0.9	1.3	3.5	3.9	1.7	1.3	1.9	3.7	2.2
1000 ..	2.8	1.7	1.2	1.4	0.9	0.8	1.9	2.5	0.7	0.7	1.2	3.5	1.6
1600 ..	3.5	2.3	1.1	1.7	1.9	1.0	1.7	1.8	0.8	0.7	1.7	3.3	1.8
<b>MASIRA ISLAND</b>													
0600 ..	2.7	1.7	1.1	2.0	2.8	4.0	6.1	7.2	8.3	2.5	1.3	3.5	3.6
1000 ..	3.3	1.9	1.1	2.1	1.5	2.4	4.1	5.6	5.0	2.0	1.6	4.2	2.9
1600 ..	2.9	1.1	0.6	1.1	1.7	0.8	1.9	3.3	1.2	1.2	1.0	3.6	1.7
2200 ..	1.5	0.9	0.5	0.5	0.7	1.2	1.3	3.3	2.5	0.9	0.6	2.0	1.3
<b>SOCOTRA</b>													
0600 ..	4.0	3.5	2.0	2.6	2.3	4.9	4.0	3.6	2.9	3.0	3.6	5.3	3.5
1000 ..	4.0	3.6	1.1	1.0	2.5	3.8	3.7	3.3	2.5	3.5	3.5	5.2	3.1
1600 ..	3.1	3.1	1.8	2.4	3.0	2.4	1.6	1.9	2.3	3.8	3.9	5.1	2.9
2200 ..	3.1	2.1	0.9	1.3	0.9	1.1	1.7	1.2	1.0	2.1	3.3	3.9	1.9
<b>SALALAH</b>													
0600 ..	2.6	1.7	1.9	3.0	3.2	7.3	10.0	10.0	9.0	3.4	1.7	2.1	4.7
1000 ..	2.5	1.8	1.5	1.5	1.4	4.4	10.0	10.0	7.6	2.1	1.9	2.9	4.0
1600 ..	2.3	1.6	1.1	1.2	1.7	3.6	9.0	9.0	6.6	2.1	1.7	2.7	3.5
2200 ..	2.1	1.8	1.6	1.4	2.8	5.3	10.0	9.4	7.4	1.4	1.0	2.3	3.9
<b>RIYAN</b>													
0500 ..	3.9	3.5	1.5	4.9	4.3	4.1	4.8	4.8	5.7	3.8	1.3	2.3	3.7
0900 ..	5.6	4.3	4.5	4.5	3.6	3.1	2.3	3.6	4.9	3.3	1.7	2.7	3.7
1500 ..	2.5	2.0	1.1	2.9	2.8	3.3	2.3	2.7	2.5	2.1	1.7	1.7	2.3
2100 ..	4.0	3.9	1.6	2.3	1.3	2.4	3.2	3.0	1.4	2.4	1.9	3.1	2.5
<b>ADEN</b>													
<b>Total</b>													
0500 ..	4.3	4.5	3.5	4.1	3.7	3.5	4.6	4.1	2.8	1.5	1.7	3.2	3.5
0900 ..	6.3	6.7	5.8	5.3	4.2	3.3	3.5	3.6	3.9	2.9	3.1	5.5	4.5
1500 ..	3.1	3.2	3.2	3.2	2.9	2.3	2.4	1.8	2.4	2.1	1.9	2.6	2.5
2100* ..	3.1	3.9	1.3	2.5	1.3	2.6	3.9	2.2	1.0	0.9	1.2	1.7	2.1
<b>Low</b>													
0500 ..	3.9	4.1	3.2	2.7	2.3	1.7	1.2	0.9	1.5	1.0	1.3	2.9	2.2
0900 ..	5.7	5.9	4.7	3.6	2.7	1.4	0.7	0.9	2.8	2.3	2.5	4.9	3.2
1500 ..	2.0	1.9	1.6	1.1	1.1	0.5	0.3	0.5	1.2	1.3	1.2	1.9	1.2
2100* ..	1.5	2.8	1.0	0.7	0.3	0.5	0.3	0.1	0.3	0.5	0.7	1.1	0.8
<b>PERIM</b>													
0500 ..	4.3	5.0	4.3	4.4	3.3	4.8	5.8	5.3	4.7	2.3	2.0	3.0	4.1
0900 ..	5.3	6.1	5.2	5.4	3.8	3.4	4.7	4.4	3.9	3.5	3.5	4.9	4.5
1500 ..	3.3	4.1	4.3	5.2	3.0	2.5	3.5	2.5	3.4	2.6	2.5	2.7	3.3
2100* ..	1.7	2.0	2.2	1.9	1.9	4.1	3.7	3.7	3.4	1.3	1.5	1.5	2.4
<b>BERBERA</b>													
0800 ..	3.8	3.8	2.9	2.4	1.5	1.2	2.1	1.7	1.1	1.3	1.9	2.3	2.2
1400 ..	2.5	2.2	2.0	2.4	2.1	1.2	2.0	1.8	1.6	1.6	1.9	2.0	1.9
2000 ..	1.5	1.3	1.3	1.9	2.5	1.3	2.1	2.2	2.1	1.4	1.3	1.1	1.7
<b>BANDER KASSIM</b>													
0500 ..	1.9	2.7	1.2	1.1	1.4	1.4	4.5	3.0	2.4	1.5	1.9	2.7	2.1
0900 ..	3.4	3.4	1.4	0.8	1.3	1.6	2.5	2.6	2.9	2.1	3.4	3.2	2.4
1500 ..	2.4	2.5	1.6	1.8	1.9	2.2	1.9	2.8	3.0	2.8	3.8	3.1	2.5
2100 ..	2.5	1.3	1.4	1.1	1.0	0.4	1.7	1.0	0.8	1.5	2.1	2.7	1.5
<b>CAPE GUARDAFUI</b>													
0700 ..	7.6	5.6	5.2	3.9	2.2	3.1	5.0	3.5	1.9	2.6	4.9	6.2	4.3
1200 ..	6.3	4.8	4.9	3.5	2.5	3.4	3.7	2.3	2.4	2.3	5.2	6.2	4.0
1700 ..	6.6	4.7	4.4	4.2	2.9	4.4	4.4	3.0	3.4	3.0	4.8	6.4	4.3

Authorities.—Bibliography Nos. Cape Guardafui, 69; other stations, 94.

Periods.—See Table I.

Note.—Observations at the evening hour are difficult owing to darkness.

\* Observations are available for a shorter period only at these hours.

the amount of cloud is 2 tenths or less. Over the western part of the Gulf of Aden the changes during the season are slight but are the reverse of those farther east, December being the clearest month of the four.

No information is available as to the diurnal variation over the open sea, but the frequency of rain and therefore probably the frequency of low cloud is slightly greater in the night and morning than after midday. On the coasts there is often a large diurnal variation in the amount, and averages for a single hour have to be used with caution.

At Ras al Hadd and Masira island the clearing of the sky as the season progresses is well marked; in December and January the average cloud amount ( 3 to 3½ tenths, whereas in March, it is only 1 tenth. Overcast

skies are rare throughout the season and in March the sky is completely clear for some 50 per cent. of the time, particularly in the afternoon and early part of the night.

At Salalah on the Arabian coast there is very little cloud of any sort during this season; even in December and January, the cloudiest months, the amount is 2-3 tenths and completely overcast skies are rare. Farther west on the northern shores of the Gulf of Aden the amount is larger, observations at Riyan give values of just over 2 tenths in December rising to 4 tenths in January. The amount is greatest at about 0900 and decreases appreciably in the afternoon, by which time the sky has 3 tenths or less of cloud cover on about 80 per cent. of the days even in January.

At Aden the diurnal range in this season amounts to more than 3 tenths with the greatest cloud cover at about 0900 and the least at 1600 (see Fig. 39 on which the more recent averages are shown by black crosses). The usual type of cloud is stratocumulus, which frequently drifts from inland in the morning. Its base is usually at 2,000 or 3,000 feet although in showers it is often down to 1,500 feet and then shows considerable cumulus development and may extend upwards over several thousand feet in isolated heaps. The sky is likely to be completely overcast at 0900 on one or two mornings a month and 7 tenths or more covered on about 15. At Perim conditions are similar except that the mornings are less cloudy than at Aden.

On the southern shores of the Gulf the amount of cloud is less. Jibuti has an average of between 2 and 3 tenths at 0800, and Berbera and Bander Kassim at the same hour have about 3 to 4 tenths but show a well marked clearing during the day. Cumuliform clouds are the most frequent and are reported on about half the days in both the morning and early afternoon but less frequently in the evening. Judging from observations in a single year they occur most often in January and February. Other types are also recorded but less frequently than cumulus.

Observations from Aden indicate that amounts of 6 to 9 tenths of morning stratocumulus at 3,000 feet are sometimes reported all along the African coast, though more often the cloud is confined to a few localities. It nearly always disperses by about 1400 local time. The amount is likely to be greatest where the land rises steeply from the sea.

On this coast once or twice a month the sky is likely to be completely overcast in the morning, and 7 tenths or more covered on 6 mornings; it usually clears by the afternoon. These cloudy skies are less frequent in March.

The region of Cape Guardafui seems to be more cloudy than any other at this time of the year, probably because the wind blows on shore. Between 6 and 7 tenths of the sky are covered in December and January and about 5 tenths in February and March. Judging from observations of pilot balloons the clouds are at a fairly high level, much higher than during the SW. monsoon. There is a slight tendency to clear in the afternoon but only by about 1 tenth. Farther south along the coast where the prevailing winds are more or less parallel with the shore, the amounts are less, but they show large variations from place to place, possibly

partly owing to deficiencies in the data. At Obbia the amount is only about 1 tenth, at Mogadiscio between 2 and 3 tenths clearing slightly in the evening and at Giumbo between 3 and 4 tenths. The cloud is probably chiefly cumulus, stratocumulus and cumulonimbus. Inland in Italian Somaliland the amount of cloud is comparatively small, probably about 2 or 3 tenths, or even less.

**Transition season (April and May).**—During this season the average amount of cloud over the sea increases from north to south. The distribution in the two months is similar but except in the Gulf of Aden the amounts in May are about 1 tenth greater than in April. Over the sea off the south-east coast of Arabia the amount is about 2 tenths in April and 3 tenths in May. Over the Gulf of Aden the average is about 2 tenths but is slightly less in May than in April. Over the open sea to the east, April is one of the least cloudy months of the year with only about 2 tenths of cloud increasing to about 3 tenths in May. Skies with 7 tenths or more of cloud are infrequent especially in April. In the south the amount of cloud increases with the onset of the monsoon from about 4 tenths in April to over 5 tenths in May.

Not much detailed information is available for the coasts. Along the eastern part of the south-east coast of Arabia the average is still only about 1-2 tenths but further west at Riyan the cloudiness increases from just over 2 tenths in March to about 4 tenths in April and shows little change in May. At Aden conditions are similar to those during the NE. monsoon except that the diurnal variation is rather less, the amount of cloud being about 2-3 tenths during most of the day and showing little change from about 1100 until midnight or early morning; it increases fairly rapidly after 0300, reaching a maximum of 4 or 5 tenths at about 0800 and thereafter decreases slowly. Completely overcast skies are recorded about once a month at any time of the day. Skies 7 tenths or more cloudy occur most often in the morning when the frequency at 0900 is about 10 days a month; they are less than half as frequent in the afternoon. The base of the cloud is nearly always above 2,000 feet and in the afternoon it is usually above 3,000 feet. During March and April 1941 altostratus at 15,000-20,000 feet was observed quite often moving from a westerly direction and at times it covered 9 tenths of the sky. On four occasions it increased to 10 tenths and took on a typical altostratus appearance in places. Each time rain fell either at Aden, Perim or in the southern Red sea.

Along the north coast of Africa the sky is almost continuously clear, the average amount being only 1 or 2 tenths. Completely overcast skies are rare and skies with 7 tenths or more of cloud are experienced only 2 or 3 mornings a month and about the same number of afternoons.

With the cessation of the NE. winds the amount of cloud at Cape Guardafui decreases, the average being about 4 tenths in April and less than 3 in May. In April there is little regular diurnal variation but in May there is a tendency for cloud to form during the day, the evening values being about 1 tenth higher than the morning. Farther south along the coast the amount of cloud increases from about 3 tenths at Mogadiscio to over 4 tenths near the equator.

**SW. monsoon (June to September).**—In July-August, when the SW. monsoon is at its height, the amount of cloud north of 10° N. is least near the mouth of the Gulf of Aden, where it is less than 3 tenths. It increases thence to over 3 tenths both westwards to Bab el Mandeb and eastwards to long. 60° E. South of 10° N. the amount increases to over 5 tenths in the equatorial region to the south-east. It is probable that the general features in June and September are similar. There is not much variation from month to month but over the open sea August tends to be the least cloudy of the four. Very little information about the diurnal variation over the sea is available but the amount of cloud in the Gulf is probably greater in the early morning than in the afternoon; this is borne out by the following table which gives the frequency of cumuliform cloud in July and August. In using the table the difficulty of identifying cloud forms at night must be remembered, but the decrease in the frequency of cumulus cloud in the Gulf between 0800 and 1200 seems to be well established. It is of some interest as it suggests that the air over the Gulf may be subsiding during the day.

DIURNAL VARIATION OF THE PERCENTAGE FREQUENCY OF CUMULIFORM CLOUD IN JULY AND AUGUST

Lat. N.	Long. E.	0400	0800	1200	1600	2000	2400	No. of obs.
		<i>per cent.</i>						
GULF OF ADEN								
12-13°	45-46°	31	21	9	30	16	21	204
12-13°	46-48°	24	24	9	9	13	16	253
ARABIAN SEA								
12-13°	55-60°	49	62	75	65	52	40	534

*Authority.*—Bibliography No. 58.

*Note.*—For the Gulf of Aden the data are for years before 1888 and refer to cumulus and stratocumulus; for the Arabian sea the data are for 1905-19 and refer to cumulus, cumulonimbus and stratocumulus.

On the coast the cloudiness depends very much on the aspect of the coast in relation to the prevailing winds, and there are very notable changes along the south-east coast of Arabia. At Ras al Hadd the average cloud cover is only 1 tenth in June and September and less than 3 tenths in July and August; the amount increases rapidly westwards and in July and August Masira island has an average of 4-6 tenths while Salalah has nearly 10 tenths. In the east there is a well marked clearing during the day, the difference in cloud cover at Masira island between 0600 and 1600 being about 4 tenths, whereas at Salalah the diurnal variation is only 1 tenth.

In July and August the frequency of skies 7 tenths or more covered at 0600, 1000 and 1600 is 23, 11 and 9 per cent. at Ras al Hadd, 66, 37 and 20 per cent. at Masira island and 100, 100 and 89 per cent. at Salalah. Cloudless skies are practically unknown at Salalah in these months, but reach a frequency of about 50 per cent. at Ras al Hadd and Masira island in the afternoon. At Salalah the SW. monsoon type of weather lasts from about mid June until the end of September, and during this period the sky is almost continuously overcast with stratus cloud with intermittent slight drizzle. The cloud base is usually at about 600 feet in the morning, lifting to about 1,000 feet in the afternoon, and

the number of occasions when it lifts above 1,500–2,000 feet and visibility improves beyond 2,000 yards is very small. Local inhabitants refer to this period as "the hundred days without the sun". The actual limit of this cloud layer is not known but it is said to extend for at least 50 miles inland and out to sea and from about Ras Fartak to Ras al Hadd. Ships often report cloud or overcast skies in the western Arabian sea some hundreds of miles from land so it is possible that the cloud is not always merely a coastal phenomenon. At the eastern and western ends of this area the cloud normally clears or at least breaks during the morning and at Masira island, for example, there is usually little cloud remaining by 1100 local time. The top of the cloud layer is about 3,000–5,000 feet over the whole area and there are generally small amounts of medium or high cloud above. Approach to Salalah by air in this season is always difficult, the usual method is to come down through the cloud well over the sea, shortly before reaching Salalah, and to approach from the sea; but many pilots prefer not to attempt a landing. The area of coast affected by stratus appears to coincide with that which is fed by air that has travelled entirely over the ocean and has not crossed the African continent. The temperature of the sea off the African coast, especially near Cape Guardafui and Socotra, is exceptionally low at this time of the year owing to upwelling of cold water, and this may give rise to a surface inversion in the south-westerly air stream. It is possible, however, that the cloud may be due to the fact that at this season the intertropical front which separates the south-westerly southern hemisphere air from the north-westerly continental air lies roughly along the Arabian coast and the land air is likely to overrun the cooler monsoon air at about 3,000–5,000 feet, giving rise to an inversion at the top of the cloud layer. Until upper air observations are available this suggestion cannot be verified. The charts of volume III show weak cold fronts parallel with the Arabian coast marking the surges of SW. monsoon air.

Along the northern shore of the Gulf of Aden the average amount of cloud in the morning is between 3 and 4 tenths and shows little variation through the season; there is a tendency for the amount to be greatest, about 4 tenths, between about 0500 and 0900, and to fall to a minimum of about 2 tenths in the early afternoon (Fig. 39). Even in the morning completely overcast skies occur only once or twice a month and more than half the mornings have less than 3 tenths cloud. From June to August the height of the cloud base at Aden is usually above 3,000 feet but it may fall to between 2,000 and 3,000 feet on 4 or 5 days a month in the morning; on many days there is no low cloud at all. The amount of low cloud increases in September and on the majority of occasions its base is between 2,000 and 3,000 feet in the morning, rising somewhat in the afternoon. During this season, and also during the transition periods, cumulus cloud can be seen building up during the late morning on the high ground to the north and north-west of Aden. Anvil formation usually follows and with favourable upper winds may spread over Aden before sunset, occasionally giving rise to thunderstorms. The sandstorms which come down from the north in this season give warning of their approach in the form of a wide arch of cloud lying roughly from east to west (it is a dust cloud and not water drops).

Over the southern shores of the Gulf skies are very clear during this season. Jibuti has an average of little over 1 tenth, and Berbera between 1 and 2 tenths, the relatively high figure of over 2 tenths in July and August is probably partly due to dust haze. At the latter station there is little diurnal variation in June and July, but towards the end of the season skies are  $\frac{1}{2}$  to 1 tenth cloudier in the evening than in the morning. Completely overcast skies occur only about once or twice during the season even in the evening.

At Cape Guardafui the amount of cloud is about 4 tenths in June and July but decreases to about 3 tenths as the season advances. The cloudiness is appreciably less than during the NE. monsoon but it is probable that the clouds are at a very low level. Elsewhere in Italian Somaliland this is the cloudiest season of the year with an average of 4 or 5 tenths; the amount decreases slightly in September. Judging from observations at Mogadiscio the cloud is chiefly cumulus or cumulonimbus.

**Transition season (October and November).**—Over the sea the general distribution is similar in the two months, increasing from about 2 tenths in the north-west to 4 tenths over the equatorial sea in the south-east. Near the mouth of the Gulf of Aden there is a slight increase of cloud at the end of the monsoon between September and October, but elsewhere there is a decrease. In November, however, there is an increase of about a tenth almost everywhere. Completely overcast skies are rare in the north.

Over the Gulf of Aden the sky is practically clear, October having the lowest cloud amount of any month of the year. Overcast skies are rare.

On the Arabian coast east of about 55° E. the sky clears rapidly about the middle or end of September, and in October–November the average cloud cover is 1–2 tenths. Completely overcast skies are rare at all times of the day and even cloud cover of 4 tenths or more is comparatively infrequent, occurring for less than 15 per cent. of the time.

At Aden the average amount of cloud in the morning is about 3 tenths in October and differs little in November. In the evening and the early morning skies are about 2 tenths clearer than at 0900. Completely overcast skies are rare at all times of the day. Cloud cover of 7 tenths or more is recorded about 4 or 5 times a month in the morning but only about twice in the afternoon. The height of the cloud base is usually between 3,000 and 5,000 feet but at any time of the day it may fall to between 2,000 and 3,000 feet 5 or 6 times during the month.

At Berbera the amount in both October and November is between 1 and 2 tenths; in October there is very little diurnal variation but in November there is the same tendency for the sky to clear in the evening that is noticeable during the NE. monsoon. Overcast skies are rare.

At Cape Guardafui there is a slight decrease of cloud in October to about 3 tenths and a very well-marked increase to nearly 5 tenths in November; there is no well-marked diurnal variation. On the coast of Italian Somaliland farther south the average amounts are about 3 or 4 tenths, inland they appear to be appreciably higher, mostly about 4 or 5 tenths.

VII—RAIN AND HAIL

1.—RAIN

Step diagrams showing the average monthly rainfall and the number of rain days are reproduced in Figs. 40 and 41. The corresponding data are given in the general climatological tables on pages 128-35 and for some additional stations in the table below. The short-period data given in the general climatological tables for Ras al Hadd, Masira island, Salalah, Riyan, Bander Kassim and Socotra have not been used for these diagrams. In order to show the difference between the coastal regions and the interior, data for a few inland places in Somaliland are also included.

AVERAGE RAINFALL AND NUMBER OF RAIN DAYS

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
	<i>millimetres</i>												
Obbia ..	17	0	4	16	28	0	0	<1	2	33	15	9	125
Sheikh ..	7	19	40	86	77	37	39	60	79	73	28	13	558
Oddur ..	3	1	6	122	62	4	5	1	12	120	88	3	427
Bardera ..	3	13	20	103	71	31	50	8	15	83	58	33	488
Gelib..	1	0	6	131	82	91	79	28	30	133	130	76	787
	<i>days</i>												
Obbia ..	3	0	<1	3	3	0	0	<1	2	3	3	2	19
Sheikh ..	1	0	0	12	13	2	2	6	20	8	7	4	75
Oddur ..	4	2	1	8	5	6	1	2	2	9	6	4	34
Bardera ..	7	9	3	7	4	3	5	2	2	5	6	4	43
Gelib..	2	0	2	8	7	8	4	3	3	4	6	2	47

Authorities.—Bibliography Nos. Obbia, 103; Sheikh, 94; other stations, 40, 43.

Periods.—Obbia: rainfall, 4-5 years, rain days, 1932-3; Sheikh: 1921, 1923-36; other stations, 1922-30.

Note.—The definition of the rain day which has had to be adopted for this area is a day on which 0.1 mm. (0.004 in.) of rain falls; this differs from that of the India Meteorological Department, i.e. 2.5 mm. (0.1 in.) which has been used elsewhere in this volume. The effect of the difference of definition is shown by the following figures for Aden and Berbera, which give the average number of days in the year with rain of different amounts:—

Amount of rain equal to or greater than		No. of days	
mm.	in.	Aden	Berbera
0.1	0.004	15.7	—
0.25	0.01	11.6	9.3
1	0.04	6.4	6.4
2.5	0.1	3.5	4.0
10	0.4	1.1	1.7
25	1.0	0.8	0.6
50	2.0	0.2	0.04

Authority.—Bibliography Nc. 94.

Periods.—Aden, Jan. 1940-May, 1943; Berbera, 1916-38.

For the sea the only information is the monthly frequency of rainfall expressed as a percentage of the total number of observations; this is given in the table below for four sea areas north of 10° N., and is illustrated for three sea areas in the diagrams of Fig. 41.

N.	E.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
		<i>per cent.</i>											
GULF OF ADEN													
10-15°, 44-50°..		1	1	3	1	2	0	6	7	0	2	1	1
ARABIAN SEA													
15-22°, 55-60°..		5	0	0	0	5	5	1	0	3	1	8	4
10-17° 50-55°..		4	1	5	0	2	0	0	4	1	3	5	3
10-15°, 55-60°..		3	8	9	7	6	2	2	0	1	6	9	6

Authority.—Bibliography No. 94.

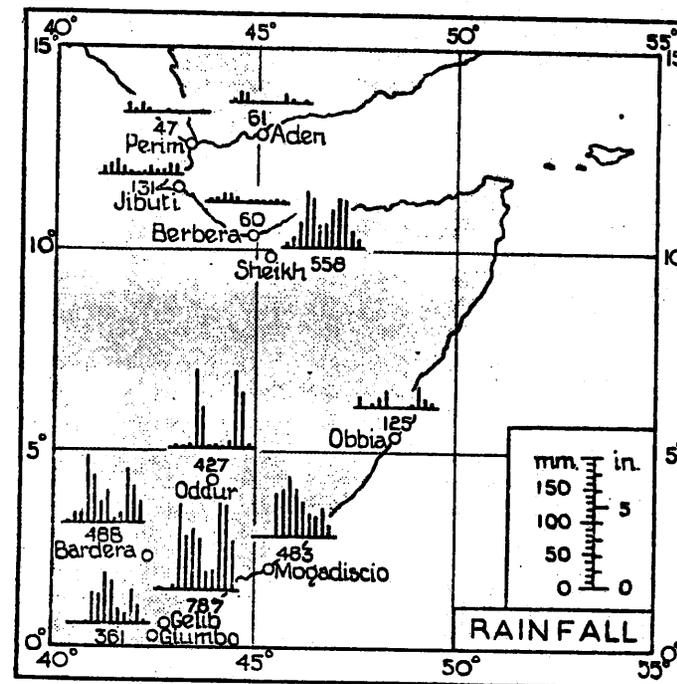


FIG. 40—ANNUAL VARIATION OF RAINFALL

The figures below the diagrams indicate the total annual amount of rain in millimetres. Note.—Gumbo has been plotted just north of the equator instead of south.

Annual rainfall

According to the most recent estimates the annual rainfall over the sea shows a very well marked increase from an arid climate in the north-west off Ras Hafun with only 100 mm. (4 in.) to one of copious rainfall, 1,500 mm. (60 in.), in the extreme south-east (0° N., 60° E.). On the south-east coast of Arabia rainfall is very scanty. Detailed measurements are not yet available but it is said that at Masira island rain is very uncommon though at infrequent intervals heavy storms may occur. Inland from Mukalla also heavy rains are occasionally experienced not more than about six times a year; the rain falls from heavy cumulus clouds which build up over the high hills in the late afternoon. [In the year 1943 measurable rain fell at Masira island on only 4 days, 2 in January (10.4 mm.) and 2 in December (8.8 mm.), the latter during thunderstorms.]

In the Gulf of Aden itself the rainfall is even less than off Ras Hafun, the average being only about 50-100 mm. (2-4 in.). Both Aden and Berbera have an average of 50-60 mm., and Jibuti has about twice that amount. The rainfall is so variable from year to year that an average in this region has little meaning, sometimes a whole year may pass

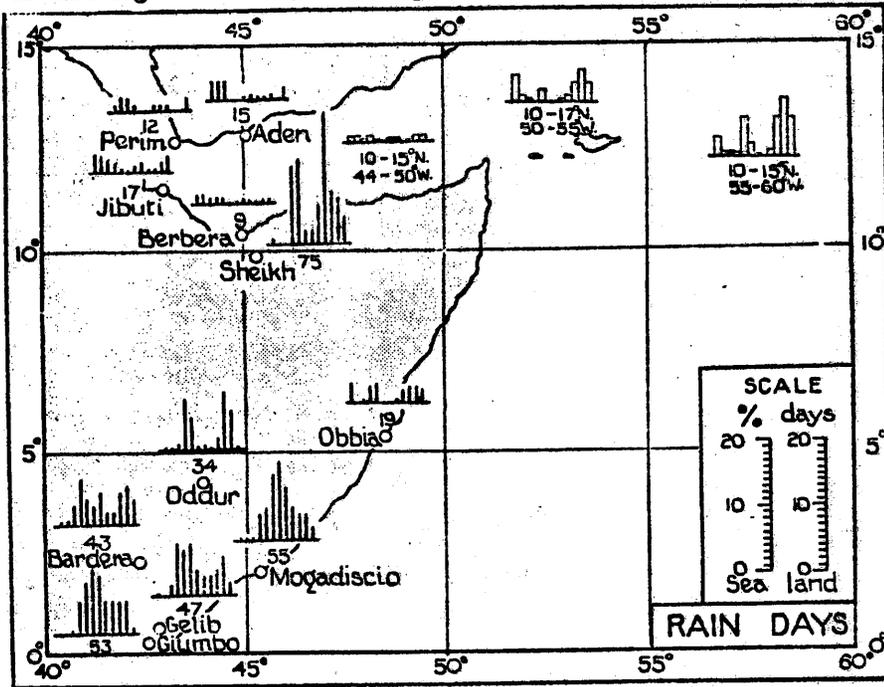


FIG. 41—ANNUAL VARIATION IN THE FREQUENCY OF RAIN DAYS

The figures below the diagrams indicate the total number of rain days in the year. A rain day is taken as one on which 0.004 in. (0.1 mm.) or more of rain falls, except at Berbera where the amount is 0.01 in. (0.25 mm.).

The diagrams for the three sea areas, drawn in open column, show the frequency of precipitation expressed as a percentage of all observations at the watch hours.

Note.—Giumbo has been plotted just north of the equator instead of just south.

without any rain at all, whereas in others there may be as much as 200 mm. (8 in.). A better idea of the conditions is given by the frequencies with which different annual falls occur as shown in the following table for Aden and Berbera.

Annual rainfall in inches	NUMBER OF YEARS IN A HUNDRED WITH ANNUAL RAINFALL BETWEEN GIVEN LIMITS						
	0-1	1-2	2-3	3-4	4-5	5-6	≥6
Aden .. .. .	31	35	12	14	2	4	2
Berbera .. ..	24	30	31	3	3	0	9

Authorities.—Bibliography Nos. 18, 94.

Periods.—Aden, 49 years, 1881-1930 (except 1885); Berbera, 33 years, 1906-38. Owing to the difference in period, the frequencies are expressed as percentages in order to make them comparable.

On the tableland north of Aden falls are heavier. Detailed observations are lacking but scattered measurements at Mukeiras (7,000-8,000 feet) indicate that rain may fall there in any season of the year; falls in 1941-2 gave over 20 mm. in February, June, July, August and October.

In the mountainous interior of British Somaliland also the rainfall is very much heavier than on the coast; at Sheikh, which lies only 50 miles or so inland from Berbera at a height of about 4,500 feet, the average annual fall, judging from the few years' data available, is about 558 mm. (22 in.).

On the coast of Italian Somaliland the rainfall is least in the north, in the neighbourhood of Cape Guardafui and Ras Hafun, where less than 100 mm. (4 in.) falls; it increases southwards to Mogadiscio, where the annual average is about 500 mm. (20 in.). Inland the fall is for the most part between 250 and 500 mm. (10-20 in.) but it rises to about 800 mm. (32 in.) in the south near Ischia Bardoa and Gelib. Inland the heaviest rainfall occurs during the afternoon or early evening and is of the thunderstorm type.

The number of rain days (0.1 mm. or more) is about 15 or less in the Gulf of Aden, about 55 on the southern part of the coast of Italian Somaliland and between 30 and 50 in the interior.

Annual variation

Broadly speaking most of the scanty rainfall on the Arabian coast eastward of Ras Fartak (52° E.) falls during the SW. monsoon, whereas on the shores of the Gulf of Aden rain is more likely during the latter part of the NE. monsoon. In the latter region, however, the rainfall is so spasmodic that there is really no rainy season. On the east coast of Italian Somaliland, January to March is almost entirely dry and the rainy season extends from April to November.

Inland the regime is somewhat different; there are two rainy seasons, one in April and May and another in October and November. In some parts of the interior the period from June to September is one of almost complete drought, in others some rain falls but less than during either of the two rainy seasons.

NE. monsoon (December to March).—Over the sea the probability of rain is greatest in the south-east where there is about 1 chance in 20 that there will be rain in any given quarter of an hour; the chance is only 1 in 100 near the eastern entrance to the Gulf of Aden, and even less than that in the Gulf itself.

During this season there is little rain on most of the south-east coast of Arabia, but in the Gulf of Aden about half the scanty rainfall of the year falls in these four months. At Aden and Berbera the average is about 10 mm. (0.4 in.) a month. Sometimes there is no rain throughout the whole season and any month is likely to be completely rainless about once in two or three years (see page 101). The rain generally falls in short showers or as cloud bursts which may be sufficiently heavy to give 50-75 mm. (2-3 in.) of rain. In 1941 most of the rainfall in this season at Aden fell in a period of continuous rain from March 3-4 which gave 28 mm. during a time when the Sudan-Abyssinian low was unusually far south. The sky was overcast with typical thick altostratus during most of the

3rd and all the 4th. Rain started with cloud base at 15,000 feet. Later a layer of ragged stratiform cloud formed at just over 1,000 feet, and the visibility for a time fell to 1 mile. Surface wind was NE. throughout but only up to 2,000 feet at the start of the rain, with SE. to 4,500 feet, followed by a sharp veer to SSW. and to W. by 7,000 feet.

Reliable normals are not available further east but rainfall appears to be very variable from year to year. Two years' data for Mukalla gave a mean for the four months of about 150 mm. of which nearly 140 mm. fell in February and March. In the year 1943 the total rainfall in the four months was about 15 mm. at places between Riyan and Ras al Hadd.

In the interior of British and French Somaliland this is the dry season and very little rain falls.

At Socotra detailed measurements are lacking but November to January is said to be the wettest time of the year, the rain falling in squalls. Observations in 1943 gave 90 mm. in November and 136 mm. in December, whereas in 1942 there were only 24 mm. from November 8-30 and only 6 mm. in December. In both 1943 and 1944 less than 5 mm. fell in January and February, and March 1943 was dry except for heavy dew.

On the east coast of Italian Somaliland and also in the interior this is a dry period particularly from January onwards; it is known locally as Gilal. During these months the average monthly rainfall is less than 25 mm. (1 in.) almost everywhere, although in the south there may be more than that in December. January and February are almost completely dry. On the rare occasions when rain falls on the coast it is localised.

**Transition season (April and May).**—On the coast of Arabia and on the shores of the Gulf of Aden there is little if any rain in this season except at the western end of the Gulf where Jibuti and Berbera both have about 12 mm. (0.5 in.) in April. At Sheikh conditions are very different; the rainy season extends from April to November but the heaviest falls of 75-100 mm. (3-4 in.) a month occur on the average at the beginning and end of that period, i.e. at the change of the monsoon.

On the coast of Italian Somaliland and for some 50-100 miles inland this is the wettest period of the year and is known locally as Gu. Towards the south the average on the coast in the wettest month is 50-100 mm. (2-4 in.) and inland 100-150 mm. (4-6 in.). The rain is usually in the form of heavy showers which sometimes occur for many days in succession.

**SW. monsoon (June to September).**—During this season rain is much less frequent in the west of the Arabian sea than in the east. In the western part of the sea the chance of its raining during any given quarter of an hour is greatest in the south-east (0-5° N., 55-60° E.) where it is 1 in 25, and is practically nil off the coast of Africa and Arabia and over the Gulf of Aden. On the Arabian coast east of Ras Fartak, where the SW. monsoon strikes the land after a fairly long fetch over the sea, there are light rains in July and August. At Merbat rain seldom falls but farther west on the mountains and plains of Dhofar it is said to fall abundantly at times in this season. The rain is apparently very localised and dependent on the configuration of the mountain massifs; Jebel Qara

is said to receive effective monsoon rains whereas Jebel Qamar and Jebel Samman to the west and east, though higher, are almost rainless.

At Salalah from mid June to the end of September the amounts were estimated to be about 50 mm. (2 in.) a month, but records in 1943 gave 3, 28, 14 and 10 mm. for those months. The rainfall is said to be mostly in the form of drizzle and there is seldom if ever enough rain to make the ground soft or muddy. The absence of heavy rain is probably due to the presence of an inversion which checks convection.

At Mukalla no rain was recorded in June and July, 1938 and 1939, but 13 mm. (0.5 in.) fell in August 1938 and 24 mm. in September. Riyan recorded only 2 mm. (0.1 in.) in the period June-September 1942 and 3 mm. in 1943.

On the shores of the Gulf of Aden practically no rain falls during this season except in the extreme west, where Jibuti has an average of about 12 mm. (0.5 in.) in August, and this is probably due to isolated heavy falls; recent data for Perim give only 2 mm. (0.1 in.) in August. Aden is almost rainless but slight showers with thunder and lightning are occasionally experienced, usually between 1700 and 0600 and mostly after midnight. The sky is rarely completely overcast and the cloud base is usually above 5,000 feet. Occasionally 2-4 mm. (0.1-0.2 in.) of rain falls but more often only a trace. The showers are dying when they reach Aden and have very little motion; they drift out to sea but probably not far. Berbera records very little rain (6 mm.) and Bander Kassim had none in 1943.

At Socotra to the east of the Gulf some rain is said to fall from June to September; in 1943 none fell from June to August and only 3 mm. in September.

On the east coast of Italian Somaliland the rain continues into June or July after which it usually decreases slightly, and in August-September it probably falls only in light showers. Within some 50-100 miles of the coast the decrease usually sets in earlier, though some rain continues to fall throughout the SW. monsoon season. Further inland there is a second dry season (Hagui) lasting from June until nearly the end of September during which practically no rain falls, the average for all months being less than 25 mm. (1 in.). During this season, therefore, there is a well marked increase in rainfall on approaching the coast. This greater rainfall on the coast is characteristic of the season when winds are from SW.; later in the year when SE. winds are prevalent the reverse is true.

**Transition season (October and November).**—On the Arabian coast and over the Gulf of Aden there is practically no rain in these months except at Jibuti where a little rain sometimes falls, 8 mm. (0.3 in.) in October and 16 mm. (0.6 in.) in November. Mukalla recorded 23 mm. (0.9 in.) in October 1939, but little or none in either October or November, 1938, or November 1939; Riyan recorded no rain in October 1942, but 6 mm. (0.2 in.) in November.

Inland in British Somaliland the rainfall increases again and there is a second rainy season in September and October, when the monthly average at Sheikh is between 75 and 100 mm. (3-4 in.).

At Socotra there is said to be a slight risk of rain if it lies in the col between the lows over Africa and southern India and the highs over north-west India and the South Indian ocean. Usually it is within the circulation round the northern hemisphere high and the weather is dry; more humid conditions prevail, however, if it is within the southern hemisphere circulation and there is then a possibility of rain in the south-west of the island. In 1943 there were 4 mm. (0.2 in.) of rain in October and 90 mm. (3.5 in.) in November.

In Italian Somaliland also there is a well marked increase of rainfall in October which continues into November. In fact in the north in the neighbourhood of Cape Guardafui November is said to be the wettest month of the year. On the coast the average monthly fall is comparatively small, being between 25 and 50 mm. (1 and 2 in.), but inland the amounts rise to 100 or 125 mm. (4 or 5 in.) and in the interior, where there is complete drought in summer, October and November are the wettest months of the year. The rains may begin as early as September. Winds in this season show a slight prevalence of SE., and with this direction more rain falls inland at Duca degli Abruzzi than at Mogadiscio on the coast.

Extremes of monthly and annual rainfall

The table below gives the greatest amount of rainfall that has occurred in each month and in the year at Aden, Berbera and Jibuti and also the number of years in which a month was completely dry. Records in other regions are not available over a sufficiently long period.

During the same periods the lowest annual fall at Aden was 0 mm., at Jibuti 11 mm. (0.4 in.) and at Berbera 9 mm. (0.3 in.).

HIGHEST MONTHLY AND ANNUAL RAINFALL AND NUMBER OF RAINLESS MONTHS

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
	<i>millimetres</i>												
Aden .. .. .	84	40	187	98	36	34	16	50	35	57	33	39	218
Berbera .. ..	62	57	122	88	56	3	15	19	17	30	47	17	178
Jibuti .. .. .	72	155	99	182	42	0	17	51	64	62	71	83	253
	<i>number of rainless months</i>												
Aden (50 yrs.) ..	17	23	29	37	36	43	38	27	32	45	37	23	—
Berbera (33 yrs.) ..	16	13	20	15	15	30	24	16	23	29	19	17	—
Jibuti (19-26 yrs.) ..	3	4	6	7	11	20	13	4	11	14	12	5	—

Authorities.—Bibliography Nos. Aden, 18; Berbera and Jibuti, 94.

Periods.—Aden, 1881-1930; Berbera, 1906-38; Jibuti, 1911-14, 1921-2, 1924-36.

Note.—In comparing the number of rainless months at the three stations it should be noted that the period at Berbera is only about two thirds that at Aden, and Jibuti only two fifths.

Maximum rainfall in 24 hours

Monthly values of the highest daily rainfall that has been recorded are included in the general climatological tables where they are available. The stations with long records are all in the western end of the Gulf of Aden.

The total rainfall in 24 hours rarely exceeds 75 mm. (3 in.) and except in March and April most of the values are less than 50 mm. (2 in.). At Berbera during a period of 26 years there were only 15 days with rain exceeding 25 mm. (1 in.) and only 1 with rain exceeding 50 mm. (2 in.).

Sometimes, however, nearly the whole year's rain falls in a single storm lasting a few hours. For instance, at Jibuti in March 1910, 200 mm. (8 in.) fell in three consecutive days, the annual total being only 237 mm. (9.5 in.). At Mukalla 86 mm. (3.4 in.) fell on November 13, 1940 during the passage of a cyclone farther to the east (see page 15).

For Italian Somaliland records of daily rainfall are scanty and no data of heavy falls are available on the coast. The rain is said to fall chiefly in the afternoons, when it may be intense and violent. The total fall in a day, however, does not often exceed 50 mm. though falls of 2 or 3 times that amount have been recorded: for example, 116 mm. (4.6 in.) at Giumbo on May 17, 1910; 120 mm. (4.7 in.) at Bur Hacaba (2° 49' N., 44° 05' E.) on May 17, 1923, and 144 mm. (5.7 in.) at Bardera on May 14, 1923.

2.—HAIL

There is no record of hail ever having occurred over the Gulf of Aden, but it is experienced at times in the mountains of southern Arabia during thunderstorms, and was recorded at Ras al Hadd during a line-squall on April 4, 1943. At Aden itself hail, though comparatively rare, is sometimes heavy.

VIII—TEMPERATURE

1.—SURFACE AIR TEMPERATURE

Monthly values of mean temperature at coastal places are given in the general climatological tables on pages 123-35 and data of the mean daily and monthly extremes and of the highest and lowest values that have been recorded are also included.

Information with regard to temperature at sea is limited to the mean monthly values computed from ships' observations taken at four-hourly intervals. These are set out in the following table, which gives data for two-degree strips of longitude across the Gulf of Aden and for five-degree areas of the open ocean.

MEAN TEMPERATURE OF THE AIR OVER THE SEA

Area	Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.											
	<i>degrees Fahrenheit</i>											
<b>GULF OF ADEN*</b>												
10-15° N. 42-44° E. ..	77	78	80	83	86	88	88	88	88	85	81	79
44-46° E. ..	77	78	80	82	86	87	85	84	86	84	81	78
46-48° E. ..	77	77	79	82	85	87	87	86	86	83	80	78
48-50° E. ..	77	77	79	82	85	87	87	86	86	82	80	78
<b>OPEN OCEAN</b>												
15-20° N. 50-55° E. ..	75	76	77	81	84	83	78	76	78	80	80	78
55-60° E. ..	75	75	78	81	83	83	78	76	77	80	79	77
10-15° N. 50-55° E. ..	76	77	79	82	84	81	80	79	78	79	79	77
55-60° E. ..	77	77	79	82	84	81	79	77	78	79	79	78
5-10° N. 50-55° E. ..	78	79	81	84	83	81	77	77	77	79	79	78
55-60° E. ..	78	80	80	83	84	79	79	79	79	80	79	79
0-5° N. 45-50° E. ..	(80)	79	81	83	82	(80)	(78)	77	77	79	80	79
50-55° E. ..	79	81	(81)	84	83	79	78	78	79	(79)	(80)	79
55-60° E. ..	79	81	82	(83)	83	81	79	80	80	81	80	80

Authority.—Bibliography No. 94.

Note.—Figures in brackets are based on less than 50 observations.

\* Mean air temperature for every 2° of longitude referred to the central line of the sea in the Gulf of Aden.

In view of the exceptional diurnal variation of wind experienced on the African coast a comparison of the average daily maximum and minimum temperatures at Berbera and Sheikh with the mean temperature over the sea is of some importance. These are given in the table below. Sheikh is some 50 miles south of Berbera at a height of 4,800 feet. The figures for both places refer to the years 1928-32 and so are strictly comparable; they differ slightly from the normals taken over a longer period of years, used in the rest of the text and in the climatological table on page 131.

ANNUAL VARIATION OF TEMPERATURE OVER THE GULF OF ADEN AND AFRICAN COAST

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	<i>degrees Fahrenheit</i>											
<b>GULF OF ADEN (44-46° E.)</b>												
Mean air	77	78	80	82	86	87	85	84	86	84	81	78
Mean sea	77	77	79	82	85	86	81	81	84	84	81	78
<b>AFRICAN COAST</b>												
Mean daily max.												
Berbera	82	83	85	88	95	106	105	105	101	91	87	85
Sheikh..	70	74	77	80	82	84	84	84	83	79	73	68
Mean daily min.												
Berbera	70	71	75	77	80	87	88	88	84	77	72	69
Sheikh..	50	50	54	57	61	64	63	62	62	53	49	52

Authority.—Bibliography No. 57.

#### Annual variation

Over the open sea and on the coasts that are exposed to the SW. monsoon the hottest season is the transition period before the arrival of the monsoon. Over the sea south of 10° N. and on the east coast of Italian Somaliland, April and May are the hottest months; north of 10° N. the hottest period is rather later, namely in May, or May and June, and the same is true of the south-east coast of Arabia.

In the Gulf of Aden, especially at the western end where the monsoon does not blow so strongly, the temperature continues to rise until July or even August; throughout the period from May to September the average temperature exceeds 85° F.

Over the sea and on the coasts south of 10° N. the range of the monthly means is less than 10° F. and near the equator only 5° F. Over the Gulf of Aden and on its northern shores it is between 10° and 15° F. while on its southern shores it is between 15° and 20° F. and a similar range is found also on the south-east coast of Arabia.

**NE. monsoon** (December to March).—Over the open sea this is one of the two slightly cooler periods of the year. The average temperature decreases northwards from about 80° F. in the equatorial regions to rather over 75° F. in the north. In general January is the coolest of the four months; there is not much difference of temperature from December to February, but temperature begins to rise in March and the average for that month is 2° F. higher than in February. Over the area 5-15° N., 50-60° E. the highest and lowest temperatures recorded in over 5,000 observations in January were 90° and 68° F. Over the open sea the diurnal range is probably about 2° F. with a minimum about 0300 and a maximum about 1400.

Over the Gulf of Aden this is definitely the cool season, average temperatures both over the sea and on the coasts lying between 75° and 80° F. in all months. At the beginning and end of the season the western end of the Gulf is a degree or two warmer than the eastern end, but in January, which is the coolest month, the mean temperature is remarkably uniform, being about 77° F. The daily range on the coasts is usually between 10° and 15° F. from some 70-75° at night to about 80-85° F. by day. The highest temperatures at Aden occur, on the average, shortly after midday. During this season the temperature on both coasts has been known to rise above 95° F. but 85-90° F. is a more usual figure. Temperature usually falls to 70° F. at Aden and 65° F. at Berbera but has been known to drop to 61° F. at Aden and 52° F. at Berbera. At Sheikh, some 50 miles south of Berbera at a height of 4,800 feet, the temperature in January ranges from rather less than 50° F. at night to over 70° F. by day; the difference of temperature between Sheikh and Berbera is 20° F. at night but only 12° F. during the day. Over the land the temperature begins to rise rapidly in March.

On the coast of Italian Somaliland the average monthly temperatures vary between 74° and 78° F. in the north and between 81° and 83° F. in the south, December being the coolest month of the four. The daily range is between 10° and 15° F. In the north the temperature varies from about 70° F. at night to between 80° and 85° F. during the day and in the south from about 75° to nearly 90° F. Records are not available over a sufficiently long period to give the extreme values accurately but in the north the range is probably from about 60° to 95° F. and in the south from 65° or 70° to 100° F. Inland the average temperature rises continuously from December until March, which with April is the hottest period of the year. At most places the average in December is about 80° F. and in March 85° F.

**Transition season** (April and May).—Over the open sea and especially in the south this is the hottest period of the year. There is a well marked rise of 3° or 4° F. between March and April, and in April the average temperature is between 83° and 84° F. in the south, decreasing slowly northwards to about 81° F. north of 15° N. In the north the rise continues into May whereas in the south there is a slight fall, so that in that month temperature is about 83° F. everywhere, being if anything rather higher in the north than in the south.

In the Gulf of Aden temperatures are appreciably higher than over the open sea and continue to rise throughout the season. The average is 82-83° F. in April and 85-86° F. in May, the western end being slightly warmer than the eastern. The average temperatures on the coasts are 2° or 3° F. higher than over the Gulf and show little difference between north and south. The averages in April range from rather less than 80° F. at night to about 90° F. by day, and in May are a few degrees higher. In both months, but especially in May, the night temperatures at Berbera and Jibuti are rather lower than at Aden. The temperature rarely if ever falls below 65° F. and the usual lower limit is about 73° F. Very high temperatures have been recorded especially on the African coast, where 112° F. has been reached at Berbera in May; at Aden the extreme is about 10° F. lower.

On the east coast of Italian Somaliland and also in the interior April is the hottest month of the year, average temperatures at most places being 83–85° F., rather higher in the south than in the north. In the south there is a slight fall in May. On the coast the daily range is between 10° and 15° F., from about 75° F. at night to 85° or 90° F. during the day; the temperature has been known to fall to 66° F. and it may rise to 100° F. but such values are exceptional. In the interior much higher temperatures are likely and 100° F. is likely to be exceeded at some time in April almost everywhere. At Lugh Ferrandi during 1932–3 the temperature rose to 122° F. in April and to 110° F. in May.

**SW. monsoon (June to September).**—Over the open sea there is a slight fall of temperature in June and the gradient is directed towards the south, values decreasing from 83° F. north of 15° N. to about 80° F. near the equator. In the north there is a further and more rapid fall in July, in which month the temperature everywhere is about 78° F. and shows little regular change from north to south. July to September is the coolest time of the year south of 10° N. In the central area (5–15° N., 50–60° E.) the highest and lowest temperatures shown by over 4,000 observations in July were 93° F. and 68° F. The diurnal range over the open sea is not likely to exceed 2° F., with a minimum shortly after midnight and a maximum shortly after noon.

In the Gulf of Aden temperature continues to rise in June, which with July is the hottest time of the year, average values being 87–88° F., some 8° or 10° F. higher than over the open sea to the east. In this season the coolest part of the south-east coast of Arabia is that which is well exposed to the monsoon, i.e. between Merbat bay and Ras al Hadd.

Over the centre of the Gulf (12–13° N., 46–48° E.) the diurnal variation in this season is about 3° F. from over 84° F. at 0400 to over 87° F. at 1600; over the open sea in the same latitude farther east (55–60° E.) the corresponding figures are 77·5° F. and 79° F.

The rise of temperature is much more rapid on the African coast than on the Arabian, and by July the difference between the two coasts is some 8° or 10° F. The weather on the African coast is almost unbearably hot. The high temperatures are associated with the kharif (see page 59), a strong south-westerly wind which after passing over the scorched plateau to the south is further warmed during its descent to the coast. At Sheikh (1,800 feet) the average maximum is about 85° F. whereas at both Berbera and Jibuti at the hottest time of the day it is about 106° F. At all three stations the temperature falls some 20° F. at night. At Aden, which is exposed to the sea winds, conditions are not quite so bad and temperatures are some 10° F. lower, ranging from 82° to 94° F. during the 24 hours; in this season the highest temperatures of the day are usually experienced in the late afternoon between 1600 and 1700. Sudden changes of temperature of 5° F. sometimes occur with the onset of the ( ) breeze and occasionally with duststorms.

The extreme temperatures ever recorded in July are 116° and 69° F. at Berbera but at Aden the maxima are lower and the extreme range is from 109° to 70° F. On the Arabian coast temperatures show little change until the end of the season but on the African coast there is a fall of 3° or 4° F. in September.

In view of the exceptionally strong SW. winds experienced at Berbera in this season it is of some interest to note that the average temperature at Berbera at night is higher than the average temperature over the sea (see page 103) so that conditions are not favourable for a land breeze of thermal origin.

On the east coast of Italian Somaliland conditions are very different from those in the Gulf of Aden and this is a comparatively cool period. In general the average temperature differs little from 80° F., there is a slight decrease until July or August, when the SW. monsoon is at its height, followed in most parts by a slight increase in September, but the changes amount to only 2° or 3° F. The daily range is about 13° F. from 70–75° F. at night to 83–88° F. during the day. Extreme values are not likely to exceed 100° F. or to fall much below 65° F. on the coast, though inland they may rise above 105° F. and fall below 60° F.

**Transition season (October and November).**—Over the open sea there is a slight rise of temperature in October of between 1° and 3° F. compared with September. The average in October and November is about 80° F. over the whole area with little or no regular change from north to south.

In the Gulf of Aden, on the other hand, temperature falls by about 3° F. in October and by a similar amount in November. The fall is rather greater at the western end than at the eastern. In October the average is 85° F. in Bab el Mandeb and 82° F. near the entrance to the Gulf; in November it is between 80° and 81° F. everywhere. On the African coast the fall of temperature between September and October is rapid, amounting to 8° F. at Berbera and in October and November the temperatures on both the northern and southern shores of the Gulf differ little from those over the sea except in daily range. At Aden the range is 15° F. from 78° to 92° F. in October and from 75° to 91° F. in November. At Berbera the day temperatures are similar to those at Aden and the night temperatures are 2–5° F. lower. The temperature has been known to rise above 100° F. in October on both coasts, the highest on record being 107° F. at Berbera, but in November it has not reached 100° F. Minima range from 61° F. at Berbera to 68° F. at Aden.

On the east coast of Italian Somaliland the average temperature is about 80° F., increasing slightly towards the equator. The range is from about 75° F. at night to about 86° F. in the day. There is very little difference from month to month or from place to place. The highest and lowest temperatures on record are 98° F. and 66° F. but the periods over which observations are available are short. In the interior the averages are slightly higher, and the extremes considerably higher; values of over 110° F. have been recorded at Lugh Ferrandi and minima have been known to fall to about 60° F. at Oddur.

## 2.—UPPER AIR TEMPERATURE

The only information available about the temperature of the upper air over this region is from a few ascents at Aden made between November 1939 and March 1941; these are summarised in the following table:—

## TEMPERATURE OF THE UPPER AIR OVER ADEN

Time of ascents : 0700 (Z-3) approximately

Height above M.S.L.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>feet.</i>	<i>degrees Fahrenheit</i>											
30,000 ..	-21	—	—	—	—	—	—	—	—	—	-23	-25
25,000 ..	0	1	-1	-4	1	5	0	1	-2	-4	-1	-3
20,000 ..	18	18	17	17	17	16	15	14	18	18	18	19
15,000 ..	36	35	33	36	37	31	39	32	32	33	35	37
10,000 ..	51	52	50	52	57	55	59	56	53	48	50	50
8,000 ..	55	59	56	59	65	64	67	62	63	57	56	55
6,000 ..	58	61	62	68	74	73	74	72	71	67	63	59
4,000 ..	62	63	67	71	77	79	82	77	75	75	69	64
2,000 ..	70	71	77	76	84	83	88	82	82	83	74	72
1,000 ..	75	75	77	79	87	86	90	83	82	86	78	76
Surface ..	80	81	82	85	91	89	93	84	87	89	77	80
No. of obs. ..	11	9	8	9	5	4	3	3	4	2	6	16

Authority.—Bibliography No. 94.

Note.—The values are only approximate, because the heights are read by an altimeter graduated according to the I.C.A.N. regulations but uncorrected.

From the character of the anemograms at Berbera during the two monsoons reproduced in Figs. 15 and 16 it has been inferred that during the NE. monsoon when an off-shore wind is blowing an inversion forms during the early part of the night but is broken down in the latter part of the night when the wind strengthens; the on-shore wind from NE. by day is definitely of an unstable type, the instability extending probably between 1,500 and 2,500 feet. During the SW. monsoon the gustiness of the off-shore wind indicates that a layer of instability and vertical convection extends from 4,000 to 7,000 feet, and it is likely that aircraft operating in this region will encounter very bumpy conditions. With an on-shore wind the stable air characteristic of the Gulf of Aden in this season is probably carried over the coast. Upper air ascents at Aden in July 1943 showed frequent inversions of temperature in the lowest few thousand feet. The range of temperature at the 1000-mb. surface was 10° F. (83–93° F.) but at the 900-mb. surface 21° F. (74–95° F.); at higher levels up to 400 mb. the range was about 12° F. On one occasion the temperature rose from 83° F. at 999 mb. to 95° F. at 902 mb. while the relative humidity fell from 84 per cent. to 31 per cent.

## 3.—SEA TEMPERATURE

Isotherms of the average temperature of the surface water in each month are shown on the charts of surface winds, Figs. 2–13, pages 18–41.

## Annual variation

Everywhere the sea temperature shows a double oscillation, being comparatively low during the two monsoons and high in the transition

seasons. The average range from the warmest to the coolest month is about 10° F. in the Gulf of Aden and off the Arabian coast; elsewhere it is less, in most places between 7° and 9° F. and in some areas south of 6° N. 4° or even 3° F. In general the highest temperatures of the year occur just before the onset of the SW. monsoon. South of 10° N. the warmest month is either April or May; between 10° and 20° N., May; and in the Gulf of Aden, June. South of 10° N. the coolest month is either July, August or September and north of 10° N., August, though in some areas, especially in the north, January and occasionally December or February are equally cool. In the Gulf of Aden either January or February is definitely the coolest.

NE. monsoon (December to March).—During this season the temperature of the surface water increases towards the south-east. In January, which is the coolest month of the four in most parts, the temperature off the eastern part of the Arabian coast is about 74° F., off the mouth of the Gulf of Aden about 77° F. and in equatorial regions about 80° F. In the other months temperatures are 2° or 3° F. higher but the general distribution shows little change. In the central region (5–15° N., 50–60° E.) out of 5,300 observations the extreme range of temperature in January was from 70° to 84° F.

In the Gulf of Aden the sea temperature is 77° F. in December, 76–77° F. in January and 79° F. in March. From December to February there is a slight increase of temperature westwards along the Gulf, but it amounts to only 1° or at most 2° F.

The temperatures off Cape Guardafui are comparatively uniform in this season and do not show the rapid changes that are characteristic during the SW. monsoon. Their average value in January and February is 77–78° F., and they rarely vary more than 4° F. above or below that figure.

Transition season (April to May).—In most parts these are the hottest months of the year; the average temperature is between 81° and 85° F. with weak and irregular gradients. In April there is a slight increase from north to south as in the NE. monsoon. In May there is an increase southwards to over 84° F. in about 10° N. but an area of cooler water appears off the African coast, along which from Cape Guardafui southwards the temperature decreases 2° or 3° F. to the equator.

In the Gulf of Aden the temperature is 81–82° F. in April and it rises rapidly to 85° F. in May.

SW. monsoon (June to September).—With the onset of the SW. monsoon the sea temperature undergoes a well marked change. In general, throughout the four months the isotherms over the open ocean run roughly from south to north or from south-west to north-east approximately along the direction of the monsoon flow, with lower temperature in the west. With the onset of the monsoon there is a comparatively large fall of temperature over the whole of the open ocean. South of about 12° N. this takes place chiefly between May and June, but north of that latitude between June and July. In June the values over the open sea are for the most part between 78° and 82° F.; in August

they lie between 74° and 80° F. The extreme range of temperature in the central area (5–15° N., 50–60° E.) shown by over 4,000 observations in July was from 63° to 90° F., considerably greater than in January.

In the Gulf of Aden June is the month of highest sea temperature of the whole year. The average is 86° F. and is fairly uniform over the area. The temperature falls slightly in July, shows little change in August and then rises again in September. For reasons indicated below the fall is greater at the western than at the eastern end so that in July and August there is a gradient westwards with temperatures of 84° F. over the eastern and central part of the Gulf and 81° F. at the western end.

The strength of the SW. monsoon off the African and Arabian coasts with its accompanying drift of water to the north-east causes the coastal water to be drawn off towards the east and hence gives rise to a local upwelling of cooler water from below.

The areas of exceptionally cold water appear to be localised on certain parts of the coast, though the exact positions are constantly changing. It is possible that the position is controlled in part by the configuration of the coast and of the sea bed and that it varies in relation to the strength of the monsoon current. The two most notable areas are in the neighbourhood of Ras Hafun and Bab el Mandeb. The latter is probably due to the fact that the SW. monsoon draws away some of the surface water of the Gulf of Aden and that this is replaced by water from greater depths. From Perim to east of Aden the water shoals gradually over a wide area to the coast and the upwelling water would pass up this slope and come to the surface. In the Gulf of Aden the temperature at a depth of 650 feet is some 18° F. cooler than at the surface.

On the charts of mean isotherms the area near Ras Hafun is marked by lines running close to the coast, indicating that the average temperature there is several degrees cooler than in the same latitude to the east. In July and August the sea temperature within 5 miles of Cape Guardafui is about 81° F., ranging between 88° and 77° F.; 15 miles to the southward it lies between 70° and 80° F. and off Ras Hafun between 65° and 70° F. In the same months the sea temperature at Abd-al-Kuri is 6° F. cooler than at Cape Guardafui 50 miles to the west-south-west. On occasions the differences are very much larger than the average isotherms indicate, and ships passing through the area may experience very large changes of temperature. For example, on August 29, 1929, a fall of temperature of 16° F. was recorded by a ship approaching Ras Hafun from the south, followed by a rise of 25° F. as it rounded Cape Guardafui. Similarly, on September 1, 1931, in approximately the same region (10° 00' N., 51° 26' E.) the sea temperature fell 12° F. in an interval of a few minutes. On this occasion large numbers of dead fish were observed.

Even larger changes have been noted at the western end of the Gulf of Aden. On August 29, 1930, in 12° 42' N., 40° 20' E., a ship approaching Perim from the Red sea measured a sea temperature of 90° F., a second measurement, after crossing a tide rip, indicated water 20° F. cooler. Shortly after, the temperature rose to 84° F., then dropped to 77° F. and rose again to 82° F. in 12° 37' N., 44° 44' E. Similarly, in August 1924 a rise of temperature of 25° F. in half an hour was recorded by a ship off Perim. On August 26, 1937, a ship 35 miles, bearing 110°, from H<sup>o</sup> island recorded a rise of temperature from 66° to 90° F. in

half an hour on approaching the straits. Another ship on the following day passed through a cold area extending from 12° 24' N., 44° 15' E. to 12° 40' N., 43° 21' E. At 2300 the temperature was 91° F., it dropped to 57° F. during the middle watch and rose again to 91° F. at 0400 on the 28th. On one occasion (July 29, 1929) the cooling was accompanied by a decrease of density, which makes it difficult to attribute it to upwelling.

Similar conditions are possible elsewhere though for areas not on the main trade routes details are lacking. Off the south coast of Arabia there is evidence of upwelling between Ras Nus and Ras Madraka and the mean temperature there falls to about 72° F. in July and possibly even lower in August. Readings as low as 64° F. have been recorded. The phenomenon begins to disappear in September.

Observations on August 17, 1938, also point to the existence of another such area between Ras Qusaiyir and Ras al Kalb. A ship in approximate position 14° 25' N., 49° 49' E. recorded a fall of temperature from 79° F. at 0500 local time to 66° F. at 0730 followed by a rise to 85° F. at noon. This area of cold is first apparent in June, becomes more marked in July and persists until September.

**Transition season (October and November).**—In these months the temperature of the open ocean is about 80° F. and is slightly higher than during either of the monsoons. In October the temperature rises slightly from west to east and in November from north-west to south-east, but there is very little variation from place to place or from month to month. With the cessation of the monsoon the areas of local upwelling disappear. At the beginning of the season irregularities of temperature near Cape Guardafui are not entirely unknown. On October 4, 1925, for example, a ship steering north-west towards Cape Guardafui recorded a sea temperature of 80° F. at 1600; on entering the Gulf of Aden the water temperature fell rapidly and at 1815 was 65° F., the air temperature fell likewise from 80° to 72° F.; the water temperature then rose gradually to the normal value of 82° F. by the following morning. Changes of 10° F. on October 10, 1937, are referred to in volume III, page 196.

The temperature off the Arabian coast is if anything slightly higher than over the open ocean in both months.

In the Gulf of Aden the temperature at the eastern end in October is about 82° F., having fallen about 4° F. from the September value. In the west the temperature remains at about 84° F. so that in this month there is a slight gradient from west to east, the reverse of that during the SW. monsoon. In November there is a general fall over the whole Gulf of 3° F., temperature ranging from 81° F. in the west to 79° F. in the east.

#### Diurnal variation

The diurnal variation of the temperature of the sea surface in July and August in the Gulf of Aden and in the west Arabian sea is shown below:—

N.	E.	0400	0800	1200	1600	2000	2400	Range
<i>degrees Fahrenheit</i>								
GULF OF ADEN 12–13°, 46–48°	..	83.2	83.8	84.5	84.5	83.7	83.4	1.3
WEST ARABIAN SEA 12–13°, 55–60°	..	76.7	76.5	77.4	77.2	76.6	76.8	0.9

Authority.—Bibliography No. 58.

No information is available for other seasons but the range of temperature is not likely to differ much from that given in the table.

Over the open sea the range is not likely to be greater than 1° F. at any time of the year, with a minimum shortly after midnight and a maximum shortly after midday.

#### 4.—RELATIVE VALUES OF SEA AND AIR TEMPERATURE

Except during the SW. monsoon differences of sea and air temperature are everywhere too small to show a regular distribution, the average being for the most part less than 2° F. and in much of the area less than 1° F. During the SW. monsoon, however, and especially at its height in July and August the air is almost everywhere warmer than the sea. The average difference is greatest at the western end of the Gulf of Aden where it exceeds 3° F. over a fairly large area and may exceed 5° or 6° F. locally. It falls to about 2° F. over the entrance to the Gulf just to the north of Cape Guardafui, and rises above 2° F. again farther east. South of Cape Guardafui and off the south-east coast of Arabia in the region of local upwelling the difference is probably as high as 5° F. in July and August. Over the open sea to the north and south the difference is rather less than 2° F. but observations are few.

Near the coasts in regions where there is local upwelling of cold water differences are sometimes very large, the air being, of course, warmer than the water. For example, a difference of 16° F. (air 82° F., sea 66° F.) was noted near Bab el Mandeb on August 26, 1937, and of 11° F. (air 81° F., sea 70° F.) on September 2, 1936.

#### IX.—HUMIDITY

##### Relative humidity

Average values of the mean monthly relative humidity, where possible for morning and afternoon hours separately, are given in the general climatological tables on pages 123-35.

In order to give a better idea of the daily range, values for the early morning hour, 0200 G.M.T. (about 0500 local time), are added in the following table. At that hour the relative humidity is probably not far from its highest value of the day. For Mogadiscio, where observations at 0500 are not available, averages for the evening hour are included instead, but these may fall short of the maximum values:—

Station	AVERAGE RELATIVE HUMIDITY AT NIGHT											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	<i>per cent.</i>											
Ras al Hadd	88	85	81	73	69	75	81	91	87	88	89	89
Masira island	79	78	78	89	88	86	90	90	90	89	83	79
Socotra	77	74	81	79	73	72	67	67	69	76	79	77
Salalah	67	57	65	79	83	84	96	95	90	73	57	68
Riyan	87	83	86	90	92	89	89	89	87	93	73	77
Aden	77	81	82	81	81	76	76	73	81	75	78	79
Perim	79	81	81	84	85	83	81	79	83	79	77	80
Berbera	88	87	89	89	79	59	49	53	59	79	84	86
Bander Kassim	82	79	77	73	74	43	36	40	53	83	91	88
Mogadiscio	84	82	81	80	83	86	87	83	87	87	83	83

*Authorities.*—Bibliography Nos. Mogadiscio, 103; other stations, 94.

*Time of observation.*—Mogadiscio, 1900; other stations, 0200 G.M.T., approximately 0800 local time.

*Periods.*—See general climatological tables, except for Berbera where it is February 1942-October 1943 and February 1944. Many are based on a few months' observations only.

Comparison of these figures with those for the afternoon hour given in the general climatological tables shows that on the coast the average daily range of humidity is of the order of 20 per cent.; it varies irregularly from month to month and from place to place. Of stations in the Gulf of Aden, Berbera is exceptional in showing a range of less than 5 per cent. during July-September.

Over the open sea the relative humidity is between 70 and 80 per cent. increasing towards the equator during the NE. monsoon, and between 80 and 85 per cent. during the SW. Over the Gulf of Aden the values range from about 77 per cent. from December to February to about 83 per cent. in April and 82 per cent. in August.

The scarcity of observing stations except at its western end and the large differences between conditions on the northern and southern shores, especially during the SW. monsoon, make it dangerous to generalise for the Gulf of Aden from the few data available.

At Riyan, near Mukalla, in November, December and February values range from 73-83 per cent. at night to 50-60 per cent. at the driest time of the day; in January the values are somewhat higher, but as data are available for less than 2 years it is difficult to know whether this is a regular phenomenon. From April to October the corresponding range is from about 90 to 65 or 70 per cent.

At Aden the difference between the highest and lowest monthly averages is only about 10 per cent. whereas the average daily range is about 20 per cent. and may be as much as 30 per cent. in some months. The air is relatively most humid (75-80 per cent.) in the early morning at about 0600 and driest (55-60 per cent.) in the afternoon. From October to May the driest time of the day is in the early afternoon, 1300-1500, but not until the late afternoon, about 1700, from June to September.

Sudden changes of humidity are frequent—a rapid fall from 70 to 30 per cent. quite often occurs during the afternoon with no obvious wind change, and an equally rapid rise to the original value frequently occurs with the appearance of the land breeze. The change in water content is often so large that it could only have been produced by considerable subsidence, from say 3,000 feet to the surface over the Gulf of Aden. It is not unusual, however, for a sudden fall of humidity to occur at the onset of the land breeze.

At Berbera on the southern shore the annual range is very much larger, and in contrast with Aden it is much greater than the daily range. Values at 0800 vary from 46 per cent. in June, the driest month, to nearly 80 per cent. in March and April, the wettest. Except during the SW. monsoon the diurnal variation is similar to that at Aden, but as no hourly values are available it is impossible to make a strict comparison. During the SW. monsoon owing to the prevalence at night of the dry kharif wind the humidity fails to rise in the evening and in consequence shows little change throughout the 24 hours. It is probable that these conditions prevail also further east where there is high land near the coast.

At Bander Kassim, for example, the humidity in July remains below 45 per cent. at all four hours of observation ranging from 31 per cent. at 0900 to 44 per cent. at 1500; but in the other months of the SW. monsoon it rises to over 60 per cent. at 2100 (75 per cent. in September) and has

a daily range of 30 per cent. Here the lowest range is in October and November when the humidity remains above 80 per cent. throughout the day.

In the interior on both sides of the Gulf relative humidity during the day is much lower than on the coast except during the rainy season in British Somaliland.

On the east coast of Italian Somaliland very few observations are available, but it is probable that the air is most humid during the SW. monsoon and driest in March and April. Observations at Mogadiscio give a range of 17 per cent. in the values at 0800 local time, but at Giumbo the range is only 5 per cent. Over the greater part of the year the mean humidity exceeds 80 per cent. and in some parts exceeds 90 per cent. during the SW. monsoon. On the coast the diurnal range is probably 10-15 per cent. during the NE. monsoon, but less than 5 per cent. during the SW. At Mogadiscio in most months the humidity shows a gradual rise from 0800 to 1900 instead of an afternoon minimum. Inland the air is very much drier; at Lugh Ferrandi, for example, the means range from about 60 to 65 per cent. at the morning hour, and there is a fall of 20 or 25 per cent. in the afternoon.

The range of extreme values of relative humidity likely to be experienced at Aden and Berbera at different hours of the day is shown in the table below.

HIGHEST AND LOWEST VALUES OF RELATIVE HUMIDITY

	Time (Z-3)	per cent.											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Highest													
Aden ..	0500	94	93	95	95	94	93	91	91	92	94	90	95
	1500	85	85	91	84	79	77	74	77	79	72	69	95
Berbera ..	0800	100	91	95	91	92	86	92	85	96	96	91	91
	1400	87	86	91	95	88	81	89	82	85	96	88	85
Lowest													
Aden ..	0500	55	68	67	46	42	48	47	46	49	41	47	58
	1500	39	43	17	21	15	41	37	39	34	19	22	26
Berbera ..	0800	50	53	64	45	29	24	23	26	28	41	44	45
	1400	43	49	54	47	27	18	19	21	24	39	49	41

Authority.—Bibliography No. 94.

Periods.—Aden, 1940-3; Berbera, April 1924-November 1934.

At Salalah a value as low as 8 per cent. has been recorded in May at 0900 during a dusty northerly wind and 7 per cent. in February at 1500 in similar circumstances.

#### Absolute humidity

The absolute humidity, which gives a measure of the amount of water vapour in the air, shows a well marked seasonal variation. Over the greater part of the region it reaches its lowest value during the NE. monsoon, probably either in January or February, and its highest sometime between May and September. Near the equator, however, where the seasonal range is small, the variation is likely to be the reverse of this.

In January during the NE. monsoon the vapour pressure over the sea decreases northwards from about 27 mb. (dew point 72° F.) on the equator to about 20 mb. (dew point 63.5° F.) near Ras al Hadd. During the SW. monsoon, in July, the vapour pressure is between 25 and 30 mb. (dew point 70-75.5° F.) and at this time of year the lowest values are on the equator near the African coast and the highest in the north of the Arabian sea.

Monthly means of vapour pressure at coastal places, chiefly in the Gulf of Aden, are given in the table below. As the diurnal variation is small the values are given only for 0900, except at Riyan and Aden, where data for the early morning and afternoon are also included to show the magnitude of the range.

MEAN VAPOUR PRESSURE

	Time (Z-3)	millibars											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Ras al Hadd ..	0900	21	20	20	26	28	28	28	27	26	28	27	22
Masira island ..	0900	19	19	20	26	31	29	27	25	25	23	22	21
Socotra ..	0900	20	20	22	24	26	25	21	22	22	22	24	22
Salalah ..	0900	18	15	19	27	28	30	30	28	27	21	17	17
Riyan ..	0500	21	20	21	27	30	31	29	30	30	25	18	19
	0900	21	21	22	29	32	33	31	32	31	28	19	19
	1500	22	22	23	29	33	33	29	29	31	29	21	21
	2100	23	22	24	30	33	33	28	29	31	28	21	21
Aden ..	0500	22	25	26	28	32	33	30	29	32	26	24	23
	0900	23	25	26	28	32	33	31	31	32	27	24	24
	1500	22	24	25	25	29	31	28	29	30	25	23	23
Perim ..	0900	24	25	27	31	34	34	33	33	35	30	27	26
Berbera ..	0900	25	24	29	33	34	30	25	29	25	27	24	23
Bander Kassim ..	0900	21	21	21	23	27	20	17	20	24	32	28	24

Authority.—Bibliography No. 94.

Periods.—See general climatological tables. Berbera, Mar. 1942-Oct. 1943, Feb. 1944. Except at Aden and Perim the data are based on a few months' observations only.

Note.—The corresponding dew points can be judged from the following equivalents: 20 mb. = 63.5° F.; 25 mb. = 70° F.; 30 mb. = 75.5° F.; 35 mb. = 80° F.

In general there is a fairly regular annual variation from a minimum in January or February to a maximum in June. There is a slight fall in July and August, followed by a partial recovery in September and a further fall thereafter. At Riyan the sudden fall between October and November and the sharp rise between March and April are notable as is also the large fall between May and June at Berbera and Bander Kassim.

The annual range of the monthly means is between 10 and 15 mb. and is in striking contrast with the daily range, which in most months is only 2 or 3 mb. The hour of occurrence of maximum water content varies from place to place. At Riyan, judging from two years' observations, from September to June, the lowest humidity is in the early morning and the highest in the afternoon or evening, whereas in July and August the afternoon and evening are at least as dry as the morning. At Aden, on the other hand, rather surprisingly the afternoon is drier than the morning throughout the year, the fall of vapour pressure between 0900 and 1500 amounting to about 2.5 mb. from April to September and 1-1.5 mb. in the other months.

The highest and lowest vapour pressures recorded at the three standard hours of observation (0500, 0900, 1500) at Aden during the period 1940-3, are shown in the following table:—

		EXTREMES OF VAPOUR PRESSURE AT ADEN											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Highest	.. ..	30	30	32	35	40	40	39	40	39	34	37	33
Lowest	.. ..	14	19	8	11	10	17	20	19	20	10	12	11

Authority.—Bibliography No. 94.

Absolute extremes at other places are: Salalah, 36 and 3 mb., Riyan, 44 and 6 mb. and Perim, 46 and 15 mb.

The value of 8 mb. at Aden was accompanied by a gusty NNE. wind and sand haze.

#### Wet-bulb temperature

Average monthly wet-bulb temperatures at two hours of observation are given in the general climatological tables. At stations on the shores of the Gulf of Aden the day-time values show an annual variation from just over 70° F. in January, when the daily range is 3-5° F., to about 82° F. in the hot season, when the daily range is similar.

At Salalah the values during the NE. monsoon are about 5° F. lower than in the Gulf and show a daily range of 8-10° F.; during the SW. monsoon the values vary from 79° F. in June to 74° F. in September with a daily range of 2-4° F.

A value of 78° F. is generally regarded as the wet-bulb temperature above which continuous hard physical labour is impracticable for white population in calm weather, and 85° or 86° F. seems to be near the limit of physical endurance for Europeans, a rise of even 1° F. above that value being acutely felt.

At most places in the Gulf the average monthly values exceed 78° F. from May to September and at Berbera probably from April to October, and this in spite of low relative humidities. Owing to the exceptionally high temperatures at Berbera (mean daily maximum in June and July 107° F.) even with a relative humidity as low as 50 per cent. the water content is 28 grams per cubic metre and the wet bulb 90° F.

The frequency of high wet-bulb temperatures is shown in the following table:—

		AVERAGE NUMBER OF DAYS WITH WET-BULB TEMPERATURE ABOVE 78° F. AT 0900 (Z-3)												
Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
		<i>days</i>												
Ras al Hadd ..	..	0	0	0	7	23	21	13	8	3	11	2	0	88
Masira island ..	..	0	0	0	3	23	11	1	0	0	0	0	0	38
Socotra ..	..	0	0	0	0	6	5	0	0	0	0	0	0	11
Salalah ..	..	0	0	0	3	16	26	3	0	0	0	0	0	48
Riyan ..	..	0	0	0	11	25	28	21	27	22	7	0	0	141
Aden ..	..	0	0	0	9	27	27	19	22	28	9	<1	0	141
Perim ..	..	0	0	<1	17	31	29	29	30	29	18	4	<1	188
Berbera ..	..	0	0	<1	14	26	14	12	17	19	16	2	0	121
Bander Kassim	..	0	0	1	4	16	3	1	3	10	15	0	0	53

Authority.—Bibliography No. 94.

The variation in frequency from one year to another is large. At Aden, for example, in April 1940 the wet bulb did not exceed 78° F. at 0900, whereas in 1941 it exceeded that limit on 16 days. At Riyan during July and August and at Aden from April to September the frequencies at 1500 are rather lower than at 0900, though the difference is not great. At Berbera, on the other hand, the afternoon frequencies are greater than the morning.

Annual totals at 0500, 0900 and 1500 are as follows:—

	Z-3	Salalah	Riyan	Aden	Perim	Berbera	Bander Kassim
0500	6	45	107	162	—	20	
0900	48	141	141	188	121	53	
1500	68	130	131	201	186	181	

Wet-bulb temperatures in the Gulf sometimes rise to exceptionally high levels. Values of 86° and 87° F. have been recorded at both Riyan and Aden in the months of April to June, and similar values have been reached at Perim from May to October, rising as high as 90° F. in June and July. A record of 100° F. at Berbera is of very doubtful accuracy though exceptionally high values are likely to be experienced in that locality. During the NE. monsoon the wet bulb rarely, if ever, rises above 80° F. and in January rarely above 78° F.

Outside the Gulf values are lower but 80° F. has been reached at Salalah from April to July, and at Socotra in May.

#### X—MISCELLANEOUS

##### 1.—THUNDERSTORMS

Observations of the frequency of thunderstorms are almost entirely lacking but the evidence indicates that storms are infrequent over the whole area. The total number of days in the year with thunder is probably little more than 20 even in equatorial regions where they are likely to occur most often, and in the Gulf of Aden it is less than 10.

The summarised data available for the sea are set out in the following table, which gives the frequency with which either thunder or lightning was observed, expressed as a percentage of the total number of observations.

##### FREQUENCY OF THUNDER AND LIGHTNING AT SEA

Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
N.	E.	<i>per cent.</i>											
10-15°	44-50°	0	.4	.5	1	3	1	2	3	1	.1	0	0
10-17°	50-55°	0	0	.5	0	2	0	.5	.7	.3	.4	.3	.5
10-15°	55-60°	0	.2	0	0	.5	0	0	.2	0	2	1	.2

Authority.—Bibliography No. 94.

For coastal stations data are included in the general climatological tables but at most places the observations are for very short periods.

##### Annual variation

Over the open sea in the northern part of the area and in the Gulf of Aden thunder appears to be more frequent during the SW. monsoon than during the NE. but in the neighbourhood of the equator and also in the extreme north near Ras al Hadd the reverse is the case.

During the six months from October to March the frequency in the Gulf of Aden and along the south-east Arabian coast is only 2 or 3 days; it increases south-eastwards to between 10 and 15 in the neighbourhood of the equator. From April to September the frequency is about 5 in the Gulf, increasing slightly at its western end, and between 5 and 10 elsewhere except on the south-east coast of Arabia where storms are probably very rare. At Berbera, of the 9 storms to be expected during the year, 7 are likely to occur in these six months. Thunder and lightning sometimes accompany sandstorms.

Detailed information is lacking for Aden but during the SW. monsoon slight showers, sometimes with thunder and lightning, are occasionally experienced. They drift towards the sea from the interior and are in a dying condition when they reach the coast, so that often they give only a trace of rainfall though there may be 2-4 mm. They usually occur between 1700 and 0600 and by far the greater number are after midnight.

In the mountainous districts of the interior of Somaliland storms appear to be more frequent.

## 2.—DUSTSTORMS AND SANDSTORMS

In the Gulf of Aden duststorms may be experienced in any month, but the majority occur between June and August. The total number reported at sea near Aden during 1921-6 was 120 distributed throughout the year as follows:—

TOTAL NUMBER OF DUSTSTORMS DURING 1921-6

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1	3	3	6	9	25	26	32	11	2	1	1	120

No clear distinction seems to have been made between sandstorms, which are technically defined as composed of coarse sand particles that are rarely carried to a greater height than 50-100 feet above ground, and duststorms, which are composed of finer particles lifted from the ground by a very turbulent wind sometimes to several thousand feet. Some differentiation also seems to be desirable between an active storm, accompanied by strong winds, on the one hand, and a dense dust cloud raised at some distance from the observer and drifting in the prevailing wind, on the other. The data available at present do not permit of exact definition and the table above gives therefore only a general idea of the seasonal variation rather than of the absolute frequency.

The average number of duststorms at Riyan, Aden and Perim is given below. Of these about half passed over the station and half were seen at or near it.

DUSTSTORMS

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Riyan	0	0	0	5	0	7	3	4	2	0	0	0	17
Aden	3	2	2	5	1	3	3	4	0	7	3	7	18
Perim	0	1	1	3	1	2	2	2	1	3	2	0	13

Authority.—Bibliography No. 94.

Period.—Riyan, April 1942-May 1943; Aden, January 1940-May 1943; Perim, May 1942-September 1942, March-May 1943.

The following is a description of a sandstorm experienced by S.S. *Aeneas* between Bab el Mandeb and Aden:—

"On 21st September, 1933, at 1700 (local time) when the ship was in position 12° 36' N., 44° 04' E., a cloud of sand was observed travelling quickly in a south-westerly direction from off shore. Above this sand cloud existed a heavy bank of cumulonimbus cloud, superimposed with cirrocumulus cloud, the former appearing to travel in the same direction and to approach as quickly as the sand cloud. When approximately two miles off, the temperature suddenly dropped 10° F., and the wind, which previously had been WNW., force 2, veered to NE. and attained a force of 6 to 7. At 1735 the squall struck the vessel, heeling her 3°, and the visibility was reduced to not more than two cables. These conditions lasted for twenty minutes, and then gradually the wind subsided and the sand became less dense. When the wind had fallen to force 4 the visibility was about one mile and the temperature had risen 5° F. At 1830 the storm had completely passed over, leaving a cloudless sky and Perim light visible at a distance of 25 miles; the wind then resumed its previous direction (WNW., force 3), and the temperature returned to its normal reading of 84° F. During the passage of this sandstorm the wind remained steady from NE. and the barometer fell only 1 mb."

True sandstorms occur more often in the evening than at any other time of the day; at Aden they are most frequent between 1600 and 0200 local time. As a rule they give little warning of their approach though a dense cloud of sand may sometimes be seen banking up over the land an hour or so before a storm. Thunder and lightning sometimes accompany these disturbances.

On the southern side of the Gulf sandstorms usually move with the prevailing wind since at the season when they are frequent the wind is off the land; on the northern side, on the other hand, they move towards the south even when the SW. monsoon is blowing. At Aden they generally come from some direction between W. and NE. They tend to occur on days of light winds, though this is not always so. When the brownish sand cloud is first seen on the horizon the wind will probably be from SE., the usual direction of the sea breeze when the gradient is light, but very soon it swings round and blows in increasing gusts from the direction where the sand cloud is seen. Sometimes a bank of stratified cloud, estimated at about 5,000 feet, is seen moving towards the station at this stage, but in less than 15 minutes the sand cloud arrives, and may reduce visibility to 50 yards. The storms do not usually last more than 30 minutes, they drift out to sea but it is not known how far. At Aden a storm has been described extending over a front of 15-20 miles.

Two storms at Aden are described below; one was preceded by gales and the other by a period of comparatively light winds.

Before the storm of July 16, 1878 (Bibliography No. 88), a gale had been blowing for two days. The storm came from the west at about 1730, the cloud moving across the harbour at a speed estimated at over 50 knots. It is said to have produced almost complete darkness for nearly 20 minutes. Windows were broken and doors torn off their hinges. As it cleared the wind suddenly changed to N. and brought the storm back again though with less intensity. On September 22, 1926, on the other hand, a storm experienced between Aden and Perim was preceded by light winds; on its arrival the wind blew from NNE. with full gale force. The air became much cooler and drier during the storm; the air was thick with sand and dust, and visibility fell to less than half a mile for about 10 minutes, after which it suddenly cleared and visibility was excepti

During duststorms the air is often impregnated with dust up to 6,000 or 7,000 feet and sometimes up to 10,000 feet and as a result heavily loaded aircraft frequently fail to avoid them if they try to do so by climbing, though they can usually be avoided by flying round them. Very bad bumps are usually experienced in a duststorm.

Little information is available about the localities most likely to be visited by duststorms but such storms are liable to occur to leeward of any dry sandy region. The critical wind speed at the surface required for raising dust is usually about 15 knots but may vary between 12 and 22 knots according to the nature of the surface.

The kharif and other winds from the land (see pages 59-61) usually raise thick clouds of dust.

On the maritime plain of the Aden peninsula duststorms are frequent between May and September but they occur less often in the lower valleys and river beds. It is said that in April and May frequent gusty winds may give rise to very local duststorms.

On the east coast of Somaliland duststorms are said to be especially prevalent about 20 miles south-westward of Obbia, where they reduce the visibility almost to nil.

### 3.—SAND-DEVILS, WHIRLWINDS AND WATERSPOUTS

Sand-devils are whirls of sand which rise to a height of a few hundred feet only and are similar to waterspouts over the sea. In fact waterspouts have been observed to change into sand-devils on reaching the shore and to continue on their path as such. Waterspouts appear not to be very frequent and in the years 1920-31 only 4 were observed in the sea area 10-20° N., 40-50° E. and 5 in the same latitude 50-60° E.

Sand-devils and waterspouts may occur at any time of year. Their effects are only local and they can easily be seen and avoided by aircraft.

On July 10, 1922, at 1600 a ship which had passed Perim at noon noted a remarkable change in the sky and 20 minutes later the coastline was covered with an enormous cloud of dust. As the storm approached the wind changed from W. through S. and E. to NE. and increased in force. Two small whirlwinds passed  $\frac{1}{2}$  mile from the ship. The wind shifted to N. and back to NE., reaching 60 knots, and the swell, which had come from west before the storm, flattened out and as the wind slackened swell came in from north-east and the sea became rough. The whole phenomenon lasted only 15 minutes.

In the Gulf of Tajura the onset of the khamsin is said to be indicated by the whirlwinds of sand which it raises in the valley and on Obok plateau.

### 4.—SEA AND SWELL

Table XIV on page 176 gives the percentage frequencies of swell of different intensities in four 10-degree areas of the open sea, and also the frequency with which the swell comes from different quadrants. Charts for representative months are reproduced in volume I. Conditions are obviously at their worst during the SW. monsoon. In July and August there is frequently a dangerous confused swell in a region about 120 to 200 miles south of Socotra (8 $\frac{1}{2}$ -10° N., 53-56° E.).

The frequency of different states of the sea at Aden and Socotra is given in Table XV.

Brief notes of conditions on the several coasts during the two monsoons are given below; for further details the "Pilots" should be consulted.

**South-east coast of Arabia.**—Most of this coast experiences a moderate swell during the NE. monsoon and a heavy swell during the SW. monsoon. In the transition months of March, April and October the sea is usually only slight.

During the NE. monsoon the sea between the northern end of Masira island and the mainland is heavy and the northern end of the Masira channel is unapproachable except for boats. During this season also there is always a heavy swell and high surf on the beach at Sukra bay, which lies to the south-west of Ras Madraka, and at Qishn bay (15° 21' N., 51° 40' E.), and swell is said to roll into the eastern part of Mukalla bay.

During the SW. monsoon there is a heavy swell almost everywhere along the coast. Few details are available, but observations in 1943 indicate that at Mykalla only is it possible to use the harbour, and then only occasionally for a few hours just after dawn.

**Gulf of Aden.**—During the NE. monsoon at Aden there is very little swell in the harbour and the sea varies according to the strength of the local wind. In the Gulf of Tajura boats can land on the south side of Ras Duan (11° 48' N., 43° 04' E.) even when there is a heavy swell between Taguarre and Ras Duan. At Jibuti the sea in this season is generally calm, but at Salt Lake the anchorage is open to E. winds which cause a choppy sea and frequently sufficient swell to prevent landing from boats. At Zeila a moderate swell sets in to the roadstead and generally increases towards the afternoon. Further east near Ras Filuk with NE. winds the sea rounds the cape, and entering the bay on its western side forms a surf near its head.

During the SW. monsoon a fairly heavy swell normally runs in the harbour at Aden but the amount varies very considerably from day to day. The intensity seems to be dependent on the strength of the monsoon in the Arabian sea but no precise relationship has been established. At Jibuti from June to August the sea is sometimes rough and there may be heavy breakers so that communication with the shore is difficult. On rare occasions a short choppy sea is experienced owing to swell being deflected from the northern side of the Gulf of Tajura. A considerable swell sets in to Ghubbat Onkhor at times making landing dangerous.

The summer monsoon appears to cause moderate and at times very rough seas all along the coast. At Gandalo (Kandalo) loading and unloading is said to be impossible, and at Bandar Marayeh (11° 45' N., 50° 30' E.) and Bandar Alula (11° 48' N., 50° 43' E.) it is frequently hampered.

**Socotra.**—During the NE. monsoon, judging from observations in October and November, 1939, there is a light to moderate wind on the north of the island with a long low swell that makes landing from boats almost impossible.

During the SW. monsoon from June to August there are heavy breakers and a long low ground swell. On the southern side landings are difficult but can usually be made; in November, 1939, two or three weeks after the NE. monsoon had set in, a long low south-west swell was experienced on the south side of the island which was sufficient to prevent landing from a boat. On the northern side at Ghubbet Karma ( $12^{\circ} 36' N.$ ,  $53^{\circ} 50' E.$ ) and Tamrida bay ( $12^{\circ} 39' N.$ ,  $54^{\circ} 00' E.$ ) a heavy swell is felt when the wind is well to the westward.

Ghubbet Shoab in the west of the island is exposed during the SW. monsoon but sheltered during the NE. except for strong squalls. Although it experiences a long low ground swell from seawards, landings from boats are said to be usually possible.

**East coast of Italian Somaliland.**—Not infrequently there is a moderate or heavy swell during both monsoons and in some places a heavy surf on the beach which makes landing difficult so that it is often advisable to use native surf boats.

During the NE. monsoon at Ghubbet Binna, which lies to the south of Cape Guardafui, a dangerous surf is experienced but owing to the diurnal variation of the wind landing can be effected easily between an hour before and two hours after sunrise. In the Baia Sud di Hafun the NE. wind blows across the isthmus and gives rise to a cross swell over the greater part of the bay except the eastern corner. At Bender Belia, which lies just to the north of Ras Mabber, although the NE. monsoon seriously hampers shipping loading and unloading can be carried out in native boats when the wind is moderate. At Ilig landing is difficult, the best place is the entrance to Wadi Golulle. At Obbia also landing is difficult, and at El Hur it is said to be impossible when there is a heavy sea.

During the SW. monsoon, the anchorage in Baia Sud di Hafun is said to be unsuitable from early May to mid October owing to the heavy sea. At Bender Belia and Ilig loading and unloading are possible but it is advisable to make use of native boats when landing on the beach. At Bed Eil ( $7^{\circ} 58' N.$ ,  $49^{\circ} 50' E.$ ) it is said to be impossible to load and unload if the monsoon blows strongly. At Obbia landing is difficult and there is a short confused sea.

#### 5.—REFRACTION

During the SW. monsoon off the south-east coast of Arabia very high air temperatures are often connected with passing barometric lows. These hot air currents passing over the areas of cold sea water (see page 109) give rise to refraction and distort the measurements of the position of stars by 10' or even 20'.

Similar refraction is likely to be experienced during the SW. monsoon off the east coast of Africa and near Aden.

#### 6.—PHOSPHORESCENCE

Remarkable phosphorescence is observed not infrequently both in the Gulf of Aden and in the Arabian sea. In the six years 1920-5, 88 reports of its occurrence were contained in ships' logs for the area  $10-20^{\circ} N.$ ,

$40-50^{\circ} E.$  and 98 for the area  $10-20^{\circ} N.$ ,  $50-60^{\circ} E.$  It was recorded in all months but its greatest frequency was in August, some 20-30 per cent. of the reports being in that month. The number of reports varied very much from year to year in spite of the fact that the number of observing ships remained approximately the same; in 1923, for example, only 31 occurrences were reported and in 1925 nearly four times that number.

The phenomenon takes several forms. Sometimes the water is reported as being "white" or "milky" and of such brightness that its light exceeds that from the starlit sky, sometimes the phenomenon takes the form of sparkling points of light. The former type is reported frequently in the neighbourhood of the eastern end of the island of Socotra; it was very prevalent in August, 1925 (see *Mar. Obs.*, London, 3, 1926, p. 131).

An account of the phenomenon on September 5, 1932, was given by a ship in  $12^{\circ} 53' N.$ ,  $51^{\circ} 21' E.$ , about 60 miles north of Cape Guardafui. The effect of the phosphorescence was that of diffused illumination at the bottom of the ocean giving a steady continuous light showing from horizon to horizon. The sky was overcast and hazy and at 0400 the water was brighter than the sky. A remarkable feature was the difficulty in gauging visibility; lights of a passing steamer were observed at 7 miles when it had been thought that the visibility was less than 2 miles. The phosphorescence faded at day-break but reappeared in the evening. The distance run by the ship between the first appearance and final disappearance of the phenomenon was 400 miles.

TABLE I—GENERAL CLIMATOLOGICAL TABLES

Ras al Hadd. 22° 33' N., 59° 47' E. 9 ft.

Times of obs. : 0600, 1000, 1600, 2200 (Z-4)

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Gales §	Wind††										Poor visibility* Relative humidity %	Cloud amount	Wet-bulb temperature °F.			
	Average*	Daily range	Average †	Mean of		Mean of		Extreme	Average fall	No. of days	Max. fall in 24 hours			Percentage of observations from															
				Daily max.	Daily min.	Highest	Lowest							Highest	Lowest	N.	NE.	E.	SE.	S.	SW.	W.	NW.				Calm		
January ..	mb. 1016	mb. 3-4	°F. 73	°F. 80	°F. 67	°F. 87	°F. 63	mm. 4	in. 0.1	†	††	mm. 4	in. 0.1	days 0	0	20	1	3	7	28	19	8	14	0	0	0	67	2.8	69
February ..	1016	3-1	73	79	67	93	58	7	0.3	2	0.5	13	0.5	1	0.5	19	12	3	10	12	8	9	26	5	0	5	68	1.7	68
March ..	1013	3-0	77	85	69	98	64	3	0.1	1	1	3	0.1	0	0	28	5	3	6	23	3	24	3	3	0	1	59	1.2	70
April ..	1009 <sub>0</sub>	3-2 <sub>0</sub>	84	93	75	Data not available	104	50	49**	1.9	1	1	1.9	1	1	17	22	12	8	3	5	3	20	10	0	0	59	1.4	76
May ..	1003	2-4	88	97	78	Data not available	113	75	0	0	0	0	0	0	0	16	3	16	19	5	15	5	21	0	0	0	59	0.9	79
June ..	998	1-9	88	98	79	Data not available	105	75	0	0	0	0	0	0	0	5	8	8	22	18	17	2	17	3	3	59	0.8	86	
July ..	997	2-0	86	95	76	Data not available	106	71	0	0	0	0	0	0	0	3	3	5	23	20	32	3	8	3	0	59	1.9	78	
August ..	999	2-2	86	97	75	Data not available	109	72	0	0	0	0	0	0	0	0	0	6	8	29	44	7	6	0	1	54	2.5	78	
September ..	1004	2-7	80	90	71	Data not available	98	66	0	0	0	0	0	0	0	2	3	0	33	27	27	3	5	0	0	66	0.7	75	
October ..	1012	2-8	79	87	71	Data not available	90	66	0	0	0	0	0	0	0	39	5	13	5	6	11	2	19	0	0	69	0.7	76	
November ..	1014	2-9	78	84	72	Data not available	87	64	0	0	0	0	0	0	0	51	7	5	5	0	0	2	30	0	0	74	1.2	75	
December ..	1018	3-1	74	80	68	Data not available	84	62	2	< -1	1	1	2	< -1	0	29	11	8	15	10	11	0	10	6	0	69	3.5	70	
Year ..	1008	2-7	81	89	72		113	50	65	2.5	6	5	49	1.9	2	19	7	7	13	14	17	4	17	2	5	63	1.6	75	

Authority.—Bibliography No. 94.

Periods.—Wind direction, Jan. 12, 1943–Feb., 1944.

Other elements, Feb., 1943–Feb., 1944.

Notes.—\* Mean of observations at 1000 and 1600.

|| Difference between the means at 1000 and 1600.

o 8 obs. only.

† † (max. + min.).

\*\* This all fell in one day associated with a line-squall, severe thunder and heavy hail.

† Day with 0.1 mm. (.004 in.) or more of rain.

†† Day with 1 min. (.04 in.) or more of rain.

§ Beaufort force 8 or more.

††† Frequencies at 0600 are given in Table IV.

¶ No. of days with visibility less than 2 nautical miles.

Month	Observations at 1600 (Z-4)												
January ..	29	18	14	23	6	1	0	5	4	0	68	3.5	69
February ..	35	22	8	18	6	2	0	9	0	0	71	2.3	69
March ..	56	8	3	11	11	0	3	8	0	1	65	1.1	71
April ..	12	12	18	33	12	2	2	6	3	3	61	1.7	77
May ..	6	2	13	63	13	0	0	0	3	1	64	1.9	80
June ..	2	7	8	45	33	0	0	5	0	6	63	1.0	81
July ..	0	3	5	36	42	11	0	0	3	8	60	1.7	78
August ..	3	0	0	37	41	19	0	0	0	15	58	1.8	77
September ..	3	0	3	35	47	9	0	0	3	2	70	0.8	76
October ..	43	19	2	21	5	0	0	10	0	0	71	0.7	77
November ..	65	26	2	0	0	0	0	7	0	0	75	1.7	75
December ..	28	37	11	19	2	0	0	3	0	0	72	3.3	71
Year ..	23	13	7	29	18	4	< 1	5	1	36	67	1.8	75

Table I—General climatological tables

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TABLE I—continued

Salalah. 17° 03' N., 54° 05' E. 55-9 ft.

Times of obs. : 0600, 1000, 1600, 2200 (Z-4)

Month	Pressure at M.S.L.		Air Temperature						Rainfall			Thunder heard	Gales§	Wind††										Poor visibility¶	Relative humidity %	Cloud amount	Wet-bulb temperature °F.			
	Average*	Daily range	Average†	Mean of		Mean of		Extreme	Average fall	No. of days	Max. fall in 24 hours			Percentage of observations from																
				Daily max.	Daily min.	Highest	Lowest							Highest	Lowest	N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm		
	mb.	mb.	F.	F.	F.	F.	F.	F.	mm. in.	†	††	mm. in.	days	Observations at 1000 (Z-4)																
January ..	1016	3-9	74	82	66	87	80	90	59	0	0	0	0	10	16	9	12	30	11	2	4	6	0	54	2.5	67				
February ..	1016	3-9	73	82	65	—	—	88	59	0	0	0	0	14	16	5	27	22	4	0	5	7	0	46	1.8	63				
March ..	1013	3-1	77	85	68	—	—	94	62	0	0	0	0	8	2	5	10	43	14	0	5	13	0	54	1.5	69				
April ..	1012	3-0	79	87	72	—	—	93	67	0	0	0	0	0	0	0	8	60	30	2	0	0	0	69	1.5	76				
May ..	1007	2-9	84	92	75	—	—	108	69	0	0	0	0	5	0	0	6	55	29	0	2	3	0	62	1.4	78				
June ..	1003	3-0	85	90	80	—	—	109	77	3	0-1	3	1	2	0	0	2	61	30	3	2	0	1	69	4.4	80				
July ..	1003	2-7	78	83	74	—	—	87	70	28	1-1	22	9	0	0	0	8	64	26	2	0	0	18	91	10-0	76				
August ..	1004	2-8	76	81	72	—	—	83	70	14	0-6	17	6	0	0	3	37	50	10	0	0	0	11	91	10-0	74				
September ..	1007	3-1	77	83	72	—	—	87	67	10	0-4	14	4	0	0	2	40	35	13	7	3	0	7	81	7-6	74				
October ..	1013	3-5	78	87	69	—	—	94	64	0	0	0	0	0	0	2	30	32	24	10	2	0	0	56	2-1	72				
November ..	1015	3-6	78	88	68	97	63	100	63	0	0	0	0	15	14	14	14	15	18	3	5	2	0	43	1-9	69				
December ..	1017	3-7	75	83	66	91	61	94	61	13	0-5	1	0-5	15	18	18	20	18	6	<1	2	2	0	50	2-9	67				
Year ..	1011	3-3	78	85	71			109	59	68	2-7	57	21	25	1-0	1	0	6	5	5	18	40	18	2	3	3	37	64	4-0	72

Authority.—Bibliography No. 94.

Period.—Nov., 1942-Jan., 1944.

Notes.—\* Mean of observations at 1000 and 1600.

|| Difference between the means at 1000 and 1600.

† ‡ (max. + min.).

† Day with 0.1 mm. (.004 in.) or more of rain.

†† Day with 1 mm. (.04 in.) or more of rain.

‡ Beaufort force 8 or more.

†† Frequencies at 0600 are given in Table IV.

¶ No. of days with visibility less than 2 nautical miles.

Month	Observations at 1600 (Z-4)												
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Poor visibility¶			
January ..	5	<1	<1	22	58	11	0	2	0	0	56	2.3	69
February ..	10	5	4	27	48	4	0	2	0	0	47	1-6	66
March ..	0	0	3	10	71	16	0	0	0	0	57	1-1	72
April ..	0	0	0	10	62	28	0	0	0	0	68	1-2	76
May ..	0	0	0	8	63	29	0	0	0	0	69	1-7	79
June ..	0	0	0	0	45	55	0	0	0	2	74	3-6	80
July ..	0	0	0	3	66	31	0	0	0	12	84	9-0	77
August ..	0	0	0	13	68	19	0	0	0	7	84	9-0	75
September ..	0	0	0	5	62	33	0	0	0	3	78	6-6	75
October ..	0	0	0	23	56	21	0	0	0	0	61	2-1	73
November ..	3	3	<1	32	42	15	<1	3	0	0	50	1-7	71
December ..	8	4	2	47	31	6	0	2	0	0	53	2-7	69
Year ..	2	1	<1	17	56	22	<1	<1	0	24	65	3-5	73

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TABLE I—continued

Aden. 12° 47' N., 44° 59' E. 123 ft.

Times of obs. : 0500, 0900, 1500, 2100 (Z-3)

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Month	Pressure at M.S.L.		Air Temperature °							Rain			Thunder heard	Gales§	Beaufort force	Wind††									Poor visibility¶	Relative humidity %	Cloud amount	Wet-bulb temperature °F.				
	Average*	Daily range	Average†	Mean of		Mean of		Extreme		Average fall	No. of days	Max. fall in 24 hours				Percentage of observations from																
				Daily max.	Daily min.	Highest	Lowest	Highest	Lowest							N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm								
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	mm. in.	+	††	mm. in.	days	Observations at 0900 (Z-3)																	
January ..	1015	3-9	79	85	73	87	69	92	65	5	0-2	3	1	55	2-2	0	0	0	19	52	19	3	1	<1	<1	0	<1	5	0-5	70	6-3	71
February ..	1014	3-8	81	86	75	89	71	91	61	19	0-7	3	1	54	2-1	0	0	0	18	45	26	4	4	<1	<1	0	6	0	75	6-7	73	
March ..	1012	3-7	82	88	76	93	73	98	67	15	0-6	3	1	76	3-0	0	0	0	17	56	16	4	2	<1	<1	0	3	0	73	5-8	74	
April ..	1011	3-9	86	93	79	98	74	101	69	0	0-0	0	0	66	2-6	0	0	0	17	58	17	2	2	<1	<1	0	4	0	70	5-3	77	
May ..	1007	3-6	89	95	83	100	79	102	70	0	0-0	0	0	35	1-4	0-3	0	0	13	34	11	15	20	0	0	1	6	0	70	4-2	81	
June ..	1004	3-5	91	97	86	101	82	109	73	0-2	<1	0-5	0	25	1-0	0-5	0	0	9	15	7	21	35	4	0	0	9	0-6	66	3-3	81	
July ..	1003	3-9	88	94	82	99	77	109	70	0-2	<1	0-7	0	15	0-6	1-0	0	0	4	7	2	21	52	8	<1	2	3	3	71	3-5	79	
August ..	1003	4-3	88	93	82	99	78	107	63	<1	<1	0-5	0	36	1-4	0	0	0	2	4	1	14	63	10	<1	0	6	0-9	71	3-6	79	
September ..	1007	4-2	89	95	83	99	77	102	71	9	0-4	0-5	0-3	49	1-9	0-3	0	0	10	23	9	12	33	6	0	0	7	0	72	3-9	81	
October ..	1012	3-9	85	92	78	97	74	101	70	4	0-2	0-7	0-7	57	2-2	0-3	0	0	21	47	11	4	7	0	0	0	10	0	63	2-9	76	
November ..	1013	3-9	83	91	75	95	71	97	68	0	0-0	0	0	21	0-8	0	0	0	21	51	19	3	0	0	0	<1	6	0	64	3-1	74	
December ..	1016	3-7	80	86	74	91	69	93	63	4	0-2	2	2	27	1-1	0	0	0	21	50	19	4	0	0	0	0	6	0	71	5-5	72	
Year ..	1010	3-9	85	91	79	103	68	109	61	56	2-2	14	6	76	3-0	2	0	0	15	37	13	9	18	2	<1	<1	6	5	70	4-5	76	

The Gulf of Aden

Authority.—Bibliography No. 94.

Periods.—1940-3. For the extremes of temp. and the max. rainfall in 24 hours, data for 1881-1938 from stations on different sites have been included.

Notes.—\* Mean of observations at 0900 and 1500.

|| Difference between the means at 0900 and 1500.

° The max. temps. in the table are appreciably higher than those obtained from earlier observations; the difference in the case of the mean daily max. is 4-6° F. from Nov. to Apr. and 2-3° F. from May-Oct. The differences in the min. are only about 1° F. (max. + min.).

† Day with 0.1 mm. (.004 in.) or more of rain.

†† Day with 1 mm. (.04 in.) or more of rain.

‡ Wind of Beaufort force 8 or more.

††† Frequencies at 0500 are given in Table IV.

¶ No. of days with visibility less than 2 nautical miles.

Month	Observations at 1500 (Z-3)																
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Poor visibility¶	Relative humidity %	Cloud amount	Wet-bulb temperature °F.				
January ..	9	27	27	12	22	2	0	0	<1	0-3	57	3-1	72				
February ..	6	29	27	13	21	<1	0	<1	2	0	60	3-2	73				
March ..	10	26	19	12	30	2	0	<1	0	0	59	3-2	75				
April ..	9	32	20	12	25	2	0	<1	0	0	51	3-2	76				
May ..	3	7	7	30	45	5	<1	0	2	0	57	2-9	80				
June ..	<1	<1	0	29	66	4	0	0	0	0-7	58	2-3	81				
July ..	<1	<1	0	17	70	11	0	<1	<1	1	58	2-4	79				
August ..	0	0	0	14	75	11	0	0	0	0	59	1-8	79				
September ..	1	5	4	14	69	6	0	0	<1	0	59	2-4	80				
October ..	3	15	11	14	47	5	0	0	5	0	54	2-1	76				
November ..	7	14	7	15	50	3	0	0	4	0	51	1-9	74				
December ..	5	21	18	11	39	<1	0	0	5	0	58	2-6	73				
Year ..	4	15	12	16	47	4	<1	<1	2	2	57	2-5	77				

(20000)

✓ Perim. 12° 39' N., 43° 24' E. 88 ft.

TABLE I—continued

Times of obs.: 0500, 0900, 1500, 2100 (Z-3)

Month	Pressure at M.S.L.		Air Temperature °						Rain			Thunder heard	Gales‡	Wind ††										Poor visibility‡	Relative humidity%	Cloud amount	Wet-bulb temperature °F.														
	Average*	Daily range‡	Average†	Mean of		Mean of		Extreme	Average fall	No. of days	Max. fall in 24 hours			Percentage of observations from																											
				Daily max.	Daily min.	Highest	Lowest							Highest	Lowest	N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm													
January ..	1015	3-5	79	84	75	87	72	89	60	10	0-4	1	0-7	18	0-7	0	0	5	Observations at 0900 (Z-3)										0	1	16	71	9	<1	1	<1	1	0	73	5-3	72
February ..	1013	3-4	80	85	75	86	73	88	68	3	0-1	2	1	14	0-6	0	0	1	6	1	16	64	7	0	0	4	2	0	0	0	75	6-1	73								
March ..	1012	3-4	82	87	77	89	74	92	70	15	0-6	2	2	74	2-9	0	0	1	5	1	8	63	10	<1	3	6	2	0	0	73	5-2	75									
April ..	1010	3-6	85	91	80	94	77	96	72	4	0-2	1	1	26	1-0	0-3	0	0	2	2	39	28	1	0	2	9	1	0	74	5-4	79										
May ..	1007	3-3	89	95	83	100	81	102	72	0	0-0	0	0	56	2-2	0-7	0	0	2	6	15	3	0	6	15	3	0	0	73	3-8	82										
June ..	1005	3-0	91	98	85	104	82	105	72	0	0-0	0	0	34	1-3	2	0-3	0	24	6	7	12	11	<1	14	24	2	2	67	3-4	83										
July ..	1004	3-0	92	99	85	103	81	106	74	3	0-1	0-7	0-5	23	0-9	1	1	1	16	2	6	4	3	3	33	32	<1	0	65	4-7	82										
August ..	1004	3-5	93	99	87	104	83	106	73	2	<1	1	0-5	42	1-7	1	1	1	18	4	5	2	6	2	26	35	2	3	64	4-4	83										
September ..	1007	4-0	90	96	84	101	79	102	74	14	0-5	1	1	27	1-1	3	0-3	1	17	3	9	27	16	3	9	14	2	0	72	3-9	83										
October ..	1011	3-6	87	92	81	95	77	99	74	2	<1	0-5	0-3	12	0-5	1	2	2	2	<1	10	65	19	<1	1	<1	<1	0	69	3-5	79										
November ..	1013	3-4	84	89	79	91	76	94	70	<1	<1	0-3	0	6	0-2	0	0-3	0	0	0	7	86	7	0	0	0	0	0	68	3-5	79										
December ..	1015	3-3	81	85	76	87	73	89	65	15	0-6	2	1	44	1-7	0-5	1	0	0	0	14	75	10	0	0	0	<1	0	73	4-9	74										
Year ..	1010	3-4	86	92	81	105	71	106	60	68	2-7	12	8	74	2-9	10	13		8	1	9	48	12	<1	8	12	1	2	71	4-5	78										

Authority.—Bibliography No. 94.

Period.—May, 1940-Dec., 1943. For the extremes of temp. and the max. rainfall in 24 hours, data between 1891 and 1911 from a station on a different site have been included.

Notes.—\* Mean of observations at 0900 and 1500.

† Difference between the means at 0900 and 1500.

‡ The temperatures in this table are higher than those obtained from earlier observations; the difference in the case of the mean daily max. is 3-4° F. from Apr. to Aug. and 1-2° F. from Sept.-Mar. The difference in the case of the mean daily min. is only 1° or 2° F. except in Aug. (4° F.).

†† (max. + min.).

‡‡ Day with 0.1 mm. (.004 in.) or more of rain.

§§ Day with 1 mm. (.04 in.) or more of rain.

¶ Wind of Beaufort force 8 or more at any hour of the day.

††† Frequencies at 0600 are given in Table IV.

‡‡‡ No. of days with visibility less than 2 nautical miles

Month	Observations at 1500 (Z-3)													
January ..	1	<1	3	61	28	3	1	2	0	0	3	64	3-3	73
February ..	2	0	6	52	28	4	0	7	1	0	65	4-1	75	
March ..	5	0	4	44	34	2	2	6	3	0	66	4-3	76	
April ..	2	0	8	51	27	2	<1	9	0	0	66	5-2	79	
May ..	5	0	4	33	38	3	4	13	0	0	63	3-0	82	
June ..	19	3	3	19	18	2	10	25	<1	1	60	2-5	84	
July ..	26	2	<1	6	9	2	11	44	0	0	57	3-5	83	
August ..	29	2	2	3	11	2	8	42	<1	0	56	2-5	83	
September ..	19	1	10	27	24	1	2	15	<1	0	63	3-4	83	
October ..	<1	0	2	58	38	<1	<1	<1	0	0	63	2-6	79	
November ..	0	0	2	67	27	3	<1	0	0	0	63	2-5	76	
December ..	<1	0	2	68	24	5	0	<1	0	0	65	2-7	75	
Year ..	9	<1	4	41	25	2	3	14	<1	1	63	3-3	79	

Table I—General climatological tables



(2898)

TABLE 1—continued

Berbera. 10° 22' N., 45° 02' E. 45 ft.\*\*

Times of obs.: 0800, 1400, 2000 (Z-3)

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder heard	Gales§	Beaufort force	Wind									Poor visibility¶	Relative humidity%	Cloud amount	Wet-bulb temperature °F.				
	Average*	Daily range	Average†	Mean of		Mean of		Extreme		Average fall	No. of days				Max. fall in 24 hours	Percentage of observations from															
				Daily max.	Daily min.	Highest	Lowest	Highest	Lowest							N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm			
January ..	1015	3-1	77	85	68	87	63	94	55	5	0.2	1.2	0.7	38	1.5	0.4	1	1.0	<1	2	6	22	12	3	7	1	47	0	73	3-8	71
February ..	1014	3-1	77	84	70	87	65	92	54	6	0.2	1.6	0.9	38	1.5	0.5	0.5	0.7	2	5	2	10	7	8	5	<1	61	0	77	3-8	73
March ..	1012	3-1	79	86	73	89	68	95	52	12	0.5	1.0	0.6	132	5.2	0.6	0.3	0.6	1	2	1	4	8	7	11	2	64	0	79	2-9	75
April ..	1010	3-4	83	90	77	94	72	108	66	12	0.5	1.0	0.8	60	2.3	2	0.2	0.7	4	2	<1	1	14	11	6	61	0	79	2-4	78	
May ..	1008	2-4	88	96	80	106	76	112	69	8	0.3	1.0	0.9	38	1.5	2	0.5	0.8	2	2	2	2	16	7	2	65	1	69	1-5	81	
June ..	1005	2-2	96	107	86	112	80	117	72	<1	<1	0.1	<1	3	0.1	0.5	11	5.2	<1	<1	<1	4	80	<1	<1	14	3	46	1-2	79	
July ..	1004	2-2	97	107	88	111	81	116	69	2	<1	0.4	0.4	20	0.8	0.7	19	6.8	0	0	0	1	2	97	<1	0	1	1	47	2-1	78
August ..	1005	2-5	96	106	87	110	81	116	63	2	<1	0.9	0.5	12	0.5	0.9	13	6.1	0	0	0	1	96	<1	<1	2	0	48	1-7	79	
September ..	1007	3-3	92	102	83	109	77	114	64	2	<1	0.4	0.4	17	0.7	0.9	3	2.8	<1	2	4	4	1	53	2	33	0	55	1-1	80	
October ..	1011	3-2	84	92	76	98	70	107	62	3	0.1	0.3	0.2	29	1.1	0.5	0	0.7	1	2	3	16	9	6	2	2	59	0	70	1-3	78
November ..	1014	3-2	80	89	71	92	66	98	61	5	0.2	0.7	0.5	47	1.9	<1	<1	0.8	<1	1	4	27	9	3	1	2	53	0	68	1-9	74
December ..	1015	3-4	77	86	68	89	63	96	59	3	0.1	0.7	0.4	17	0.7	0	0.2	1.0	<1	7	3	23	13	2	4	<1	48	0	69	2-3	71
Year ..	1010	2-9	86	94	77	112	62	117	52	60	2.4	9.3	6.4	132	5.2	9	49	2.3	1	2	2	9	6	32	4	1	43	5	65	2-2	76

Authority.—Bibliography No. 94.  
 Periods.—Pressure (average), 1908-34; (daily range), Apr., 1924-Nov., 1934.  
 Temp. (average, mean daily max. and min.), 1908-32.  
 Temp. (mean highest and lowest, extremes), rain (max. fall in 24 hours), no. of days with gale, 1908-38.  
 Rain (average fall), 1906-33; (no. of days), 1916-38.  
 No. of days with thunder, 1916-38.  
 Wind (direction and force), cloud amount, 1918-34.  
 Poor visibility, Mar. 1942-Oct. 1943, Feb. 1944.  
 Relative humidity and wet-bulb temp., Apr., 1924-Nov., 1934.  
 Notes.—\*\* 31 feet before June, 1925. From Mar., 1942, 10° 26' N., 45° 01' E., 39 ft.

\* Corrected to mean of 24 hours.  
 || Difference between means at 0800 and 1400.  
 † (max. + min.).  
 ‡ No. of days with 0.25 mm. (.01 in.) or more of rain.  
 § No. of days with 1 mm. (.04 in.) of rain.  
 ¶ Beaufort force 8 or more at any time of the day.  
 ¶ No. of days with visibility less than 2 nautical miles.

Month	Observations at 1400 (Z-3)									1500	1400			
January ..	3-6	19	77	<1	0	0	0	<1	3	0	0	67	2-5	73
February ..	3-7	16	80	<1	0	0	0	1	2	0	0	68	2-2	74
March ..	3-4	21	73	<1	0	0	0	0	1	<1	0	71	2-0	77
April ..	3-3	15	73	5	1	<1	2	1	1	1	0	73	2-4	80
May ..	2-9	22	60	2	<1	<1	3	1	9	2	0	65	2-1	82
June ..	3-3	22	21	<1	0	0	25	11	19	2	.5	45	1-2	83
July ..	3-7	9	<1	0	0	0	44	20	24	2	0	48	2-0	84
August ..	3-2	24	5	0	0	0	19	20	31	1	.5	48	1-8	83
September ..	3-0	29	28	1	4	0	5	7	26	1	0	56	1-6	83
October ..	3-1	24	72	<1	1	<1	1	0	3	0	0	66	1-6	80
November ..	3-3	19	76	0	<1	<1	1	0	3	0	0	65	1-9	76
December ..	3-5	24	74	<1	0	0	<1	<1	1	<1	0	64	2-0	74
Year ..	3-3	20	54	1	1	<1	8	5	10	1	1	61	1-9	79

Table 1—General climatological tables

TABLE I—continued

Bander Kassim. 11° 17' N., 40° 12' E. 20 ft.

Times of obs.: 0500, 0900, 1500, 2100 (Z-3)

Month	Pressure at M.S.L.		Air Temperature						Rain				Thunder heard	Gales§	Wind††										Poor visibility¶	Relative humidity %	Cloud amount	Wet-bulb temperature °F.	
	Average*	Daily range	Average†	Mean of		Mean of		Extreme	Average fall	No. of days	Max. fall in 24 hours	Beaufort force			Percentage of observations from														
				Daily max.	Daily min.	Highest	Lowest								Highest	Lowest	N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	mm.	in.	†	††	mm.	in.	days	Observations at 0900 (Z-3)													
January ..	1015	3-7	75	82	69			86	64	<.1	<.1	0-5	0	<.1	0	15	30	12	16	4	0	0	8	15	0	65	3-4	70	
February ..	1014	3-3	76	83	69			94	64	0	0-0	0	0	0-0	0	7	52	14	21	0	0	0	2	4	0	62	3-4	70	
March ..	1011	3-3	79	88	71			96	65	0	0-0	0	0	0-0	0	13	18	16	35	18	0	0	0	0	0	57	1-4	71	
April ..	1011	2-9	84	93	75			100	70	0	0-0	0	0	0-0	0	7	18	2	41	32	0	0	0	0	0	52	0-8	74	
May ..	1007	2-5	88	97	79			105	73	0	0-0	0	0	0-0	1	19	10	0	29	19	2	5	13	3	0	55	1-3	78	
June ..	1004	2-3	95	103	86			106	81	0	0-0	0	0	0-0	0	0	2	2	44	44	0	2	2	4	0	33	1-6	75	
July ..	1003	2-6	96	104	88			107	85	0	0-0	0	0	0-0	0	0	0	5	95	0	0	0	0	0	3	31	2-5	73	
August ..	1003	2-7	95	103	86			107	82	0	0-0	0	0	0-0	0	0	0	2	90	4	0	2	2	0	1	34	2-6	75	
September ..	1006	3-3	92	100	84			106	75	0	0-0	0	0	0-0	0	3	7	5	69	3	3	2	5	3	0	44	2-9	77	
October ..	1012	3-9	80	87	73			94	61	3	0-3	1	1	0-3	0	28	40	3	17	0	0	0	12	0	0	80	2-1	79	
November ..	1014	3-6	75	82	67			87	61	0	0-0	0	0	0-0	0	3	34	3	3	0	0	5	42	10	0	81	3-4	75	
December ..	1015	3-4	75	82	68			92	62	0-7	<.1	0-5	0-5	<.1	0	28	34	3	5	0	0	0	22	8	0	72	3-2	72	
Year ..	1010	3-1	84	92	76			107	61	9	0-3	2	1	8	0-3	10	21	6	39	10	<.1	1	9	4	4	55	2-4	74	

Authority.—Bibliography No. 94.

Periods.—Dec., 1942—Jan., 1944.

Notes.— \* Mean of observations at 0900 and 1500.

|| Difference between observations at 0900 and 1500.

† ‡ (max. + min.).

‡ Day with 0.1 mm. (.004 in.) or more of rain.

†† Day with 1 mm. (.04 in.) or more of rain.

§ Beaufort force 8 or more.

†† Frequencies at 0500 are given in Table IV.

¶ No. of days with visibility less than 2 nautical miles.

Month	Observations at 1500 (Z-3)										Poor visibility¶	Relative humidity %	Cloud amount	Wet-bulb temperature °F.
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Beaufort force				
January ..	39	47	<1	0	0	0	0	13	0	0	68	2-4	72	
February ..	43	48	4	0	0	0	0	5	0	0	66	2-5	72	
March ..	32	54	3	0	0	0	0	11	0	0	69	1-6	75	
April ..	35	53	0	0	0	0	0	12	0	0	71	1-8	78	
May ..	52	29	3	2	0	0	3	11	0	0	70	1-9	82	
June ..	28	4	0	0	0	0	2	66	0	0	62	2-2	83	
July ..	6	0	0	6	0	0	23	62	3	0	44	1-9	78	
August ..	6	3	2	2	0	0	18	66	3	0	61	2-8	82	
September ..	27	17	0	0	0	0	8	48	0	0	68	3-0	83	
October ..	59	31	0	3	0	0	0	7	0	0	87	2-8	81	
November ..	53	22	0	0	0	0	0	25	0	0	84	3-8	78	
December ..	50	26	0	0	0	0	0	24	0	0	73	3-1	73	
Year ..	36	28	1	1	0	0	4	29	<1	0	69	2-5	78	

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The Gulf of Aden

(Lagosa)

TABLE I—continued

Cape Guardafui. 11° 44' N., 51° 15' E. 262 ft.

Times of obs. : 0700, 1200, 1700 (Z-3)

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder heard	Gales	Beaufort force	Wind										Poor visibility	Relative humidity %	Cloud amount	Wet-bulb temperature °F.	
	Average	Daily range	Average†	Mean of		Mean of		Extreme		Average fall	No. of days				Max. fall in 24 hours	Percentage of observations from													
				Daily max.	Daily min.	Highest	Lowest	Highest	Lowest							N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm					
January ..	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	mm. in.	mm. in.	mm. in.	days	Morning observations ††										0700						
February ..			74	80	69			84	64	7	0.3		20	49	17	8	0	0	0	0	6	0		78	7.6				
March ..			77	82	71			86	69	1	0.1		4	23	19	41	11	0	0	1	1	0		73	5.6				
April ..			78	83	74			93	70	9	0.3		1	6	20	55	16	0	0	1	2	0		71	5.2				
May ..	Data not available	Data not available	81	87	75			97	69	7	0.1		2	4	5	54	35	0	0	0	0	0		71	3.9				
June ..			82	89	76			95	69	1	0.1		0	1	5	54	39	0	0	0	1	0		74	2.9				
July ..	Data not available	Data not available	81	88	75			97	70	0	0.0		1	1	1	51	46	1	1	0	0	0		76	3.1				
August ..			80	87	73			99	68	1	0.1		0	0	1	47	53	0	0	0	0	0		69	5.0				
September ..			77	84	71			99	68	0	0.0		0	0	0	50	49	0	0	0	0	0		75	3.5				
October ..			78	85	71			93	67	0	0.0		0	0	0	48	52	0	0	0	0	0		79	1.9				
November ..			77	83	71			93	68	2	0.1		16	12	10	26	24	0	0	6	6	6		78	2.6				
December ..			74	81	68			85	64	69*	2.7		37	39	7	5	1	0	1	20	0	0		80	4.9				
Year ..			78	85	72			99	64	110*	4.3		41	39	5	5	0	0	0	10	0	0		75	4.3				

Authorities.—Bibliography Nos. 69, 103, 105.

Periods.—Temp. (average, mean daily max. and min.), 3-5 years, 1930-1, 1937-9; (extremes), Feb., 1930-Dec., 1931.

Rain, 2-3 years, 1937-9.

Wind, Jan., 1930-July, 1933.

Relative humidity, Feb., 1930-Dec., 1931.

Cloud amount, 3 years.

Notes.—† ‡ (max. + min.).

\* The greater part of this total is due to a fall of 130 mm. in Nov., 1937.

†† Time of observation variable but mostly before 1000 local time.

Month	Observations at 1500										1200	
January ..	40	32	10	4	0	0	1	8	5		63	6.3
February ..	10	20	21	44	4	0	0	0	1		67	4.8
March ..	7	11	19	48	11	0	1	1	2		67	4.9
April ..	3	5	1	54	36	0	0	0	1		72	3.5
May ..	2	4	1	50	39	1	0	1	2		75	2.5
June ..	0	0	1	54	45	0	0	0	0		69	3.4
July ..	0	0	0	45	49	1	0	1	4		67	3.7
August ..	0	0	0	44	56	0	0	0	0		69	2.3
September ..	0	0	0	48	43	0	0	0	9		73	2.4
October ..	3	9	0	12	12	0	3	20	41		74	2.3
November ..	39	11	5	3	0	0	0	35	7		63	5.2
December ..	50	15	6	1	1	0	0	17	11		65	6.2
Year ..	13	9	5	34	25	1	1	7	7		69	4.0

Table I—General climatological tables

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TABLE I—continued

Mogadiscio. 2° 01' N., 45° 20' E. 39 ft.

Times of obs. : 0800, 1400, 1900 local time\*\*

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Gales	Wind										Poor visibility	Relative humidity%	Cloud amount	Wet-bulb temperature *F.							
	Average	Daily range	Average †	Mean of		Mean of		Extreme	Average fall	No. of days	Max. fall in 24 hours ††			Percentage of observations from																				
				Daily max.	Daily min.	Highest	Lowest							Highest	Lowest	N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm						
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	mm.	in.	†	mm.	in.	days	Observations at 0800, 1400, 1900 local time.										0800	s								
January ..	Data not available	Data not available	81	89	74			100	69	74	0	0	0	3	3	72	13	9	0	0	0	0	0	0	0	0	0	0	0	0	71	2.4		
February ..	Data not available	Data not available	83	89	78			98	70	77	0	0	0	2	0	80	20	0	0	0	0	0	0	0	0	0	0	0	0	70	2.7			
March ..	Data not available	Data not available	82	89	76			93	71	77	0	0	0	3	0	80	16	0	0	0	0	0	0	0	0	0	0	0	68	2.7				
April ..	Data not available	Data not available	84	91	77			100	70	77	0	0	0	3	0	23	20	20	5	11	2	1	1	18	0	0	0	70	3.3					
May ..	Data not available	Data not available	82	88	76			92	69	76	5	4	47	1.9	4	1	17	8	19	52	1	1	1	1	0	0	0	74	3.2					
June ..	Data not available	Data not available	80	86	75			90	68	75	10	7	74	2.9	10	0	0	2	10	80	8	0	0	0	0	0	0	81	4.6					
July ..	Data not available	Data not available	79	84	74			89	69	74	12	11	0.4	11	0	0	1	5	7	81	6	0	0	0	0	0	0	85	4.9					
August ..	Data not available	Data not available	79	85	73			93	68	73	8	5	0.2	8	0	0	0	9	6	82	2	0	0	1	0	0	0	85	4.3					
September ..	Data not available	Data not available	80	87	73			93	69	73	5	5	1.9	6	0	0	0	9	7	84	0	0	0	0	0	0	0	84	3.6					
October ..	Data not available	Data not available	81	87	75			94	71	75	4	4	0.5	2	0	1	8	24	17	47	0	0	0	0	0	0	0	81	3.3					
November ..	Data not available	Data not available	82	88	76			98	70	76	4	4	0.5	3	2	26	17	35	3	15	0	0	0	0	0	0	2	71	3.3					
December ..	Data not available	Data not available	81	88	74			96	71	74	2	0	0.0	3	3	9	50	6	34	0	0	0	0	0	0	0	1	70	3.3					
Year ..			81	87	75			100	68	75	55	74	2.9	5	1	28	10	13	6	38	2	0	2	0	0	0	0	76	3.5					

Month	Observations at 1200	1400		
January ..	18		76	
February ..	17		74	
March ..	12		69	
April ..	8		71	
May ..	8		74	
June ..	11		82	
July ..	12		85	
August ..	11		84	
September ..	11		83	
October ..	5		81	
November ..	10		73	
December ..	13		75	
Year ..	11		77	

**Authorities.**—Bibliography Nos. 42, 96, 103, 104.  
**Periods.**—Temp. (average, mean daily max. and min.), 27 years.  
 Temp. (extremes), rain (average fall and no. of days), 15 years.  
 Rain (max. fall in 24 hours), 1937.  
 Wind (speed), 1922; (direction), cloud amount, 5 years.  
 Relative humidity, Jan., 1937–June, 1938.  
**Notes.**—\*\* 0600, 1200, 1800 before 1935.  
 † ‡ (max. + min.).  
 † Day with 0.1 mm. (.004 in.) or more of rain.  
 †† Note that these data are for 1 year only.  
 s Mean of observations at 0800, 1400, 1900.

Data for 1922 indicate that from November to February the wind is NE. or E. at 0600 and veers to E. by midday. In other months the change is less, S. and SW. winds increasing slightly in frequency at midday at the expense of W. winds.

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The Gulf of Aden

(66987)

**Giumbo.** 0° 15' S., 42° 37' E. 36 ft.

Times of obs. : 0700, 1200, 1800\*\*

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Gales	Wind										Poor visibility	Relative humidity %	Cloud amount	Wet-bulb temperature °F.				
	Average	Daily range	Average†	Mean of		Mean of		Extreme		Average fall	No. of days			Max. fall in 24 hours	Beaufort force	Percentage of observations from ø															
				Daily max.††	Daily min.††	Highest	Lowest	Highest	Lowest							N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm			
														Observations at 0700, 1200, 1800														0700	*		
January ..	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	mm.	in.	†	mm. in.	days	2	28	70	0	0	0	0	0	0	0	0	0	0	0	0	0	83	3.5
February ..			83	82	88	74	90	66	0	0.0	0			1	92	7	0	0	0	0	0	0	0	0	0	0	0	0	85	4.0	
March ..			83	89	89	76	93	70	1	√-1	0.4			0	76	7	12	4	1	1	0	0	0	0	0	0	0	0	88	3.8	
April ..			85	91	91	76	97	70	49	1.9				1	8	30	37	17	6	1	0	0	0	0	0	0	0	0	84	4.1	
May ..			83	86	86	73	93	66	45	1.8				0	0	0	36	57	6	1	0	0	0	0	0	0	0	0	86	4.3	
June ..			82	84	84	71	88	63	79	3.1	10			0	0	0	0	11	87	2	0	0	0	0	0	0	0	0	82	4.7	
July ..	Data not available	Data not available	81	84	84	71	88	62	67	2.6	9			0	0	0	4	84	12	0	0	0	0	0	0	0	0	0	0	83	4.1
August ..			81	83	83	70	89	64	21	0.8	5			0	0	0	17	74	9	0	0	0	0	0	0	0	0	0	84	4.5	
September ..			80	84	84	71	87	64	15	0.6	5			0	0	0	14	86	0	0	0	0	0	0	0	0	0	0	85	3.3	
October ..			81	86	86	73	89	68	51	2.0	5			1	3	3	53	40	0	0	0	0	0	0	0	0	0	0	84	3.0	
November ..			81	87	87	74	90	66	29	1.1	5			1	29	14	49	5	2	2	0	0	0	0	0	0	0	0	85	4.0	
December ..			81	88	88	74	93	67	4	0.2	1			14	41	36	9	0	0	0	0	0	0	0	0	0	0	0	84	3.7	
Year ..			82	87	87	73	97	62	361	14.2	53			2	22	14	21	38	3	0	0	0	0	0	0	0	0	0	84	3.9	

*Authorities.*—Bibliography Nos. 10, 36, 40, 43.

*Periods.*—Temp. (average), rainfall, 1922-30.

Temp. (mean and extreme max. and min.), wind direction, relative humidity, cloud amount, 1910-2.

*Notes.*—\*\* The standard of time is not known but it is probably local time.

† ‡ (max. + min.).

†† These data are for a period of only 2-3 years, and their mean differs appreciably from the average for 1922-30.

‡ Definition uncertain, but probably 0.1 mm. (.004 in.) or more of rain.

ø All winds have been assigned to a direction.

\* Probably mean of 0700, 1200 and 1800.

Month	Observations at 1200												
January ..												74	
February ..												74	
March ..												72	
April ..												71	
May ..												78	
June ..												78	
July ..												80	
August ..												77	
September ..												78	
October ..												79	
November ..												77	
December ..												79	
Year ..												76	

Table I—General climatological tables

TABLE II—MONTHLY FREQUENCY OF WIND DIRECTION AND FORCE AT SEA

Number of occasions per 100 on which particular winds may be expected

I = Beaufort force 1-3. II = force 4-7. III = force 8-12.

Bab el Mandeb. South of 16° N., West of 44° E.

Period: 1855-1904.

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals of			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III					
January ..	4	-8	0	2	-2	0	3	3	-1	11	24	2	9	29	3	1	-6	0	-9	-1	0	3	1	0	3	33	59	5	1,015
February ..	7	2	0	2	-1	0	3	3	-1	10	19	2	9	23	3	2	1	-1	1	-4	0	6	2	0	4	40	51	5	1,156
March ..	7	1	0	2	-3	0	3	3	0	11	17	-3	11	21	1	3	3	0	1	-3	0	7	2	0	5	46	47	2	1,339
April ..	6	1	0	2	-2	0	3	2	0	14	15	0	12	21	-4	3	2	0	2	-3	0	7	2	0	6	51	43	-4	1,180
May ..	6	-6	0	2	-1	0	6	1	0	17	12	0	16	9	0	5	-9	0	4	-7	0	10	2	0	9	65	26	0	497
June ...	15	3	0	3	-5	0	4	-2	0	8	2	0	5	-4	0	5	-1	0	8	2	0	24	9	-2	11	72	17	-2	390
July ..	6	5	0	1	-9	0	4	0	0	5	0	0	4	1	0	4	4	0	12	13	0	17	17	0	5	53	42	0	158
August ..	12	6	0	4	1	0	7	-8	0	7	2	0	5	1	0	7	2	0	9	2	0	19	9	0	8	68	24	0	256
September ..	15	-9	0	7	2	0	5	-6	0	10	2	0	8	1	0	5	-6	0	8	1	0	14	3	0	17	72	11	0	470
October ..	3	-6	0	3	0	0	4	1	-1	17	17	-1	16	24	-3	3	-4	0	2	-1	0	3	-2	0	7	50	43	-5	930
November ..	1	-2	0	1	-3	-1	3	2	0	11	26	-4	10	34	2	1	3	-1	-8	0	0	1	0	0	3	30	65	2	1,223
December ..	2	-5	0	-8	-1	0	3	2	-1	11	28	-6	9	32	1	1	-9	0	-8	0	0	1	-5	0	4	30	64	2	1,264

Gulf of Aden. 44-50° E.

January ..	2	-3	0	14	6	0	40	20	0	9	3	0	2	-2	0	-7	-1	0	-3	0	0	-2	0	0	4	67	29	0	1,669
February ..	2	-2	0	16	7	0	39	20	0	8	2	0	1	-1	0	1	-1	0	-3	0	0	-4	-1	0	3	68	29	0	1,807
March ..	2	-4	0	16	8	0	37	16	0	7	1	0	3	-1	0	1	0	0	-6	0	0	-6	-1	0	7	67	26	0	2,202
April ..	3	-5	0	17	5	0	34	12	0	8	1	0	5	-2	0	3	0	0	2	-2	0	-6	-2	0	8	73	19	0	1,810
May ..	3	-3	0	10	1	-1	29	3	0	12	-5	0	7	-1	0	9	-8	0	6	-8	0	2	-1	0	15	79	6	-1	1,644
June ..	4	-2	0	5	-1	0	5	-1	0	7	-5	0	13	4	0	16	9	0	11	4	0	5	1	0	15	66	19	0	1,356
July ..	2	-6	0	2	-2	0	3	-3	0	4	-4	0	8	7	-5	16	21	-6	10	10	0	3	2	0	11	46	42	1	964
August ..	4	-2	0	4	-1	0	5	-1	0	5	-6	0	12	3	-1	17	11	-7	13	6	-4	3	-9	0	13	63	23	1	934
September ..	5	-4	0	7	1	0	15	-7	0	8	-6	0	10	1	0	15	3	0	9	1	0	4	0	0	19	73	8	0	1,107
October ..	4	-3	0	17	4	0	35	8	0	11	1	0	5	-4	0	1	0	0	2	-1	0	1	0	0	9	77	14	0	1,332
November ..	4	-6	0	18	5	0	33	11	0	11	1	0	3	-1	0	2	-2	0	2	-1	-1	1	0	0	7	75	18	-1	1,678
December ..	2	-2	0	18	5	0	39	13	0	11	2	0	2	-2	0	-6	0	0	-9	0	0	1	0	0	5	75	20	0	1,632

Authorities.—Bibliography Nos. 5, 94.

Number of occasions per 100 on which particular winds may be expected

I = Beaufort force 1-3. II = force 4-7. III = force 8-12.

15-20° N., 50-55° E.\*

Period: 1855-1904.

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals of			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III					
January ..	6	-9	0	29	11	0	32	5	0	1	0	0	2	0	0	-1	0	0	1	0	0	0	0	0	11	72	17	0	107
February ..	2	-8	0	13	2	0	26	4	0	6	0	0	11	0	0	17	0	0	5	0	0	-9	0	0	13	81	6	0	113
March ..	3	4	-4	9	2	0	21	2	0	13	0	0	12	0	0	5	-3	0	4	-3	-3	3	1	-6	20	69	10	1	153
April ..	0	0	0	-6	0	0	3	0	0	17	0	0	14	0	0	31	1	0	14	0	0	2	0	0	17	82	1	0	81
May ..	-9	0	0	-9	0	0	-9	0	0	6	0	0	16	1	0	42	11	0	11	2	0	2	0	0	5	81	14	0	105
June ..	0	0	0	0	0	0	0	0	0	1	0	0	5	11	0	11	53	0	2	14	0	0	0	0	1	20	79	0	66
July ..	-9	0	0	0	0	0	0	0	0	3	1	0	3	15	-4	17	50	1	1	5	0	0	0	-9	25	72	2	110	
August ..	1	0	0	3	0	0	5	0	0	3	0	0	7	9	-7	23	29	5	7	2	0	0	0	0	4	49	41	6	68
September ..	0	0	0	0	0	0	3	0	0	3	0	0	8	2	0	48	14	0	11	3	0	0	0	0	6	74	20	0	62
October ..	4	-7	0	13	10	0	13	3	0	11	2	0	3	-7	0	8	-7	0	6	1	0	7	0	0	17	65	18	0	71
November ..	6	2	0	22	9	0	33	9	0	6	1	0	1	0	0	0	0	0	1	-5	0	-5	1	0	6	71	23	0	102
December ..	5	-8	0	21	21	0	25	11	0	4	0	0	2	0	0	-8	0	0	-8	0	0	4	1	0	3	62	35	0	123

15-20° N., 55-60° E.

January ..	8	11	0	24	17	0	21	4	0	2	1	0	1	-5	0	1	-5	0	-5	-1	0	2	2	0	3	61	36	0	572
February ..	5	6	0	18	11	0	16	5	0	5	1	0	6	1	0	6	2	0	4	0	0	2	1	0	9	63	28	0	448
March ..	4	-9	0	16	3	0	21	1	0	7	-9	0	9	2	0	7	1	0	4	-1	0	2	1	0	19	71	10	0	648
April ..	3	-6	0	5	-2	0	5	0	0	9	-1	0	13	-3	0	26	3	0	16	3	0	4	-6	0	12	80	8	0	570
May ..	-6	-1	0	1	0	0	3	0	0	5	-4	0	9	4	0	29	31	0	6	7	0	-3	-4	0	4	53	43	0	489
June ..	0	0	0	0	0	0	0	0	0	0	0	0	4	8	-3	9	61	2	2	12	-7	0	0	0	-3	15	82	3	836
July ..	0	0	0	0	0	0	0	0	0	-6	-7	0	2	14	-7	-5	70	7	0	4	-3	0	0	0	0	3	89	8	338
August ..	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	5	68	8	1	7	0	0	0	0	0	7	85	8	178
September ..	-7	0	0	1	0	0	-9	-2	0	4	-7	0	12	11	0	28	30	0	3	5	0	-2	0	0	3	50	47	0	272
October ..	10	2	0	19	5	0	17	3	0	4	-4	0	5	1	0	9	2	0	4	2	0	5	-1	0	11	73	16	0	470
November ..	10	4	-1	34	14	-2	15	3	0	5	-5	0	-7	-1	0	2	-3	0	-9	-4	0	3	3	0	4	71	25	-3	406
December ..	8	5	0	27	24	0	16	6	0	4	-4	0	2	-2	0	-3	0	0	1	0	0	1	1	0	3	60	37	0	546

Authorities.—Bibliography Nos. 5, 94.

\* The number of observations is too small to give a reliable normal.

Table I—Monthly wind direction and force at sea 2 137

TABLE II—continued

Number of occasions per 100 on which particular winds may be expected  
 I = Beaufort force 1-3. II = force 4-7. III = force 8-12.

10-15° N., 50-55° E.

Period: 1855-1904.

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals of			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		I	II	III	
January ..	6	2	0	24	21	0	25	11	0	3	-1	0	-8	-1	0	-5	0	0	-4	0	0	1	0	0	4	61	35	0	1,108
February ..	6	2	0	21	15	-1	28	10	0	6	1	0	3	-2	0	-7	0	0	-3	0	0	-9	0	0	6	65	29	-1	905
March ..	5	-2	0	14	3	0	33	7	0	13	2	0	7	1	0	3	0	0	-9	0	0	1	-1	0	9	77	14	0	1,124
April ..	2	0	0	6	-6	0	19	3	0	15	3	0	13	4	0	11	2	0	5	-1	0	2	-1	0	15	73	12	0	1,108
May ..	2	-1	0	1	-1	0	9	-3	0	12	2	0	17	11	-1	15	11	-4	5	1	0	2	0	0	8	64	27	-5	984
June ..	-7	-1	-1	1	0	0	2	-4	0	6	5	-1	6	28	4	6	26	6	2	2	-1	1	-3	-1	4	25	61	10	836
July ..	1	0	0	1	-1	0	1	0	0	4	3	0	4	32	5	5	28	7	2	2	-1	1	-3	0	4	19	65	12	872
August ..	-7	0	0	1	-2	0	2	-6	0	3	5	-2	7	31	5	6	29	4	2	-5	-2	-5	0	0	3	22	66	9	820
September ..	2	0	0	3	-1	0	6	-9	0	7	6	0	12	26	-9	7	22	-6	1	-4	0	-7	0	0	5	38	55	2	866
October ..	7	1	0	15	5	0	20	3	-1	7	1	-1	5	2	0	8	1	0	4	-3	0	3	-4	0	17	69	14	-2	1,046
November ..	11	9	-1	26	33	0	7	5	-1	-4	-4	-1	-2	-3	0	-2	-1	0	3	-1	0	2	-8	0	1	50	49	-3	736
December ..	6	4	0	26	29	0	21	9	0	1	-1	0	-4	-2	0	-1	0	0	-1	0	0	-7	-1	0	3	54	43	0	1,081

10-15° N., 55-60° E.

January ..	5	8	0	19	47	0	8	11	0	-3	-3	0	-1	0	0	0	0	0	0	0	-4	0	0	0	0	33	67	0	784
February ..	9	9	0	24	33	0	15	7	0	1	-2	0	-2	0	0	-2	-1	0	-1	0	0	-1	0	0	1	50	49	0	664
March ..	9	4	0	26	14	0	21	6	0	6	-6	0	2	-2	0	1	0	0	-4	0	0	3	-2	0	7	69	24	0	842
April ..	11	-3	0	18	-9	0	15	-8	0	6	-4	0	5	-5	0	7	-1	0	8	-8	0	5	-2	0	21	75	4	0	885
May ..	2	0	0	5	-3	-1	6	0	-2	9	-9	0	11	3	-1	16	16	-3	12	5	0	2	-1	0	12	62	25	-7	872
June ..	0	0	0	0	0	0	0	0	0	-3	0	0	-4	13	1	1	64	12	-1	7	-6	0	0	0	-5	2	84	14	588
July ..	0	0	0	0	0	0	0	0	0	0	0	0	-1	15	4	-1	62	15	0	3	-6	0	0	0	0	-2	80	20	543
August ..	0	0	0	0	0	0	0	0	0	0	0	0	-2	16	3	-2	68	10	0	3	-2	0	0	0	0	-4	87	13	502
September ..	0	0	0	0	0	0	-6	0	0	2	-1	0	8	14	-2	14	51	-4	4	5	0	-4	-4	0	-2	28	71	-6	581
October ..	13	2	0	18	6	0	11	1	0	3	-3	0	3	-2	0	6	3	0	6	3	0	7	3	0	13	67	20	0	712
November ..	12	4	0	28	19	0	15	6	0	2	-3	0	-3	-1	0	-5	-3	0	2	-2	0	2	-5	0	9	61	30	0	1,015
December ..	8	10	-2	19	47	-6	7	7	0	-4	0	0	-2	0	0	0	0	0	0	0	0	-1	-1	0	2	61	30	0	1,015

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The Gulf of Aden

Number of occasions per 100 on which particular winds may be expected  
 I = Beaufort force 1-3. II = force 4-7. III = force 8-12.

5-10° N., 50-55° E.\*

Period: 1855-1904.

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals of			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		I	II	III	
January ..	8	15	0	25	40	0	4	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	
February ..	13	4	0	37	32	0	7	3	0	0	0	0	1	0	0	0	6	0	0	0	0	0	0	0	0	0	74		
March ..	2	5	0	35	8	0	22	6	0	13	4	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	103		
April ..	8	7	0	25	10	0	20	2	0	14	0	0	0	0	0	2	0	0	4	0	0	12	0	0	0	0	69		
May ..	2	6	0	4	2	0	5	0	0	7	4	0	13	7	0	15	23	0	10	6	0	3	4	0	0	0	260		
June ..	0	0	0	0	0	0	0	0	0	0	0	0	6	19	3	1	64	7	4	4	4	0	0	0	0	0	299		
July ..	0	0	0	0	0	0	0	0	0	0	0	0	2	13	2	1	65	11	4	7	7	0	0	0	0	0	389		
August ..	0	0	0	0	0	0	0	0	0	0	0	0	2	20	2	1	61	7	4	4	2	0	0	0	0	0	283		
September ..	0	0	0	0	0	0	0	0	0	0	0	0	3	31	4	5	55	1	1	3	0	0	0	0	0	0	222		
October ..	8	1	0	10	2	0	4	0	0	7	7	0	15	2	0	17	8	0	6	0	0	9	3	0	8	0	134		
November ..	12	2	0	31	23	0	5	8	0	2	4	0	2	0	0	8	1	0	3	2	0	3	8	0	6	0	123		
December ..	10	12	0	13	52	0	3	5	0	2	2	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	92		

5-10° N., 55-60° E.\*

January ..	3	15	0	22	47	0	4	8	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	169
February ..	8	9	0	27	32	0	18	5	0	9	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	113
March ..	7	7	0	35	23	0	15	4	0	8	0	0	6	0	0	0	0	0	0	0	0	0	0	0	2	0	66
April ..	1	0	0	22	6	0	26	4	0	22	1	0	8	0	0	1	0	0	0	0	0	1	0	0	9	0	137
May ..	6	4	0	2	0	0	4	0	0	7	0	0	3	7	0	9	11	0	14	15	0	13	1	0	15	0	146
June ..	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1	2	74	4	8	10	9	0	0	0	0	0	342
July ..	0	0	0	0	0	0	0	0	0	0	0	0	7	3	0	4	70	5	4	16	0	0	0	0	0	0	265
August ..	0	0	0	0	0	0	0	0	0	0	0	0	2	7	0	3	65	5	2	17	6	0	0	0	0	0	195
September ..	0	0	0	0	0	0	0	0	0	0	0	0	4	10	0	13	57	0	5	10	0	0	0	0	0	0	170
October ..	17	9	0	11	0	0	1	0	0	7	0	0	3	7	0	10	9	0	12	6	0	15	3	0	12	0	154
November ..	10	3	0	36	22	0	9	1	0	5	0	0	3	0	0	2	2	0	3	1	0	1	0	0	4	0	105
December ..	7	12	0	6	57	0	9	9	0	7	3	0	1	0	0	1	0	0	0	2	0	3	1	0	7	0	156

Authorities.—Bibliography Nos. 5, 94.

\* The number of observations in some months is too small to give a reliable normal.

Table I—Monthly wind direction and force at sea

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TABLE II—continued

Number of occasions per 100 on which particular winds may be expected

I = Beaufort force 1-3. II = force 4-7. III = force 8-12

0-5° N., 45-50° E.\*

Period: 1855-1904.

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III					
January ..	1	8	0	27	49	0	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	64	0	45
February ..	1	1	0	19	35	0	15	22	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	64	0	73
March ..	0	5	0	28	24	0	18	12	0	12	2	0	2	0	0	0	0	0	0	0	0	0	0	0	5	61	39	0	180
April ..	0	0	0	2	0	0	25	0	0	30	6	0	14	2	0	17	6	0	3	0	0	0	0	0	7	90	3	0	87
May ..	2	0	0	8	0	0	2	0	0	8	1	0	18	9	0	22	29	0	4	5	0	0	0	0	0	57	43	0	65
June ..	0	0	0	0	0	0	0	0	0	5	1	0	11	24	0	15	32	0	4	7	0	0	0	0	0	35	65	0	48
July ..	0	0	0	0	0	0	0	0	0	7	5	0	23	18	0	18	27	0	2	0	0	0	0	0	0	50	50	0	30
August ..	0	0	0	0	0	0	0	0	0	6	5	0	16	20	0	15	33	0	1	5	0	0	0	0	0	37	63	0	80
September ..	0	0	0	0	0	0	0	0	0	2	3	0	20	38	0	16	18	0	2	2	0	0	0	0	0	39	61	0	97
October ..	3	0	0	7	0	0	20	0	0	34	6	0	14	7	0	3	1	0	0	0	0	0	0	0	5	81	14	0	122
November ..	4	0	0	20	7	0	25	5	0	8	0	0	14	8	0	9	6	0	2	0	0	2	0	0	0	84	16	0	95
December ..	3	5	0	29	44	0	8	11	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60	0	87

0-5° N., 50-55° E.\*

January ..	5	17	0	26	39	0	3	3	0	0	0	0	0	0	0	6	0	0	1	0	0	1	0	0	3	38	59	0	164
February ..	18	8	0	47	20	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	2	70	28	0	57
March ..	24	9	0	32	8	0	5	1	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	13	69	18	0	38
April ..	11	0	0	32	2	0	22	5	0	6	0	0	5	0	0	5	0	0	2	0	0	6	0	0	11	83	6	0	76
May ..	4	0	0	4	0	0	2	0	0	2	0	0	18	1	0	16	7	3	21	3	3	11	7	0	9	78	12	6	150
June ..	0	0	0	0	0	0	0	0	0	6	9	0	6	16	0	14	48	0	3	12	0	0	0	0	0	24	76	0	161
July ..	0	0	0	0	0	0	0	0	0	1	3	0	9	11	0	16	50	0	7	9	0	0	0	0	0	27	73	0	148
August ..	0	0	0	0	0	0	0	0	0	8	8	0	10	17	0	11	50	0	5	5	0	0	0	0	0	27	73	0	190
September ..	0	0	0	0	0	0	0	0	0	3	3	0	13	24	0	21	21	0	8	4	0	1	0	0	3	46	51	0	103
October ..	0	0	0	15	0	0	0	0	0	4	0	0	19	11	0	7	6	0	5	0	0	13	0	0	20	63	17	0	40
November ..	2	0	0	2	16	0	0	6	0	0	0	0	5	0	0	10	0	0	24	2	0	29	3	0	0	73	27	0	41
December ..	4	4	0	33	27	0	14	3	0	4	0	0	7	0	0	7	7	0	5	7	0	1	0	0	1	63	36	0	73

Authorities.—Bibliography Nos. 5, 94.

\* The number of observations is too small to give a reliable normal.

TABLE II—continued

Number of occasions per 100 on which particular winds may be expected

I = Beaufort force 1-3. II = force 4-7. III = force 8-12

0-5° N., 55-60° E.\*

Period: 1855-1904.

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals of			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III					
January ..	22	6	0	23	10	0	16	4	0	3	0	0	0	0	0	0	0	0	1	0	0	12	1	0	2	77	21	0	92
February ..	14	7	0	43	19	0	11	8	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	72	27	0	67
March ..	1	1	0	36	7	0	27	8	0	15	0	0	3	0	0	0	0	0	5	0	0	0	0	0	5	86	9	0	66
April ..	5	0	0	12	3	0	8	0	0	19	0	0	22	0	0	8	0	0	12	0	0	11	0	0	0	97	3	0	37
May ..	2	0	0	1	0	0	5	0	0	3	0	0	11	4	0	32	14	0	14	11	0	2	5	0	3	63	34	0	186
June ..	0	0	0	0	0	0	0	0	0	4	0	0	12	17	0	15	43	4	2	7	5	0	0	0	4	33	66	9	232
July ..	0	0	0	0	3	0	0	5	0	4	1	0	8	15	0	11	47	0	4	11	0	4	2	0	3	24	76	0	305
August ..	1	2	0	2	0	0	3	0	0	4	8	0	13	15	0	21	23	0	9	6	0	1	2	0	5	53	46	0	240
September ..	0	5	0	2	2	0	3	3	0	11	1	0	21	8	0	15	25	0	5	4	0	0	2	0	3	55	42	0	223
October ..	2	0	0	0	0	0	0	0	0	0	0	0	5	0	0	10	7	0	26	8	0	30	4	0	8	73	19	0	59
November ..	9	9	0	5	2	0	0	0	0	0	0	0	3	0	0	13	3	0	40	6	0	11	5	0	2	81	17	0	59
December ..	28	7	0	18	16	0	0	3	0	0	0	0	3	0	0	6	0	0	7	3	0	5	1	0	8	61	31	0	75

Authorities.—Bibliography Nos. 5, 94.

\*The number of observations in most months is too small to give a reliable normal.

Table II—Monthly wind direction and force at sea

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TABLE III—MONTHLY FREQUENCY OF WIND DIRECTION AND FORCE AT BERBERA

Number of occasions per 100 on which particular winds may be expected

I = Beaufort force 1-3. IIa = force 4-5. IIb = force 6-7. III = force 8-12

Berbera. 10° 22' N., 45° 02' E. 45 ft.

Time of obs.: 0800 (Z-3).

Period: Jan., 1918-Nov., 1934\*

Month	N.				NE.				E.				SE.				S.				SW.				W.				NW.				Cal	Totals			
	I	IIa	IIb	III	I	IIa	IIb	III	I	IIa	IIb	III	I	IIa	IIb	III	I	IIa	IIb	III	I	IIa	IIb	III	I	IIa	IIb	III	I	IIa	IIb	III		I	IIa	IIb	III
January..	.2	0	0	0	2	.2	0	0	6	0	0	0	22	0	0	0	12	0	0	0	3	0	0	0	7	0	0	0	.2	0	0	0	47	53	.2	0	0
February	2	0	0	0	5	0	0	0	2	0	0	0	10	0	0	0	7	0	0	0	8	.2	0	0	5	0	0	0	.2	.2	0	0	61	38	.4	0	0
March ..	1	0	0	0	2	.2	0	0	1	0	0	0	4	0	0	0	8	0	0	0	7	0	0	0	11	0	0	0	2	0	0	0	64	36	.2	0	0
April ..	4	0	0	0	2	.2	0	0	.2	0	0	0	1	0	0	0	.9	0	0	0	14	0	0	0	11	0	0	0	6	0	0	0	61	39	.2	0	0
May ..	2	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	.2	0	0	10	3	2	.6	7	.2	.2	0	2	.1	0	0	65	29	3	2	.6
June ..	.2	0	0	0	.6	0	0	0	.4	0	0	0	.2	.3	0	0	.7	2	1	.1	8	13	36	24	.3	.1	0	0	.4	.1	0	0	14	10	15	37	24
July ..	0	0	0	0	0	0	0	0	0	0	0	0	.2	0	0	0	0	.4	1	.6	.6	12	51	33	0	.2	0	0	0	0	0	0	1	.8	12	52	34
August ..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	.1	.1	2	19	57	18	.2	.3	.2	0	0	.1	0	0	2	2	20	58	18
September	.6	0	0	0	2	0	0	0	4	0	0	0	3	.6	0	0	1	.2	0	0	11	22	17	2	2	.3	0	0	.4	0	0	0	33	25	23	17	2
October..	1	0	0	0	2	0	0	0	3	0	0	0	16	0	0	0	9	0	0	0	6	0	.2	0	2	0	0	0	2	0	0	0	59	41	0	.2	0
November	.6	0	0	0	1	0	0	0	4	0	0	0	27	0	0	0	9	0	0	0	3	0	0	0	1	0	0	0	2	0	0	0	53	47	0	0	0
December	.2	0	0	0	7	0	0	0	3	0	0	0	23	.6	0	0	13	.2	0	0	2	.4	0	0	4	.2	0	0	.2	0	0	0	48	51	1	0	0

Time of obs.: 1400 (Z-3)

January..	9	9	.5	0	38	37	2	0	0	.2	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	47	3	0	
February	11	5	.4	0	33	40	7	.1	0	.4	.4	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	47	8	.2	
March ..	14	7	.5	0	44	27	2	0	.1	4	.4	0	.2	.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	59	38	3	0	
April ..	12	3	.2	0	40	30	3	0	0	5	0	0	.2	.9	0	0	.2	.2	.2	0	2	.2	0	0	.8	.4	0	0	1	0	0	1	56	40	3	0	
May ..	17	5	0	0	41	18	1	0	.8	1	0	0	0	.3	.2	0	0	.3	0	0	2	1	0	0	.4	.4	0	0	8	1	0	0	2	69	28	1	0
June ..	14	8	.2	0	15	6	0	0	.3	.1	0	0	0	0	0	0	0	0	0	0	8	11	6	.4	6	4	.5	0	16	3	0	0	2	60	31	7	.4
July ..	7	2	.2	0	.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	24	7	3	12	8	.6	0	17	7	0	0	2	46	41	8	3
August ..	17	7	.2	0	3	1	.2	0	0	0	0	0	0	0	0	0	0	0	0	8	8	3	0	17	3	.4	0	21	8	.8	0	1	68	27	4	0	
September	18	11	.2	0	22	6	0	0	.4	0	0	0	4	.2	0	0	0	0	0	2	2	.4	0	4	3	0	0	20	6	0	0	6	71	28	.6	0	
October..	15	9	0	0	51	20	.8	0	0	.3	0	0	.2	0	0	0	.2	0	0	0	.2	.2	0	0	0	0	0	3	.5	0	0	0	70	29	.8	0	
November	12	7	.4	0	46	29	1	0	0	0	0	0	.7	0	0	0	.1	.1	0	0	1	.1	0	0	0	0	0	2	.5	0	0	0	62	36	2	0	
December	13	10	.5	0	43	25	6	0	.4	.1	.2	0	0	0	0	0	0	0	0	0	.4	0	0	0	.2	0	0	0	1	.3	0	0	2	58	36	6	0

Time of obs.: 2000 (Z-3)

January..	.2	0	0	0	59	12	.6	0	17	6	.2	0	3	.1	0	0	.2	0	0	0	0	0	0	.2	0	0	0	.6	0	0	0	.8	80	18	.8	0	
February	.4	.2	0	0	50	19	5	0	16	3	.1	0	1	.4	0	0	0	0	0	0	.2	0	0	0	.7	0	0	0	0	0	0	4	68	23	5	0	
March ..	4	0	0	0	63	7	5	0	6	5	.2	0	2	2	0	0	2	0	0	0	0	0	0	.4	0	0	0	.4	0	0	0	18	61	19	2	0	
April ..	3	0	0	0	53	16	2	0	2	.9	0	0	2	1	0	0	.6	0	0	0	.3	0	0	0	.4	0	0	0	.7	0	0	0	36	54	8	1	.6
May ..	1	.1	0	0	37	7	.6	.4	7	.3	.4	.2	3	.3	0	0	.7	.1	.2	0	3	.2	0	0	.3	0	0	0	2	.5	0	0	55	30	12	3	0
June ..	.6	0	0	0	11	1	0	0	5	.1	0	0	1	0	0	0	2	.7	.1	0	9	9	3	0	2	.6	0	0	.1	0	0	0	55	30	12	3	0
July ..	2	0	0	0	2	.4	.2	0	1	0	0	0	1	.2	0	0	2	.7	.1	0	8	16	7	.8	4	.8	.5	0	2	.2	0	0	52	22	18	7	.8
August ..	3	0	0	0	5	2	0	0	2	.2	0	0	1	.2	0	0	2	.3	0	0	8	7	.2	0	1	.2	0	0	1	.1	0	0	68	23	9	.2	0
September	3	.2	0	0	24	2	0	0	10	.1	0	0	5	.6	.2	0	.7	.3	0	0	1	.9	.4	0	.5	0	0	0	0	0	0	51	44	4	.6	0	
October..	3	.1	0	0	35	6	.3	0	19	.5	.5	0	7	0	0	0	2	0	0	0	.5	.2	.2	0	.8	0	0	0	.4	0	0	0	24	68	7	1	0
November	2	.3	0	0	49	10	2	0	23	2	.4	0	3	0	0	0	0	0	0	0	.6	0	0	0	.6	.2	0	0	.9	.5	0	0	6	80	12	2	0
December	2	.1	0	0	57	19	4	0	12	3	.1	0	.1	0	.1	0	.2	0	0	0	0	0	0	0	0	0	0	0	.2	0	0	0	2	72	22	4	0

Authority.—Bibliography No. 94.

\* Owing to change in the hours of observation the data for Jan.-Mar., 1924, are omitted.

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The Gulf of Aden

**TABLE IV—MONTHLY FREQUENCY OF WIND DIRECTION AT COASTAL STATIONS IN THE EARLY MORNING**

Number of occasions per 100 on which particular wind directions may be expected

Time of obs. : 0200 G.M.T. (approx. 0600 local time)

Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.
	RAS AL HADD									MASIRA ISLAND								
January .. ..	15	2	0	2	25	41	5	2	8	2	5	16	13	17	16	14	11	6
February .. ..	19	9	2	<1	21	26	4	7	11	3	10	15	7	12	23	10	9	11
March .. ..	24	0	0	0	11	24	5	20	16	0	2	2	2	13	9	13	14	45
April .. ..	5	0	0	0	20	42	8	8	17	0	3	3	5	23	37	2	0	27
May .. ..	0	0	0	0	27	36	8	3	26	3	0	3	3	13	59	13	3	3
June .. ..	0	0	0	7	37	50	3	0	3	0	0	3	13	22	52	7	0	3
July .. ..	0	0	0	2	30	63	2	0	3	0	0	3	7	6	84	0	0	0
August .. ..	0	0	0	2	27	69	2	0	0	0	0	0	0	19	81	0	0	0
September .. ..	0	0	0	5	27	55	0	0	13	0	0	0	2	32	63	3	0	0
October .. ..	3	0	0	0	13	48	10	16	10	11	11	0	3	15	16	15	23	6
November .. ..	32	3	0	0	10	27	0	25	3	17	36	13	5	0	7	7	8	7
December .. ..	19	10	2	6	10	43	2	8	0	3	19	29	10	5	7	11	3	13
	SOCOTRA									SALALAH								
January .. ..	0	29	9	6	3	0	0	0	53	48	13	2	<1	0	2	2	19	13
February .. ..	0	16	34	22	4	0	0	0	24	37	19	7	4	9	2	0	18	4
March .. ..	0	2	19	40	16	0	0	0	23	59	18	0	0	3	0	3	11	6
April .. ..	2	7	25	28	16	0	0	2	20	36	11	0	2	2	2	7	20	20
May .. ..	0	0	10	16	35	23	0	0	16	27	10	3	3	2	8	5	42	0
June .. ..	0	0	0	0	67	33	0	0	0	18	18	9	20	15	14	0	3	3
July .. ..	0	0	0	0	55	45	0	0	0	0	0	10	53	29	2	0	0	6
August .. ..	0	0	0	0	69	31	0	0	0	0	0	9	53	26	5	2	2	3
September .. ..	0	0	0	0	65	35	0	0	0	12	2	8	34	23	12	3	3	3
October .. ..	2	6	8	10	18	18	3	0	35	42	10	0	0	0	5	8	29	6
November .. ..	<1	25	27	7	7	<1	0	0	32	40	28	6	0	2	0	0	21	3
December .. ..	2	52	15	0	5	0	0	0	26	48	22	2	2	2	0	>1	20	3

Table IV—Monthly wind direction at coastal stations 2 143

Authority.—Bibliography No. 94.

Note.—For positions of stations see Table I.

Periods.—Ras al Hadd, Masira island : Jan., 1943–Feb., 1944 ; Socotra : Nov., 1942–Feb., 1944 ; Salalah : Nov., 1942–Jan., 1944.

TABLE IV—continued

Number of occasions per 100 on which particular wind directions may be expected  
Time of obs. : 0200 G.M.T. (approx. 0500 local time)

Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.
	RIYAN									ADEN								
January .. ..	57	4	0	2	<1	0	0	18	18	12	54	17	2	<1	0	0	0	14
February .. ..	67	14	3	<1	0	0	2	3	10	14	46	26	4	<1	0	0	<1	9
March .. ..	87	3	0	0	0	0	0	10	0	15	45	20	<1	0	0	<1	0	18
April .. ..	54	8	<1	0	0	0	0	5	32	11	52	18	2	2	0	<1	<1	14
May .. ..	35	<1	2	0	0	0	0	<1	61	6	32	13	3	13	<1	0	<1	31
June .. ..	14	8	13	4	0	5	0	3	53	9	20	7	14	34	1	0	<1	14
July .. ..	8	17	10	7	7	3	0	3	45	3	12	3	23	39	6	0	0	14
August .. ..	2	19	24	5	6	0	0	2	42	6	17	5	11	40	7	<1	0	14
September .. ..	17	22	10	2	0	0	0	<1	48	9	24	10	6	29	1	0	0	21
October .. ..	50	11	5	0	0	<1	<1	11	21	19	55	11	1	1	<1	0	0	13
November .. ..	60	2	0	0	0	0	0	21	17	29	46	13	0	0	0	0	0	12
December .. ..	64	6	0	0	0	0	2	20	8	19	50	15	<1	<1	0	0	<1	14
	PERIM									BANDER KASSIM								
January .. ..	0	0	18	64	12	0	0	1	5	9	12	6	19	18	<1	0	0	35
February .. ..	4	<1	18	65	6	0	0	5	2	0	20	9	41	12	0	0	0	18
March .. ..	10	0	6	59	12	2	<1	6	4	0	0	6	48	36	0	0	0	10
April .. ..	5	0	7	58	19	2	0	7	2	2	3	3	54	28	0	0	0	10
May .. ..	3	2	2	32	35	<1	7	13	5	8	7	8	29	23	3	3	0	19
June .. ..	11	<1	2	5	16	4	27	29	6	0	0	2	44	46	4	0	0	4
July .. ..	6	2	4	2	5	5	47	27	2	0	0	5	90	5	0	0	0	0
August .. ..	12	2	<1	2	5	6	30	37	5	0	0	3	94	3	0	0	0	0
September .. ..	15	1	3	17	25	5	10	15	9	3	3	9	70	5	0	0	0	10
October .. ..	<1	2	6	62	25	<1	2	<1	2	4	4	5	37	11	0	0	0	39
November .. ..	0	0	11	78	10	<1	0	0	<1	7	18	15	17	0	0	0	0	43
December .. ..	0	<1	12	77	9	<1	0	0	<1	3	6	6	19	23	2	2	2	37

Authority.—Bibliography No. 94.

Note.—For positions of stations see Table I.

Periods.—Riyan : Apr., 1942–Feb., 1944 ; Aden : 1940–3 ; Perim : May, 1940–Dec., 1943 ; Bander Kassim : Dec., 1942–Jan., 1944.

TABLE V—MONTHLY FREQUENCY OF WINDS OF DIFFERENT FORCES AT COASTAL STATIONS

Number of occasions per 100 on which particular wind forces may be expected

Ras al Hadd. 22° 33' N., 59° 47' E. 9 ft.		Period: 12 Jan., 1943–Feb., 1944																		
Beaufort force	0					1-3					4-5					6-7 ≥8				
	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8
	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)				
January .. ..	8	70	20	2	0	0	69	23	8	0	4	49	39	8	0	Data not available				
February .. ..	11	56	28	5	0	5	60	26	7	2	0	42	40	18	0					
March .. ..	16	58	23	3	0	3	55	36	6	0	0	48	52	0	0					
April .. ..	17	80	3	0	0	10	87	0	3	0	3	73	17	7	0					
May .. ..	26	68	6	0	0	0	87	13	0	0	3	81	16	0	0					
June .. ..	3	70	17	10	0	3	67	27	3	0	0	43	43	14	0					
July .. ..	3	65	32	0	0	3	52	45	0	0	3	29	65	3	0					
August .. ..	0	26	61	13	0	0	49	48	3	0	0	13	64	23	0					
September .. ..	13	50	34	3	0	0	43	57	0	0	3	20	70	7	0					
October .. ..	10	84	6	0	0	0	71	29	0	0	0	65	35	0	0					
November .. ..	3	64	33	0	0	0	50	47	3	0	0	30	63	7	0					
December .. ..	0	90	10	0	0	6	65	26	3	0	0	58	39	3	0					
Masira island. 20° 42' N., 58° 50' E. 45–58 ft.*		Period: Jan., 1943–Feb., 1944																		
	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)				
January .. ..	6	79	15	0	0	0	79	19	2	0	2	66	32	0	0	2	80	16	2	0
February .. ..	11	83	6	0	0	0	69	31	0	0	0	52	46	2	0	13	64	23	0	0
March .. ..	45	49	6	0	0	0	94	6	0	0	10	68	22	0	0	19	68	13	0	0
April .. ..	27	56	17	0	0	3	80	17	0	0	0	67	33	0	0	7	60	33	0	0
May .. ..	3	55	42	0	0	0	48	52	0	0	0	39	58	3	0	3	42	52	3	0
June .. ..	3	40	44	13	0	0	37	53	10	0	0	13	70	17	0	0	20	57	20	3
July .. ..	0	10	26	64	0	0	6	58	36	0	0	3	49	48	0	0	10	32	55	3
August .. ..	0	13	23	64	0	0	3	55	42	0	0	3	55	42	0	0	7	58	32	3
September .. ..	0	50	50	0	0	0	30	70	0	0	0	30	70	0	0	0	40	60	0	0
October .. ..	6	91	3	0	0	0	84	16	0	0	0	52	48	0	0	10	87	3	0	0
November .. ..	7	93	0	0	0	0	83	17	0	0	0	47	53	0	0	0	60	40	0	0
December .. ..	13	77	10	0	0	3	61	36	0	0	0	55	45	0	0	3	58	39	0	0

Authority.—Bibliography No. 94.

\* 20° 39' N., 58° 54' E., 56 ft. Nov., 1943–Feb., 1944.

Table V—Winds of different forces at coastal stations 2 145

TABLE V—continued

Number of occasions per 100 on which particular wind forces may be expected

Socotra. 12° 38' N., 53° 53' E. 147 ft.		Period : Nov., 1942–Feb., 1944																							
Beaufort force	0					1-3					4-5					6-7					≥8				
	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8
		0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)								
January .. ..	53	42	5	0	0	14	52	34	0	0	0	23	74	3	0	18	79	3	0	0	0	0	0	0	0
February .. ..	24	67	9	0	0	9	65	23	3	0	0	46	51	3	0	9	79	12	0	0	0	0	0	0	0
March .. ..	23	77	0	0	0	3	74	23	0	0	0	45	42	13	0	6	84	10	0	0	0	0	0	0	0
April .. ..	20	80	0	0	0	3	97	0	0	0	0	77	23	0	0	23	77	0	0	0	0	0	0	0	0
May .. ..	16	45	36	3	0	0	58	32	10	0	0	48	45	7	0	3	68	29	0	0	0	0	0	0	0
June .. ..	0	0	33	57	10	0	3	10	74	13	0	0	13	87	0	0	3	64	33	0	0	0	0	0	0
July .. ..	0	0	0	86	14	0	0	10	66	24	0	0	14	86	0	0	15	50	31	4	0	0	0	0	0
August .. ..	0	6	45	49	0	0	0	23	77	0	0	7	61	32	0	0	32	61	7	0	0	0	0	0	0
September .. ..	0	20	60	20	0	0	7	37	56	0	0	10	60	30	0	7	17	76	0	0	0	0	0	0	0
October .. ..	35	65	0	0	0	0	90	10	0	0	3	81	16	0	0	48	52	0	0	0	0	0	0	0	0
November .. ..	32	59	7	2	0	2	55	43	0	0	0	48	49	3	0	13	73	14	0	0	0	0	0	0	0
December .. ..	26	55	19	0	0	6	41	51	2	0	0	27	71	2	0	13	66	21	0	0	0	0	0	0	0
Salalah. 17° 03' N., 54° 05' E. c. 55 ft.		Period : Nov., 1942–Jan., 1944																							
		0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)								
January .. ..	13	82	5	0	0	6	81	13	0	0	0	84	16	0	0	21	77	2	0	0	0	0	0	0	0
February .. ..	4	85	11	0	0	7	64	29	0	0	0	50	50	0	0	7	82	11	0	0	0	0	0	0	0
March .. ..	6	94	0	0	0	13	77	10	0	0	0	61	39	0	0	35	65	0	0	0	0	0	0	0	0
April .. ..	20	80	0	0	0	0	93	7	0	0	0	20	80	0	0	33	67	0	0	0	0	0	0	0	0
May .. ..	0	100	0	0	0	3	87	10	0	0	0	29	71	0	0	26	74	0	0	0	0	0	0	0	0
June .. ..	3	90	7	0	0	0	63	37	0	0	0	7	90	3	0	0	97	3	0	0	0	0	0	0	0
July .. ..	6	94	0	0	0	0	94	6	0	0	0	68	32	0	0	3	97	0	0	0	0	0	0	0	0
August .. ..	3	97	0	0	0	0	97	3	0	0	0	87	13	0	0	3	97	0	0	0	0	0	0	0	0
September .. ..	3	97	0	0	0	0	100	0	0	0	0	50	50	0	0	3	94	3	0	0	0	0	0	0	0
October .. ..	6	94	0	0	0	0	97	3	0	0	0	61	39	0	0	13	87	0	0	0	0	0	0	0	0
November .. ..	3	87	10	0	0	2	81	15	2	0	0	83	17	0	0	8	90	2	0	0	0	0	0	0	0
December .. ..	3	87	10	0	0	2	74	21	3	0	0	85	13	2	0	8	88	2	2	0	0	0	0	0	0

Authority.—Bibliography No. 94.

TABLE V—continued

Number of occasions per 100 on which particular wind forces may be expected

Riyan. 14° 39' N., 49° 23' E. 49 ft.

Period: Apr., 1942–Feb., 1944

Beaufort force	0500 (Z-3)				0900 (Z-3)				1500 (Z-3)				2100 (Z-3)				
	0	1-3	4-5	6-7 ≥8	0	1-3	4-5	6-7 ≥8	0	1-3	4-5	6-7 ≥8	0	1-3	4-5	6-7 ≥8	
January .. ..	18	82	0	0	11	89	0	0	0	56	44	0	0	27	73	0	0
February .. ..	10	90	0	0	5	95	0	0	0	32	68	0	0	28	72	0	0
March .. ..	0	100	0	0	3	94	3	0	0	32	68	0	0	0	100	0	0
April .. ..	32	68	0	0	3	95	2	0	0	70	30	0	0	53	47	0	0
May .. ..	61	39	0	0	6	94	0	0	0	89	11	0	0	79	21	0	0
June .. ..	53	45	2	0	5	92	3	0	0	33	42	25	0	21	77	2	0
July .. ..	45	55	0	0	7	90	3	0	0	28	53	19	0	16	79	5	0
August .. ..	42	58	0	0	8	90	2	0	0	47	48	5	0	10	88	2	0
September ..	48	50	2	0	7	77	16	0	0	66	30	2	0	43	57	0	0
October .. ..	21	79	0	0	3	97	0	0	0	82	18	0	0	61	39	0	0
November ..	17	83	0	0	13	83	2	2	0	65	35	0	0	20	80	0	0
December ..	8	87	5	0	8	81	9	2	0	39	61	0	0	13	85	2	0

Aden. 12° 47' N., 44° 59' E. 123 ft.

Period: 1940-3

Beaufort force	0500 (Z-3)				0900 (Z-3)				1500 (Z-3)				2100 (Z-3)*				
	0	1-3	4-5	6-7 ≥8	0	1-3	4-5	6-7 ≥8	0	1-3	4-5	6-7 ≥8	0	1-3	4-5	6-7 ≥8	
January .. ..	14	79	7	0	5	85	10	0	<1	90	9	0	0	13	84	3	0
February .. ..	9	72	19	0	6	85	8	<1	3	94	3	0	0	25	68	7	0
March .. ..	18	69	13	0	3	82	15	0	<1	93	5	<1	0	3	68	29	0
April .. ..	14	79	7	0	4	83	13	0	0	93	7	0	0	7	71	22	0
May .. ..	31	67	2	0	6	89	5	0	2	80	18	0	0	31	66	3	0
June .. ..	14	77	9	0	9	83	7	<1	0	70	29	<1	0	27	70	3	0
July .. ..	14	72	12	2	3	76	19	2	<1	65	34	0	0	13	71	14	2
August .. ..	14	71	15	0	6	80	14	0	0	60	40	0	0	16	78	6	0
September ..	21	73	6	0	7	91	2	0	<1	82	17	0	0	28	65	7	0
October .. ..	13	77	10	0	10	82	8	0	5	83	12	0	0	11	81	8	0
November ..	12	81	7	0	6	89	5	0	4	82	14	0	0	17	81	2	0
December ..	14	77	9	0	6	84	10	0	5	83	12	0	0	35	60	5	0

Authority.—Bibliography No. 94.

\* Apr., 1942–Dec., 1943.

Table V—Winds of different forces at coastal stations 2 147

TABLE V—continued

Number of occasions per 100 on which particular wind forces may be expected

Perim. 12° 39' N., 43° 24' E. 88 ft. Period: May, 1940-Dec., 1943

Beaufort force	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)*				
	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8
January .. ..	5	17	37	27	14	1	34	32	25	8	0	19	43	31	7	0	3	29	68	0
February .. ..	2	24	40	32	2	2	22	49	25	2	1	24	48	26	1	7	7	22	64	0
March .. ..	4	25	42	29	0	2	28	46	24	0	3	22	47	28	0	13	3	10	74	0
April .. ..	2	25	63	10	0	1	33	57	9	0	0	27	65	8	0	3	17	47	33	0
May .. ..	5	49	42	4	0	3	57	37	3	0	0	48	48	4	0	4	48	48	0	0
June .. ..	6	63	27	4	0	2	76	21	<1	0	<1	47	47	5	0	5	43	42	10	0
July .. ..	2	40	45	12	<1	<1	55	38	6	0	0	26	62	12	0	0	11	45	42	2
August .. ..	5	54	31	10	0	2	67	28	3	0	>1	34	51	14	0	2	13	48	37	0
September .. ..	9	55	33	3	0	2	71	25	2	0	>1	38	57	4	0	8	25	55	12	0
October .. ..	2	33	49	14	2	<1	37	51	10	<1	0	26	56	18	0	0	21	71	8	0
November .. ..	<1	35	44	20	0	0	31	54	15	0	0	24	54	22	0	0	3	80	17	0
December .. ..	<1	10	44	43	2	<1	12	56	31	0	0	11	49	38	2	0	2	43	55	0

Bander Kassim. 11° 17' N., 49° 10' E. 20 ft.

Period: Dec., 1942-Jan., 1944

Beaufort force	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)				
	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8	0	1-3	4-5	6-7	≥8
January .. ..	35	63	2	0	0	15	77	8	0	0	0	77	23	0	0	6	88	6	0	0
February .. ..	18	64	18	0	0	4	78	18	0	0	0	82	18	0	0	7	86	7	0	0
March .. ..	10	84	6	0	0	0	74	26	0	0	0	81	19	0	0	26	74	0	0	0
April .. ..	10	73	17	0	0	0	60	37	3	0	0	77	23	0	0	30	70	0	0	0
May .. ..	19	71	10	0	0	3	68	29	0	0	0	94	6	0	0	39	61	0	0	0
June .. ..	4	37	44	15	0	4	33	48	15	0	0	59	41	0	0	26	55	19	0	0
July .. ..	0	6	78	16	0	0	0	71	29	0	3	81	16	0	0	39	10	48	3	0
August .. ..	0	19	68	13	0	0	13	64	23	0	3	87	10	0	0	58	29	13	0	0
September .. ..	10	67	23	0	0	3	57	40	0	0	0	87	13	0	0	63	37	0	0	0
October .. ..	39	54	7	0	0	0	86	14	0	0	0	66	34	0	0	42	54	4	0	0
November .. ..	43	54	3	0	0	10	83	7	0	0	0	70	30	0	0	47	40	13	0	0
December .. ..	37	61	2	0	0	8	84	6	2	0	0	90	10	0	0	15	77	8	0	0

Authority.—Bibliography No. 94.

\* June, 1942-Dec., 1943.

TABLE VI—MONTHLY AND HOURLY SPEED AND DIRECTION OF THE RESULTANT WIND

Berbera. 10° 22' N., 45° 02' E. 45 ft.

Period : May, 1931–Apr., 1933

Hour	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	Means
January	99	118	132	146	152	155	155	153	133	57	1	6	11	17	22	25	29	37	51	60	65	69	76	85	44
degrees	2.7	2.1	2.3	1.9	2.3	2.5	2.5	2.3	1.7	1.1	4.9	9.0	11.9	14.0	15.0	15.1	15.1	14.1	12.6	11.3	9.7	7.9	6.2	4.1	5.6
knots	101	165	172	184	183	194	184	185	217	320	336	356	9	18	22	29	35	46	57	63	66	70	75	79	38
February	1.0	1.0	1.3	1.2	1.8	2.3	2.6	1.9	1.3	2.3	6.0	8.9	11.6	13.4	14.3	14.7	14.9	14.1	13.3	11.4	9.2	7.4	4.8	2.4	5.1
degrees	333	360	293	270	270	254	217	297	24	15	22	31	40	48	53	59	65	69	75	78	78	78	79	32	56
knots	0.6	0.4	0.7	0.5	0.5	0.6	0.4	0.2	0.9	4.0	7.6	10.6	12.8	14.1	15.1	15.5	15.2	13.9	12.3	10.7	8.3	5.5	2.8	0.8	5.9
March	295	293	270	249	242	225	230	267	301	334	351	8	28	41	50	56	63	69	78	84	91	90	315	297	44
degrees	1.5	1.3	1.2	1.5	1.7	1.6	1.4	1.5	2.5	5.6	7.5	9.0	10.5	11.9	13.4	13.7	13.6	12.8	10.8	8.0	4.3	1.7	0.3	1.0	4.0
knots	240	231	209	198	185	190	172	159	285	343	355	359	3	12	22	33	40	47	50	59	51	52	69	219	24
April	1.2	1.1	1.6	1.1	1.0	1.5	1.2	0.8	1.0	4.3	7.7	9.9	11.4	12.3	12.5	11.7	10.9	9.2	7.6	5.3	4.4	2.4	0.8	1.1	3.8
degrees	212	206	206	206	206	204	202	204	211	220	231	253	275	298	328	353	13	42	73	111	189	202	212	213	221
knots	7.1	9.4	11.8	12.5	13.2	13.5	14.7	17.7	20.7	19.1	15.2	11.0	8.3	6.9	7.1	7.0	6.5	4.0	2.6	1.2	2.2	3.5	4.5	6.0	6.8
May	209	205	204	204	204	204	207	209	212	214	221	232	245	263	290	307	291	222	203	203	208	213	215	211	216
degrees	13.8	16.4	19.1	20.0	21.4	22.5	23.9	26.9	29.2	28.1	23.9	19.1	13.5	10.5	8.0	6.0	2.6	2.1	3.1	4.0	6.2	9.0	10.4	11.7	13.7
knots	219	219	213	211	210	209	209	211	213	219	233	253	281	309	325	337	346	356	270	227	214	223	222	219	229
June	11.4	13.0	14.9	15.9	17.3	19.3	20.9	24.2	26.9	25.7	20.8	15.5	12.4	11.6	10.7	8.8	6.3	2.3	0.3	1.6	2.9	4.5	7.5	9.7	10.2
degrees	222	215	209	214	212	202	201	205	209	221	254	291	325	344	356	4	20	45	57	65	68	102	142	180	264
knots	2.3	2.9	3.6	4.5	5.6	5.7	6.9	8.7	10.8	10.9	7.6	6.9	8.8	10.7	10.8	9.1	6.9	4.4	3.3	2.7	2.1	1.2	1.0	1.0	1.6
July	171	176	168	177	180	175	170	166	155	328	347	355	359	5	12	20	31	42	55	67	75	121	160	159	31
degrees	1.1	1.3	2.1	3.4	4.1	4.5	4.5	3.9	1.5	2.7	7.0	9.2	11.0	11.7	12.2	11.4	10.4	9.5	7.8	5.6	3.4	1.6	1.3	1.2	2.9
knots	185	183	185	181	174	169	165	160	148	52	10	7	11	18	23	27	35	46	58	65	73	89	122	171	57
August	2.9	3.5	4.2	4.8	5.3	5.7	6.4	5.7	3.1	2.9	7.4	10.8	13.0	14.4	14.8	14.7	14.2	12.9	11.3	9.9	7.6	4.5	2.4	2.1	4.9
degrees	145	160	168	169	169	168	168	162	154	83	17	7	13	19	23	27	33	45	55	64	72	78	96	126	54
knots	2.9	2.9	3.3	4.2	4.9	5.0	5.6	5.2	3.6	2.0	6.3	10.3	12.5	14.2	15.1	15.3	14.5	13.6	12.5	10.9	8.7	6.8	4.8	2.9	4.9
September	205	204	202	201	199	198	197	200	208	227	282	326	351	5	15	25	35	49	62	69	80	101	155	193	52
degrees	3.2	4.1	5.1	5.7	6.3	6.8	7.3	7.8	7.7	5.8	4.3	5.8	7.9	9.7	10.7	10.7	10.1	8.9	7.5	6.1	4.2	2.3	1.7	2.3	0.3
knots																									
October																									
November																									
December																									
Year																									

Table VI—Speed and direction of the resultant wind

Authority.—Bibliography No. 57.

TABLE VII—SEASONAL FREQUENCY OF WIND DIRECTION AND SPEED IN THE UPPER AIR

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Masira island. 20° 42' N., 58° 50' E. 45-58 ft.††    Time of obs.: Chiefly 1400-1700 (Z-4).\*    Period: Feb., 1943-Feb., 1944

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
DECEMBER-FEBRUARY																																		
Surface†	3	6	0	0	9	2	0	0	26	7	0	0	16	4	0	0	2	0	0	0	7	1	0	0	10	2	0	0	4	0	0	0	5	163
1,700	3	1	0	0	11	7	0	0	18	17	0	0	7	1	0	0	11	2	0	0	7	2	0	0	4	2	0	0	1	2	0	0	4	166
3,300	6	2	0	0	19	8	0	0	12	12	0	0	2	3	0	0	7	2	0	0	4	1	0	0	7	3	0	0	7	4	0	0	1	163
6,500	13	8	1	0	5	10	0	0	7	6	7	0	5	2	0	0	2	1	0	0	2	1	0	0	5	8	7	0	7	14	1	0	0	143
10,000	5	13	2	0	7	8	0	0	7	3	8	0	2	2	0	0	5	2	0	0	2	2	0	0	4	15	5	0	4	11	7	0	2	131
13,000	4	5	5	0	9	0	0	0	3	9	9	0	9	2	0	0	2	4	3	0	2	6	0	0	7	17	12	2	5	8	11	0	0	110
MARCH-MAY																																		
Surface†	0	0	0	0	1	0	0	0	9	1	0	0	26	3	0	0	3	0	0	0	34	14	0	0	5	0	0	0	1	0	0	0	3	74
1,700	3	0	0	0	3	0	0	0	6	4	0	0	11	0	0	0	13	0	1	0	17	20	0	0	11	1	0	0	0	0	0	0	9	70
3,300	9	1	0	0	4	0	0	0	3	0	0	0	4	1	0	0	9	1	0	0	13	16	0	0	12	3	0	0	15	1	0	0	6	68
6,500	12	4	0	0	17	2	0	0	2	0	0	0	4	2	0	0	13	2	0	0	2	0	0	2	13	4	2	0	12	6	0	0	2	52
10,000	10	10	2	0	12	5	0	0	7	0	0	0	0	2	0	0	5	0	0	0	5	0	0	0	17	5	2	0	10	2	0	0	7	42
13,000	12	9	0	0	6	15	0	0	3	0	0	0	3	0	0	0	0	3	0	0	0	6	0	0	26	3	0	0	3	3	0	0	9	34
JUNE-AUGUST																																		
Surface†	0	0	0	0	0	0	0	0	3	0	0	0	3	2	0	0	0	9	0	0	12	63	5	0	3	0	0	0	0	0	0	0	0	65
1,700	0	2	0	0	2	0	0	0	3	0	0	0	2	2	0	0	9	8	0	0	11	41	6	0	3	3	3	0	3	3	0	0	0	65
3,300	5	0	0	0	3	2	0	0	3	2	0	0	0	0	0	0	14	2	0	0	12	8	0	0	18	15	2	0	3	3	0	0	9	65
6,500	22	3	0	0	14	6	0	0	5	2	0	0	0	0	0	0	2	0	0	0	5	0	0	0	8	6	2	0	13	8	0	0	5	63
10,000	43	4	2	0	14	12	0	0	2	2	0	0	2	2	0	0	0	0	0	0	2	0	0	0	2	0	2	0	8	4	0	0	0	51
13,000	26	5	0	0	5	9	2	0	12	7	5	0	0	0	0	0	0	0	0	0	2	0	0	0	5	2	2	0	9	2	0	0	7	43
SEPTEMBER-NOVEMBER																																		
Surface†	1	0	0	0	5	0	0	0	33	9	0	0	15	7	0	0	5	3	0	0	12	7	0	0	0	1	0	0	0	0	0	0	1	75
1,700	0	0	0	0	9	4	1	0	11	16	0	0	8	1	0	0	16	7	0	0	12	0	0	0	4	0	0	0	0	0	0	0	11	75
3,300	15	0	0	0	22	18	3	0	7	9	0	0	1	0	0	0	3	0	0	0	0	0	0	0	7	1	0	0	8	0	0	0	7	74
6,500	14	9	1	0	17	35	0	0	3	7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	1	0	0	6	69
10,000	14	8	0	0	8	29	0	0	14	5	0	0	0	0	0	0	5	2	0	0	2	2	0	0	0	2	0	0	6	0	0	0	5	63
13,000	25	4	0	0	9	13	2	0	2	5	0	0	0	0	0	0	5	2	0	0	7	4	0	0	5	0	0	0	9	0	0	0	9	56

Authority.—Bibliography No. 94.

†† 20° 39' N., 58° 54' E. 56 ft. Nov., 1943-Feb., 1944.

\* The times of observation in Dec.-Feb. were between 1000 and 2300 (Z-4). † The surface observations refer to a height of 30-50 feet above ground.

TABLE VII—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Socotra. 12° 38' N., 53° 53' E. 147 ft.

Time of obs. : All hours\*

Period : Nov., 1942-Feb., 1944

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
<b>DECEMBER-FEBRUARY</b>																																						
Surface†	5	0	0	0	42	21	-5	0	16	2	0	0	-5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	182
1,800	8	0	0	0	24	29	3	0	15	6	0	0	1	0	0	0	-5	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	12	182
3,300	1	0	0	0	13	20	-6	0	16	12	-6	0	3	0	0	0	7	0	0	0	3	1	0	0	2	0	0	0	3	0	0	0	2	0	0	0	17	176
6,500	5	-7	0	0	13	13	2	0	20	31	-7	0	5	3	0	0	1	-7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	150
10,000	9	6	0	0	15	12	0	2	18	23	5	0	3	-8	0	0	2	0	0	0	-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	132
13,000	13	9	0	0	14	10	0	0	17	16	1	0	4	1	0	0	3	3	0	0	2	0	0	0	1	0	0	0	3	1	1	0	3	102				
<b>MARCH-MAY</b>																																						
Surface†	27	0	0	0	42	6	0	0	0	0	0	0	0	0	0	0	3	3	0	0	8	6	0	0	0	0	0	0	3	0	0	0	0	62				
1,800	18	2	0	0	21	5	0	0	2	0	0	0	2	0	0	0	5	2	0	0	6	13	0	0	6	0	0	0	3	0	0	0	0	62				
3,300	3	0	0	0	6	0	0	0	3	2	0	0	11	0	0	0	19	0	0	0	23	5	0	0	3	5	0	0	3	0	0	0	16	62				
6,500	6	0	0	0	6	4	2	0	10	21	4	0	8	15	0	0	4	2	0	0	0	0	0	0	4	4	0	0	6	4	0	0	2	52				
10,000	4	4	0	0	13	13	7	0	9	28	7	0	2	0	2	0	2	0	0	0	0	0	0	0	2	0	0	0	0	4	0	0	2	46				
13,000	3	11	0	0	17	9	3	0	6	34	9	0	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	35				
<b>JUNE-AUGUST</b>																																						
Surface†	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	68	7	0	0	16	2	0	0	0	0	0	0	0	0	0	0	120				
1,800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	4	-8	25	39	13	-8	-8	0	0	0	0	0	0	0	118				
3,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	22	31	14	4	22	6	0	0	0	0	0	0	51				
6,500													Insufficient observations																									
10,000													Insufficient observations																									
13,000													Insufficient observations																									
<b>SEPTEMBER-NOVEMBER</b>																																						
Surface†	8	0	0	0	27	8	0	0	-6	0	0	0	0	0	0	0	7	28	0	0	5	2	0	0	-6	0	0	0	2	0	0	0	12	166				
1,800	2	1	0	0	18	18	-6	0	7	-6	0	0	1	0	0	0	4	7	7	6	6	13	4	2	-6	0	0	0	2	0	0	0	5	166				
3,300	-7	0	0	0	18	12	2	0	9	3	0	0	1	-7	0	0	7	3	-7	0	4	8	3	1	4	9	1	0	3	-7	0	0	10	152				
6,500	5	3	-8	-8	15	20	5	2	8	13	0	0	-8	0	0	0	2	0	0	0	2	0	0	0	3	6	-8	0	6	4	0	0	2	130				
10,000	14	-9	-9	0	18	21	-9	0	10	6	-9	0	3	2	0	0	2	0	0	0	3	0	0	0	4	0	0	0	6	0	0	0	8	112				
13,000	8	2	0	0	29	22	0	0	10	12	2	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	6	90				

Authority.—Bibliography No. 94.

\* 1400 (Z-4) only, Mar.-May.

† The surface observations refer to a height of 16 feet above ground.

Table VII—Seasonal wind direction and speed in the upper air 2 151

TABLE VII—continued

Number of occasions per 100 on which particular winds may be expected  
 I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)  
 Salalah. 17° 03' N., 54° 05' E. c. 55 ft. † Time of obs. : all hours\*. Period : Oct., 1942-Feb., 1944 ††

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
DECEMBER-FEBRUARY																																		
Surface	17	4	.4	0	5	.4	0	0	5	0	0	0	7	.4	0	0	31	3	0	0	2	.4	0	0	1	0	0	0	3	0	0	0	19	258
1,700	6	8	.3	0	4	1	0	0	12	.3	0	0	14	.3	0	0	15	3	0	0	11	.3	0	0	4	0	0	0	1	.3	0	0	20	320
3,300	15	6	1	.3	9	4	.3	0	15	1	0	0	14	.3	0	0	6	1	0	0	4	1	0	0	5	0	0	0	3	.3	0	0	13	317
6,500	9	8	1	0	13	14	1	0	13	12	1	0	7	2	.4	0	5	2	0	0	1	1	0	0	3	.4	0	0	3	1	.4	0	4	276
10,000	11	11	0	0	13	9	0	0	8	4	.4	0	4	4	.4	0	4	.4	0	0	3	1	0	0	5	4	0	0	7	2	0	0	9	231
13,000	20	4	0	0	7	6	0	0	6	2	0	0	5	1	0	0	3	0	0	0	4	1	0	0	11	7	0	0	13	7	0	0	3	180
MARCH-MAY																																		
Surface	1	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	71	4	0	0	15	4	0	0	0	0	0	0	0	0	0	0	0	91
1,700	2	0	0	0	1	0	0	0	2	0	0	0	7	1	0	0	17	0	0	0	40	6	0	0	7	1	0	0	4	0	0	0	12	90
3,300	7	1	0	0	2	0	0	0	2	1	0	0	8	0	0	0	22	3	0	0	26	11	2	0	5	0	0	0	3	0	0	0	5	89
6,500	8	7	0	0	8	1	0	0	13	8	0	0	10	7	0	0	10	14	1	0	2	2	0	0	0	0	0	0	1	2	0	0	2	83
10,000	9	15	2	0	5	14	0	0	9	12	6	0	5	2	0	0	3	2	2	0	2	0	0	0	6	0	0	0	0	3	0	0	6	68
13,000	11	18	2	0	9	7	0	0	7	11	0	0	9	4	0	0	7	0	2	0	4	0	0	0	2	0	0	0	5	5	0	0	0	57
JUNE, AUGUST																																		
Surface	1	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	26	17	0	0	16	10	0	0	0	0	0	0	0	0	0	0	23	80
1,700	5	1	0	0	5	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	28	4	0	0	20	0	0	0	9	0	0	0	22	79
3,300	3	14	3	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	15	7	0	0	12	1	0	0	16	10	0	0	15	73
6,500	15	27	2	0	6	4	2	0	6	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	2	0	0	10	15	0	0	6	52
10,000	14	26	9	0	9	11	0	0	3	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	20	6	0	0	0	35
13,000	4	8	0	4	4	23	0	0	12	8	4	0	0	0	0	0	8	0	0	0	4	0	0	0	4	0	0	0	8	12	0	0	0	26
SEPTEMBER-NOVEMBER																																		
Surface	12	4	0	0	2	0	0	0	2	.7	0	0	9	1	0	0	28	2	0	0	3	.3	0	0	2	0	0	0	5	0	0	0	29	291
1,700	7	6	.7	.3	4	3	.7	0	7	.3	0	0	15	.7	0	0	8	0	0	0	8	.7	0	0	5	0	0	0	1	0	0	0	32	291
3,300	9	8	.3	0	12	9	.3	0	11	1	0	0	15	.3	0	0	8	0	0	0	6	.3	0	0	4	0	0	0	3	0	0	0	12	288
6,500	9	12	.4	0	16	32	2	0	9	12	1	0	2	.8	0	0	1	0	0	0	.4	0	0	0	0	0	0	0	2	.4	0	0	8	257
10,000	9	10	0	0	12	23	2	0	11	15	2	0	3	.5	0	0	2	.5	0	0	1	0	0	0	1	0	0	0	2	0	0	0	5	206
13,000	8	5	0	0	23	9	0	0	13	8	0	0	8	.6	0	0	4	.0	0	0	2	.6	0	0	6	2	0	0	3	2	0	0	6	171

Authority.—Bibliography No. 94. \* 1400-1600 (Z-4) only, Mar.-May. † The exact height above ground to which the surface observations refer is not known. †† Data for July, 1943 are missing. Surface data are missing for Dec., 1942 and Jan., 1943.

TABLE VII—continued

Number of occasions per 100 on which particular winds may be expected  
 I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Riyan. 14° 39' N., 49° 23' E. 49 ft.

Time of obs. : afternoon.

Period : Apr., 1942-Feb., 1944

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
<b>DECEMBER-FEBRUARY</b>																																						
Surface*	1	-6	0	0	0	0	0	0	19	8	0	0	38	15	0	0	14	2	0	0	-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-6	169
1,700	1	-6	0	0	-6	0	0	0	38	4	0	0	34	2	0	0	9	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	169
3,300	19	0	0	0	29	0	0	0	28	-6	0	0	2	0	0	0	1	0	0	0	2	0	0	0	-6	0	0	0	5	-6	0	0	13	167				
6,500	18	13	0	0	17	5	0	0	11	5	0	0	4	2	0	0	8	-7	0	0	6	2	0	0	5	0	0	0	1	0	0	0	2	149				
10,000	8	10	-8	0	21	15	0	0	7	9	0	0	4	3	0	0	6	0	0	0	3	2	0	0	2	-8	0	0	7	0	0	0	2	122				
13,000	7	6	0	0	16	9	0	0	9	6	1	0	9	0	0	0	5	0	0	0	6	2	0	0	9	3	0	0	4	4	0	0	6	102				
<b>MARCH-MAY</b>																																						
Surface*	0	0	0	0	0	0	0	0	5	-8	0	0	43	25	0	0	16	5	0	0	2	-8	0	0	0	0	0	0	0	0	0	0	2	128				
1,700	0	0	0	0	-8	0	0	0	20	3	0	0	31	2	0	0	17	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	18	128				
3,300	9	0	0	0	17	-8	0	0	28	-8	0	0	14	-8	0	0	10	0	0	0	5	0	0	0	2	0	0	0	-8	0	0	0	13	126				
6,500	-1	0	0	0	5	3	0	0	20	14	1	0	14	15	1	0	8	0	0	0	4	3	0	0	1	2	0	0	1	0	0	0	5	93				
10,000	5	9	0	0	11	8	0	0	9	11	5	0	18	8	0	0	9	3	0	0	2	0	0	0	2	2	0	0	0	0	0	0	0	65				
13,000	4	20	2	0	7	20	0	0	11	15	0	0	11	2	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	4	0	0	0	46				
<b>JUNE-AUGUST</b>																																						
Surface*	0	0	0	0	0	0	0	0	5	0	0	0	11	0	0	0	22	3	0	0	30	22	0	0	0	0	0	0	0	0	0	0	6	178				
1,700	1	0	0	0	6	2	0	0	5	0	0	0	6	0	0	0	16	2	-6	0	26	16	2	3	2	-6	0	0	-6	0	0	0	11	177				
3,300	4	0	0	0	11	3	0	0	20	2	0	0	7	0	0	0	11	-6	0	0	12	8	0	-6	8	-6	0	0	3	0	0	0	8	177				
6,500	11	1	0	0	2	0	0	0	14	1	0	0	8	-7	0	0	11	0	0	0	16	4	0	0	9	4	0	0	7	0	0	0	11	141				
10,000	14	15	0	0	24	8	0	0	9	4	0	0	4	0	0	0	2	0	0	0	4	2	0	0	2	2	0	0	4	0	0	0	6	80				
13,000	12	17	0	0	15	25	10	0	6	2	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	2	0	0	2	2	0	0	2	52				
<b>SEPTEMBER-NOVEMBER</b>																																						
Surface*	0	0	0	0	0	0	0	0	13	2	0	0	43	0	0	0	24	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	10	146				
1,700	-7	0	0	0	2	-7	0	0	25	2	0	0	32	2	0	0	16	1	0	0	8	3	0	0	0	0	0	0	0	0	0	0	7	146				
3,300	8	0	0	0	21	-7	0	0	23	4	0	0	9	0	0	0	10	0	0	0	6	-7	0	0	4	0	0	0	1	0	0	0	13	142				
6,500	17	11	0	0	20	9	0	0	13	7	0	0	2	0	0	0	6	-8	0	0	2	2	0	0	2	0	0	0	4	-8	0	0	3	128				
10,000	9	31	1	0	8	29	0	0	7	6	0	0	1	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	1	99				
13,000	9	19	2	0	19	13	0	0	13	13	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0	0	2	89				

Authority.—Bibliography No. 94.

\* The surface observations refer to a height of 46 feet above ground in Jan. and Feb., 1944 but before that time the height is not known.

Table VII—Seasonal wind direction and speed in the upper air 2 153

TABLE VII—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.) II = 14-27 knots (16-31 m.p.h.) III = 28-40 knots (32-47 m.p.h.) IV = over 40 knots (over 47 m.p.h.) C = less than 3 knots (less than 4 m.p.h.)

Aden. 12° 47' N., 44° 59' E. 123 ft.

Time of obs.: 1500-1600 (Z-3).

Period: Dec., 1939-Dec., 1942†

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
DECEMBER-FEBRUARY																																		
Surface	2	0	0	0	14	0	0	0	28	0	0	0	9	0	0	0	27	-8	0	0	-4	0	0	0	0	0	0	0	-4	0	0	0	19	247
1,400*	-8	-4	0	0	12	-8	0	0	46	10	2	0	13	-8	-4	0	2	-4	0	0	0	0	0	0	-4	0	0	0	0	0	0	11	247	
3,500	3	0	0	0	29	11	0	0	23	24	-4	0	-8	0	0	0	0	0	0	0	-8	0	0	0	2	0	0	0	-4	0	0	0	6	240
6,500	8	-9	0	0	20	16	-5	0	17	10	0	0	4	-5	0	0	2	0	0	0	3	-5	0	0	6	-9	0	0	3	0	0	0	7	215
10,000	19	7	0	0	14	14	1	0	8	5	0	0	0	2	0	0	3	0	0	0	2	0	0	0	4	1	0	0	12	4	0	0	4	182
13,000	15	10	2	0	7	9	0	0	13	5	1	0	5	2	0	0	3	0	0	0	3	-7	0	0	3	4	0	0	5	5	0	0	5	149
MARCH-MAY																																		
Surface	3	0	0	0	29	3	0	0	13	-8	0	0	5	0	0	0	29	1	0	0	3	0	0	0	-4	0	0	0	-4	0	0	0	12	241
1,400*	0	0	0	0	5	3	0	-8	31	13	-8	0	10	-4	0	0	5	2	0	0	4	4	0	0	1	0	0	0	-4	-4	0	0	19	239
3,500	3	0	0	0	8	3	0	0	24	13	-4	0	8	-9	0	0	11	-4	0	0	9	-9	0	0	4	0	0	0	3	0	0	0	11	235
6,500	-9	0	0	0	6	-9	0	0	20	13	1	0	13	1	0	0	8	-5	0	0	12	2	0	0	8	1	0	0	2	0	0	0	9	216
10,000	10	4	0	0	11	10	2	0	17	16	-5	0	4	2	0	0	4	1	0	0	5	-5	0	0	2	2	0	0	4	2	0	0	2	185
13,000	7	12	3	0	13	23	5	0	9	3	0	0	4	-7	0	0	3	0	0	0	1	1	0	0	2	1	0	0	2	3	0	0	5	146
JUNE-AUGUST																																		
Surface	1	-4	0	0	5	0	0	0	0	0	0	0	5	1	0	0	65	13	0	0	4	-4	0	0	0	0	0	0	0	0	0	0	4	274
1,400*	3	-4	0	0	4	-7	0	0	2	-4	0	0	3	1	0	0	14	6	0	0	10	22	11	4	2	6	-7	-7	3	0	0	0	5	273
3,500	1	-7	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3	1	-4	0	12	7	-4	0	26	22	4	-4	6	5	0	0	7	269
6,500	2	-4	0	0	1	-4	0	0	4	3	0	0	2	1	0	0	4	0	0	0	10	-4	0	0	21	10	-9	0	13	17	-4	0	8	224
10,000	5	2	0	0	17	6	0	0	15	15	-8	0	7	-8	0	0	5	-8	0	0	6	0	0	0	5	-8	0	0	4	2	0	0	8	131
13,000	1	9	1	0	17	16	11	0	12	15	1	0	3	3	0	0	3	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	4	75
SEPTEMBER-NOVEMBER																																		
Surface	2	0	0	0	9	0	0	0	12	0	0	0	10	0	0	0	42	5	0	0	3	0	0	0	0	0	0	0	-4	0	0	0	16	243
1,400*	-8	0	0	0	4	0	0	0	36	3	0	0	15	0	0	0	12	2	0	0	5	6	2	0	-4	8	0	0	-8	0	0	0	12	242
3,500	1	0	0	0	8	1	-4	0	24	20	0	0	9	-9	0	0	10	-4	0	0	8	1	0	0	7	3	0	0	1	0	0	0	6	235
6,500	6	1	0	0	17	14	2	0	18	10	1	0	5	0	-5	0	2	0	0	0	5	0	0	0	7	0	0	0	2	0	0	0	9	221
10,000	7	14	0	0	17	33	3	0	13	6	0	0	-5	1	0	0	0	0	0	0	2	0	0	0	2	0	0	0	-5	-5	0	0	1	190
13,000	7	15	6	0	11	23	4	0	9	12	3	0	4	0	0	0	-7	0	0	0	-7	0	0	0	2	0	0	0	-7	0	0	0	2	136

Authority.—Bibliography No. 94.

\* From Sept., 1942 the data probably refer to a height of 1,900 feet. † Data for Nov.- Dec., 1941 and Mar., 1942 are missing.

TABLE VII—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Perim. 12° 39' N., 43° 24' E. 88 ft.\*

Time of obs. : 0600-0900 (Z-3).

Period : May, 1940-May, 1943†.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV									
DECEMBER-FEBRUARY																																									
Surface	.4	.4	0	0	0	0	0	0	9	5	1	.9	29	42	5	0	1	.9	0	0	0	0	0	0	.4	0	0	0	1	2	0	0	1				231				
1,400	.9	1	0	0	.4	0	0	0	0	3	.4	0	7	52	30	2	0	.4	0	0	0	0	0	0	.4	0	0	0	.4	1	.4	0	.4				231				
3,400	2	1	0	0	.5	0	0	0	4	7	4	.5	5	38	30	3	1	.5	0	0	0	0	0	0	1	0	0	0	0	2	0	0	.5				193				
6,500	9	0	0	0	7	3	0	0	11	13	3	0	6	19	4	3	1	3	0	0	3	1	0	0	1	0	0	0	4	1	0	0	7				70				
10,000	6	0	0	0	0	6	0	0	33	6	0	0	11	0	0	0	6	0	0	0	0	0	0	0	22	0	0	0	0	6	0	0	6				18				
13,500													Insufficient observations																												
MARCH-MAY																																									
Surface	3	0	0	0	.3	0	0	0	3	1	0	0	34	29	3	.3	6	2	0	0	0	0	0	0	.7	0	0	0	10	4	.7	0	3				288				
1,400	4	1	0	0	0	0	0	0	2	2	1	0	16	40	14	0	3	1	0	0	.4	0	0	0	.4	0	0	0	6	6	.4	0	1				284				
3,400	6	2	.4	0	2	0	0	0	5	14	8	1	8	25	14	.4	2	.8	0	0	.8	.4	0	0	.4	.4	0	0	4	2	0	0	2				246				
6,500	11	1	0	0	10	1	0	0	13	8	0	0	9	17	5	0	5	8	1	0	4	0	0	0	1	0	0	0	3	0	0	0	4				111				
10,000	18	0	0	0	11	2	0	0	13	3	0	0	11	3	0	0	7	8	0	0	2	0	0	0	3	0	0	0	8	2	0	0	8				61				
13,500	17	0	0	0	10	13	0	0	10	17	0	0	7	3	0	0	0	0	0	0	7	0	0	0	3	0	0	0	10	3	0	0	0				30				
JUNE-AUGUST																																									
Surface	9	0	0	0	3	0	0	0	11	0	0	0	9	0	0	0	3	0	0	0	2	0	0	0	22	6	0	0	24	4	0	0	8				195				
1,400	3	0	0	0	1	0	0	0	3	4	0	0	6	6	0	0	2	.5	0	0	2	0	0	0	10	16	1	0	17	19	7	.5	4				195				
3,400	4	.6	0	0	.6	0	0	0	2	3	0	0	7	4	.6	0	2	.6	0	0	2	1	0	0	14	17	.6	0	11	20	5	2	4				169				
6,500	10	3	4	0	6	0	0	0	5	1	0	0	4	0	0	0	3	0	0	0	4	1	0	0	5	6	0	0	14	26	5	1	3				80				
10,000	42	10	0	0	16	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	13	6	0	0	6				31				
13,500	21	21	0	0	5	42	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0				19				
SEPTEMBER-NOVEMBER																																									
Surface	1	0	0	0	2	0	0	0	5	3	1	0	32	23	3	0	8	2	0	0	0	0	0	0	7	.5	0	0	3	.5	0	0	8				186				
1,400	1	.5	0	0	.5	0	0	0	2	2	2	0	16	42	15	1	2	.5	.5	0	0	0	0	0	1	1	0	0	8	4	0	0	2				186				
3,400	4	1	0	0	3	.6	0	0	6	13	6	0	6	26	17	2	2	.6	.6	0	.6	0	0	0	3	0	0	0	4	1	0	0	2				173				
6,500	10	0	0	0	16	2	0	0	16	17	2	.8	7	11	4	.8	2	.8	0	0	.8	0	0	0	2	0	0	0	6	.8	0	0	2				122				
10,000	19	3	0	0	21	12	0	0	12	10	0	0	4	0	0	0	0	2	0	0	2	0	0	0	2	0	0	0	7	0	0	0	6				67				
13,500	13	0	0	0	18	16	0	0	21	21	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	3				38				

Authority.—Bibliography No. 94.

\*The surface observations probably refer to a height of about 30 feet above ground. † Data for Nov.-Dec., 1941 and July-Sept., 1942, are missing.

Table VII—Seasonal wind direction and speed in the upper air 2 155

TABLE VII—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Berbera. 10° 22' N., 45° 02' E. 45 ft.    Time of obs. : morning and afternoon.    Period : May, 1931-July, 1932.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
<b>DECEMBER-FEBRUARY</b>																																		
Surface	5	6	0	0	4	15	1	0	3	1	0	0	24	2	0	0	11	1	0	0	2	0	0	0	5	0	0	0	2	0	0	0	17	94
1,500	7	0	0	0	25	9	0	0	30	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	22	94
3,000	1	0	0	0	28	12	0	0	25	12	0	0	4	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	12	93
6,000	5	0	0	0	23	24	0	0	26	8	0	0	2	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	4	0	0	0	4	84
10,000	12	3	0	0	15	15	0	0	11	22	2	0	5	3	0	0	2	2	0	0	2	0	0	0	0	0	0	0	3	0	0	0	3	65
14,000	3	0	0	0	12	12	0	0	19	25	0	0	6	19	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32
16,000	0	0	0	0	10	5	0	0	30	25	0	0	10	15	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
<b>MARCH-MAY</b>																																		
Surface	7	9	0	0	13	9	0	0	4	2	0	0	3	0	0	0	9	9	0	0	2	0	0	0	8	0	0	0	6	9	0	0	43	112
1,500	9	0	0	0	14	0	0	0	4	0	0	0	4	0	0	0	7	1	0	0	12	2	0	0	8	0	0	0	7	0	0	0	32	120
3,000	4	0	0	0	4	0	0	0	14	4	0	0	26	1	0	0	11	0	0	0	6	4	0	0	3	2	0	0	4	0	0	0	17	114
6,000	9	0	1	0	9	6	0	0	17	6	0	0	13	1	0	0	17	0	0	0	4	0	0	0	1	0	0	0	3	0	0	0	13	101
10,000	6	2	0	0	18	13	2	0	15	12	2	0	7	0	0	0	1	0	0	0	3	1	0	0	3	0	0	0	9	0	0	0	6	87
14,000	0	5	0	0	5	10	0	0	20	10	0	0	10	0	0	0	5	0	0	0	0	0	0	0	15	5	0	0	10	0	0	0	5	20
16,000	0	0	0	0	6	11	0	0	17	17	0	0	6	6	0	0	0	0	0	0	22	0	0	0	11	0	0	0	0	0	0	0	6	18
<b>JUNE-AUGUST</b>																																		
Surface	12	0	0	0	13	0	0	0	6	2	0	0	2	0	0	0	4	6	2	0	3	11	6	0	3	0	0	0	3	6	0	0	26	177
1,500	5	0	0	0	3	0	0	0	1	0	0	0	1	0	0	0	3	10	2	0	9	13	4	6	16	2	0	0	18	6	0	0	6	172
3,000	0	0	0	0	6	0	0	0	6	0	0	0	2	0	0	0	5	3	0	0	18	17	5	6	27	8	0	0	4	4	0	0	5	169
6,000	8	0	0	0	2	0	0	0	2	0	0	0	3	0	0	0	5	8	0	0	19	7	0	0	28	22	0	0	3	2	0	0	5	129
10,000	22	4	0	0	12	2	1	0	10	0	1	0	2	2	0	0	1	0	0	0	4	2	0	0	7	5	0	0	7	4	0	0	14	82
14,000	0	5	2	0	16	36	5	0	14	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	43
16,000	0	7	0	0	32	36	0	0	11	7	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	28
20,000	10	0	0	0	33	19	0	0	29	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
<b>SEPTEMBER-NOVEMBER</b>																																		
Surface	5	0	0	0	7	9	0	0	4	0	0	0	23	0	0	0	22	2	0	0	13	0	0	0	0	0	0	0	0	0	0	0	23	112
1,500	7	1	0	0	19	2	0	0	14	0	0	0	5	0	0	0	3	4	0	0	7	4	0	0	3	0	0	0	5	0	0	0	26	113
3,000	3	0	0	0	16	4	1	0	22	6	1	0	6	0	0	0	3	1	1	0	11	9	1	0	4	0	0	0	3	0	0	0	8	107
6,000	2	2	0	0	13	26	1	0	16	2	0	0	9	0	0	0	3	0	0	0	4	4	0	0	10	0	0	0	1	0	0	0	7	94
10,000	11	2	0	0	27	20	0	0	8	8	0	0	3	0	0	0	2	0	0	0	2	0	0	0	3	0	0	0	6	5	0	0	3	63
14,000	8	4	4	0	15	12	0	0	23	12	0	0	0	4	0	0	0	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	11	26
16,000	0	0	0	0	23	12	0	0	12	6	0	0	23	6	0	0	0	6	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6	17

Authority.—Bibliography No. 94.

Note.—In July and August most of the ascents were made in the afternoon so that the strong SW. winds are inadequately represented.

TABLE VII—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Bander Kassim. 11° 17' N., 49° 10' E. 20 ft.

Time of obs.: variable

Period: Nov., 1942-Feb., 1944

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
<b>DECEMBER-FEBRUARY</b>																																		
Surface†	42	0	0	0	26	3	0	0	5	0	0	0	3	5	0	0	5	5	0	0	5	0	0	0	1	0	0	0	3	0	0	0	16	192
1,700	25	3	0	0	18	27	0	0	4	0	0	0	5	1	0	0	3	2	5	0	0	0	0	0	9	0	0	0	4	0	0	0	6	216
3,300	13	0	0	0	15	26	1	0	5	5	0	0	5	1	0	0	7	3	0	0	3	5	0	0	8	5	0	0	5	0	0	0	5	205
6,500	6	1	0	0	14	14	2	0	17	16	1	0	8	1	0	0	4	1	0	0	6	0	0	0	2	0	0	0	5	2	0	0	5	166
10,000	7	5	0	0	14	13	1	0	22	17	7	0	6	7	0	0	2	1	0	0	0	0	0	0	3	0	0	0	7	7	0	0	5	147
13,000	5	2	0	0	21	14	9	0	22	13	9	0	5	9	0	0	3	0	0	0	5	2	0	0	0	0	0	0	2	0	0	0	4	109
<b>MARCH-MAY</b>																																		
Surface†	59	0	0	0	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	86
1,700	34	7	0	0	7	5	0	0	1	0	0	0	1	1	0	0	7	3	0	0	0	1	0	0	5	0	0	0	20	6	0	0	2	86
3,300	12	2	0	0	10	0	0	0	1	0	0	0	0	0	0	0	12	10	0	0	11	0	0	0	13	1	0	0	15	6	0	0	7	84
6,500	10	0	0	0	13	0	0	0	7	6	0	0	10	5	0	0	7	1	0	0	5	0	0	0	16	0	0	0	11	1	0	0	7	82
10,000	6	0	0	0	13	10	1	0	18	16	0	0	10	14	0	0	1	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	5	79
13,000	4	4	0	0	9	15	0	0	23	16	1	0	14	7	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	74
<b>JUNE-AUGUST</b>																																		
Surface†	15	2	0	0	10	0	0	0	0	0	0	0	2	3	0	0	7	25	0	0	0	0	0	0	7	8	0	0	23	8	0	0	4	124
1,700	4	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	14	11	0	0	13	2	0	0	11	21	0	0	16	3	0	0	3	122
3,300	9	0	0	0	9	0	0	0	9	0	0	0	3	0	0	0	11	9	0	0	30	3	0	0	26	6	0	0	9	5	0	0	5	109
6,500	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	25	5	0	0	18	9	0	0	15	15	0	0	6	1	0	0	1	87
10,000	6	6	0	0	3	6	2	0	3	2	0	0	3	0	0	0	5	3	0	0	9	8	0	0	12	12	0	0	12	5	0	0	5	66
13,000	6	10	0	0	23	19	8	0	4	4	0	0	2	0	0	0	0	0	0	0	8	0	0	0	2	0	0	0	2	6	0	0	4	48
<b>SEPTEMBER-NOVEMBER</b>																																		
Surface†	33	6	0	0	38	6	0	0	6	0	0	0	2	1	0	0	4	5	0	0	0	0	0	0	6	0	0	0	6	0	0	0	8	154
1,700	24	4	0	0	12	14	0	0	7	0	0	0	5	7	0	0	10	3	7	0	1	0	0	0	3	3	0	0	10	7	0	0	8	148
3,300	12	2	0	0	12	18	8	0	2	0	0	0	5	0	0	0	11	2	0	0	8	0	0	0	11	3	0	0	7	2	0	0	2	121
6,500	8	3	0	0	9	20	0	0	17	3	0	0	0	1	0	0	8	0	0	0	9	0	0	0	8	5	0	0	5	1	0	0	3	76
10,000	5	10	0	0	15	15	0	0	7	10	0	0	10	0	0	0	2	0	0	0	5	0	0	0	10	0	0	0	5	2	0	0	5	41
13,000	12	12	0	0	23	18	0	0	6	12	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	17

Authority.—Bibliography No. 94.

† The surface observations are probably made at 10-20 feet above ground.

Table VII—Seasonal wind direction and speed in the upper air 2 157

TABLE VIII—MONTHLY FREQUENCY OF WIND DIRECTION AND SPEED IN THE UPPER AIR

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots    II = 14-27 knots    III = 28-40 knots    IV = over 40 knots    C = less than 3 knots  
 (4-15 m.p.h.)    (16-31 m.p.h.)    (32-47 m.p.h.)    (over 47 m.p.h.)    (less than 4 m.p.h.)

Cape Guardafui. 11° 44' N., 51° 15' E. 262 ft.

Time of obs.: morning\*.

Period: Jan., 1930-June, 1933

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
<b>JANUARY</b>																																		
Surface	18	2	0	0	47	3	0	0	17	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	86
2,000	18	2	0	0	36	8	0	0	21	2	0	0	6	0	0	0	2	0	0	0	.9	0	0	0	.9	0	0	0	2	2	0	0	0	58
3,500	13	0	0	0	29	3	0	0	24	3	0	0	10	0	0	0	2	0	0	0	1	0	0	0	3	0	0	0	12	0	0	0	0	34
5,500	0	4	0	0	27	27	0	0	12	15	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
7,000	Insufficient observations																																	
<b>FEBRUARY</b>																																		
Surface	4	.5	0	0	21	2	0	0	18	1	0	0	20	18	2	.5	5	4	2	.5	0	0	0	0	1	0	0	0	.5	0	0	0	0	105
2,000	4	2	0	0	19	3	0	0	16	0	0	0	25	10	1	0	10	6	1	0	1	0	0	0	1	0	0	0	.5	0	0	0	0	96
3,500	8	.8	0	0	7	4	0	0	22	2	0	0	32	10	0	0	9	2	0	0	2	0	0	0	.8	0	0	0	0	0	0	0	0	62
5,500	8	3	0	0	10	7	0	3	7	25	0	3	7	5	0	0	3	0	0	0	5	0	0	0	7	0	0	0	7	0	0	0	0	20
7,000	Insufficient observations																																	
<b>MARCH</b>																																		
Surface	1	0	0	0	6	0	0	0	18	2	.5	0	23	24	6	2	3	8	3	2	0	0	0	0	0	0	0	0	0	1	0	1	0	105
2,000	2	.6	0	0	7	0	0	0	15	1	0	0	32	24	2	.6	3	7	1	.6	1	0	0	0	1	.6	0	0	1	1	0	0	0	90
3,500	3	.7	0	0	5	3	0	0	22	7	0	0	20	15	0	0	7	4	0	0	4	.7	0	0	7	0	0	0	2	0	0	0	0	69
5,500	0	4	0	0	9	8	2	0	13	21	2	2	10	2	4	2	2	0	0	0	0	0	0	0	4	0	0	0	15	0	0	0	0	26
7,000	4	0	0	0	14	0	9	0	14	9	0	0	23	0	0	0	0	0	0	0	9	0	0	0	4	0	0	0	14	0	0	0	0	11
<b>APRIL</b>																																		
Surface	2	0	0	0	4	0	0	0	3	1	.5	0	9	33	10	2	2	22	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	92
2,000	5	2	0	0	3	0	0	0	5	0	0	0	17	18	1	0	16	16	3	0	5	0	0	0	3	0	0	0	5	.7	0	0	0	75
3,500	3	2	0	0	8	1	0	0	5	4	0	0	17	7	0	0	19	10	2	0	6	0	0	0	8	0	0	0	8	0	0	0	0	49
5,500	13	0	0	0	13	0	0	0	13	5	0	0	16	3	0	0	13	3	0	0	3	0	0	0	8	5	0	0	5	0	0	0	0	19
7,000	5	0	0	0	10	10	0	0	20	0	0	0	20	0	0	0	5	0	0	0	0	0	0	0	15	0	5	0	5	0	5	0	0	10

\* The exact time is not known but appears to be between 0700 and 1000 (Z-3).

TABLE VIII—*continued*

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Cape Guardafui—*cont.*

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV									
<b>MAY</b>																																									
Surface	0	0	0	0	1	0	0	0	3	2	0	0	20	21	8	5	12	16	8	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	97
2,000	17	0	0	0	11	0	0	0	12	0	0	0	9	2	2	0	18	6	0	0	7	0	0	0	4	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	60
3,500	7	0	0	0	4	0	0	0	7	0	0	0	11	5	0	0	13	1	0	0	8	1	0	0	16	2	0	0	24	1	0	0	0	0	0	0	0	0	0	0	46
5,500	0	0	0	0	13	3	0	0	13	3	0	0	3	0	0	0	6	0	0	0	6	0	0	0	28	3	0	0	19	3	0	0	0	0	0	0	0	0	0	0	16
7,000	Insufficient observations																																								
<b>JUNE</b>																																									
Surface	6	0	0	0	6	0	0	0	1	0	0	0	24	21	5	6	19	23	3	6	6	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78
2,000	35	0	0	0	10	0	0	0	11	0	0	0	1	0	0	0	5	0	0	0	13	0	0	0	9	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	43
3,500	9	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	26	7	0	0	35	15	0	0	0	0	0	0	0	0	0	0	23
5,500	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	0	0	0	5	10	0	0	25	35	0	0	10	5	0	0	0	0	0	0	0	0	0	0	10
7,000	Insufficient observations																																								
<b>JULY</b>																																									
Surface	0	0	0	0	0	0	0	0	0	0	0	0	6	13	19	8	7	16	22	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77
2,000	7	2	0	0	7	0	0	0	0	0	0	0	0	0	0	0	11	9	7	0	16	0	2	0	11	5	0	0	21	2	0	0	0	0	0	0	0	0	0	0	22
3,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	36	0	0	7	21	0	0	0	0	0	0	0	0	0	0	7
5,500	Insufficient observations																																								
7,000	Insufficient observations																																								
<b>AUGUST</b>																																									
Surface	0	0	0	0	0	0	0	0	6	0	0	0	22	15	8	6	19	15	8	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78
2,000	23	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	8	7	2	0	21	0	2	0	10	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	30
3,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	15	3	0	0	35	12	0	0	29	3	0	0	0	0	0	0	0	0	0	0	17
5,500	Insufficient observations																																								
7,000	Insufficient observations																																								

Table VIII—Monthly wind direction and speed in the upper air 2 159

TABLE VIII—*continued*

Number of occasions per 100 on which particular winds may be expected.

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Cape Guardafui—*cont.*

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV										
<b>SEPTEMBER</b>																																						
Surface	0	0	0	0	0	0	0	0	0	0	0	0	24	20	4	0	28	20	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45
2,000	18	0	0	0	7	0	0	0	0	0	0	0	4	0	0	0	25	0	0	0	32	3	0	0	7	0	0	0	4	0	0	0	34	0	0	0	0	28
3,500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	8	0	0	0	42	8	0	0	34	0	0	0	0	12				
5,500	Insufficient observations																																					
7,000	Insufficient observations																																					
<b>OCTOBER</b>																																						
Surface	16	0	0	0	12	0	0	0	10	0	0	0	19	8	0	0	16	7	0	0	0	0	0	0	0	0	0	0	6	0	0	0	6	34				
2,000	33	2	0	0	5	0	0	0	10	0	0	0	8	5	0	0	14	2	0	0	2	0	0	0	2	0	0	0	15	2	0	0	0	29				
3,500	19	4	0	0	25	0	0	0	18	0	0	0	4	0	0	0	0	4	0	0	2	0	0	0	5	0	0	0	19	0	0	0	0	28				
5,500	14	0	0	0	14	21	11	0	11	14	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	14				
7,000	Insufficient observations																																					
<b>NOVEMBER</b>																																						
Surface	33	4	0	0	29	0	0	0	7	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	18	2	0	0	0	51				
2,000	32	11	0	2	26	2	0	0	9	0	0	0	4	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	6	4	0	0	0	52				
3,500	24	11	2	0	30	11	0	0	11	1	0	0	3	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	46				
5,500	14	7	0	0	32	29	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	14				
7,000	Insufficient observations																																					
<b>DECEMBER</b>																																						
Surface	34	7	0	0	32	7	0	0	5	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	69				
2,000	30	18	0	0	19	15	0	0	6	0	0	0	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	61				
3,500	15	18	1	0	23	16	0	0	13	3	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	39				
5,500	5	15	0	0	10	30	0	0	15	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	0	0	0	0	10				
7,000	Insufficient observations																																					

Authority.—Bibliography No. 68.

(68887)

TABLE IX—DIURNAL VARIATION OF WIND DIRECTION AND SPEED IN THE UPPER AIR

Number of occasions per 100 on which particular winds may be expected.

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Aden. 12° 47' N., 44° 59' E. 33 ft.

Period: Mar.-May, 1936

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
<b>MARCH-MAY</b>																																						
Surface	17	0	0	0	17	0	0	0	27	7	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	30
1,000	0	0	0	0	10	3	0	0	42	29	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	31
2,000	3	0	0	0	6	3	0	0	39	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	31
3,000	3	0	0	0	23	6	0	0	29	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	31
4,000	8	0	0	0	12	8	0	0	23	23	0	0	8	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	0	0	0	8	0	0	0	4	26
5,000	4	0	0	0	9	13	0	0	33	9	0	0	4	0	0	0	0	0	0	0	4	0	0	0	4	0	0	0	9	0	0	0	9	0	0	0	9	23
<b>Afternoon, 1300-1500 (Z-3)*</b>																																						
Surface	0	0	0	0	0	0	0	0	20	17	0	0	30	23	0	0	3	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
1,000	0	0	0	0	0	0	0	0	19	29	0	0	29	6	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	31
2,000	0	0	0	0	3	3	0	0	32	23	0	0	13	3	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	31
3,000	0	0	0	0	6	3	0	0	36	13	0	0	20	0	0	0	6	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	31
4,000	4	0	0	0	19	12	0	0	19	8	0	0	4	0	0	0	4	4	0	0	19	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	4	26
5,000	0	0	0	0	9	0	0	0	26	9	0	0	13	4	0	0	9	0	0	0	13	0	0	0	9	0	0	0	4	0	0	0	4	0	0	0	4	23

Authority.—Bibliography No. 94.

Note.—The data refer to 31 days when there were ascents in both the morning and afternoon.

\* The times given indicate when the bulk of the ascents was made. The morning observations all took place between 0500 and 1000 and the afternoon observations between 1300 and 1700.

Table IX—Diurnal variation of wind in the upper air

2 161

TABLE IX—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Berbera. 10° 22' N., 45° 02' E. 45 ft.

Period: Dec., 1931-Jan., 1932

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
DECEMBER-JANUARY																																		
Morning, 0745-0915 local time																																		
Surface	0	0	0	0	0	0	0	0	0	0	0	0	46	0	0	0	9	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	36	11
1,000	9	0	0	0	18	0	0	0	37	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	18	11
1,500	0	0	0	0	18	0	0	0	37	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	9	11
2,000	9	0	0	0	27	0	0	0	27	9	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	9	11
3,000	0	0	0	0	37	18	0	0	9	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	9	11
4,000	0	0	0	0	27	27	0	0	18	9	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	11
5,000	0	0	0	0	18	27	0	0	27	9	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	11
6,000	0	0	0	0	30	30	0	0	20	10	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Afternoon, 1545-1715 local time																																		
Surface	9	18	0	0	0	55	9	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
1,000	9	0	0	0	55	27	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
1,500	18	0	0	0	46	27	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
2,000	0	0	0	0	73	18	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
3,000	0	0	0	0	40	0	0	0	50	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
4,000	0	0	0	0	33	11	0	0	11	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
5,000	14	0	0	0	0	14	0	0	29	0	0	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	7
6,000	0	0	0	0	40	20	0	0	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

Authority.—Bibliography No. 94.

Note.—The data used are 11 morning and evening ascents on the same or adjacent days during the period Dec., 1931, and Jan., 1932.

100000

TABLE IX—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.)    II = 14-27 knots (16-31 m.p.h.)    III = 28-40 knots (32-47 m.p.h.)    IV = over 40 knots (over 47 m.p.h.)    C = less than 3 knots (less than 4 m.p.h.)

Berbera. 10° 22' N., 45° 02' E. 45 ft.

Period: July-Aug., 1931

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.					
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV							
JULY-AUGUST																																							
Morning, 0630-0800 local time																																							
Surface	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	7	0	7	27	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	14	22	0	0	22	29	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
1,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	13	0	0	40	20	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
2,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	47	33	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
3,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8	31	31	0	15	8	0	0	0	0	0	0	0	0	0	0	0	0	13
4,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	25	0	0	38	25	0	0	0	0	0	0	0	0	0	0	0	0	8
5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	40	0	0	0	0	0	0	0	0	0	0	0	0	5
6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	50	0	0	0	0	0	0	0	0	0	0	0	0	4
Afternoon, 1630-1800 local time																																							
Surface	13	0	0	0	20	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	7	0	0	0	0	0	0	0	33	0	0	0	33	15	
1,000	13	0	0	0	7	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	13	7	0	0	7	0	0	0	40	7	0	0	0	0	0	0	0	0	15
1,500	7	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	13	7	0	0	20	0	0	0	33	7	0	0	33	7	0	0	7	0	15
2,000	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	13	7	0	0	33	0	0	0	27	7	0	0	7	0	0	0	7	0	15
3,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	13	0	0	40	7	0	0	7	0	0	0	13	0	0	0	7	0	15
4,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	40	13	0	0	7	0	0	0	7	0	0	0	7	0	15
5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	7	0	0	50	7	0	0	0	0	0	0	0	0	0	0	7	0	14
6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	7	0	0	50	14	0	0	0	0	0	0	7	0	0	0	7	0	14

Authority.—Bibliography No. 94.

Note.—The data used are 15 morning ascents and 15 evening ascents on the same or adjacent days during the period July 1-16 and Aug. 17-29, 1931.

Table IX—Diurnal variation of wind in the upper air

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TABLE IX—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots.    II = 14-27 knots.    III = 28-40 knots.    IV = over 40 knots.    C = less than 3 knots.  
 (4-15 m.p.h.)    (16-31 m.p.h.)    (32-47 m.p.h.)    (over 47 m.p.h.)    (less than 4 m.p.h.)

Riyan. 14° 39' N., 49° 23' E. 49 ft.

Period: June, 1943-Feb., 1944

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
DECEMBER-FEBRUARY																																		
Surface	28	0	0	0	29	1	0	0	13	1	0	0	4	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	3	0	0	14	76
1,700	9	1	0	0	42	1	0	0	30	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	10	70
3,300	7	1	0	0	37	0	0	0	36	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	12	70
6,500	0	2	0	0	12	12	0	0	30	16	0	0	11	3	0	0	3	2	0	0	2	0	0	0	5	0	0	0	0	0	0	0	2	57
10,000	9	6	0	0	17	8	0	0	15	11	0	0	6	4	0	0	2	2	0	0	4	0	0	0	6	0	0	0	2	2	0	0	6	48
Morning																																		
Surface	2	1	0	0	0	0	0	0	25	15	0	0	27	19	0	0	9	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	86
1,700	2	1	0	0	0	0	0	0	48	5	0	0	29	2	0	0	8	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	86
3,300	12	0	0	0	37	0	0	0	34	0	0	0	4	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	2	1	0	0	7	86
6,500	24	7	0	0	19	4	0	0	14	7	0	0	6	0	0	0	6	0	0	0	5	2	0	0	1	0	0	0	2	0	0	0	3	81
10,000	10	5	0	0	26	13	0	0	9	9	0	0	4	4	0	0	6	0	0	0	1	1	0	0	0	0	0	0	9	0	0	0	3	69
Afternoon																																		
Morning (Dawn)																																		
Surface	2	0	0	0	12	0	0	0	17	0	0	0	11	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	50	82
1,700	5	0	0	0	11	0	0	0	11	2	0	0	6	0	0	0	16	0	0	0	21	2	0	0	2	1	0	0	7	0	0	0	15	82
3,300	3	3	0	0	3	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	16	30	0	0	19	8	0	0	0	0	0	0	9	77
6,500	9	7	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	12	0	0	22	15	1	0	12	1	0	0	4	68
10,000	42	13	0	0	10	13	0	0	4	4	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	4	2	0	0	2	48
Afternoon 1600-1700 (Z-3)																																		
Surface	0	0	0	0	0	0	0	0	7	0	0	0	15	0	0	0	24	1	0	0	39	7	0	0	0	0	0	0	0	0	0	0	8	89
1,700	1	0	0	0	9	0	0	0	5	0	0	0	10	0	0	0	16	1	0	0	36	8	0	0	2	0	0	0	1	0	0	0	10	88
3,300	3	0	0	0	8	0	0	0	20	1	0	0	8	0	0	0	17	0	0	0	8	7	0	0	10	0	0	0	6	0	0	0	11	88
6,500	14	3	0	0	3	0	0	0	14	0	0	0	7	0	0	0	10	0	0	0	12	1	0	0	11	3	0	0	8	0	0	0	14	72
10,000	14	20	0	0	22	10	0	0	6	6	0	0	2	0	0	0	2	0	0	0	6	0	0	0	4	2	0	0	2	0	0	0	6	51

Authority.—Bibliography No. 94.

TABLE IX—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots. II = 14-27 knots. III = 28-40 knots. IV = over 40 knots. C = less than 3 knots.  
 (4-15 m.p.h.) (16-31 m.p.h.) (32-47 m.p.h.) (over 47 m.p.h.) (less than 4 m.p.h.)

Bander Kassim. 11° 17' N., 49° 10' E. 20 ft.

Period: June, 1943-Feb., 1944

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
DECEMBER-FEBRUARY																																		
Surface	Morning, 0730-1030 (Z-3)																																	
1,700	12	0	0	0	20	0	0	0	1	0	0	0	7	1	0	0	13	1	0	0	1	0	0	0	1	0	0	0	4	0	0	0	38	76
3,300	15	0	0	0	19	16	0	0	12	0	0	0	12	4	0	0	7	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	9	75
6,500	8	0	0	0	24	22	0	0	14	1	0	0	13	3	0	0	1	3	0	0	0	0	0	0	3	0	0	0	1	0	0	0	7	72
10,000	6	4	0	0	12	27	0	0	12	17	4	0	4	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	4	51
Surface	Afternoon, 1600-1700 (Z-3)																																	
1,700	6	3	0	0	11	19	0	0	16	36	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	36
3,300	51	0	0	0	39	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	61
6,500	26	3	0	0	25	41	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	59
10,000	29	0	0	0	10	19	0	0	2	0	0	0	0	0	0	0	4	0	0	0	6	0	0	0	20	2	0	0	6	0	0	0	2	51
Surface	Morning, 0500-0600 (Z-3)																																	
1,700	11	0	0	0	14	3	0	0	24	8	0	0	11	0	0	0	8	3	0	0	0	0	0	0	5	0	0	0	8	0	0	0	5	37
3,300	11	3	0	0	11	11	0	0	26	12	3	0	11	3	0	0	3	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	35
6,500	Afternoon, 1600-1700 (Z-3)																																	
10,000	4	0	0	0	0	0	0	0	0	0	0	0	4	6	0	0	19	51	0	0	0	0	0	0	0	2	0	0	6	0	0	0	6	47
Surface	Morning, 0500-0600 (Z-3)																																	
1,700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	24	0	0	24	4	0	0	9	0	0	0	2	2	0	0	2	45
3,300	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	11	3	0	0	53	8	0	0	18	0	0	0	0	3	0	0	0	38
6,500	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	28	40	0	0	12	4	0	0	4	25
10,000	7	20	0	0	13	13	7	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	13	7	0	0	0	15
Surface	Afternoon, 1600-1700 (Z-3)																																	
1,700	23	4	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	36	1	0	0	3	69
3,300	7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	14	38	0	0	26	4	0	0	3	69
6,500	0	0	0	0	1	0	0	0	1	0	0	0	3	0	0	0	12	0	0	0	15	0	0	0	30	9	0	0	15	6	0	0	7	67
10,000	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	37	7	0	0	27	12	0	0	8	3	0	0	3	0	0	0	0	60
Surface	Afternoon, 1600-1700 (Z-3)																																	
1,700	6	2	0	0	0	4	0	0	2	2	0	0	4	0	0	0	6	4	0	0	12	10	0	0	12	16	0	0	12	4	0	0	6	51

Authority.—Bibliography No. 94.

Table IX—Diurnal variation of wind in the upper air 2 165

TABLE X—VISIBILITY OVER THE SEA  
Percentage frequency of different degrees of visibility  
Time of obs. : daylight hours.

Gulf of Aden and Arabian sea.

Period : 1930-9

Limits of visibility Nautical miles	over					over					over					No. of obs.		
	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	10			
Sea Area	A. 10-15° N., 44-50° E.					B. 10-17° N., 50-55° E.					C. 10-15° N., 55-60° E.					A	B	C
January .. ..	0	0	0	15	85	0	0	0	5	95	Insufficient data					26	20	—
February .. ..	0	0	0	7	93	0	0	0	3	97	0	0	0	0	100	44	37	29
March .. ..	0	0	0	5	95	0	0	0	5	95	0	0	0	9	91	40	40	34
April .. ..	0	0	0	8	92	0	0	0	2	98	0	0	0	0	100	51	46	27
May .. ..	0	0	0	14	86	3	0	3	12	82	0	0	0	0	100	49	34	33
June .. ..	0	4	2	36	58	0	4	17	36	43	0	0	24	32	44	53	53	34
July .. ..	3	11	9	37	40	0	4	21	29	46	0	0	35	20	45	35	24	20
August .. ..	0	0	2	39	59	0	5	25	43	27	0	0	10	45	45	52	40	29
September .. ..	0	0	0	9	91	0	0	5	43	52	Insufficient data					22	21	—
October .. ..	0	0	0	12	88	0	0	0	12	88	0	0	0	3	97	76	77	70
November .. ..	0	0	0	2	98	0	0	0	1	99	0	0	0	0	100	56	95	75
December .. ..	0	0	0	7	93	0	0	0	15	85	0	0	0	5	95	43	41	40

Authority.—Bibliography No. 94.

TABLE XI—VISIBILITY AT COASTAL STATIONS  
Percentage frequency of different degrees of visibility

Ras al Hadd. 22° 33' N., 59° 47' E. 9 ft.

Period : Jan. 12, 1943-Feb., 1944

Limits of visibility Nautical miles	over					over					over					over				
	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	10
	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)				
January .. ..	0	0	4	20	76	0	2	2	10	86	0	2	4	14	80	Data not available				
February .. ..	0	0	4	35	61	0	2	2	23	73	0	0	7	37	56					
March .. ..	0	0	0	39	61	0	0	0	19	81	3	0	0	23	74					
April .. ..	0	0	3	23	74	0	3	0	23	74	3	7	7	13	70					
May .. ..	0	0	0	26	74	0	0	3	16	81	3	0	10	19	68					
June .. ..	0	7	13	43	37	7	3	7	43	40	3	17	17	17	46					
July .. ..	0	0	13	87	0	0	0	13	87	0	0	26	29	42	3					
August .. ..	0	0	6	91	3	0	3	13	74	10	3	45	16	26	10					
September .. ..	3	3	0	57	37	0	0	0	37	63	0	7	13	47	33					
October .. ..	3	0	0	3	94	0	0	0	3	97	0	0	0	0	100					
November .. ..	0	0	0	0	100	0	0	3	0	97	0	0	0	0	100					
December .. ..	0	0	0	3	97	0	0	0	0	100	0	0	0	0	100					

Authority.—Bibliography No. 94.

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TABLE XI—continued

Percentage frequency of different degrees of visibility

Masira island. 20° 42' N., 58° 50' E. 45-58 ft.\*

Period: Jan., 1943-Feb., 1944

Limits of visibility Nautical miles	0-1/2 1/2-2 2-5 5-10 over 10					0-1/2 1/2-2 2-5 5-10 over 10					0-1/2 1/2-2 2-5 5-10 over 10					0-1/2 1/2-2 2-5 5-10 over 10				
	0-1/2	1/2-2	2-5	5-10	over 10	0-1/2	1/2-2	2-5	5-10	over 10	0-1/2	1/2-2	2-5	5-10	over 10	0-1/2	1/2-2	2-5	5-10	over 10
	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)				
January .. ..	0	0	0	13	87	0	0	0	6	94	0	0	2	5	93	0	0	2	13	85
February .. ..	2	2	0	15	81	0	0	7	5	88	2	2	4	5	87	0	0	4	9	87
March .. ..	0	6	16	20	58	0	6	10	10	74	0	0	10	22	68	0	0	0	45	55
April .. ..	0	0	0	13	87	0	0	0	7	93	0	0	0	10	90	0	0	0	13	87
May .. ..	0	0	10	39	51	0	0	13	19	68	0	0	10	39	51	0	0	0	58	42
June .. ..	0	0	53	44	3	0	0	27	60	13	0	0	37	56	7	3	3	37	50	7
July .. ..	0	0	77	23	0	0	0	68	32	0	0	6	42	52	0	0	6	71	23	0
August .. ..	0	0	84	16	0	0	0	74	23	3	0	3	55	36	6	0	3	78	16	3
September .. ..	0	0	57	43	0	0	0	20	73	7	0	0	3	87	10	0	0	27	73	0
October .. ..	13	0	10	19	58	0	0	0	19	81	0	0	0	13	87	0	0	0	29	71
November .. ..	0	3	0	3	94	0	0	0	0	100	0	0	0	0	100	0	0	0	0	100
December .. ..	0	0	0	0	100	0	0	0	6	94	0	0	0	3	97	0	0	0	0	100

Socotra. 12° 38' N., 53° 53' E. 147 ft.

Period: Nov., 1942-Feb., 1944

Limits of visibility Nautical miles	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)				
	0-1/2	1/2-2	2-5	5-10	over 10	0-1/2	1/2-2	2-5	5-10	over 10	0-1/2	1/2-2	2-5	5-10	over 10	0-1/2	1/2-2	2-5	5-10	over 10
January .. ..	0	0	2	0	98	0	0	0	2	98	0	0	0	2	98	0	0	0	5	95
February .. ..	0	0	2	3	95	0	0	0	2	98	0	0	2	2	96	0	0	0	4	96
March .. ..	0	0	0	13	87	0	0	0	6	94	0	0	0	0	100	0	0	0	0	100
April .. ..	0	0	0	0	100	0	0	0	0	100	0	0	0	0	100	0	0	0	0	100
May .. ..	0	0	0	6	94	0	0	0	6	94	0	0	0	0	100	0	0	0	0	100
June .. ..	0	0	0	13	87	0	0	0	17	83	0	0	0	0	100	0	0	0	3	97
July .. ..	0	0	0	71	29	0	0	0	41	59	0	0	0	0	100	0	0	0	8	92
August .. ..	0	0	0	90	10	0	0	0	61	39	0	0	0	0	100	0	0	0	55	45
September .. ..	0	0	0	23	77	0	0	0	23	77	0	0	0	3	97	0	0	0	30	70
October .. ..	0	0	0	3	97	0	0	0	0	100	0	0	3	3	94	0	0	0	0	100
November .. ..	0	3	2	19	76	0	2	7	2	89	0	0	3	5	92	0	0	4	13	83
December .. ..	0	0	2	14	84	0	0	0	7	93	0	0	3	5	92	0	0	2	6	92

H Authority.—Bibliography No. 94.

\*20° 39' N., 58° 54' E., 56ft. Nov., 1943-Feb., 1944.

Table XI—Visibility at coastal stations

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TABLE XI—continued

Salalah. 17° 03' N., 54° 05' E. c. 55 ft.											Period: Oct., 1942—Jan., 1944												
Limits of visibility Nautical miles	Percentage frequency of different degrees of visibility																						
	0- $\frac{1}{2}$	$\frac{1}{2}$ -1	1-2	2-5	5-10	over 10	0- $\frac{1}{2}$	$\frac{1}{2}$ -1	1-2	2-5	5-10	over 10	0- $\frac{1}{2}$	$\frac{1}{2}$ -1	1-2	2-5	5-10	over 10	0- $\frac{1}{2}$	$\frac{1}{2}$ -1	1-2	2-5	5-10
	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)							
January .. ..	0	0	0	3	97	0	0	0	3	97	0	0	0	3	97	0	0	0	3	97			
February .. ..	0	0	0	7	93	0	0	0	18	82	0	0	0	18	82	0	0	0	11	89			
March .. ..	0	0	0	26	74	0	0	3	23	74	0	0	3	26	71	0	0	0	29	71			
April .. ..	0	0	3	3	94	0	0	0	0	100	0	0	0	0	100	0	0	0	17	83			
May .. ..	0	0	10	19	71	0	0	6	26	68	0	0	3	13	84	0	0	0	48	52			
June .. ..	3	0	70	20	7	0	3	64	23	10	3	3	57	17	20	0	0	67	20	13			
July .. ..	23	67	10	0	0	0	58	39	3	0	0	39	61	0	0	19	55	26	0	0			
August .. ..	16	74	10	0	0	3	32	59	3	3	3	20	68	6	3	6	58	36	0	0			
September .. ..	20	30	30	17	3	3	20	24	13	40	0	10	43	17	30	0	40	33	20	7			
October .. ..	0	0	3	16	81	0	0	0	0	100	0	0	0	0	100	0	0	0	10	90			
November .. ..	0	0	0	0	100	0	0	0	5	95	0	0	0	0	100	0	0	0	0	100			
December .. ..	0	0	2	3	95	0	0	0	3	97	0	0	0	5	95	0	0	2	2	96			
Riyan. 14° 39' N., 49° 23' E. 49 ft.											Period: Apr., 1942—Feb., 1944												
	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)							
January .. ..	0	0	2	2	96	0	0	0	6	94	0	0	2	10	88	0	0	2	6	92			
February .. ..	0	0	0	12	88	0	0	0	11	89	0	0	0	7	93	0	0	0	7	93			
March .. ..	0	0	0	19	81	0	0	0	16	84	0	0	0	19	81	0	0	0	23	77			
April .. ..	0	0	0	2	98	0	0	0	2	98	0	0	0	0	100	0	0	0	0	100			
May .. ..	0	2	0	14	84	0	0	0	10	90	0	0	0	3	97	0	0	0	3	97			
June .. ..	0	2	13	27	58	0	0	7	30	63	2	0	8	30	60	0	0	5	25	70			
July .. ..	0	2	16	43	39	0	0	5	47	48	0	2	9	42	47	0	0	10	35	55			
August .. ..	0	2	13	30	55	0	0	3	11	86	0	0	3	16	81	0	0	5	13	82			
September .. ..	2	0	8	40	50	0	0	2	7	91	0	0	0	7	93	0	0	2	15	83			
October .. ..	0	0	0	11	89	0	0	0	2	98	0	0	0	2	98	0	0	0	2	98			
November .. ..	0	0	0	5	95	0	2	0	3	95	0	0	0	3	97	0	0	0	3	97			
December .. ..	0	0	0	6	94	0	3	0	2	95	0	0	0	6	94	0	0	0	6	94			

Authority.—Bibliography No. 94.

(19:38)

TABLE XI—*continued*  
 Percentage frequency of different degrees of visibility

Aden. 12° 47' N., 44° 59' E. 123 ft.

Period: 1940-3

Limits of visibility Nautical miles	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)*				
	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10
January .. ..	0	.8	.8	19	79	0	2	2	6	90	0	.8	.8	5	94	0	0	0	0	100
February .. ..	0	0	8	25	67	0	0	.9	11	88	0	0	.9	8	91	0	0	0	14	86
March .. ..	0	.8	5	30	64	0	0	2	17	81	0	0	2	19	79	0	0	3	23	74
April .. ..	0	0	2	30	68	0	0	2	9	89	0	0	0	7	93	0	0	2	32	66
May .. ..	0	0	4	18	78	0	0	3	8	89	0	0	3	12	85	0	0	6	23	71
June .. ..	0	2	10	36	52	0	2	9	26	63	0	3	8	38	51	0	5	20	47	28
July .. ..	0	.8	29	47	23	0	9	31	40	20	0	3	26	46	25	0	11	48	36	5
August .. ..	0	4	23	58	15	0	2	18	57	23	0	0	9	56	35	0	5	35	50	10
September .. ..	0	0	3	50	47	0	0	.8	27	72	0	0	0	23	77	0	2	3	58	37
October .. ..	0	0	2	20	78	0	0	0	7	93	0	0	0	2	98	0	0	0	11	89
November .. ..	0	0	0	21	79	0	0	0	0	100	0	0	0	2	98	0	0	0	7	93
December .. ..	0	0	2	18	80	0	0	0	4	96	0	0	0	6	94	0	0	0	10	90

Perim. 12° 39' N., 43° 24' E. 88 ft.

Period: May, 1940-Dec., 1943

Limits of visibility Nautical miles	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)†				
	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10
January .. ..	0	1	1	22	76	0	2	1	19	78	0	1	1	23	75	0	0	0	16	84
February .. ..	0	0	2	26	72	0	0	6	21	73	0	0	5	30	65	0	0	7	54	39
March .. ..	0	0	1	25	74	0	0	3	24	73	0	0	3	16	81	0	0	0	35	65
April .. ..	0	0	0	36	64	0	0	1	22	77	0	0	0	20	80	0	0	0	77	23
May .. ..	0	0	8	23	69	0	0	2	14	84	0	0	0	16	84	0	0	32	7	61
June .. ..	0	.8	22	51	26	0	2	10	32	56	0	3	9	25	63	0	0	30	37	33
July .. ..	0	.8	41	52	6	0	0	22	47	31	0	0	15	49	36	0	3	42	42	13
August .. ..	0	0	21	64	15	0	.8	10	40	49	0	0	7	36	57	0	0	15	32	53
September .. ..	0	0	.8	31	68	0	0	2	10	88	0	0	0	5	95	0	0	0	10	90
October .. ..	0	0	0	14	86	0	0	0	3	97	0	0	0	2	98	0	0	0	3	97
November .. ..	0	0	0	4	96	0	0	0	2	98	0	0	0	5	95	0	0	0	2	98
December .. ..	0	0	0	13	87	0	0	2	6	92	0	0	0	16	84	0	0	2	8	90

Authority.—Bibliography No. 94.

\* Apr., 1942-Dec., 1943.

† June, 1942-Dec., 1943.

Table XI—Visibility at coastal stations

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TABLE XI—continued  
Percentage frequency of different degrees of visibility

Barbera. 10° 26' N., 45° 01' E. 39 ft. Period: Mar., 1942–Oct., 1943, Feb., 1944

Limits of visibility Nautical miles	0-1/2					1-2					2-5					5-10					over 10					
	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10	
	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)										
January .. ..	0	32	0	13	55	0	0	0	0	100	0	0	0	0	100											
February .. ..	0	25	0	25	50	0	0	0	21	79	0	0	0	0	19	81										
March .. ..	0	2	16	27	55	0	0	0	5	95	0	0	0	0	28	72										
April .. ..	0	0	3	47	50	0	0	0	42	58	0	0	2	35	63											
May .. ..	0	2	0	48	50	2	2	0	35	61	0	0	3	31	66											
June .. ..	0	5	2	48	45	3	5	15	33	44	0	2	2	38	58											
July .. ..	0	2	8	43	47	0	3	8	52	37	0	0	5	40	55											
August .. ..	0	0	0	34	66	0	0	2	30	68	0	2	8	24	66											
September .. ..	0	0	10	35	55	0	0	0	12	88	0	0	2	5	93											
October .. ..	0	0	0	48	52	0	0	0	2	98	0	0	0	3	97											
November .. ..	0	0	0	0	100	0	0	0	0	100	0	0	0	0	100											
December .. ..	0	0	0	0	100	0	0	0	0	100	0	0	0	3	97											

Data not available

Bander Kassim. 11° 17' N., 49° 10' E. 20 ft. Period: Dec., 1942–Jan., 1944

Limits of visibility Nautical miles	0-1/2					1-2					2-5					5-10					over 10				
	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10	0-1/2	1/2	1-2	2-5	5-10
	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)									
January .. ..	0	0	0	39	61	0	0	0	5	95	0	0	0	0	100	0	0	2	34	64					
February .. ..	0	0	4	68	28	0	0	4	4	92	0	0	4	14	82	0	0	7	61	32					
March .. ..	0	0	0	65	35	0	0	3	10	87	0	0	0	6	94	0	0	3	84	13					
April .. ..	0	0	0	7	93	0	0	0	0	100	0	0	0	3	97	0	0	0	73	27					
May .. ..	0	0	0	0	100	0	0	0	0	100	0	0	0	0	100	0	0	0	61	39					
June .. ..	0	0	0	7	93	0	0	0	0	100	0	0	0	7	93	0	0	0	41	59					
July .. ..	0	3	32	36	29	0	10	39	32	19	0	0	29	48	23	0	0	32	39	29					
August .. ..	0	0	29	19	52	0	3	29	19	49	0	0	13	29	58	0	0	16	29	55					
September .. ..	0	0	3	27	70	0	0	3	13	84	0	0	0	20	80	0	0	3	40	57					
October .. ..	0	0	0	11	89	0	0	0	3	97	0	0	0	3	97	0	0	4	19	77					
November .. ..	0	0	0	7	93	0	0	0	3	97	0	0	0	3	97	0	0	0	3	97					
December .. ..	0	0	3	29	68	0	0	0	3	97	0	0	0	5	95	0	0	7	19	74					

Authority.—Bibliography No. 94.

TABLE XII—MONTHLY FREQUENCY OF DIFFERENT AMOUNTS OF CLOUD OVER THE SEA

Percentage frequency of different amounts of cloud  
 b = 0-2 tenths. bc = 3-6 tenths. c = 7-8 tenths. o = 9-10 tenths

Period : 1856-1908

Sea area Cloud amount	15-22° N., 55-60° E.				10-15° N., 44-50° E.				10-17° N., 50-55° E.				10-15° N., 55-60° E.			
	b	bc	c	o	b	bc	c	o	b	bc	c	o	b	bc	c	o
January .. ..	45	37	10	8	54	37	7	2	41	41	8	10	29	48	10	13
February .. ..	62	34	2	2	60	29	5	6	53	37	4	6	40	44	10	6
March .. ..	86	13	0	1	59	33	5	3	64	32	4	0	48	45	5	2
April .. ..	77	20	3	0	70	22	4	4	74	22	3	1	64	32	3	1
May .. ..	52	40	5	3	66	26	6	2	58	32	7	3	42	43	8	7
June .. ..	35	29	15	21	70	21	5	4	67	22	6	5	20	50	17	13
July .. ..	27	32	20	21	49	24	14	13	63	19	8	10	38	40	15	7
August .. ..	37	39	9	15	64	19	10	7	70	17	7	6	40	37	13	10
September .. ..	27	30	17	26	72	21	4	3	70	19	5	6	31	40	19	10
October .. ..	63	34	3	0	76	21	2	1	58	33	6	3	43	45	7	5
November .. ..	73	22	4	1	68	27	3	2	42	45	8	5	34	47	11	8
December .. ..	37	44	17	2	60	34	4	2	46	43	7	4	29	56	10	5

Authority.—Bibliography No. 94. Note.—The average number of observations per month in the four areas is approximately 100, 800, 650 and 475.

TABLE XIII—MONTHLY FREQUENCY OF DIFFERENT AMOUNTS OF CLOUD AT COASTAL STATIONS

Percentage frequency of different amounts of cloud

Ras al Hadd. 22° 33' N., 59° 47' E. 9 ft.

Period : Jan. 12, 1943-Feb, 1944

Cloud amount tenths	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)				
	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10
January .. ..	6	56	16	18	4	4	66	10	16	4	0	61	10	29	0	Data not available				
February .. ..	33	42	7	18	0	28	58	7	7	0	25	54	5	14	2					
March .. ..	52	36	6	6	0	39	52	6	3	0	58	36	0	6	0					
April .. ..	37	40	13	10	0	50	30	20	0	0	33	54	3	10	0					
May .. ..	71	20	6	3	0	58	36	3	3	0	36	48	3	13	0					
June .. ..	64	23	3	10	0	60	30	10	0	0	57	37	3	3	0					
July .. ..	26	45	3	26	0	42	35	13	10	0	45	39	6	10	0					
August .. ..	26	32	13	29	0	36	35	16	13	0	45	36	10	6	3					
September .. ..	33	57	3	0	7	53	40	7	0	0	33	67	0	0	0					
October .. ..	65	23	3	6	3	61	36	3	0	0	55	42	3	0	0					
November .. ..	47	33	0	20	0	40	53	0	7	0	30	54	3	13	0					
December .. ..	10	51	10	23	6	3	55	16	26	0	10	58	10	19	3					

Authority.—Bibliography No. 94.

Table XII—Cloud amount over the sea

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TABLE XIII—continued

Percentage frequency of different amounts of cloud

Masira island. 20° 42' N., 58° 50' E. 45-58 ft.\*

Period: Jan., 1943-Feb., 1944

Cloud amount tenths	0600 (Z-4)					1000 (Z-4)					1600 (Z-4)					2200 (Z-4)				
	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10
January .. ..	19	55	13	11	2	11	48	31	10	0	18	49	19	11	3	63	16	12	7	2
February .. ..	36	45	13	6	0	35	47	9	9	0	52	35	7	4	2	76	13	9	2	0
March .. ..	36	61	0	3	0	48	42	10	0	0	65	32	3	0	0	87	7	3	3	0
April .. ..	27	53	10	10	0	26	60	7	7	0	50	44	3	3	0	74	23	3	0	0
May .. ..	29	39	16	10	6	55	32	7	3	3	65	16	6	10	3	78	16	3	3	0
June .. ..	33	17	17	33	0	44	33	10	13	0	73	20	7	0	0	60	24	13	3	0
July .. ..	10	13	19	48	10	16	35	26	13	10	61	10	16	13	0	74	10	10	6	0
August .. ..	10	13	3	45	29	19	23	7	32	19	45	16	13	13	13	51	10	13	3	23
September.. ..	3	7	10	27	53	37	27	13	23	0	47	40	10	3	0	57	13	13	10	7
October .. ..	35	39	10	6	10	42	36	13	3	6	78	10	3	6	3	84	7	3	0	0
November.. ..	43	40	17	0	0	40	44	13	3	0	67	23	7	3	0	70	27	3	0	0
December .. ..	23	29	32	10	6	10	38	26	16	10	23	31	23	13	10	61	19	0	10	10

Socotra. 12° 38' N., 53° 53' E. 147 ft.

Period: Nov., 1942-Feb., 1944

January .. ..	0	53	26	21	0	3	55	21	21	0	0	69	18	13	0	11	55	19	15	0
February .. ..	4	59	12	23	2	2	58	19	19	2	4	68	7	19	2	12	71	5	12	0
March .. ..	10	74	10	6	0	23	71	3	3	0	10	68	19	3	0	49	45	3	3	0
April .. ..	3	74	10	13	0	33	64	3	0	0	0	73	20	7	0	33	57	3	7	0
May .. ..	16	61	13	7	3	26	48	10	13	3	6	68	6	17	3	55	39	0	6	0
June .. ..	0	43	23	27	7	0	60	13	24	3	30	47	3	20	0	70	20	3	7	0
July .. ..	0	57	18	21	4	0	62	14	24	0	18	71	7	4	0	42	46	0	12	0
August .. ..	0	58	26	16	0	0	55	32	10	3	3	84	3	10	0	26	71	0	0	3
September .. ..	0	70	17	13	0	0	77	13	10	0	13	64	10	13	0	33	64	3	0	0
October .. ..	3	71	7	16	3	6	55	16	20	3	0	65	13	19	3	29	58	3	10	0
November .. ..	10	54	12	24	0	3	57	23	14	3	2	49	27	20	2	11	62	9	16	2
December .. ..	2	35	16	44	3	0	36	26	33	5	0	32	36	29	3	3	54	22	18	3

Authority.—Bibliography No. 94.

\* 20° 39' N., 58° 54' E. 56 ft. Nov., 1943-Feb., 1944.

TABLE XIII—continued

Percentage frequency of different amounts of cloud

Salalah. 17° 03' N., 54° 05' E. c. 55 ft.

Period: Nov., 1942-Jan., 1944

Cloud amount tenths	0600 (Z-4)					1000 (Z-4)					1800 (Z-4)					2200 (Z-4)				
	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10
January .. ..	32	41	8	16	3	15	61	11	13	0	10	69	13	3	5	42	37	11	8	2
February .. ..	36	43	14	7	0	28	57	4	11	0	50	28	11	11	0	64	18	0	18	0
March .. ..	39	42	13	6	0	42	45	10	3	0	49	45	3	3	0	52	32	10	6	0
April .. ..	17	47	13	20	3	27	57	13	3	0	33	57	10	0	0	50	33	10	7	0
May .. ..	16	42	26	13	3	32	55	10	3	0	32	52	7	6	3	39	26	16	16	3
June .. ..	3	17	13	20	47	20	30	13	24	13	30	20	20	27	3	22	17	7	37	17
July .. ..	0	0	0	0	100	0	0	0	6	94	0	3	13	13	71	0	0	0	6	94
August .. ..	0	0	0	0	100	0	0	0	0	100	0	6	0	23	71	0	6	0	6	91
September .. ..	3	7	0	3	87	0	20	10	13	57	3	27	0	27	43	17	10	0	3	70
October .. ..	26	36	19	6	13	16	68	3	13	0	10	74	3	10	3	62	26	6	6	0
November .. ..	30	57	3	10	0	32	53	2	13	0	25	61	7	7	0	70	22	5	3	0
December .. ..	21	61	8	5	5	10	64	8	13	5	3	75	6	10	6	42	40	0	8	10

Riyan. 14° 39' N., 49° 23' E. 49 ft.

Period: Apr., 1942-Feb., 1944

	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)				
January .. ..	14	47	3	34	2	0	36	10	48	6	3	79	3	15	0	21	35	8	26	10
February .. ..	16	47	11	21	5	9	35	23	30	3	9	75	7	7	2	37	18	10	28	9
March .. ..	23	68	6	3	0	13	29	10	48	0	29	68	3	0	0	55	29	3	10	3
April .. ..	7	37	8	48	0	5	41	22	32	0	13	57	15	15	0	38	30	22	8	2
May .. ..	6	41	19	32	2	10	39	32	19	0	13	53	18	16	0	61	24	10	3	2
June .. ..	20	30	17	28	5	33	25	20	20	2	17	42	21	15	5	51	17	12	17	3
July .. ..	18	29	8	34	11	42	34	10	14	0	21	53	16	10	0	39	26	10	14	11
August .. ..	19	29	10	31	11	18	40	18	21	3	23	49	10	13	5	42	23	13	19	3
September .. ..	10	21	17	40	12	10	29	25	33	3	7	68	15	5	5	64	25	3	5	3
October .. ..	21	37	10	32	0	7	53	24	16	0	6	76	12	6	0	55	19	7	16	3
November .. ..	42	48	5	5	0	32	50	13	3	2	27	61	2	8	2	62	18	5	13	2
December .. ..	16	63	8	13	0	11	61	10	16	2	8	82	2	6	2	31	35	10	18	6

Authority.—Bibliography. No. 94.

Table XIII—Cloud amount at coastal stations

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TABLE XIII—continued  
Percentage frequency of different amounts of cloud

Aden. 12° 47' N., 44° 59' E. 123 ft.											Period: 1940-3										
Cloud amount tenths	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	
	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)*					
January	3	47	19	27	4	0	20	28	49	3	2	64	19	15	0	29	39	13	16	3	
February	4	39	29	23	5	0	7	37	50	6	2	68	15	13	2	29	25	14	18	14	
March	11	52	14	17	6	2	23	29	35	11	10	57	10	20	3	36	55	6	3	0	
April	6	41	32	19	2	3	29	29	37	2	7	63	13	13	4	37	32	16	13	2	
May	16	39	23	22	0	6	39	27	27	8	7	62	17	12	2	42	50	3	5	0	
June	16	43	16	23	2	17	42	23	16	2	18	60	12	10	0	28	43	10	17	2	
July	15	26	27	25	7	22	34	16	22	6	35	33	19	10	3	23	35	10	26	6	
August	16	32	23	25	4	16	41	16	26	8	31	52	9	7	8	42	35	6	15	2	
September	21	46	19	12	2	7	42	27	24	0	4	77	12	7	0	60	30	5	5	0	
October	39	36	6	18	8	23	44	19	14	0	12	68	13	7	0	55	37	5	3	0	
November	52	34	5	9	0	21	40	19	20	0	19	62	16	3	0	55	31	12	2	0	
December	14	47	27	10	2	3	19	41	35	2	6	68	19	5	2	45	39	6	8	2	

Perim. 12° 39' N., 43° 24' E. 88 ft.											Period: May, 1940-Dec., 1943										
	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)†					
January	5	42	29	21	3	0	28	38	32	2	14	48	17	15	6	61	23	10	6	0	
February	4	32	33	27	4	0	21	29	45	5	5	43	30	15	7	65	14	7	14	0	
March	13	30	29	24	4	3	23	38	30	6	15	31	24	12	18	71	3	6	10	10	
April	12	29	29	28	2	1	27	40	25	7	2	33	27	20	18	70	3	17	10	0	
May	11	47	26	15	8	8	47	23	20	2	4	68	15	11	2	16	74	3	7	0	
June	14	27	21	33	5	16	44	17	21	2	15	60	12	12	8	16	35	22	25	2	
July	9	16	22	47	6	19	24	13	40	4	23	35	17	23	2	23	27	26	24	0	
August	15	19	22	40	4	16	28	20	33	3	15	61	11	13	0	29	23	23	24	1	
September	11	37	14	36	2	7	43	23	25	2	2	59	29	9	8	23	35	22	15	5	
October	34	42	12	10	2	9	47	29	15	0	6	73	9	11	8	58	32	5	3	2	
November	30	49	17	4	0	8	43	35	13	8	6	71	15	7	8	48	32	18	2	0	
December	9	54	27	10	0	8	27	61	10	8	2	72	21	5	0	55	32	10	3	0	

Authority.—Bibliography No. 94.

\*Apr., 1942-Dec., 1943.

† June, 1942-Dec., 1943.

TABLE XIII—continued

Percentage frequency of different amounts of cloud

Berbera. 10° 26' N., 45° 01' E. 39 ft.						Period: Mar., 1942–Oct., 1943, Feb., 1944														
Cloud amount tenths	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10
	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)				
January .. ..	26	55	0	19	0	20	29	16	29	6	20	74	3	3	0	Data not available				
February .. ..	41	25	18	16	0	14	51	25	10	0	16	75	7	2	0					
March .. ..	11	66	14	9	0	5	50	31	14	0	25	71	4	0	0					
April .. ..	17	76	5	2	0	26	55	15	2	2	28	49	13	8	2					
May .. ..	16	63	10	11	0	47	42	9	2	0	24	55	16	5	0					
June .. ..	43	50	3	2	2	73	15	10	2	0	28	60	7	5	0					
July .. ..	48	34	8	8	2	48	39	5	6	2	40	47	5	6	2					
August .. ..	32	55	5	6	2	32	43	15	10	0	40	40	13	7	0					
September .. ..	46	47	3	2	2	28	44	23	5	0	31	60	7	0	2					
October .. ..	64	32	2	2	0	53	31	14	0	2	42	49	6	3	0					
November .. ..	34	60	3	3	0	17	77	3	3	0	17	76	7	0	0					
December .. ..	23	77	0	0	0	26	58	10	3	3	32	65	3	0	0					
Bander Kassim. 11° 17' N., 49° 10' E. 20 ft.						Period: Dec., 1942–Jan., 1944														
	0500 (Z-3)					0900 (Z-3)					1500 (Z-3)					2100 (Z-3)				
January .. ..	31	53	6	10	0	2	61	19	18	0	6	70	16	8	0	34	45	8	14	2
February .. ..	18	53	18	11	0	7	54	21	18	0	4	78	4	14	0	39	50	11	0	0
March .. ..	16	78	6	0	0	35	55	10	0	0	3	87	3	7	0	61	39	0	0	0
April .. ..	30	63	7	0	0	33	60	7	0	0	0	97	3	0	0	40	53	7	0	0
May .. ..	13	81	3	3	0	26	71	3	0	0	6	84	10	0	0	36	58	3	3	0
June .. ..	4	96	0	0	0	22	67	11	0	0	0	81	19	0	0	78	18	4	0	0
July .. ..	23	23	19	25	10	45	26	16	13	0	42	35	13	10	0	71	7	3	16	3
August .. ..	39	32	6	20	3	42	29	10	19	0	20	65	6	6	3	71	20	6	0	3
September .. ..	37	40	10	10	3	23	40	20	17	0	0	80	10	10	0	80	14	3	3	0
October .. ..	36	53	7	0	4	31	52	10	7	0	3	73	10	14	0	58	27	11	4	0
November .. ..	33	50	7	10	0	3	57	24	13	3	3	57	13	27	0	57	20	7	13	3
December .. ..	21	53	8	18	0	0	66	19	15	0	3	71	13	13	0	21	52	16	8	3

Authority.—Bibliography No. 94.

Table XIII—Cloud amount at coastal stations

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TABLE XIV—SWELL  
Percentage frequency of swell of different intensity and direction

Period : 1921-37

Month	INTENSITY				Con-fused	DIRECTION				No. of obs.	INTENSITY				Con-fused	DIRECTION				No. of obs.
	Heavy	Mode-rate	Slight	No swell		NW.	SW.	SE.	NE.		Heavy	Mode-rate	Slight	No swell		NW.	SW.	SE.	NE.	
	10-20° N., 40-50° E.										10-20° N., 50-60° E.									
January ..	3	30	38	29	2	4	1	43	21	717	0	39	44	17	2	9	0	2	70	531
February ..	2	23	46	29	1	13	2	30	25	950	0	20	58	22	4	3	0	8	63	609
March ..	1	22	48	29	2	11	1	34	23	1,059	0	7	58	35	1	4	0	15	45	680
April ..	1	15	43	41	3	12	4	25	15	1,134	0	6	55	39	1	3	14	26	17	824
May ..	0	7	28	65	2	8	1	15	9	905	1	27	52	20	9	1	44	24	2	722
June ..	0	13	43	44	2	20	22	11	1	948	36	48	12	4	8	0	69	19	0	810
July ..	2	26	37	35	5	14	33	12	1	791	57	37	4	2	8	0	72	18	0	742
August ..	0	15	40	45	4	16	27	8	0	799	46	46	6	2	10	0	72	16	0	822
September ..	0	7	38	55	3	15	11	11	5	536	17	60	19	4	10	0	56	28	2	562
October ..	0	12	39	49	2	4	1	27	17	778	0	12	64	24	7	5	18	25	21	631
November ..	1	26	45	28	2	1	0	43	26	886	0	27	57	16	5	4	0	4	71	721
December ..	1	17	47	35	1	4	1	34	25	732	1	39	49	11	8	11	0	0	70	541
	0-10° N., 40-50° E.										0-10° N., 50-60° E.									
January ..	33	56	11	0	0	0	0	0	100	18	0	66	34	0	1	21	0	0	78	95
February ..	0	42	58	0	0	6	0	0	94	31	0	22	71	7	8	6	0	0	79	85
March ..	0	35	55	10	17	0	0	7	66	29	0	13	67	20	8	3	0	4	65	209
April ..	0	29	57	14	0	0	0	86	0	21	0	9	49	42	1	1	6	29	21	115
May ..	0	56	44	0	9	0	68	23	0	43	1	48	45	6	13	5	61	11	4	156
June ..	6	69	25	0	20	0	0	80	0	20	45	42	9	4	11	0	82	3	0	178
July ..	Data not available										41	57	2	0	7	0	92	1	0	168
August ..	Data not available										52	34	10	4	31	2	59	4	0	188
September ..	21	66	13	0	3	0	46	51	0	39	21	64	12	3	17	0	78	2	0	192
October ..	0	20	53	27	0	0	0	73	0	15	0	21	73	6	19	20	21	14	20	149
November ..	Insufficient data										0	16	62	22	6	22	4	15	31	125
December ..	45	55	0	0	31	19	0	0	50	16	1	42	50	7	6	29	0	1	57	202

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Note.—Totals for "direction" fall short of 100 by an amount equal to the frequency of "No swell".

In calculating the percentages of swell of different intensity the confused swell is divided between slight, moderate and heavy in proportion to their frequencies.

TABLE XV—MONTHLY FREQUENCY OF DIFFERENT STATES OF THE SEA

Number of occasions per 100 on which particular states of the sea may be expected

0 = Calm. 1 = Smooth. 2 = Slight. 3 = Moderate. 4 = Rough. 5 = Very rough. 6 = High.

Socotra. 12° 38' N., 53° 53' E.

Period: Nov., 1942–May 10, 1943

	0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6
	0500 (Z-3)							0900 (Z-3)							1500 (Z-3)						
January ..	74	16	10	0	0	0	0	39	35	26	0	0	0	0	3	35	52	10	0	0	0
February ..	39	18	11	18	14	0	0	32	22	14	14	14	4	0	0	39	7	25	22	7	0
March ..	94	3	3	0	0	0	0	51	26	10	13	0	0	0	0	29	29	19	23	0	0
April ..	87	13	0	0	0	0	0	43	54	3	0	0	0	0	0	20	67	13	0	0	0
May ..	90	10	0	0	0	0	0	20	80	0	0	0	0	0	Data not available						
June†† ..																					
July†† ..																					
August†† ..																					
September†† ..																					
October†† ..																					
November ..	10	31	35	17	7	0	0	14	18	29	29	10	0	0	0	42	24	17	17	0	0
December ..	6	3	26	42	23	0	0	6	3	10	45	36	0	0	0	6	10	48	36	0	0

Aden. 12° 47' N., 44° 59' E.

Period: Jan., 1940–May, 1943

	0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6
	0500 (Z-3)							0900 (Z-3)							1500 (Z-3)						
January ..	17	63	10	10	0	0	0	10	69	11	9	.8	0	0	3	76	17	4	0	0	0
February ..	22	43	22	11	1	1	0	22	45	26	7	0	0	0	9	66	22	3	0	0	0
March ..	48	31	19	2	0	0	0	28	45	25	2	0	0	0	21	46	30	3	0	0	0
April ..	35	38	21	6	0	0	0	27	44	27	2	0	0	0	25	39	29	6	.9	0	0
May ..	48	42	8	2	0	0	0	37	40	21	2	0	0	0	26	40	26	8	0	0	0
June ..	41	38	18	3	0	0	0	23	45	23	8	1	0	0	13	38	32	16	1	0	0
July ..	20	39	29	10	1	1	0	16	33	37	12	1	0	1	5	38	40	15	2	0	0
August ..	18	32	37	12	1	0	0	13	55	23	6	2	1	0	4	48	32	11	4	1	0
September ..	54	39	7	0	0	0	0	27	63	10	0	0	0	0	18	53	21	8	0	0	0
October ..	50	35	12	2	1	0	0	27	53	15	4	1	0	0	9	57	24	10	0	0	0
November ..	26	55	14	5	0	0	0	12	63	17	8	0	0	0	7	46	38	8	1	0	0
December ..	24	55	11	4	5	1	0	18	56	16	10	0	0	0	9	63	24	4	0	0	0

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†† Data not available.

Table XV—Monthly frequency of different states of the sea 2 177

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