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MEAN MONTHLY AIRFLOW AT LOW LEVELS OVER THE WESTERN INDIAN OCEAN

BY

J. FINDLATER

LONDON: HER MAJESTY'S STATIONERY OFFICE

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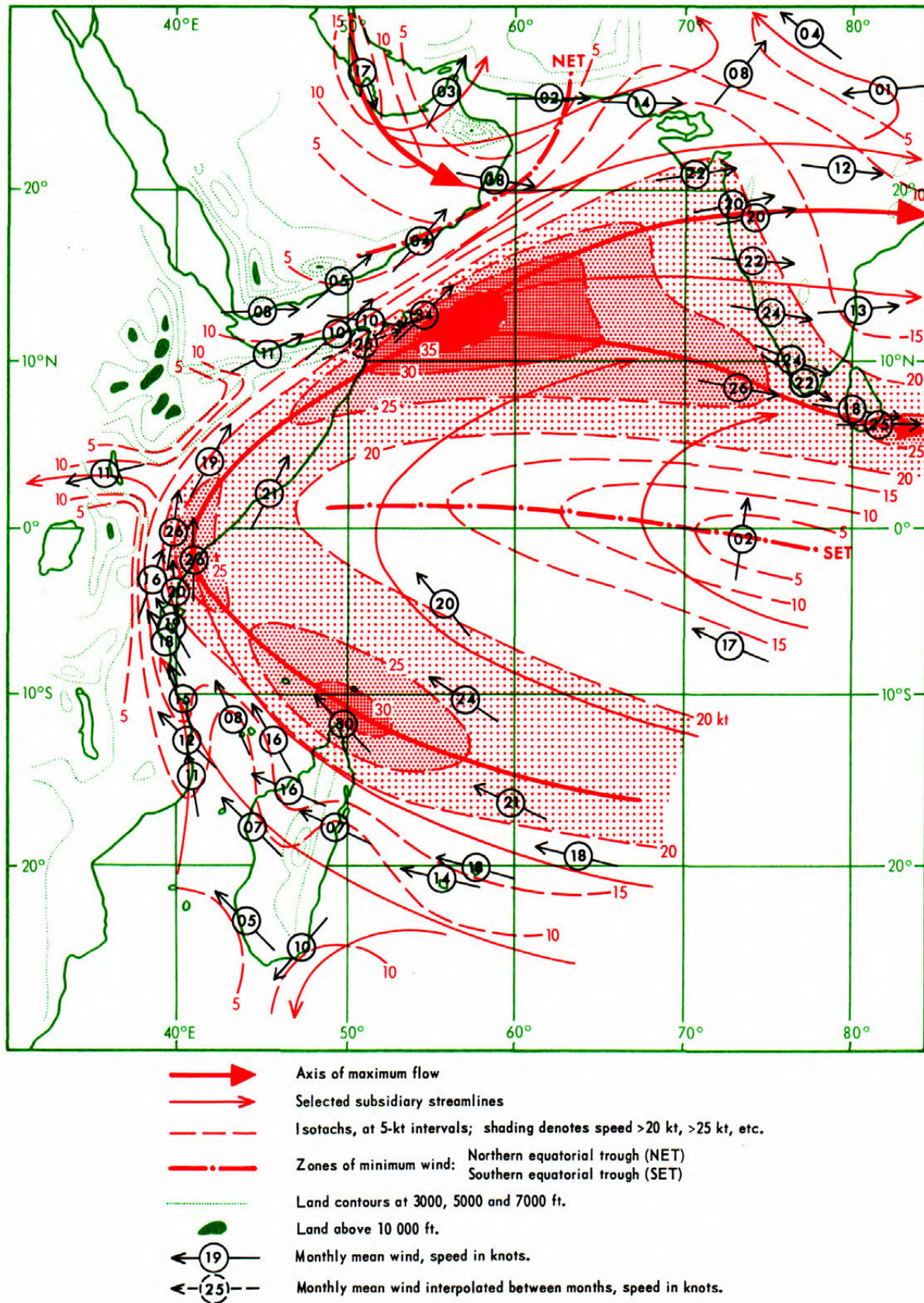
J. FINDLATER

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The mean flow pattern of air at 3000 ft (1 km) over the Indian Ocean during the summer monsoon in July. A special feature of the flow is that it is organized into a relatively narrow high-speed trans-equatorial current in the western periphery of the monsoon régime. The flow is strongest where the current is blocked or guided by high ground and is weakest in the vicinity of the oceanic equator.

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MEAN MONTHLY AIRFLOW AT LOW LEVELS OVER THE WESTERN INDIAN OCEAN

§1 - INTRODUCTION

Climatological atlases and charts of monthly mean winds at low level in the vicinity of the western Indian Ocean are, in the main, based on measurements made at the relatively few radar-equipped wind-finding stations in the area, and in some publications the lowest level analysed is 10 000 ft (approximately 3 km). However, recent studies^{1-5*} utilizing pilot-balloon and aircraft reports have demonstrated that high-speed flow (in the form of cross-equatorial jet streams at low levels, with cores occasionally attaining speeds of between 60 and 100 kt[†] at heights of 3000-7000 ft (1-2 km)) occurs in some months of the year in preferred locations over eastern Africa and western areas of the Indian Ocean. The high-speed flow is most pronounced in areas not served by adequate radar wind-finding facilities.

These recent analyses have indicated also that the occurrence of high-speed flow and the generally high values of mean monthly flow across the equator near eastern Africa, especially in the months of the northern summer, contribute significantly to the interhemispheric transport of air in the area and to the general circulation of the summer monsoon system.

The charts of mean monthly winds presented here have been prepared, therefore, to gain more insight into the climatological framework within which the high-speed currents develop and decay. Because these charts are based on collected statistics from a network of stations far more dense than has been analysed hitherto, they should prove to be useful to those who are interested in the flow patterns of the area, and provide basic data for further studies.

§2 - OBSERVATIONAL DATA

Use has been made of all available upper air data in the area, from pilot-balloon ascents and radar or radio-wind soundings. In some cases mean monthly upper winds were already available from publications issued by national meteorological services, in other cases the mean winds have been computed from tables of the frequency of direction and speed of the upper winds, and for some stations the mean winds have been calculated from a combination of several years of monthly mean winds from individual years. Data for the remaining stations were derived by calculating mean values from pilot-balloon data stored in archives or from published daily values. A map of the locations of all stations is given in Figure 1 and a list of stations used in the analysis, with their positions, altitudes, methods of measurement, times of ascents, run of years and the source of the data, is noted at Appendix I.

* The superscript figures refer to the bibliography on page 37

† 1 kt = 0.5148 m/s.



FIGURE 1. LOCATION OF STATIONS

● Pilot-balloon wind stations

▲ Radar- or radio-wind stations

The run of years varies considerably from station to station; the longest period used was 15 years, at several stations, and the shortest $1\frac{1}{2}$ years, at one station. The earliest observations used were made in 1930 and the most recent in 1967. Most of the pilot-balloon soundings were made in the early morning when convective and sea-breeze influences were minimal, but data from all hours have generally been utilized to ensure maximum sampling. Only the early morning soundings were available for a few stations. Over eastern Africa pilot-balloon soundings were made by the tail method from 1936 onwards where indicated by the symbol 'Pr' in Appendix I.

Mean values were extracted or computed for the levels of 3000 ft, 5000 ft, 7000 ft and 10 000 ft, corresponding approximately to the levels of 1, 1.5, 2 and 3 km. In some cases, where mean winds at a level were not available, the values were found by interpolation between mean values at the level above and that below, e.g. some mean winds at 5000 ft were derived by interpolation between mean winds at 3000 ft and 7000 ft, and some at 7000 ft were derived by interpolation between values at 5000 ft and 10 000 ft. No interpolations were made where the low-level flow was complex, as at Entebbe where a lake-breeze system precludes use of this method. For a few stations, mainly on the island of Madagascar, data for only the mid-season months were available, i.e. January, April, July and October, and mean winds for the intervening months were obtained by interpolation also, provided that the vector change was not great and the sampling period was not less than 10 years.

At one station, Scusciuban in Somalia, where the run of years was insufficient to provide reliable mean values for three of the months, the values were deduced by a comparison of component changes with those at nearby Socotra. The method is shown in Appendix II.

On the northern coast of Somalia data are available for Bander Kassim and Berbera, where winds at low levels undergo a pronounced diurnal variation during the months of the northern summer. Strong south-westerlies between the surface and 3000 ft in the early morning are replaced by light north-easterly winds in the afternoon. The 3000-ft level is only marginally affected. A study of the phenomenon has been made by Brooks and Durst,⁶ but their analysis does not allow mean monthly resultant winds to be determined with accuracy. Mean winds at Berbera (and at Bander Kassim) have therefore been computed from the original daily values or monthly frequency tables, and soundings made in the morning and afternoon have been combined.

Farther to the east, at Cape Guardafui, a pilot-balloon station was established in 1930 and functioned until 1933. The daily values⁷ from this station have been examined and although relatively few soundings reached higher than 3000 ft a sufficient number did so to enable monthly mean values to be calculated. However, in the months of June, July and August there were many days of very strong winds, with a large component from the south, and on these days the soundings did not reach the 3000-ft level. The mean winds for Cape Guardafui in these months should therefore be regarded as being weighted towards lighter and more westerly winds. (In July only 10 soundings reached 3000 ft and all of these were in the year 1932.) It is likely that the true mean winds at this station should have a southerly component added to the values shown for the months of the northern summer.

It is noteworthy that, below the 1000-ft level, winds at Cape Guardafui blow most frequently from between south and south-south-east from June to August and speeds exceeding 100 kt have been recorded at 225 ft and 450 ft.⁷ The lowest level considered in this analysis (3000 ft) was chosen, however, to avoid undue complication of the analysis by diurnal effects or by local winds such as sea-breezes or winds due to topography of a strictly local character. The strange behaviour of the wind close to the surface in the vicinity of Cape Guardafui is not, therefore, analysed further in this memoir.

Radar winds from Mahé in the Seychelles were available for the period September 1963 to December 1964 only, and in a summary of these observations Wright and Ebdon⁸ have pointed out that mean winds derived from this short series may not be typical of the longer-term mean values. The radar-wind series has therefore been combined with a series of pilot-balloon observations made in the years 1942 and 1943. In calculating mean values from these data equal weight has been given to monthly means by each method, except in the few cases (at 10 000 ft only) where the number of observations in a class fell to 10 or less. In such cases equal weight was given to individual wind observations, regardless of the method by which they were measured.

Despite the heterogeneity of methods of observation, period of years, number of years and times of observation of the various sets of data, the consistency of pattern and the ease with which features can be identified from place to place and from month to month is remarkably good. It had been expected that a fair-weather bias would appear in data from pilot-balloon stations adjacent to radar wind-finding stations but significant differences cannot be located, perhaps because the analysis was limited to levels below 10 000 ft. Above this level it would be surprising if some bias did not become apparent.

The agreement between mean values deduced from measurements made by different methods and in different periods is exemplified by the closely corresponding values from pilot-balloon ascents at Zanzibar Island and radar wind-soundings at Dar-es-Salaam some 30 years later. The two stations are 38 nautical miles apart. The values for Zanzibar were calculated from data for the period 1931–38 and those for 5000 ft and 10 000 ft at Dar-es-Salaam for the period 1960–63; the mean values are included in Appendix III. Although the correspondence between the mean winds at these two stations is very good some of the differences shown are most probably real. In the south monsoon season, April to August, the generally higher values of the wind speed over Zanzibar are probably a result of its location: slightly closer to the core of the monsoon current, which crosses the African coast to the north of Zanzibar, than is the mainland station of Dar-es-Salaam. Winds for the 3000-ft level at Dar-es-Salaam were not available from radar soundings and have therefore been computed from pilot-balloon data for the years 1938–43.

Similar comparisons may be made between values obtained by different methods at the island stations of Vacoas and Rodrigues, and between Indian stations such as Cochin and Trivandrum, showing compatible results. However, an inspection of the plotted charts, Figures 5–16, is enough to demonstrate the coherence between mean values from all stations. Frost and Stephenson⁹ have suggested that for three radar wind-finding stations in the area (Aden, Nairobi and Bahrain) 3-year or 4-year averages yield a very good approximation to the long-term (8–10 year) averages of upper winds.

The value of using all available pilot-balloon winds to supplement radar- or radio-wind measurements is confirmed by comparing, for example, the analysis of mean winds at 3000 ft in July (Figure 11(a)) with the 850-mb chart of Raman and Dixit¹⁰ particularly over Kenya, and that at 10 000 ft in July (Figure 11(b)) with Figure 10 of Frost and Stephenson.⁹ Pronounced differences are noticeable.

Mean winds collected or calculated for this analysis are tabulated at Appendix III. Values which have been found by interpolation between levels are shown in brackets whilst those obtained by interpolation between months are shown in asterisked brackets. All wind speeds are given in knots, some values having been converted from original data in metres per second or in miles per hour.

The inclusion of the tabulated data at Appendix III is intended to assist other workers who may wish to examine the intermediate levels or derive other parameters for the study of vector differences, cross-sections, etc.

On the plotted charts dashed arrows are used to distinguish interpolated winds from real mean winds. The key is shown in the legend to the charts.

§3 – METHOD OF ANALYSIS

Charts of mean winds have been prepared for all four levels, analysed by streamlines and isotachs. Use has been made of every level to obtain continuity of pattern in the vertical and from month to month, but only the charts at 3000 ft and 10 000 ft are presented here. The variation of wind with height between these two levels is not always near-linear, and reference should be made to the data in Appendix III if intermediate values are required at any location.

Only selected streamlines are included to avoid unnecessary complication of the analysis and over-writing of the basic data. Major streamlines have been emphasized on the charts where they are also axes of maximum wind. Isotachs have been drawn at intervals of 5 kt; areas having speeds over 15 kt are lightly shaded and those of over 20 kt are shaded more heavily.

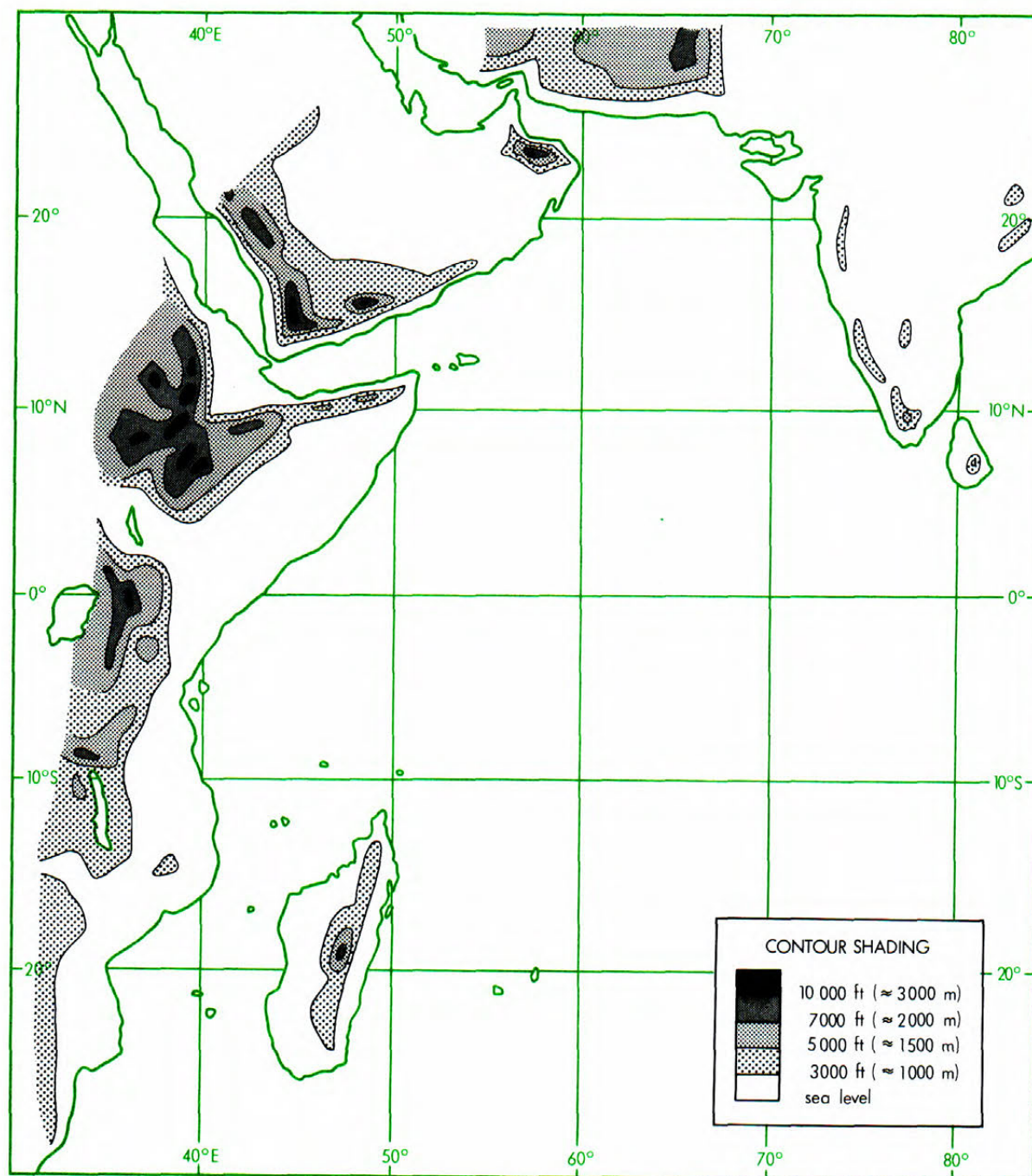


FIGURE 2. GENERAL TOPOGRAPHY

Figure 2 shows the general topography of the area, smoothed by neglecting isolated hills and ridges which would be unlikely to impede the airflow. The topographical contours are for 3000 ft, 5000 ft, 7000 ft and 10 000 ft and the contour appropriate to each wind level is reproduced on the subsequent charts.

One of the aims of the analysis was to fit every isotach to the observations, with an error not exceeding 3 kt, and this has been achieved without producing undue contortions in the analyses. No observation has been ignored. In some parts of the analysis, particularly near strong flow, the isotachs have been drawn a little way over the edge of the high ground denoted by the contour, since these are smoothed contours and the rugged nature of much of the terrain allows some air to escape through valleys and cols at the edge of the main mass of hills.

At some stations it is likely that one mean wind at a level may not be adequate to represent the flow, when two differing wind régimes can affect these stations during one month, and the analysis in such areas should be interpreted with caution. For example, two major streams are shown to approach the west coast of India in July (Figures 11(a) and (b)), but these two streams do not necessarily coexist. Each one may be dominant for different periods during the month. Also, in Figure 11(b) the wind at Socotra may be the small resultant of two different wind systems: one from the north and the other from the south-west.

§4 – SALIENT FEATURES

The main features of the flow are indicated clearly on the monthly charts and in the short discussion for each month. Nevertheless the salient features which have emerged from the analysis are, by way of summary, noted here.

The north-east monsoon – During the northern winter the roots of the monsoon flow are in Arabia and India, but the airflow becomes most pronounced close to the eastern coast of Somalia where the zones of maximum speed, elongated along the flow, are located. A narrow filament of the flow at low levels turns across the equator to flow south along the coast of Africa, whilst the main current flows into the interior of the continent as an easterly stream. The charts for January and February show the most developed form of the north-east monsoon. Over eastern Africa high-speed flow, in the form of low-level jet streams, has been noted on some days in both branches of the stream^{1, 2} and speeds of between 60 and 80 kt have been measured.

The south (or south-west) monsoon – The root of the flow is present throughout the year as an east-south-easterly current with its core over the group of islands extending 1000 miles to the east of Madagascar. This area is in the south-east trade-wind belt but the flow at all the levels which have been analysed is from a more easterly point than the name implies. As the sun moves north the flow strengthens and penetrates into eastern Africa as a strong narrow current which, blocked by high ground at its western boundary, curves into a southerly across the equator and thence to a south-westerly which crosses the Arabian Sea to reach India from a westerly or west-north-westerly point during the northern summer. The charts for the period April to July reveal the form of the mean flow as the circulation develops. The development is summarized in Figure 3 where successive monthly positions of the 20-kt isotach at 3000 ft are used to illustrate the remarkable developments over and near eastern Africa. The narrowness of the current which penetrates across the equator into eastern Africa in May is particularly well shown on the plotted charts.

It is noteworthy that the strong flow develops first at the lower levels, later extending to the higher levels. In July, the axis of the strong narrow current is well defined and mean wind maxima of about 30 kt have been computed close to the core, even at the equator where the

current is narrowest. It is within this current that low-level jet streams have been located on some days, with speeds of between 60 and 100 kt close to the 5000-ft level.^{1,2,4}

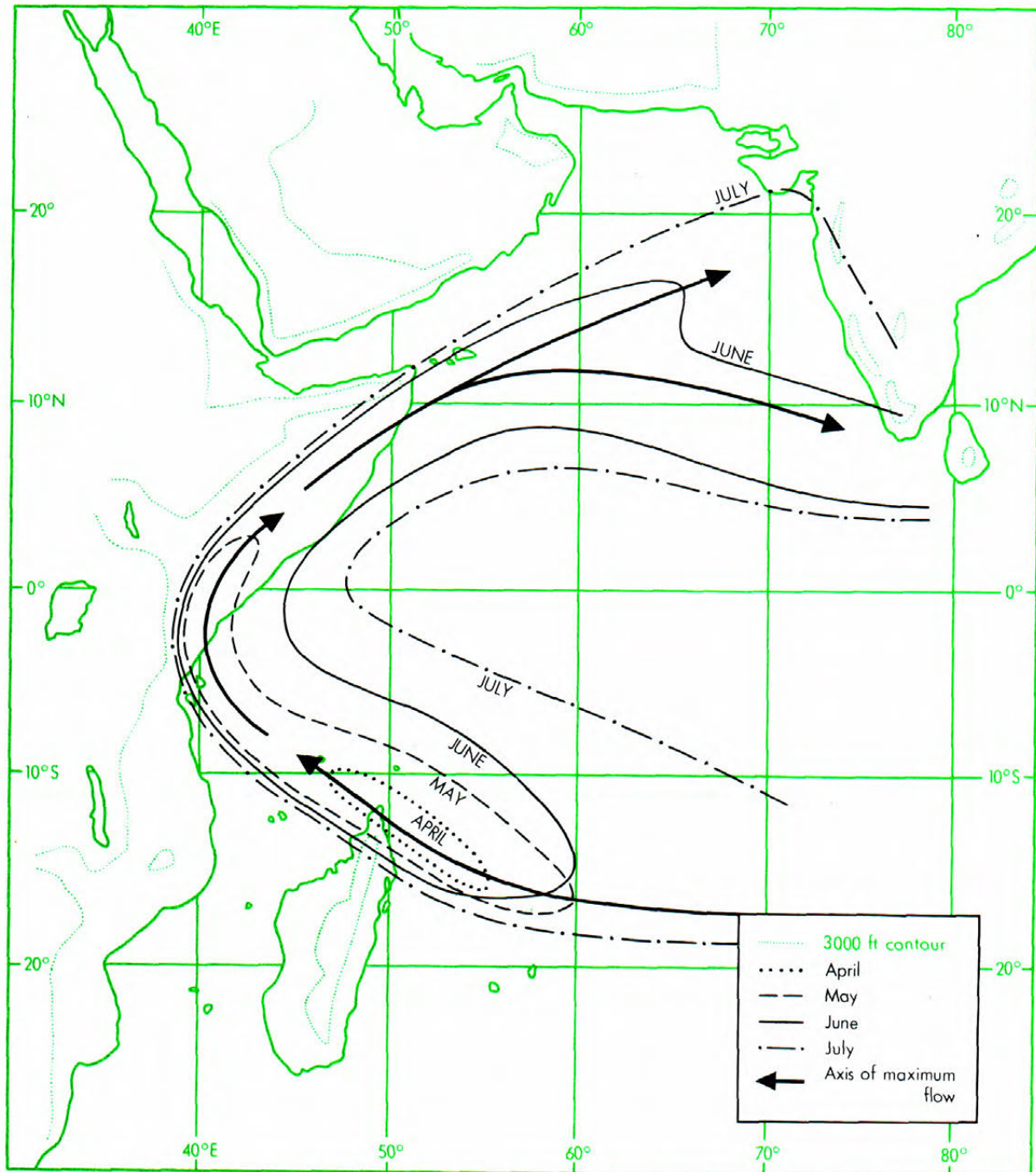


FIGURE 3. SUCCESSIVE POSITIONS OF THE 20-KNOT ISOTACH AT 3000 FEET DURING THE ONSET OF THE NORTHERN SUMMER MONSOON, APRIL TO JULY

The strong peripheral flow over the western Indian Ocean in the south-monsoon circulation is emphasized by the weak cross-equatorial flow over most of the oceanic equator, and a light wind or calm area can be located near Gan. Strong horizontal shears exist on both sides of the current and even at the equator pronounced anticyclonic shear, as well as cyclonic shear, is well in evidence; see Figure 11(a).

Over southern India and the Maldiv Islands the mean winds at all levels analysed here are from a west-north-westerly point between June and September. Data from radar-wind stations as well as from pilot-balloon stations verify this mean direction (west-north-westerly) during the south-west monsoon season.

When the monsoon circulation slows down, during the period from August to October, it is evident that the flow at the higher levels weakens before that at the lower levels.

Equatorial troughs – On all the monthly charts two zones of minimum wind, orientated approximately west to east, can be discerned. These zones are also zones of maximum curvature of streamlines and, following the usage of Frost and Stephenson,⁹ are referred to hereafter as equatorial troughs. (The use of the term 'equatorial shear lines' has been avoided because another set of shear lines would need to be introduced to define the edges of the major air currents where these cross the equator.) The equatorial troughs can be identified as far west as 45°E. The northern equatorial trough (NET) undergoes a marked latitudinal displacement of about 20° during the year whilst the southern equatorial trough (SET) oscillates over a range of only about 12° of latitude, mainly in the southern hemisphere. Air flows into the troughs from their poleward sides and recurves to a westerly stream which is contained between, and bounded by, the equatorial troughs.

The equatorial westerlies – The equatorial westerlies which lie between the two troughs are weakest and narrowest in the northern winter when they flow in a band of about 10° of latitude in width at speeds of about 10 kt. The westerlies strengthen and widen with the approach of the northern summer to cover the area from Gan to about 25°N over India and West Pakistan. The main source of air in the westerly stream appears to be in the southern hemisphere but the stream is reinforced in all months by air from the north-east or north-west which recurves through the northern equatorial trough to join the westerly.

§5 – CROSS-EQUATORIAL FLOW

A series of monthly cross-sections along the equator from 35° to 75°E and extending from the surface to 10 000 ft (3 km) has been prepared. These are illustrated in Figures 4(a) – (l), where positive components indicate flow from the south. The meridional flow in each month is most pronounced between the edge of the high ground in Africa and the coastal area, but significantly decreasing cross-equatorial flow extends as far east as the Seychelles in the middle months of the northern summer. In this season the flow is strongly concentrated close to the hills which form the western boundary of the south monsoon current. The mass of air being moved across the equator in the middle months of the two monsoon seasons, January and July, has been calculated in an earlier paper.⁵ In all 12 cross-sections the meridional components at the surface have been deduced from mean surface winds over the oceanic equator as published in *Indian Ocean oceanographic and meteorological data*.¹¹

Only in December and January are southerly components absent over the low ground of eastern Kenya. In February the weak southerly component at Garissa is noticeable at 3000 ft and in subsequent months it develops into the strong cross-equatorial current on the periphery of the south monsoon circulation. Other features of interest may be located on the cross-sections. For example, in the summer months the meridional components of the surface winds are stronger between the African coast and 50°E than farther to the east, a characteristic to which attention has been drawn earlier by Crowe.^{12, 13}

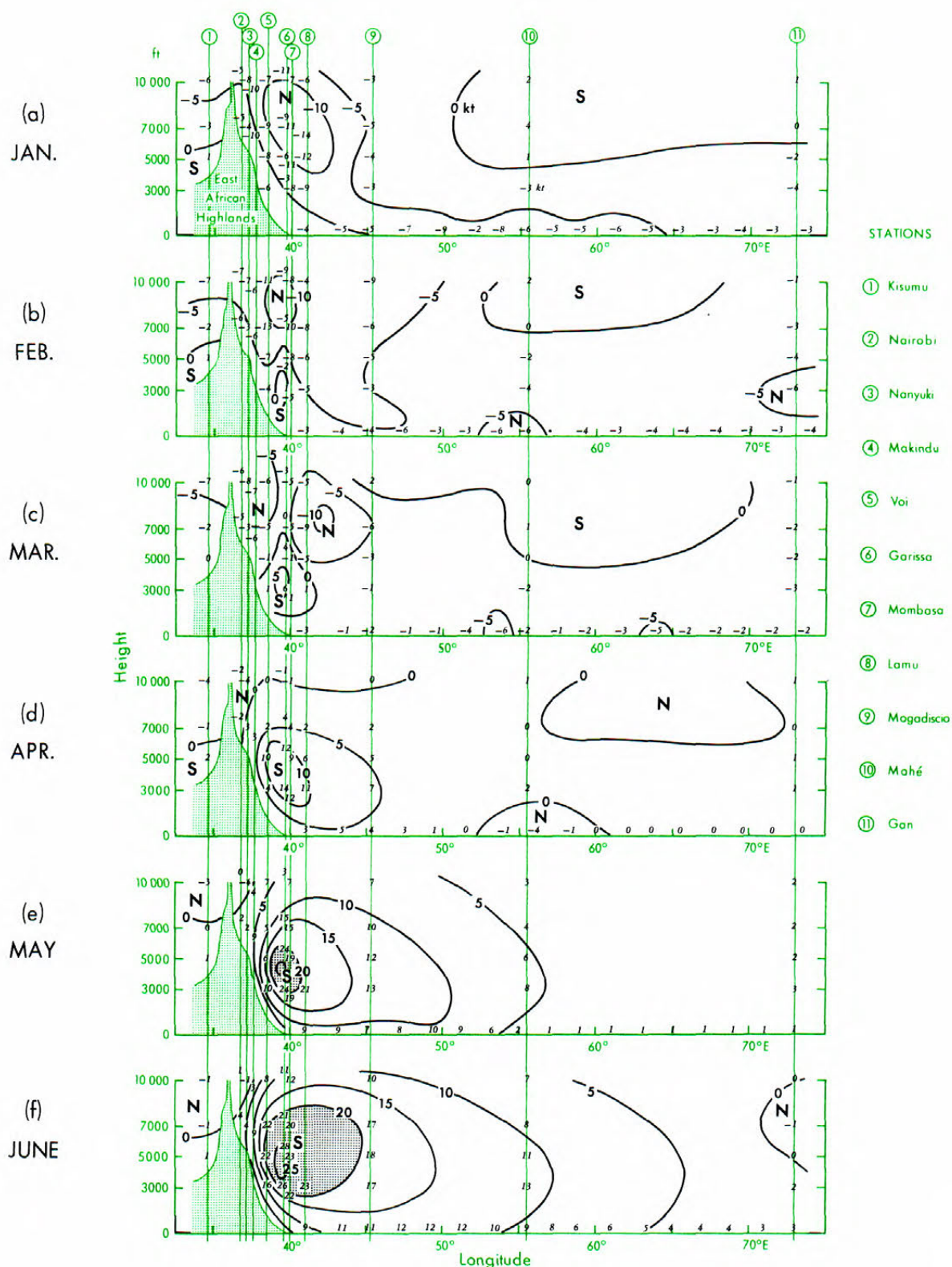


FIGURE 4(a) - (f). MONTHLY CROSS-SECTIONS ALONG THE EQUATOR FROM 35° TO 75°E

N = meridional flow from north (negative components), S = meridional flow from south (positive components).
 Areas having components > 20 kt are lightly stippled in black.

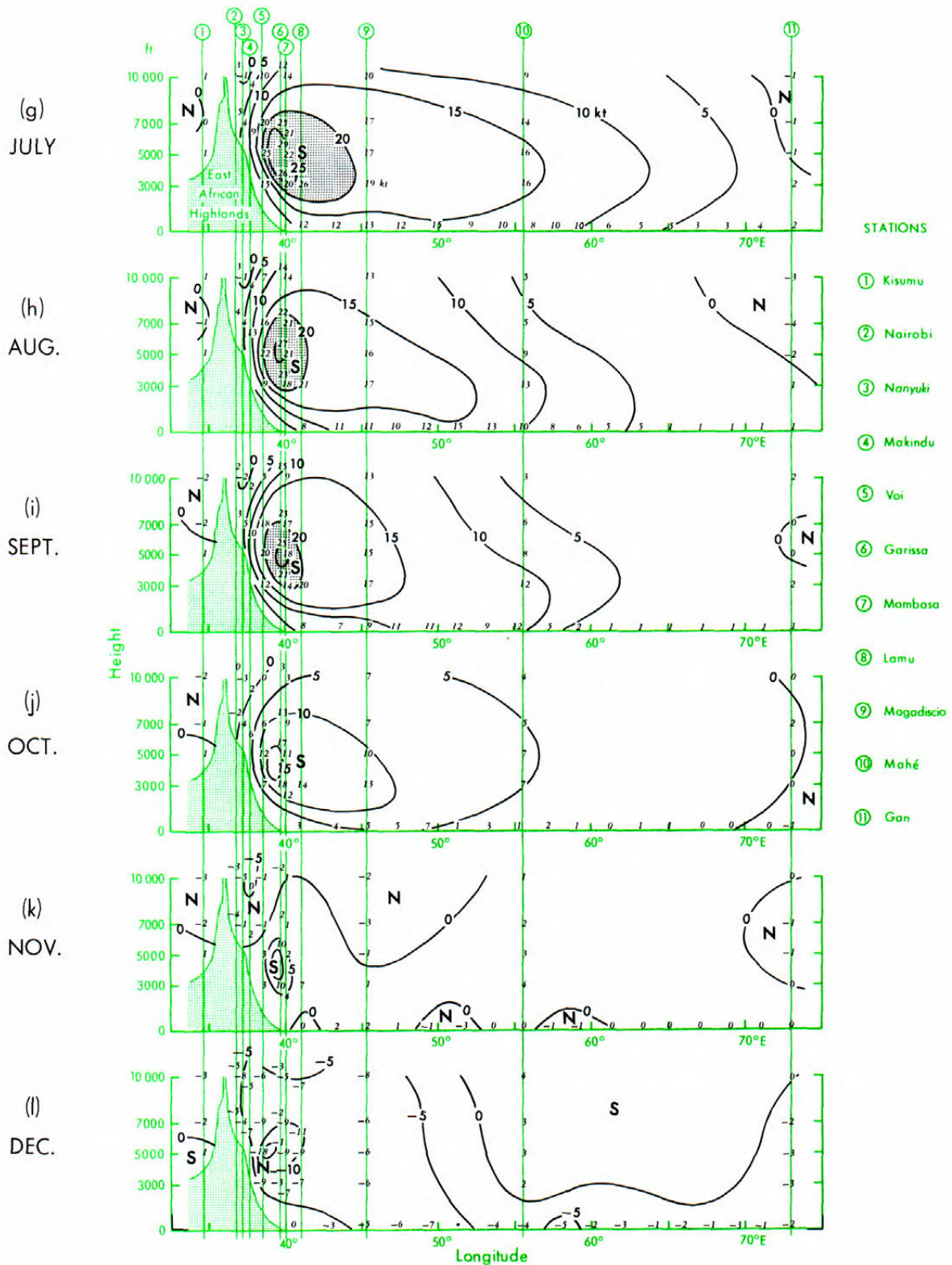








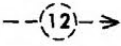



FIGURE 4(g) - (l). MONTHLY CROSS-SECTIONS ALONG THE EQUATOR FROM 35° TO 75°E

N = meridional flow from north (negative components), S = meridional flow from south (positive components).
Areas having components >20 kt are lightly stippled in black.

Explanation of symbols used in Figures 5-16: mean monthly airflow at 3000 ft and 10 000 ft.

	Major streamlines, axes of maximum flow
	Selected subsidiary streamlines
	Isotachs at intervals of 5 knots
	Areas with speeds over 15 knots
	Areas with speeds over 20 knots
	Axes of minimum wind. These are also axes of maximum curvature of streamlines and delineate the northern and southern equatorial troughs (NET and SET)
	Monthly mean wind direction and speed
	Calm, or resultant wind less than one knot
	Monthly mean wind, deduced by interpolation between winds for earlier and later months
	Calm, deduced by interpolation between earlier and later months

The green dotted lines represent land contours appropriate to the chart level.

§6 - DISCUSSION

January. (Figures 5(a) and (b).) — The north-east monsoon is nearing its maximum development and the main current of air, drawn from the Persian Gulf and southern India, flows from the east-north-east across the coast of Somalia where the highest mean speed is recorded at 7000 ft. Over north-east Kenya the flow divides, one branch turning to an easterly to flow between the highlands of Kenya and Ethiopia, and the other turning to a north wind flowing along the coast of Africa. The latter stream is best developed at the lower levels where westward flow is blocked by the high plateaux of Africa, but it can still be discerned at 10 000 ft.

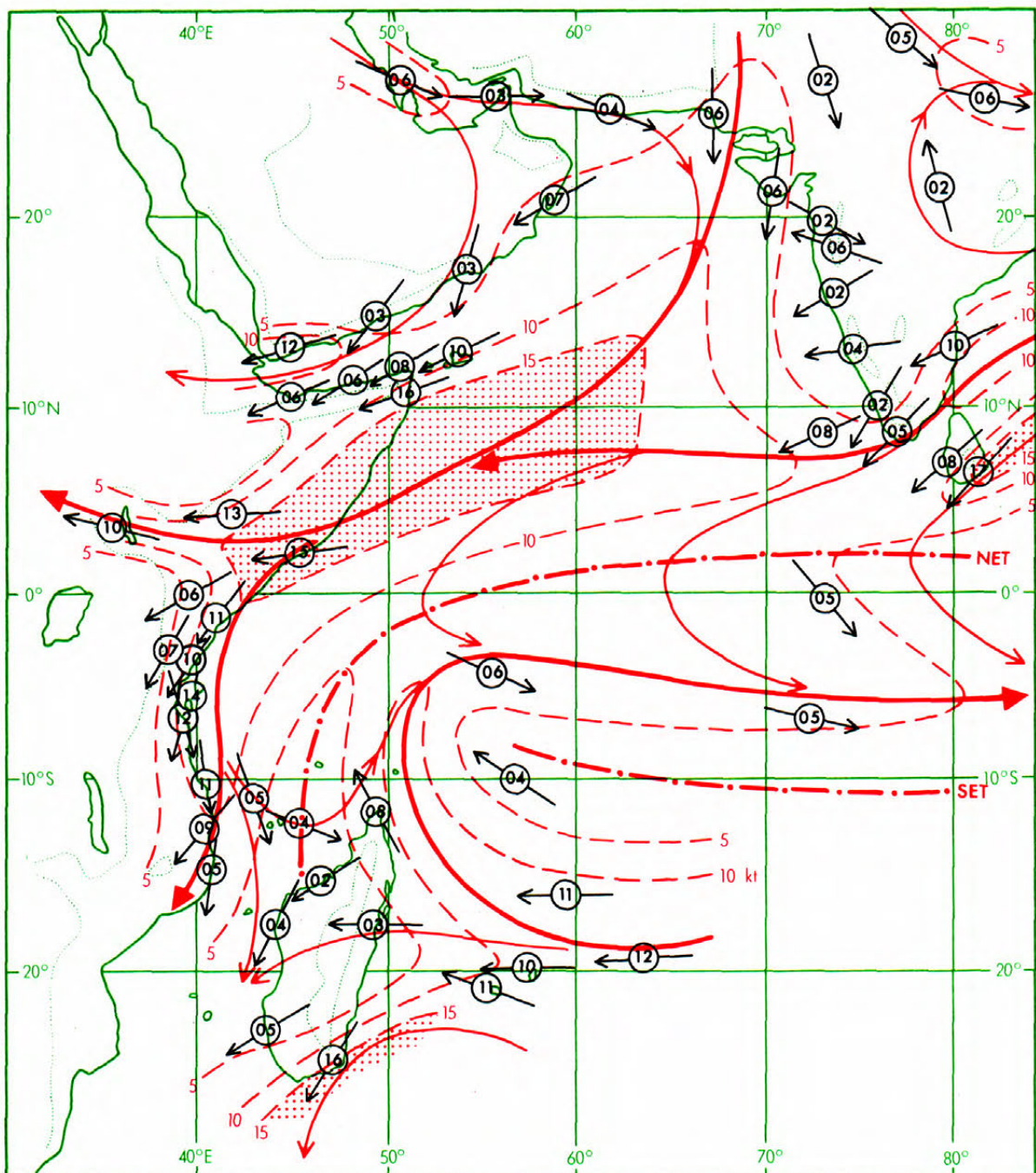


FIGURE 5(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) — JANUARY

In the southern hemisphere a weak stream of air flows at about 10 kt from the east towards Madagascar, turns to a southerly off the northern tip of the island and veers to a westerly stream traceable at all levels at Mahé, Gan, and Diego Garcia.

The westerly stream is bounded on the north and south by zones of minimum wind, or equatorial troughs, beyond which the winds become easterly. These troughs move south in this month to approach their southern limit of penetration.

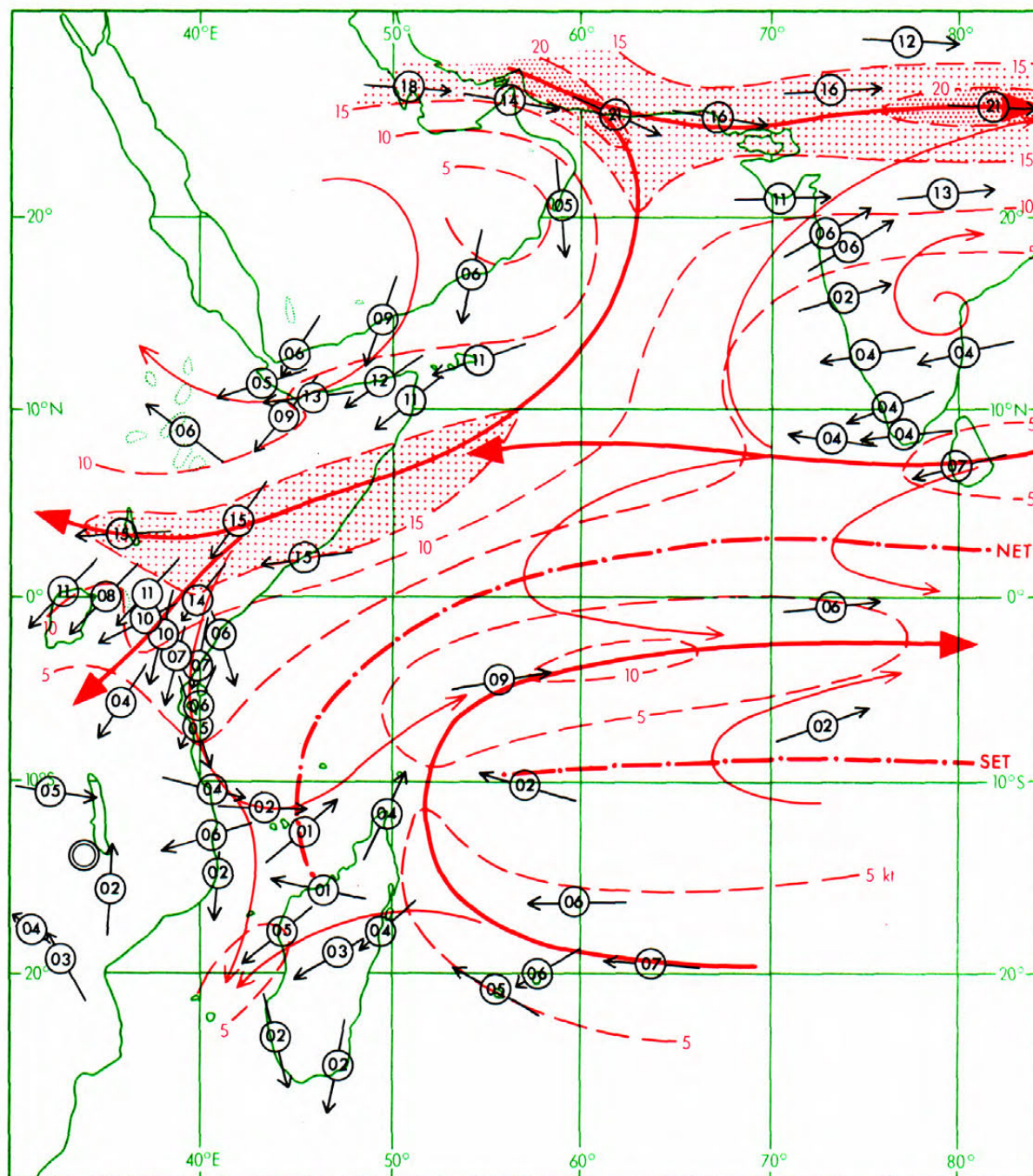


FIGURE 5(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) - JANUARY

February. (Figures 6(a) and (b).) – At the upper levels, 7000 ft and 10 000 ft, westerly air-flow over West Pakistan and northern India is strengthening and the air which circulates over the Arabian Sea and Somalia is moving a little slower. Flow through the gap in the hills over north-west Kenya is still considerable but the branch of the north-east monsoon which moves south along the coast of Africa has become very weak.

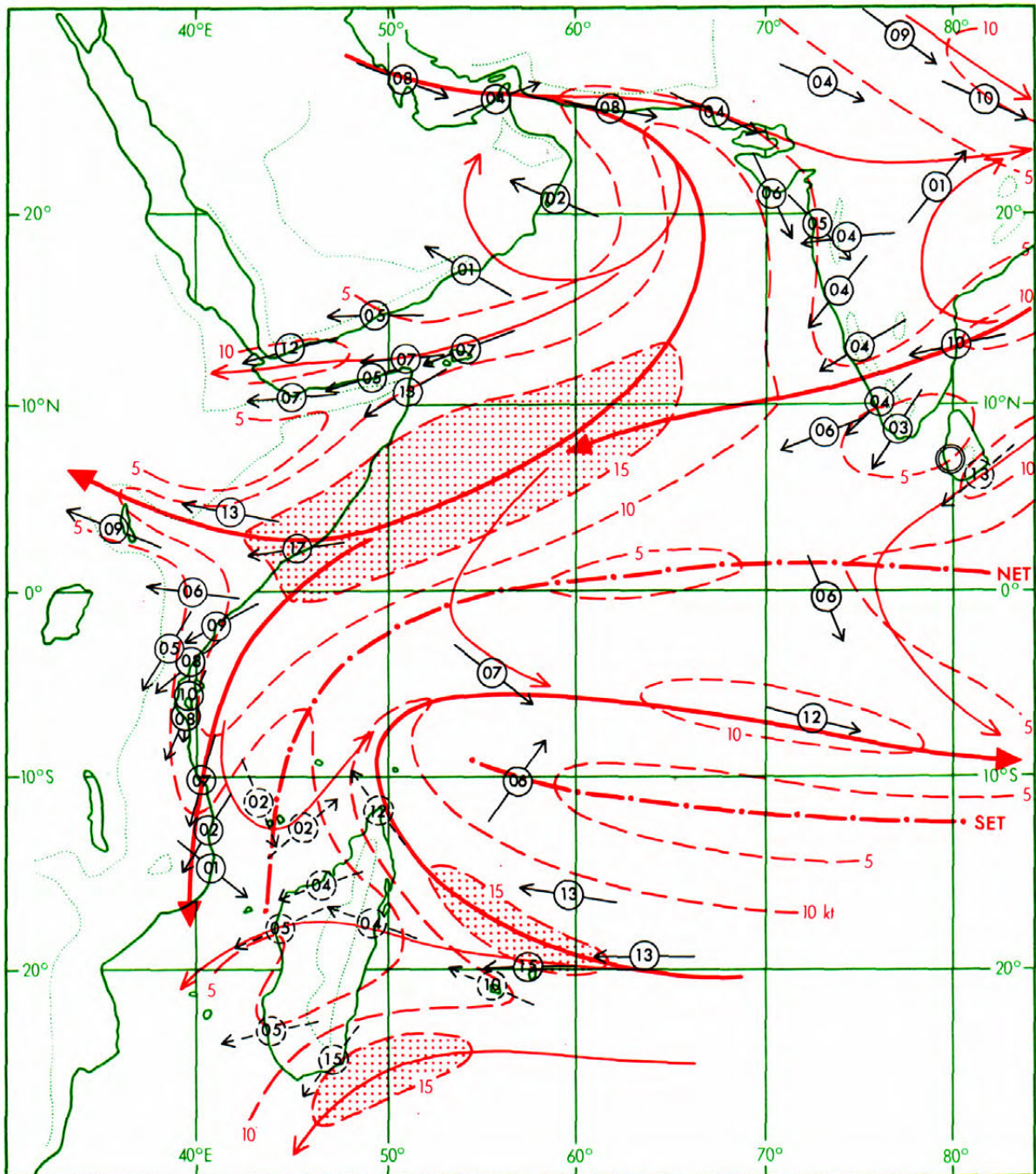


FIGURE 6(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – FEBRUARY

While the north-east monsoon weakens, flow in the southern hemisphere strengthens. The stream which approaches Madagascar from the east and then turns quickly to a westerly is moving at up to 12 kt in the westerly sector, and is edging towards eastern Africa.

The equatorial troughs show little change in position in the western half of the area, but have moved a little to the south in the east to reach their southern limit.

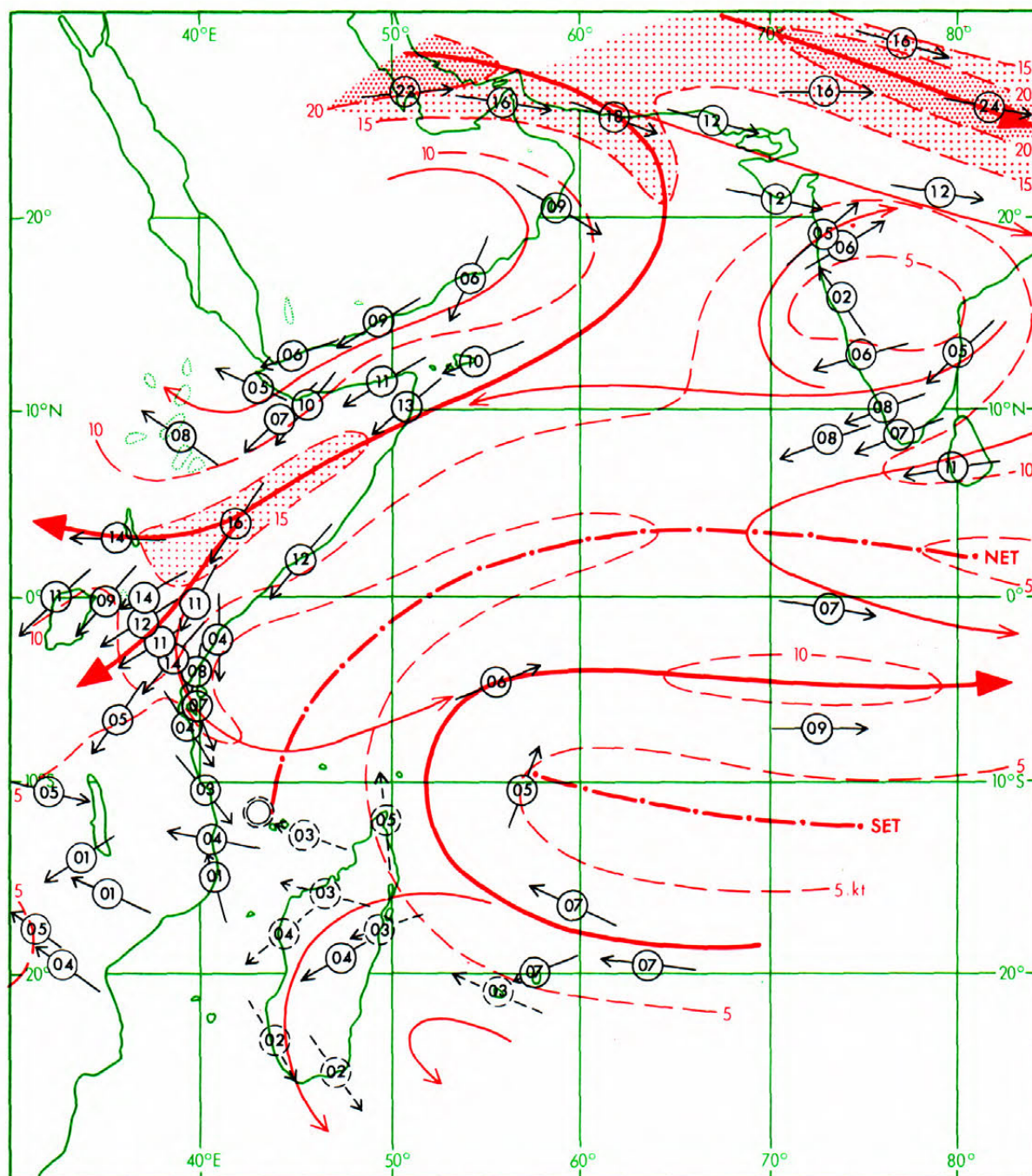


FIGURE 6(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – FEBRUARY

March. (Figures 7(a) and (b).) – The north-east monsoon continues to weaken slowly and, although the main stream still flows from the Persian Gulf across the Arabian Sea, turning to an easterly across Somalia and Kenya, the branch which flowed southwards has now ceased and at 3000 ft has been replaced by a generally light easterly wind across the coast.

Flow in the southern hemisphere is now organized into a narrow stream with a well-defined core in evidence over the islands to the east of Madagascar. The core, traceable on earlier

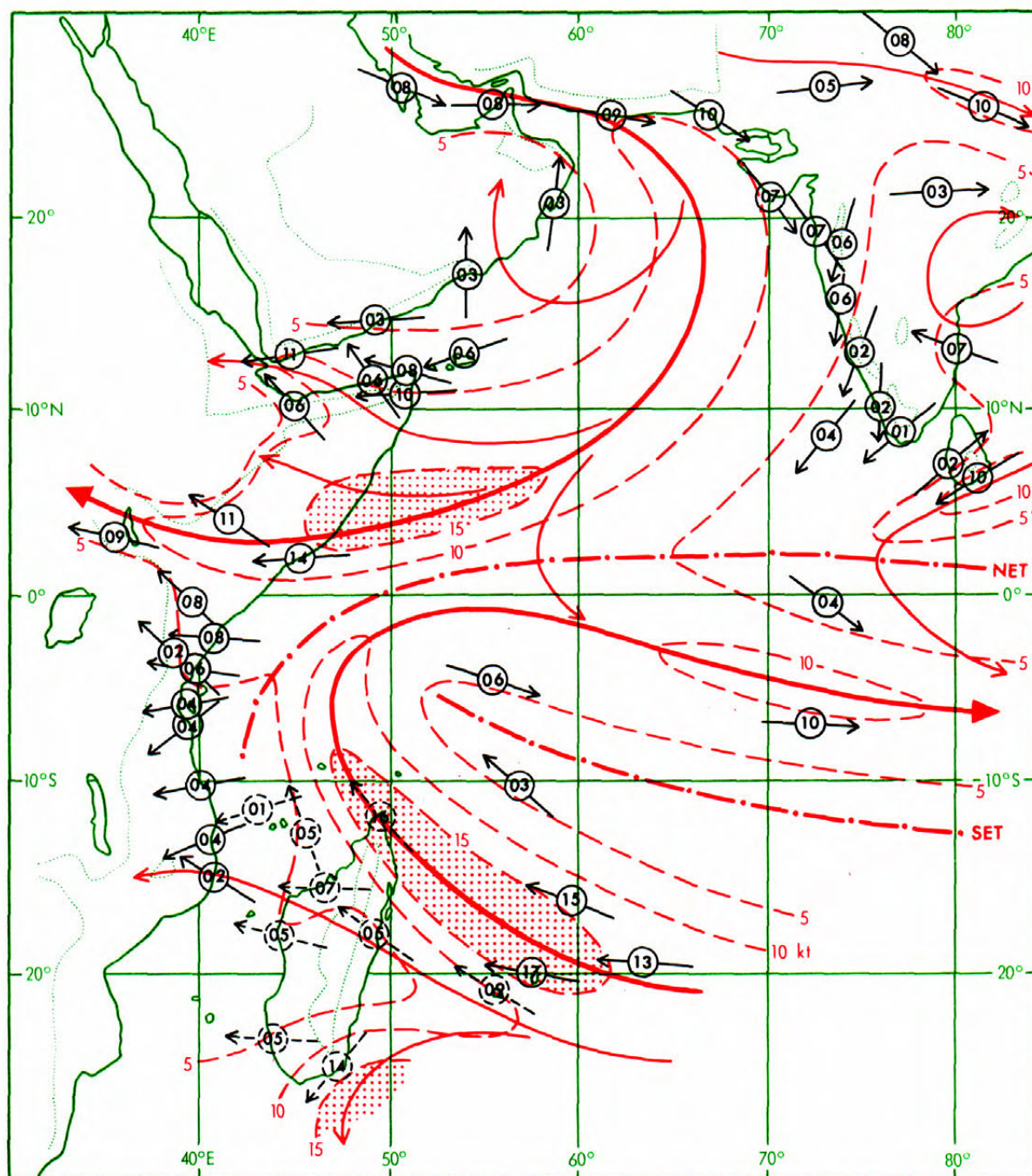


FIGURE 7(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – MARCH

charts, is now becoming a significant feature. This stream bifurcates, one branch approaching the coast of Africa, and the other maintaining its earlier form, recurving quickly to become a westerly which flows south of the equator.

The equatorial troughs show little change of position away from land areas, but the western portions are moving north in association with strengthening flow from the southern hemisphere. The northernmost trough has moved to the coast of eastern Africa at the 7000-ft and 10 000-ft levels.

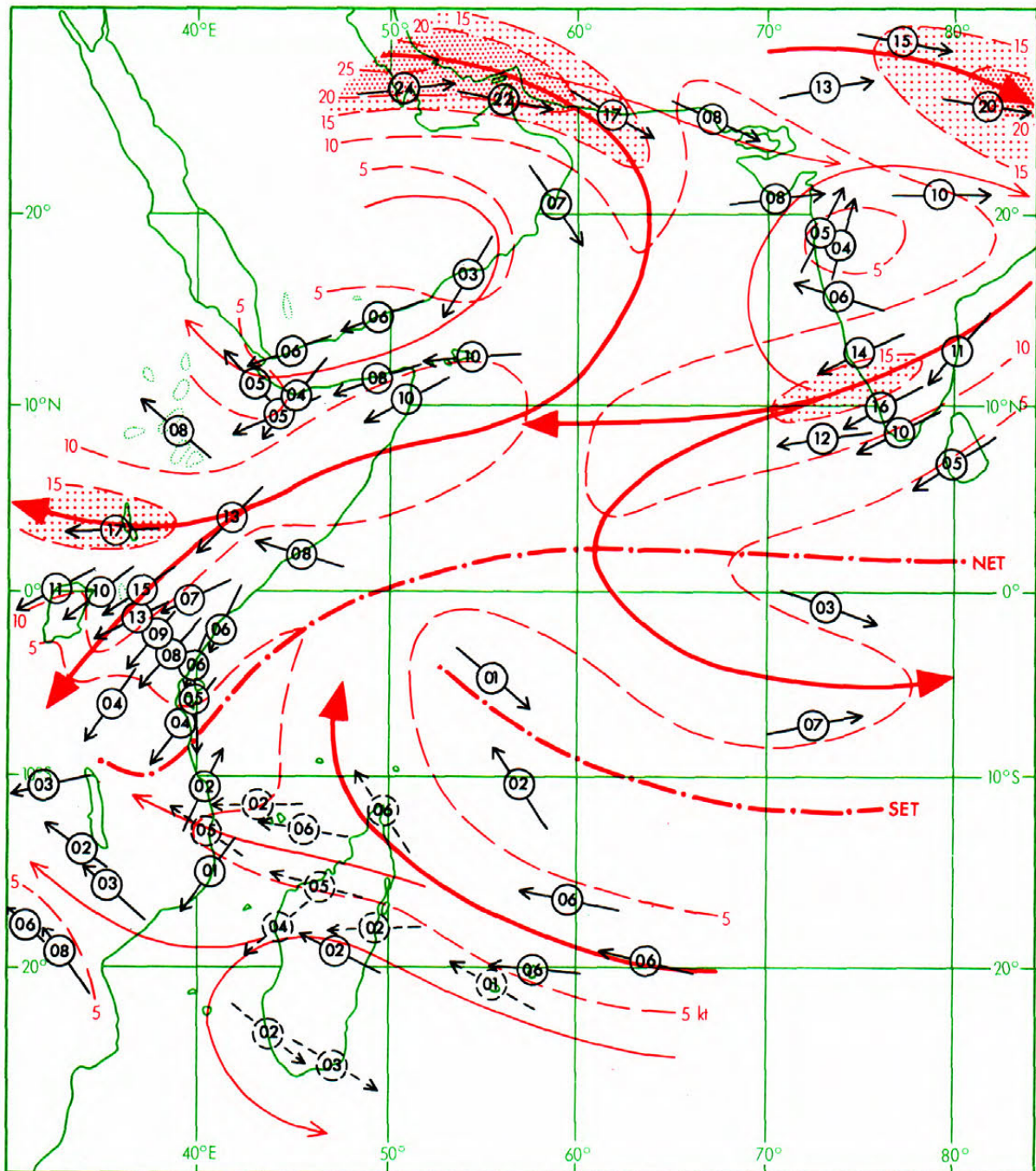


FIGURE 7(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – MARCH

April. (Figures 8(a) and (b).) – The circulation of the north-east monsoon has nearly disappeared from the charts for the lower levels and what remains is an anticyclonic eddy over the Arabian Sea giving a weak east or east-south-easterly flow into the tip of Somalia and the south-west of Arabia. At 10 000 ft, however, winds are still predominantly easterly in the northern hemisphere south of 20°N.

In the southern hemisphere the core of the (south) monsoon continues to strengthen and winds exceed 20 kt over the northern tip of Madagascar at 3000 ft where there may be some topographical intensification of the flow. The bifurcation of the main stream leads to one branch

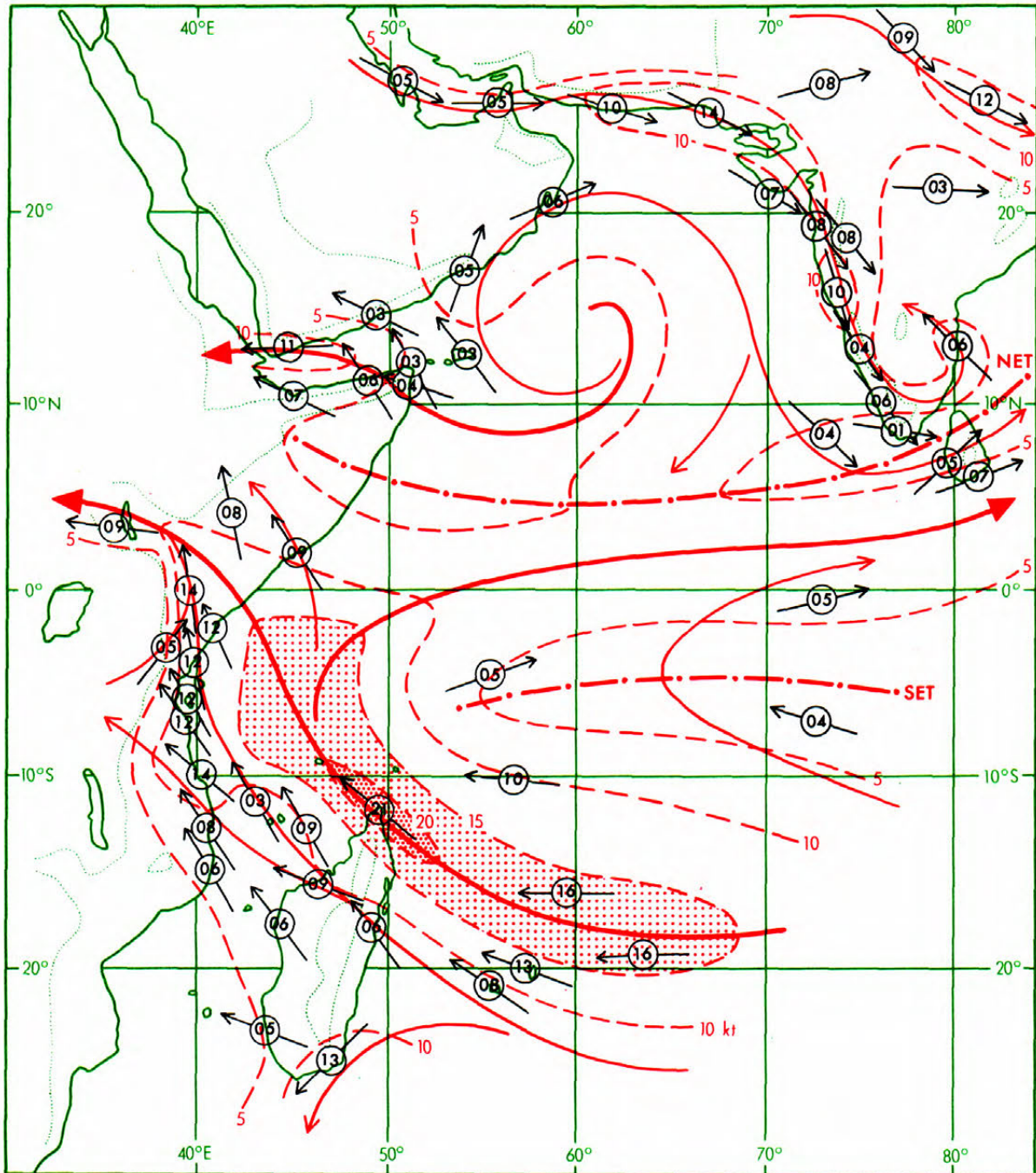


FIGURE 8(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – APRIL

protruding across the equator into eastern Africa, whilst the recurving branch advances closer to Africa and the equator before turning to a westerly. At 3000 ft the westerly crosses the equator near Gan and passes close to the south of Ceylon.

The northward movement of the equatorial troughs continues; the northern trough now lies from Somalia to Ceylon and the southern one has moved to the north of Diego Garcia, though with little change at its western end.

East-south-easterly winds are strengthening over Zambia, Malawi and southern Tanzania at 5000 ft and 7000 ft (see Appendix III).

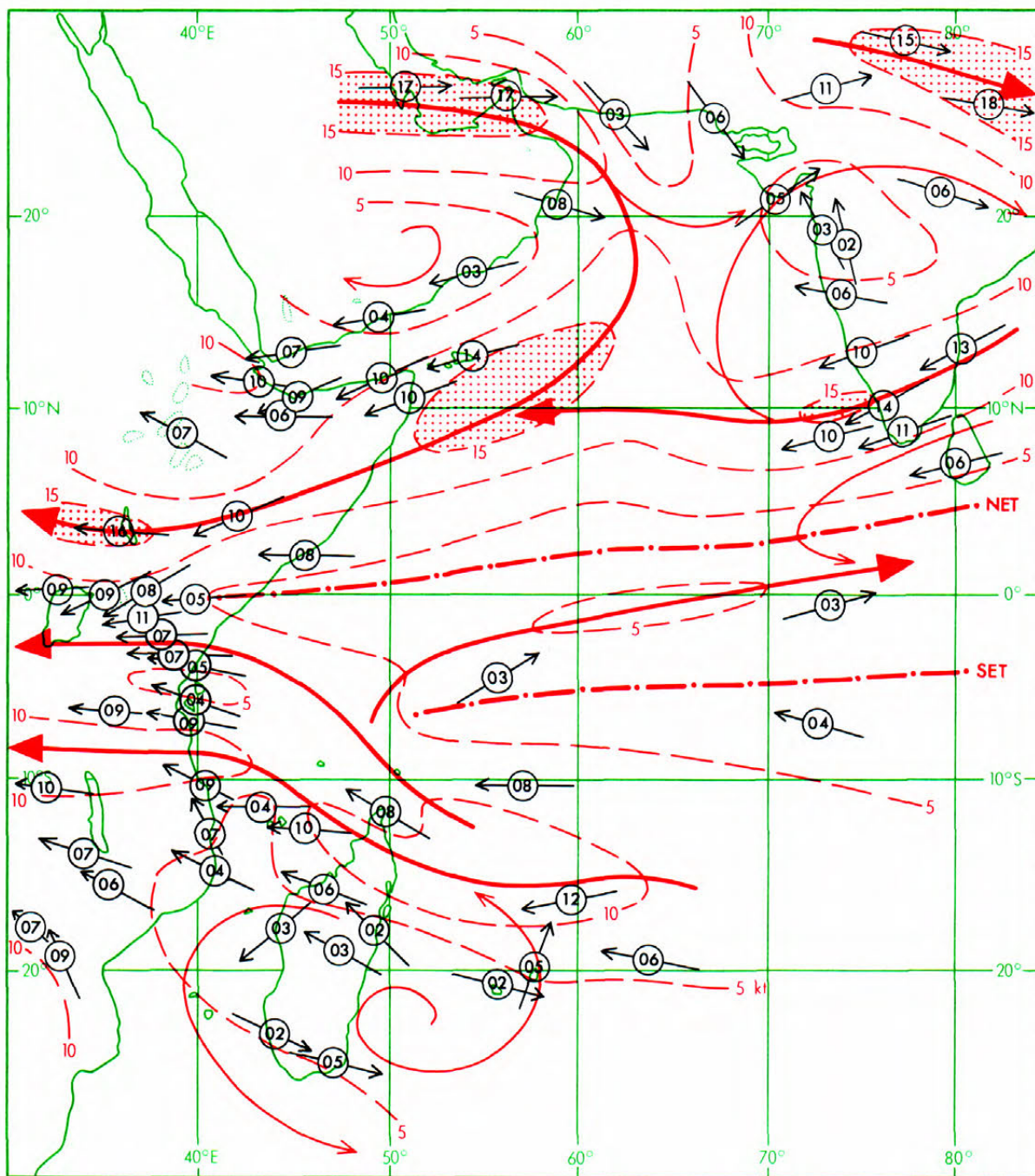


FIGURE 8(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – APRIL

May. (Figures 9(a) and (b).) – A light northerly flow persists over parts of India and Arabia at some levels but winds are very light and significant circulations are absent.

In the southern hemisphere and the equatorial zone marked changes are taking place; the narrow stream of strong winds has become well organized and the core well defined. The core now extends from the ocean area east of Madagascar, past the tip of the island to penetrate over the relatively flat eastern plains of Kenya and Somalia. To the west the flow is blocked by high ground in the interior of Africa, leading to marked (mean) horizontal shear on the western side of the current. To the east of the core, horizontal shear is less marked but is still appreciable. The stream recurves over eastern Africa, following closely the contours of high ground, to become a westerly flowing across the Indian Ocean past the southern tip of India and Ceylon.

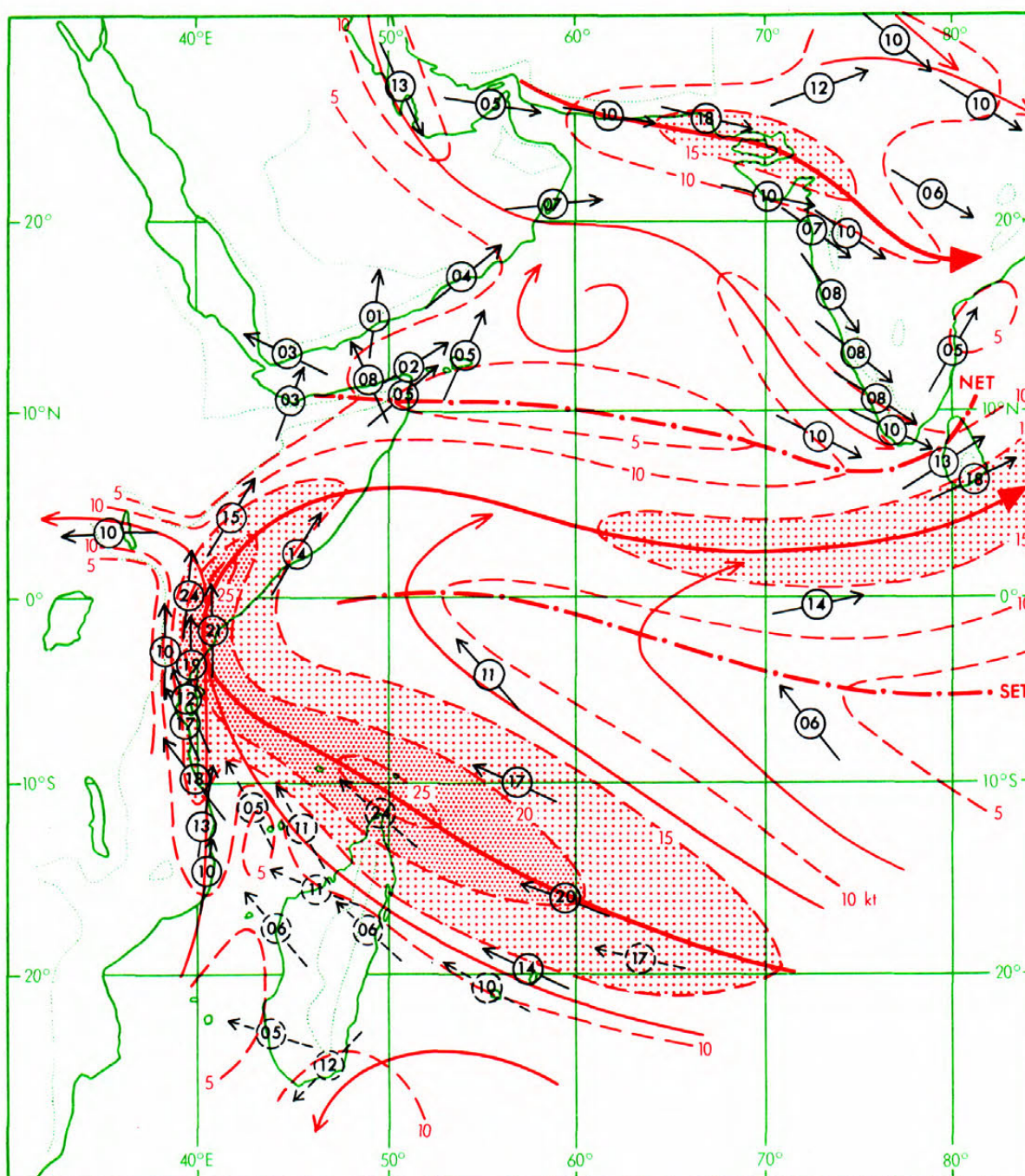


FIGURE 9(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – MAY

As the westerly stream across the Indian Ocean strengthens and broadens, the two equatorial troughs which contain it separate, the northernmost trough moving quicker to the north than the southern one. The zones of minimum wind with which these troughs are identified are becoming more marked, especially in the south where the light-wind region has become widespread and moved closer to the coast of eastern Africa. These developments intensify the horizontal shear on the eastern side of the main current.

Over Malawi, Zambia and southern Tanzania a steady east-south-easterly flow persists at 5000 and 7000 ft. The constancy* of the wind at these levels is 98–100.¹⁴ This flow, with constancy over 95, persists into August.

* The constancy, q , of the wind is defined as: $q = 100 V_R/V_S$, where V_R = vector mean speed,
 V_S = scalar mean speed.

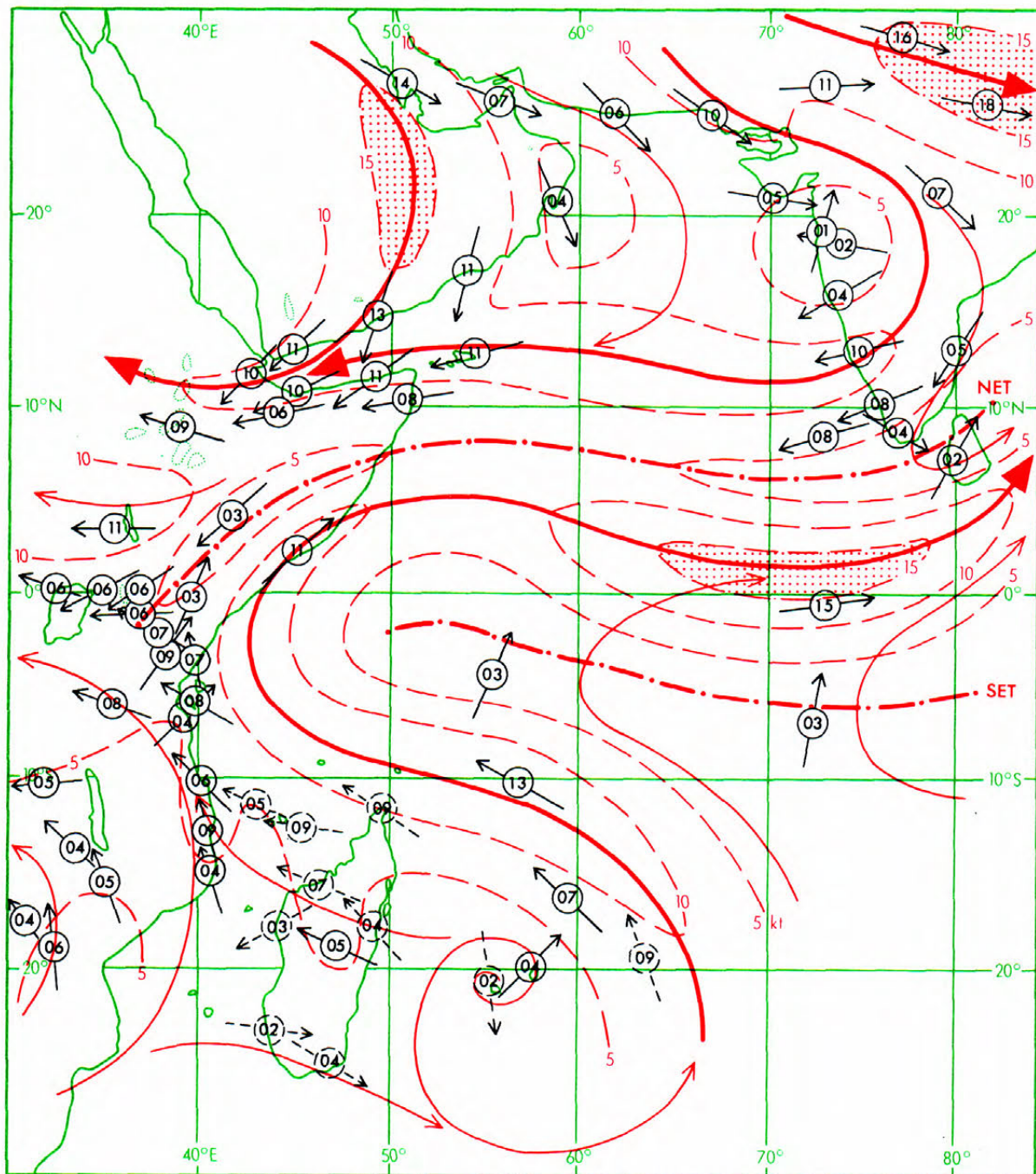


FIGURE 9(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – MAY

June. (Figures 10(a) and (b).) – Over Arabia the flow strengthens to a moderate northerly or north-westerly from Bahrain to Masirah and Salalah and thence into the northern equatorial trough to join the flow of the Indian summer monsoon. The northern equatorial trough has now changed position markedly and lies well to the north of Bombay though it is retarded at 10 000 ft. It is identified by a sharp change of wind direction, and Miller and Keshavamurthy¹⁵ have drawn attention to the formation of mid-tropospheric cyclones in this trough over the Indian coast during this season. Near Aden south-westerly flow is setting in at the lower levels. The southern equatorial trough has moved little but the equatorial light-wind area with which it is associated is now more widespread.

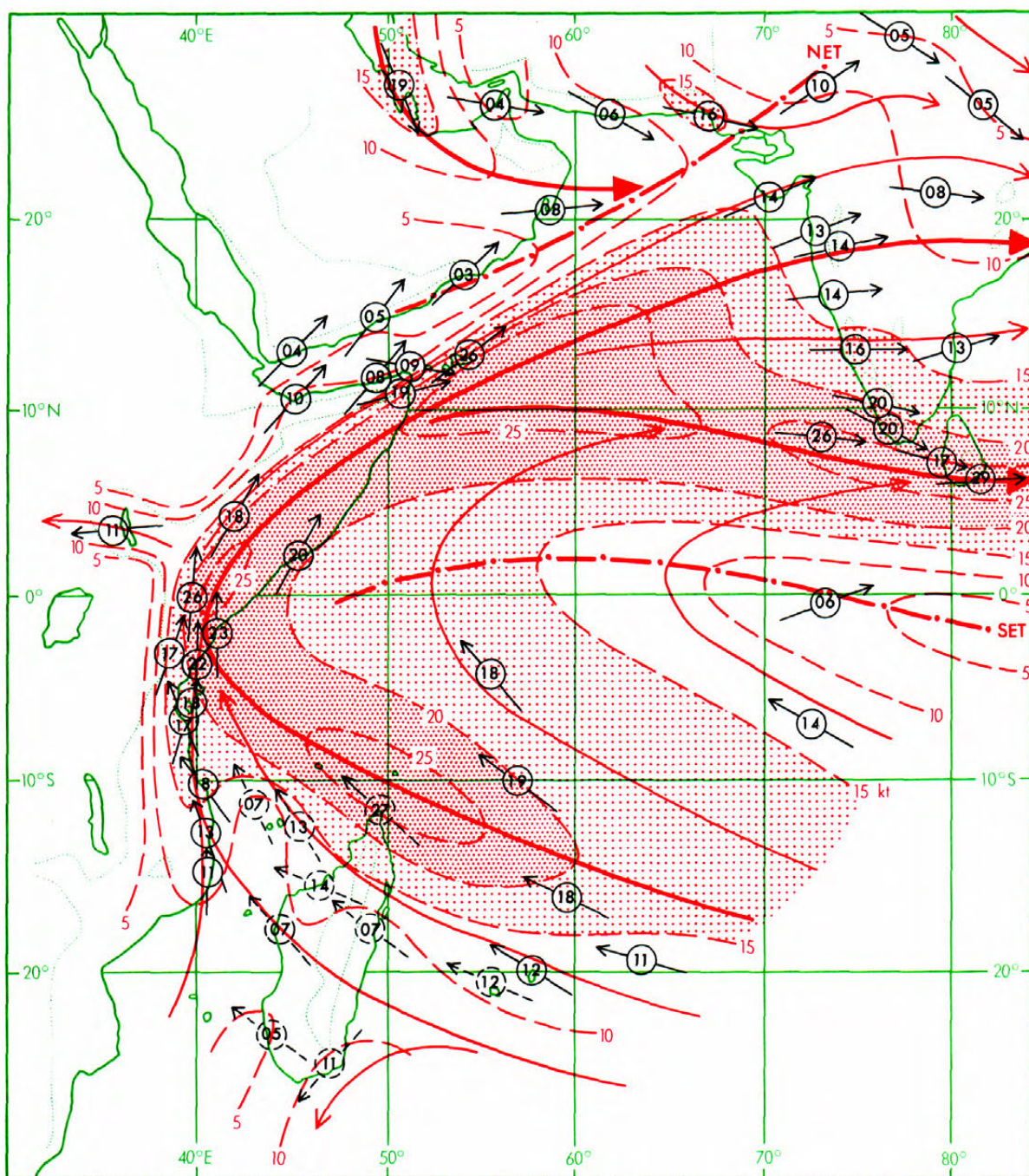


FIGURE 10(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – JUNE

The circulation of the south monsoon now dominates the rest of the area and the core of the stream retains its earlier form but protrudes farther east near India. Horizontal shears are pronounced. The core of the current divides, one branch passing around the southern tip of India and the other approaching the west coast near Vengurla. These two branches may be a true representation of the form of the current or, more probably, may reflect two favoured positions of one major stream.

Over Zambia the steady east-south-easterlies continue at levels below 10 000 ft.

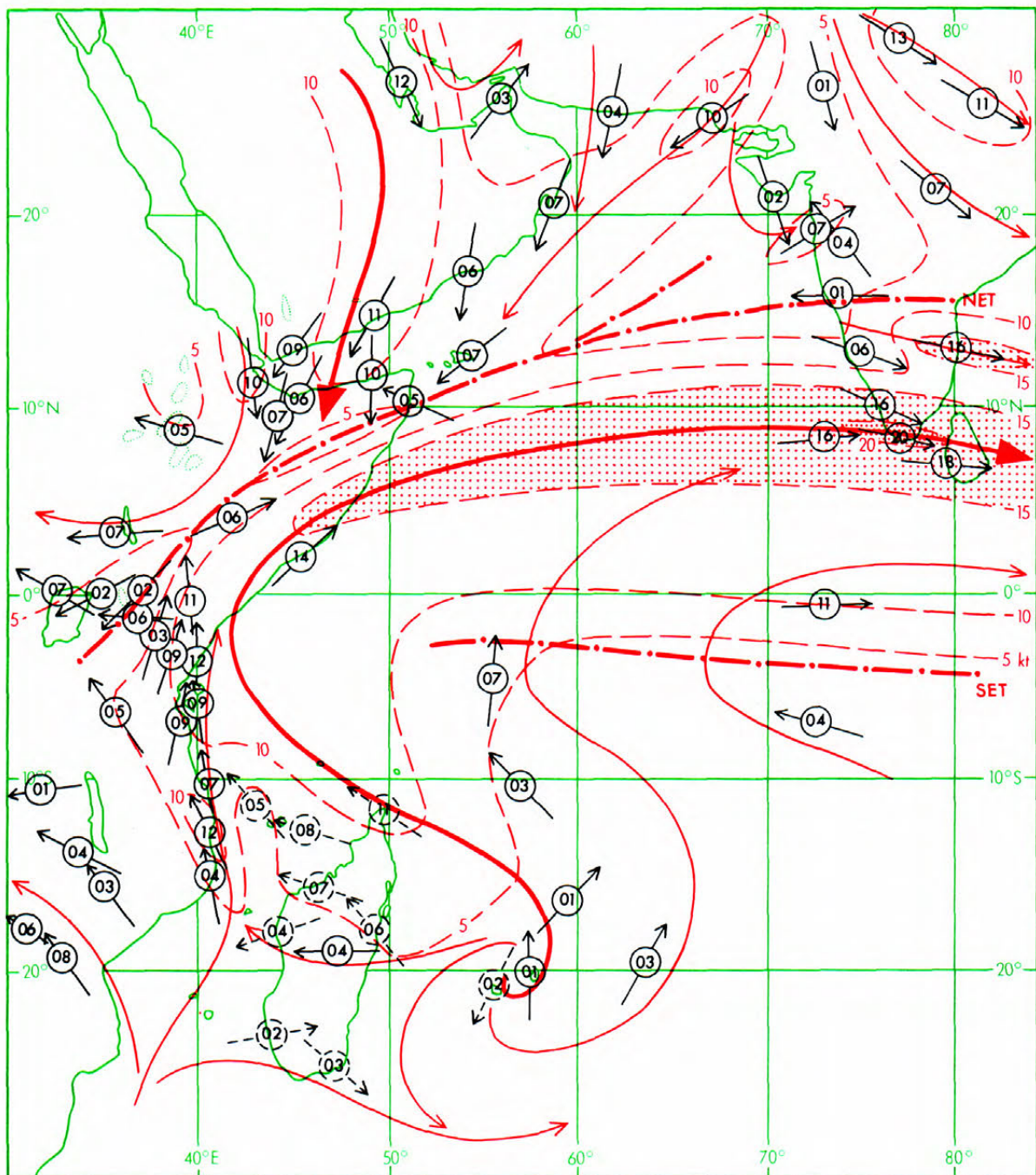


FIGURE 10(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – JUNE

July. (Figures 11(a) and (b).) – The north-westerly stream continues to flow through the Persian Gulf and has a well-defined edge between Bahrain and Sharjah. The light south-westerly winds recorded at Sharjah in this month, and also in August, represent a real and well-known change of wind régime. Westerly winds penetrate from Aden to Salalah at levels up to 7000 ft, but northerly winds persist at 10 000 ft over most of southern Arabia.

The main current of the south monsoon is now attaining its maximum development, and over eastern Kenya it is steady and persistent. At Lamu, for example, the mean wind at 3000 ft is $180^{\circ} 26$ kt with a constancy of 94. The core remains tied close to its original position over the area but it now extends downstream to India. The strongest flow is concentrated in the periphery of the monsoon circulation, being most marked on the western and north-western sides. The horizontal shears at the edges of the strong flow are considerable and can be traced over West

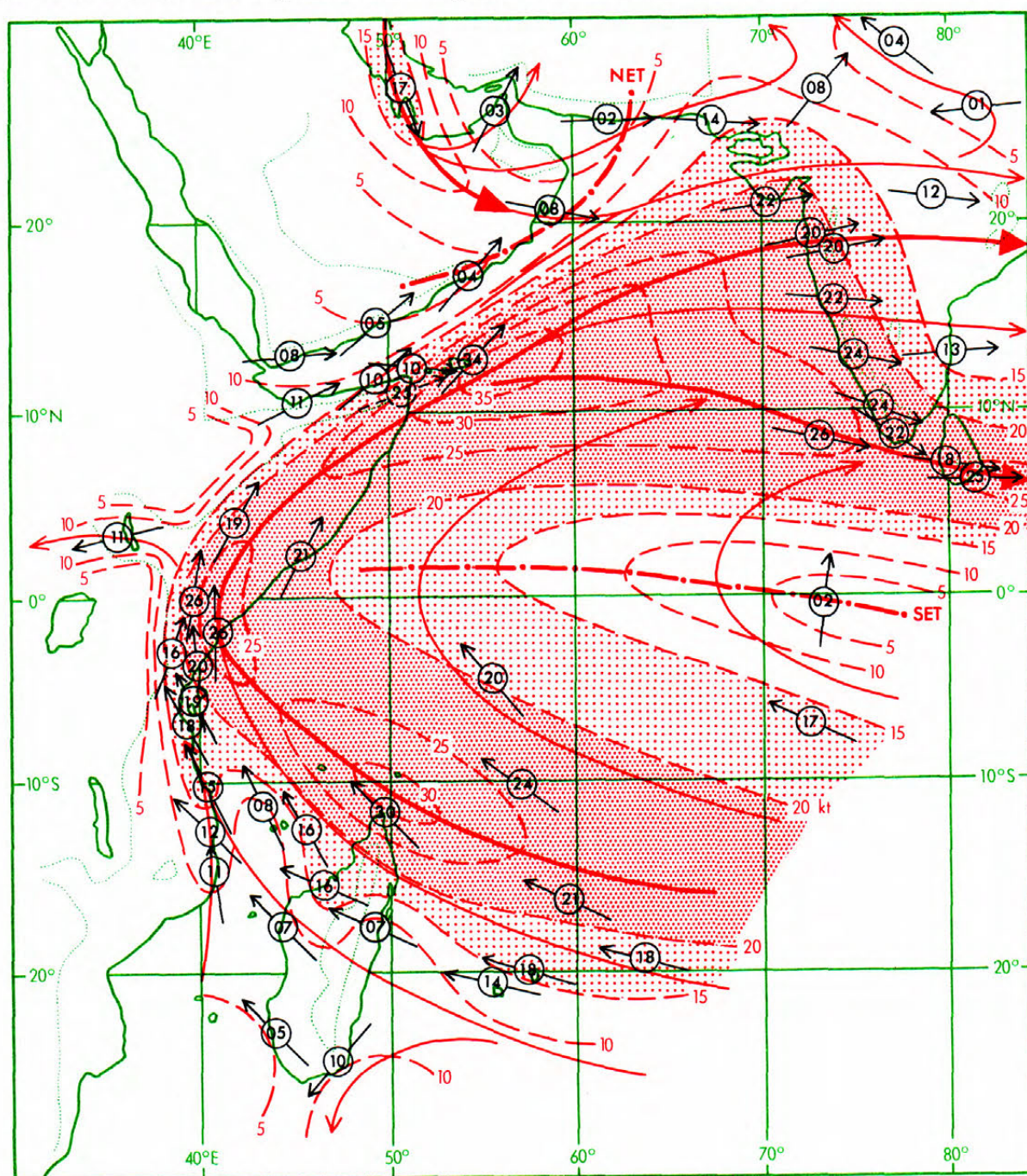


FIGURE 11(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – JULY

Pakistan and India where the edges are noticeable between Karachi and Bombay in the north, and between Minicoy and Gan in the south. Flow near the south of India is from a point slightly north of west.

The level and position at which the greatest mean wind speed has been recorded is at 3000 ft over Socotra. This is close to the level of maximum wind since mean winds computed for the 1500-ft level at Socotra show lower values than at 3000 ft in the months of the northern summer.

The equatorial troughs and their associated light-wind areas now reach their northernmost positions and a light-wind area persists in the vicinity of Gan.

Steady east-south-easterly flow continues at 5000 ft and 7000 ft over Zambia and Tanzania.

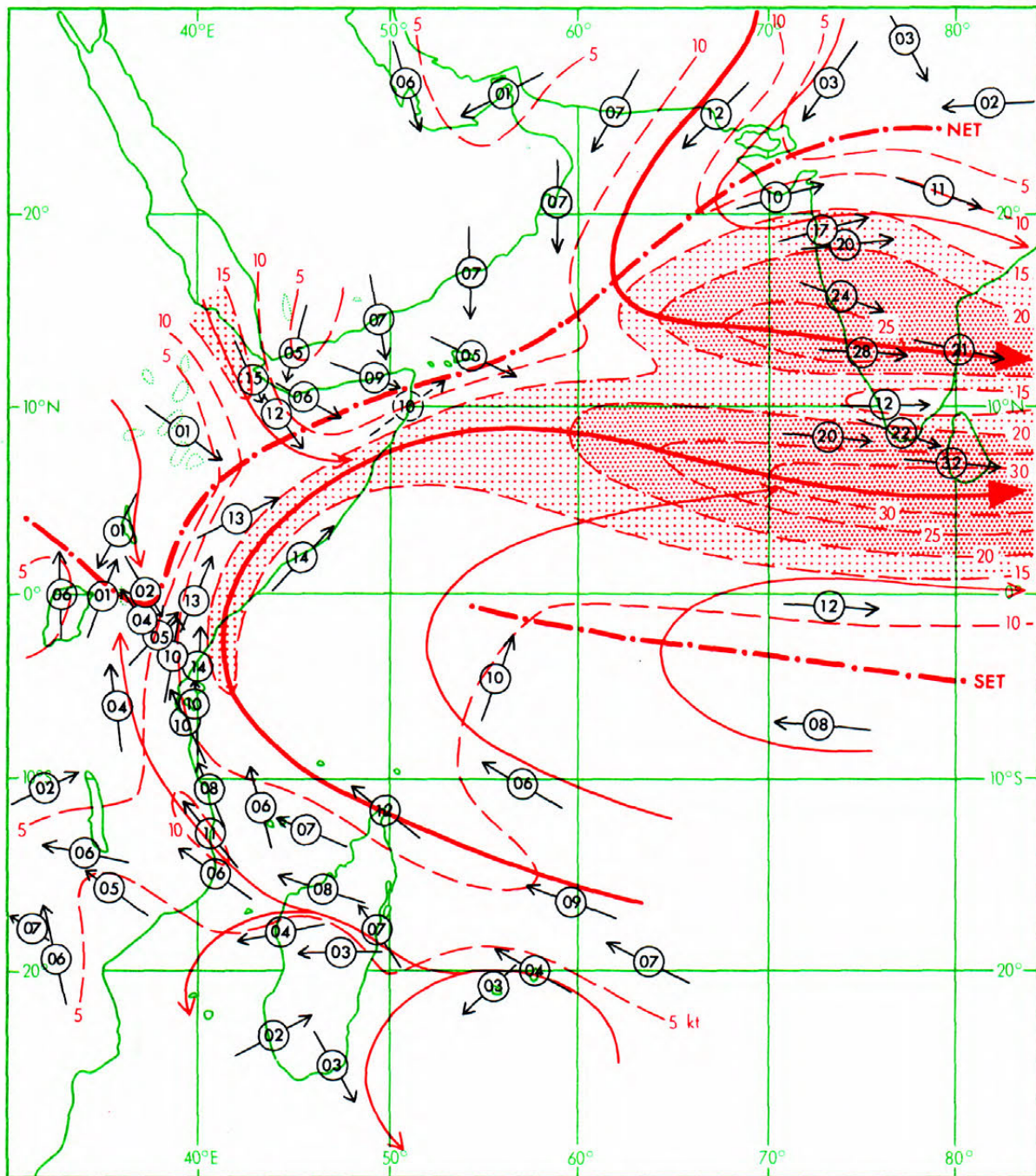


FIGURE 11(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – JULY

August. (Figures 12(a) and (b).) – Over Arabia little change has taken place from the previous month. Winds are generally light and from a northerly point except on the coast between Aden and Salalah where westerlies persist.

In the south monsoon there is again little change although the width of the strong current is decreasing. At Mogadiscio the speeds at all levels are 20 kt or less and the movement of the 20-kt isotach inland from the coast confirms the existence of the core of the stream close to the

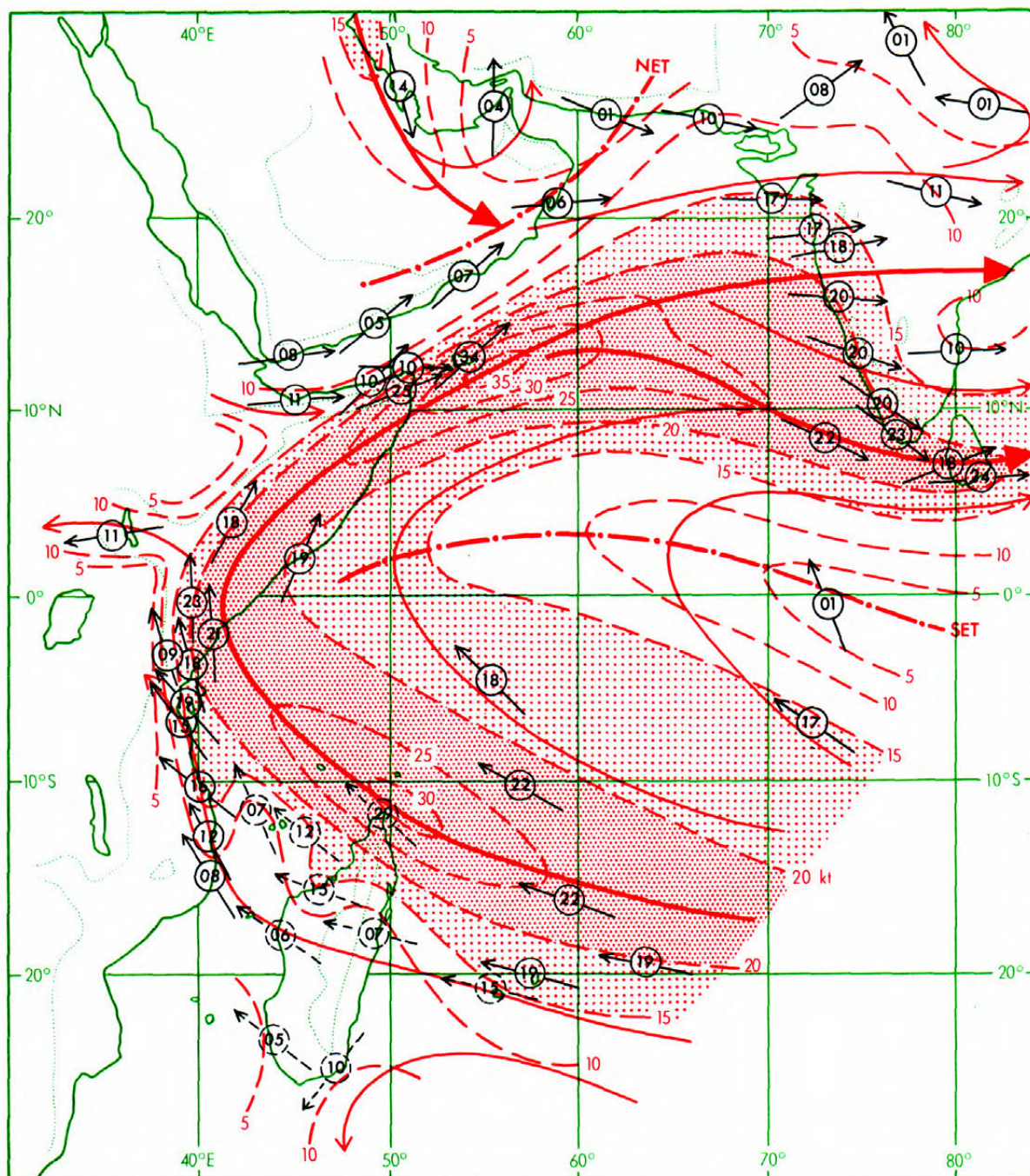


FIGURE 12(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – AUGUST

barrier of hills in Kenya, Ethiopia and Somalia. At levels above 3000 ft the continued veering of the flow near southern India to a north-westerly direction is indicated by the values from mainland stations as well as by those from the islands of Minicoy and Gan.

The equatorial troughs have changed little since July.

Over Zambia and adjoining countries the steady east-south-easterly flow continues at 5000 ft and 7000 ft.

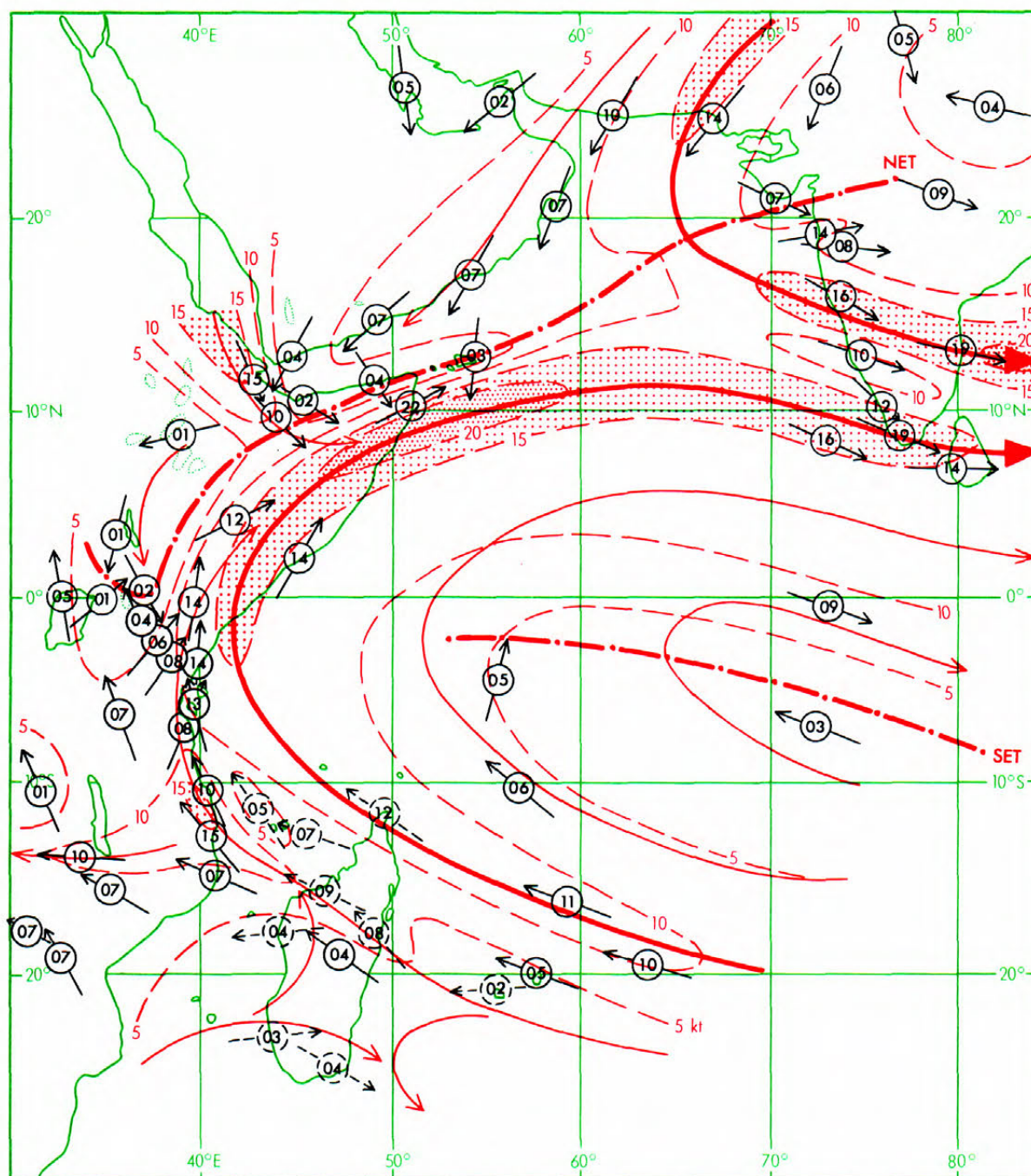


FIGURE 12(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – AUGUST

September. (Figures 13(a) and (b).) – At 7000 ft and 10 000 ft north-easterly winds are developing near Arabia as a manifestation of the north-east monsoon development. Flow at 3000 ft and 5000 ft is relatively unchanged.

The south-monsoon current is largely in its earlier form but the belt of strong winds continues to shrink and as core speeds decrease slightly the main part of the flow turns away from India as a west-north-westerly to pass the southern tip of the peninsula. The west coast is only marginally affected.

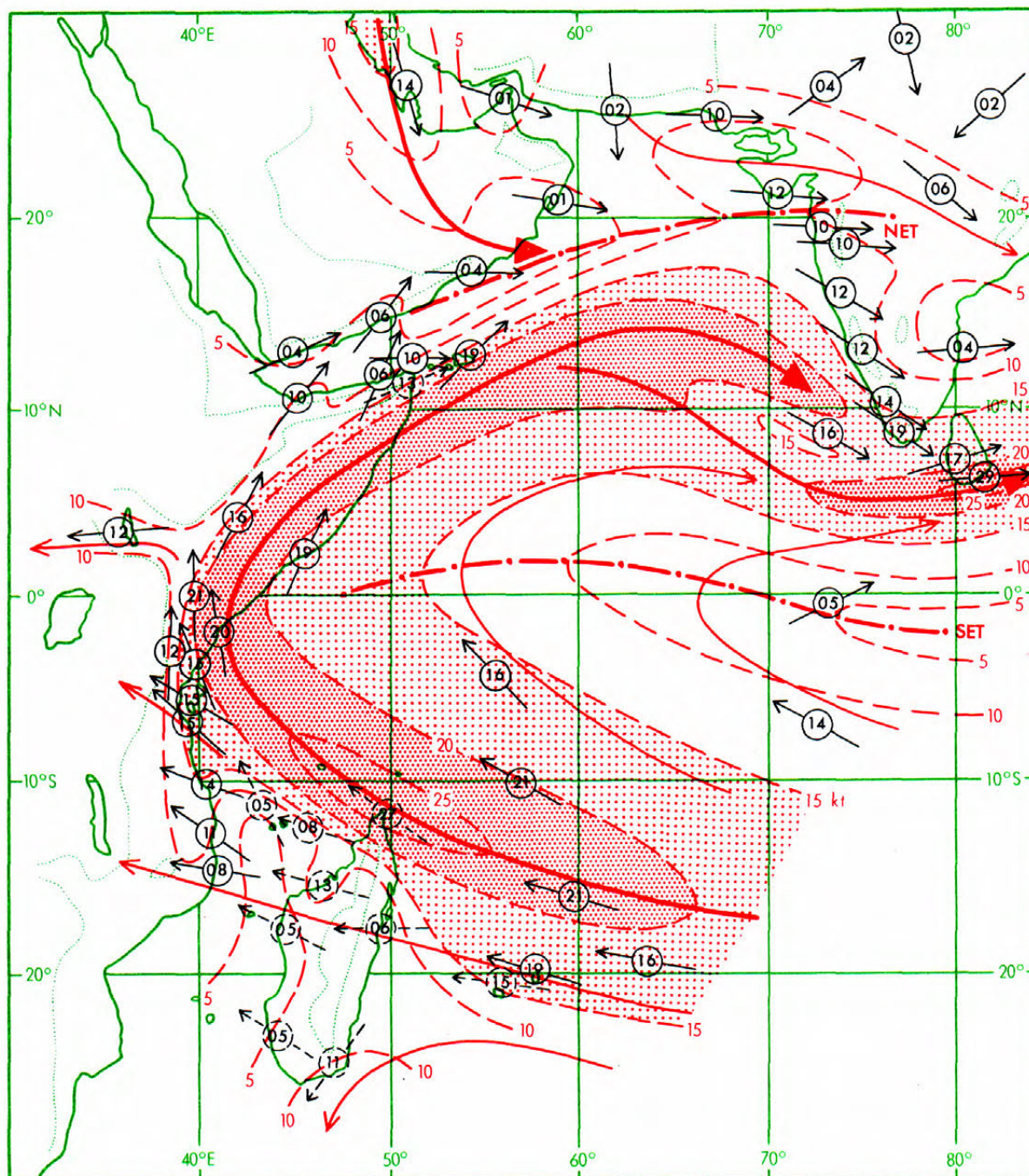


FIGURE 13(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – SEPTEMBER

The equatorial troughs move slightly to the south and the southern light-wind area extends along the equator close to where the maximum cross-equatorial flow is concentrated.

The easterly current over Zambia persists at 5000 ft and 7000 ft. At 10 000 ft an associated flow over central Madagascar has become organized into a narrow stream, subsidiary to the main flow over the northern part of the island. The two streams are separated by a zone of lighter winds.

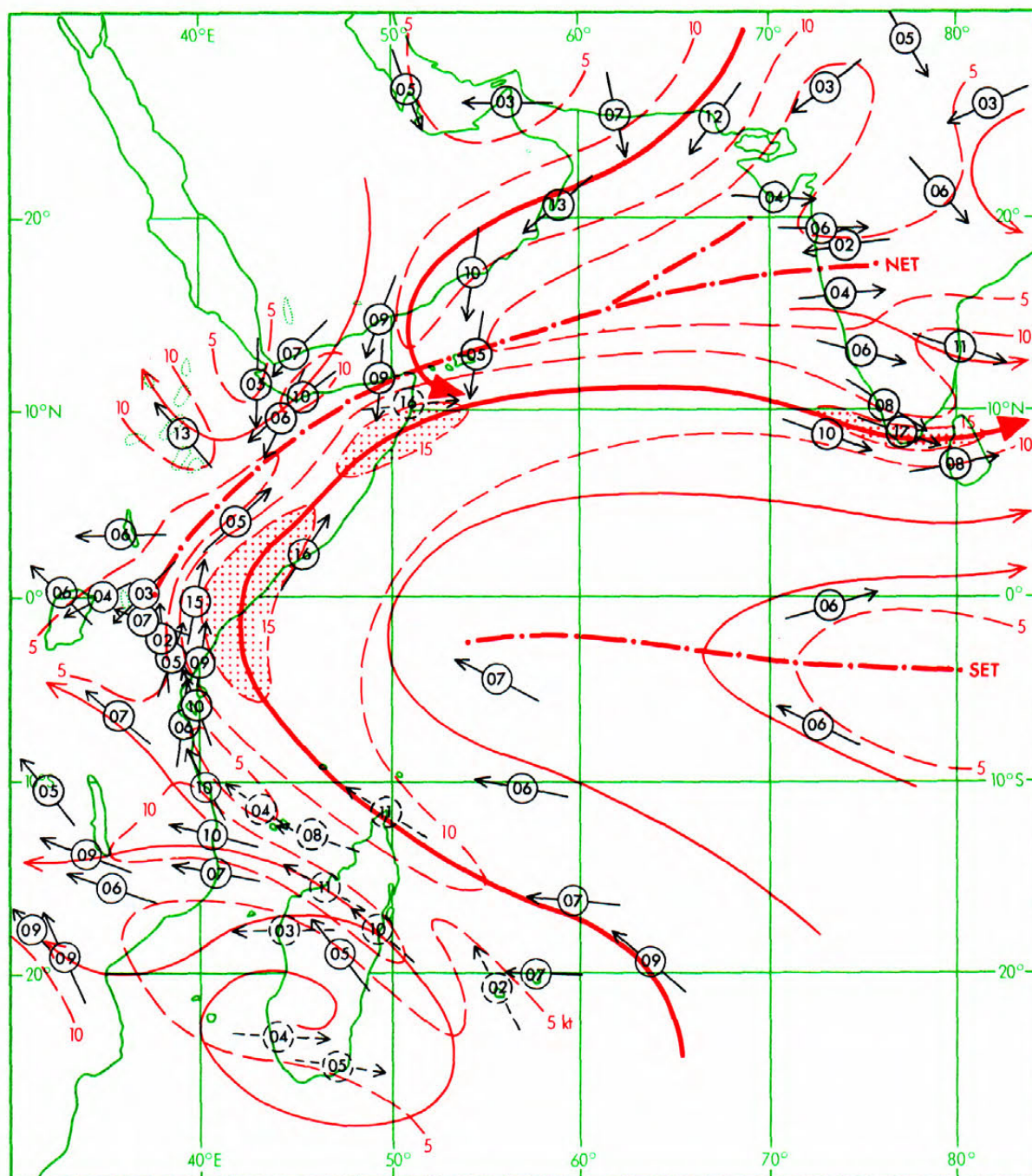


FIGURE 13(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – SEPTEMBER

October. (Figures 14(a) and (b).) – Easterly winds have set in at all levels over the south Arabian coast, and at 7000 ft and 10 000 ft axes of maximum flow are well defined.

The south-monsoon current is still well in evidence in the southern hemisphere but it does not penetrate to more than about 8°N before curving to a westerly flow. The axis of the westerly flow has moved well south of its position in the previous month. In that part of the stream to the south of India wind speeds are not known to be much in excess of 15 kt, a decrease of 10 kt from earlier months. At all parts of the south monsoon current, core speeds are reduced but

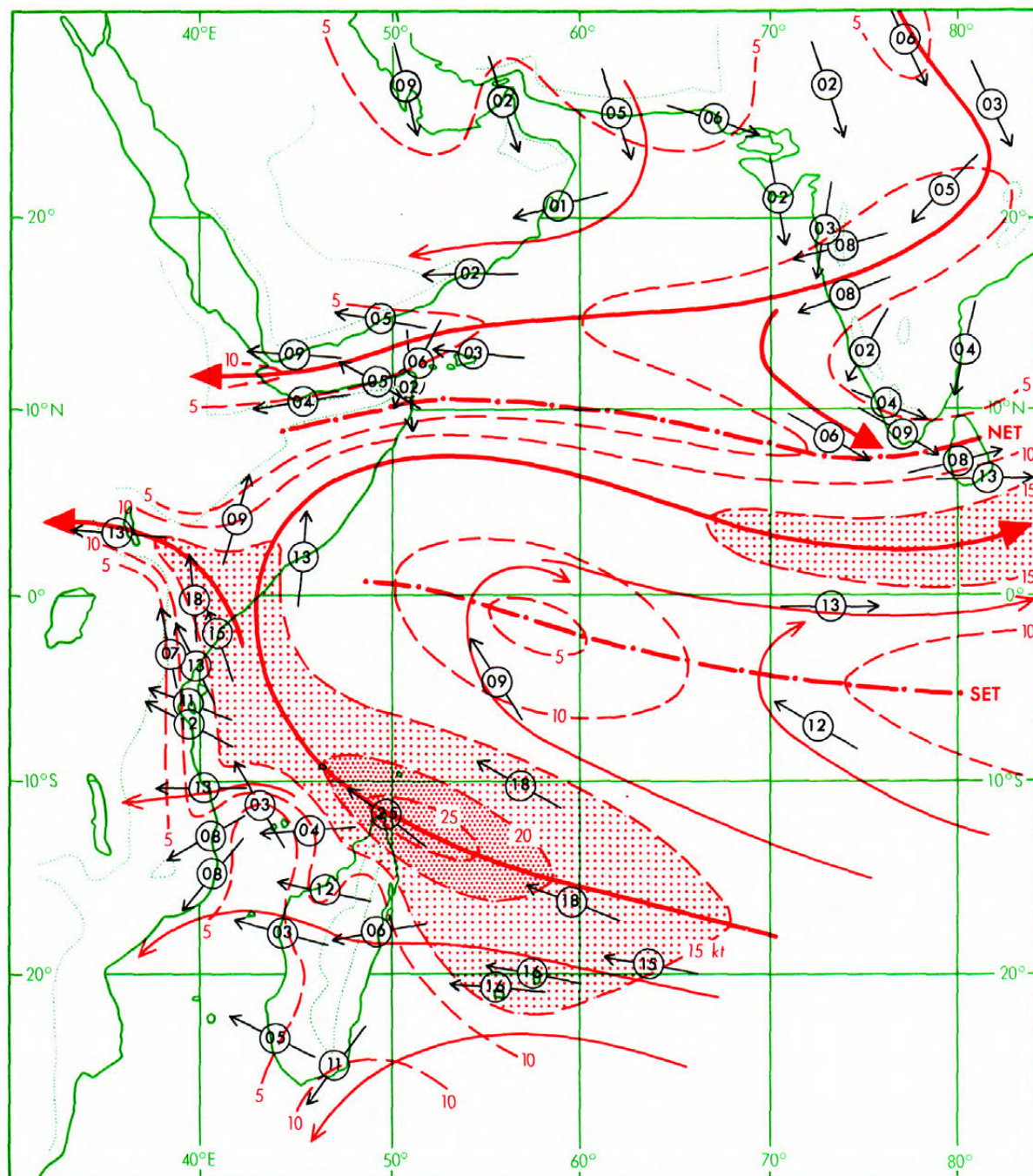


FIGURE 14(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – OCTOBER

the branch which escapes through the gap in the hills over northern Kenya is strengthening again as the northward flow of air is blocked by the advance of the north-east monsoon.

The equatorial troughs are also moving south and the gap between them, containing the weakening westerly flow, is narrowing as the northernmost trough moves equatorward quickly. This trough can be located over Somalia and Ethiopia.

The strong stream over Zambia and Malawi backs to east-north-easterly and is connected to the subsidiary core of strong winds over central Madagascar at 10 000 ft.

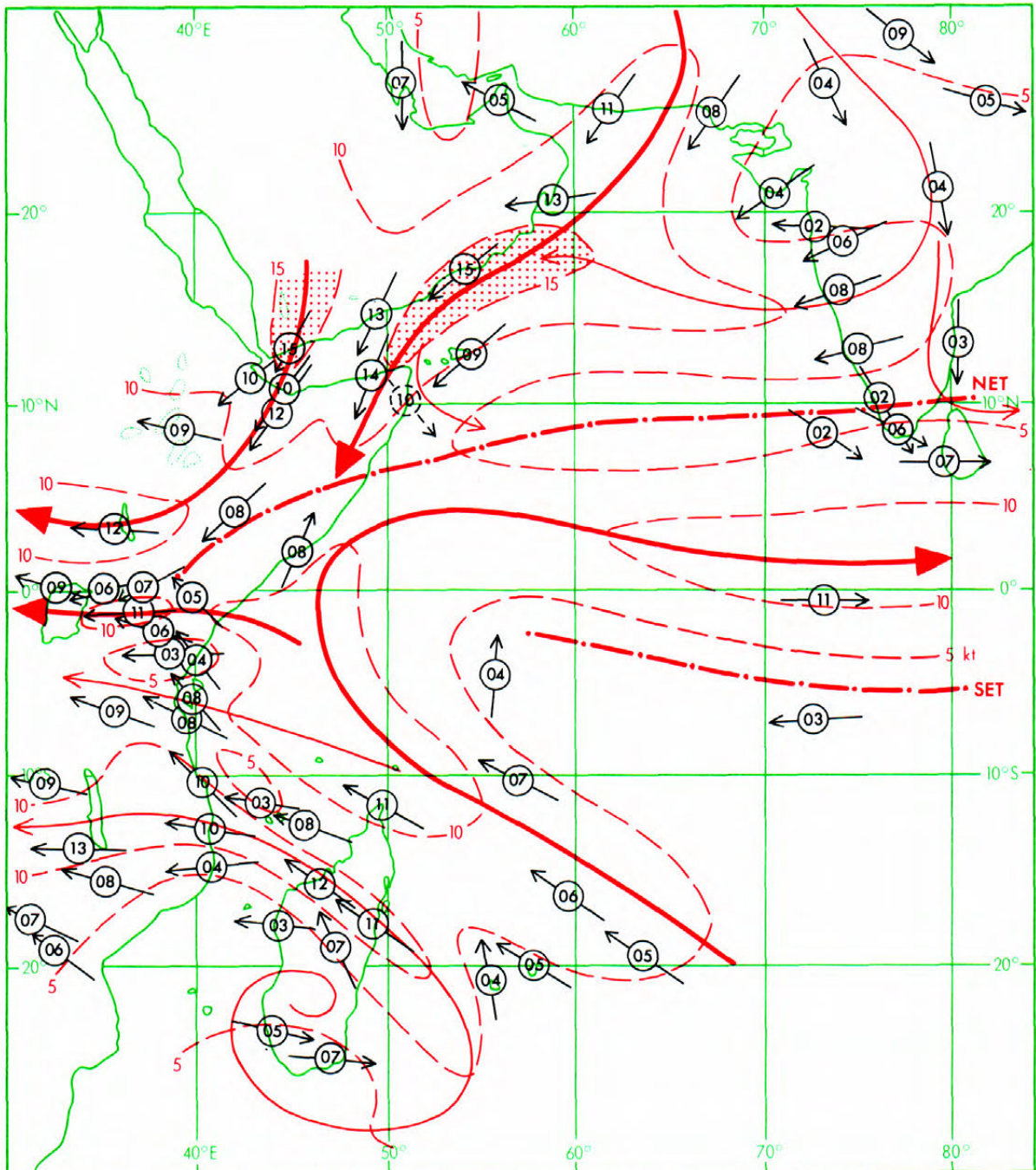


FIGURE 14(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – OCTOBER

November. (Figures 15(a) and (b).) – The north-east monsoon has now become organized into a narrow stream whose core is adequately defined as it curves from a north-easterly to an easterly over Africa.

The south-monsoon current remains a notable feature of the southern hemisphere with its axis, as before, in a nearly constant position over the islands of the southern Indian Ocean. At 3000 ft the current splits into two branches, one passing over Kenya and the other curving near

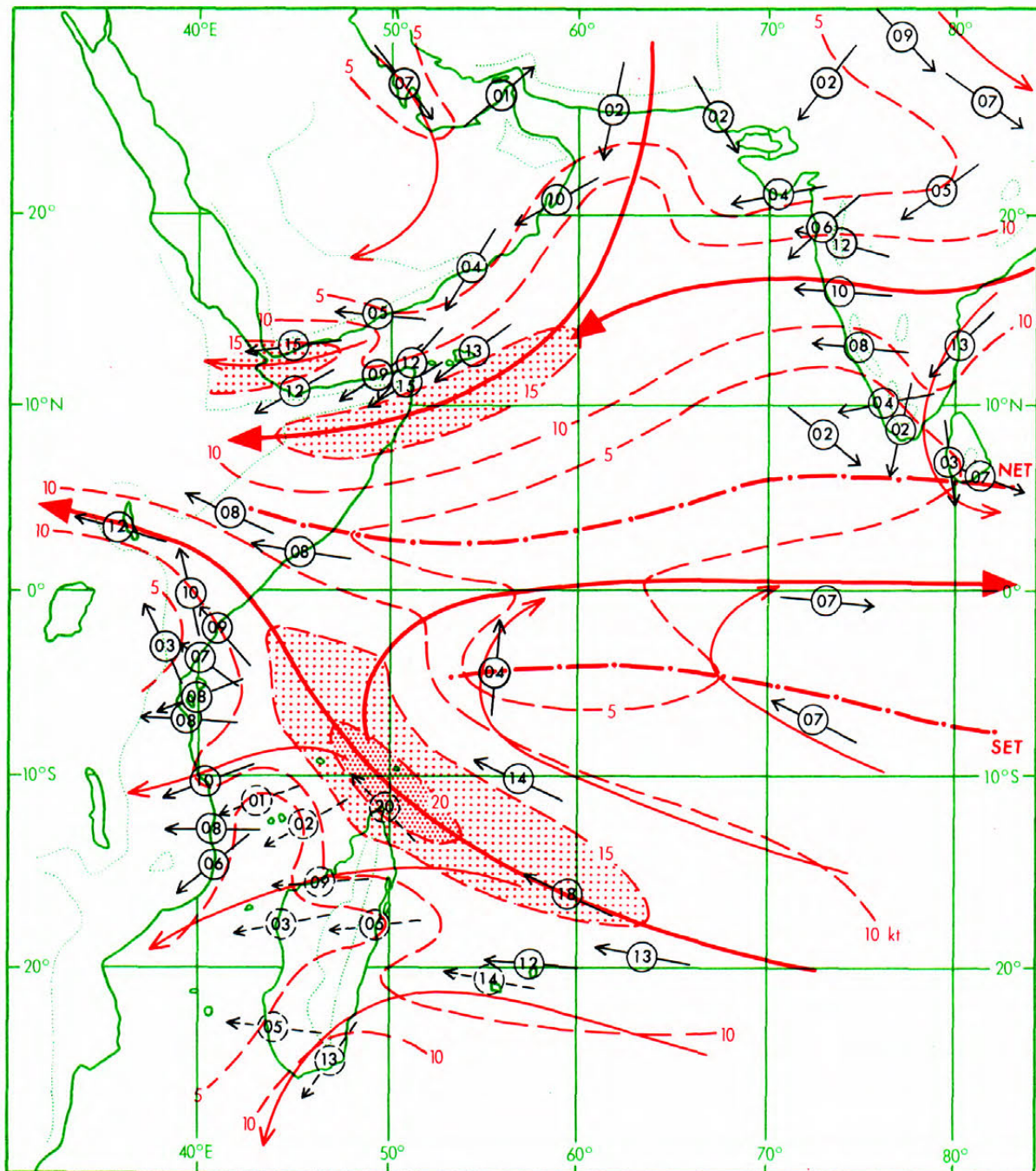


FIGURE 15(a). MEAN MONTHLY AIRFLOW AT 3000 FEET (1 KILOMETRE) – NOVEMBER

the equator to become a westerly stream in which speeds are lighter than those of the previous month.

The equatorial troughs draw closer together and the section of the northernmost one over eastern Africa is indicative of pronounced convergence of air from the two hemispheres.

Subsidiary streams in the southern hemisphere occur over Zambia, Rhodesia and Malawi up to 7000 ft and may also occur over Madagascar.

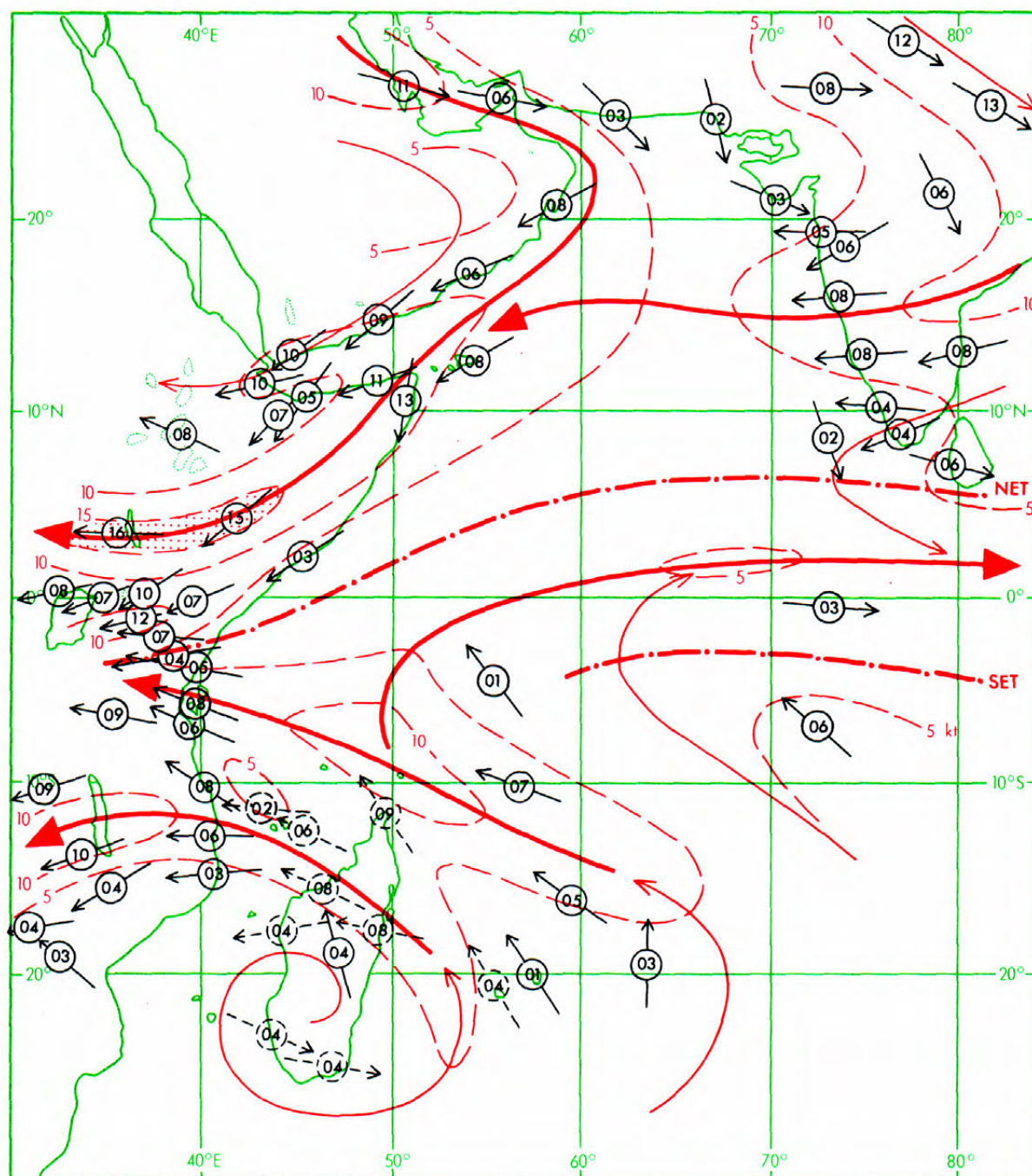


FIGURE 15(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – NOVEMBER

Blocked by the flow from the north, the south-monsoon current splits as it approaches Madagascar and, as before, the main stream curves quickly into a light westerly at about 5°S.

The western part of the northern equatorial trough moves quickly south to the Moçambique Channel as the northerly current develops southwards along the eastern coast of Africa. Elsewhere the equatorial troughs continue to move slowly south.

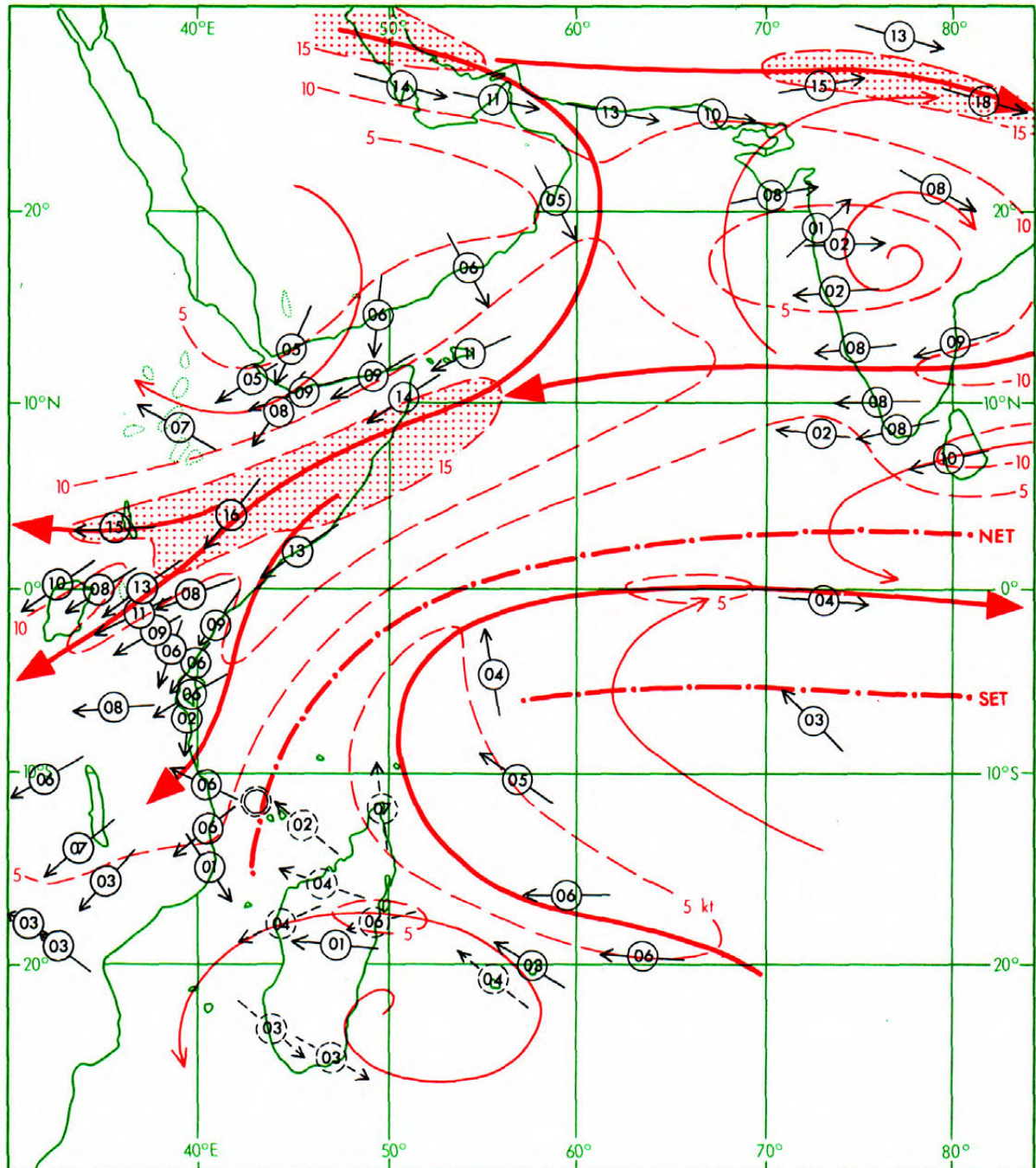


FIGURE 16(b). MEAN MONTHLY AIRFLOW AT 10 000 FEET (3 KILOMETRES) – DECEMBER

ACKNOWLEDGEMENTS

The assistance given by Messrs A.J. Ougham, D. Walton and D. Warner in calculating some of the mean winds required for this analysis is gratefully acknowledged. The author also wishes to thank Messrs J. Crabtree, A.F. Jenkinson, and D.H. Johnson for their critical examination and discussion of this paper, and for the resulting amendments which have been introduced.

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APPENDIX I – LIST OF STATIONS AND SOURCES OF DATA
USED IN THE ANALYSES

Station	Position		Height		Data			Bibliography ref. no.
	Lat.	Long.	above MSL		Years	Hours	Method	
			<i>ft</i>	<i>m</i>				
Addis Ababa	09°00' N	38°44' E	7740	2360	unknown	all	RW	10
Aden	12°49' N	45°02' E	10	3	1959–63	all	RW	16
Agalega	10°33' S	56°45' E	10	3	1964–66	all	P	17
Allahabad	25°27' N	81°44' E	322	98	1953–60	all	RW	18
Bahrain	26°16' N	50°37' E	7	2	1959–63	all	RW	16
Bander Kassim	11°17' N	49°11' E	7	2	1943–45	all	P	16
Berbera	10°27' N	45°01' E	30	9	1931–32	all	P	16
Bombay	19°07' N	72°51' E	46	14	1954–60	all	RW	18
Cape Guardafui	11°44' N	51°15' E	263	80	1930–33	all	P	7
Chileka	15°42' S	35°00' E	2520	769	1946–56	a.m.	P	14
Cochin	09°58' N	76°16' E	13	4	1942–46	all	P	19
Colombo	06°54' N	79°52' E	20	6	1956–60	all	RW	20
Dar-es-Salaam	06°53' S	39°12' E	181	55	{ 1938–43 1960–63	all	Pt RW	21 3
Diego Garcia	07°14' S	72°26' E	7	2	1963–66	all	RW	17
Diego Suarez	12°21' S	49°18' E	344	105	1933–47	all	P	22
Djibouti	11°33' N	43°09' E	42	13	1957–61	all	P	23
Dodoma	06°10' S	35°46' E	3675	1120	1931–43	all	P/Pt	21
Dzaoudzi	12°48' S	45°17' E	23	7	1942–47	all	P	22
Entebbe	00°03' N	32°27' E	3789	1155	1959–63	all	RW	3
Fort Dauphin	25°02' S	46°57' E	26	8	1933–47	all	P	22
Gan	00°41' S	73°09' E	7	2	1959–64	all	RW	16
Garissa	00°29' S	39°38' E	420	128	1962–66	all	P	3
Grand Reef	19°00' S	32°30' E	3341	1020	1948–56	a.m.	P	14
Hambantota	06°07' N	81°08' E	65	20	1956–60	all	P	20
Hargeisa	09°30' N	44°05' E	4350	1326	1944–47	all	P	16
Jiwani	25°10' N	61°47' E	184	56	1943–45	all	P	19
Jodhpur	26°18' N	73°01' E	736	224	1956–60	all	RW	18
Karachi	24°50' N	67°03' E	16	5	1942–46	all	P	19
Kasama	10°12' S	31°06' E	4549	1389	1946–56	a.m.	P	14
Kisumu	00°06' S	34°45' E	3795	1157	1952–63	all	P	3
Lamu	02°16' S	40°54' E	30	9	1939–41	all	P/Pt	21
Lilongwe	14°00' S	33°48' E	3612	1101	1946–56	a.m.	P	14
Lindi	10°00' S	39°42' E	127	39	1937–43	all	Pt	21
Lodwar	03°07' N	35°37' E	1660	506	1952–63	all	P	3
Lumbo	15°02' S	40°40' E	33	10	1961–64	all	P	24

Method of wind measurement: RW, radar- or radio-wind; P, pilot balloon; Pt, pilot balloon with tail.

The source of the data is indicated by the bibliography reference number.

APPENDIX I - *continued*

Station	Position		Height		Data			Bibliography ref. no.
	Lat.	Long.	above MSL		Years	Hours	Method	
			<i>ft</i>	<i>m</i>				
Madras	13°04' N	80°15' E	20	6	1951-60	all	RW	18
Mahé	04°37' S	55°27' E	3	1	{ 1942-43 1963-64	{ all a.m.	{ P RW	{ 21 8
Maintirano	18°03' S	44°02' E	82	25	1935-47	all	P	22
Majunga	15°40' S	46°21' E	72	22	1933-47	all	P	22
Makindu	02°17' S	37°50' E	3280	1000	1939-43	all	Pt	21
Mandera	03°57' N	41°52' E	1085	331	1953-63	all	P	3
Mangalore	12°52' N	74°51' E	131	40	1942-46	all	P	19
Masirah	20°41' N	58°54' E	53	16	1964-67	all	P	16
Minicoy	08°18' N	73°00' E	7	2	1942-46	all	P	19
Mogadiscio	02°02' N	45°21' E	30	9	{ 1943 1965-67	all	{ Pt P	{ 21 25
Mombasa	04°02' S	39°37' E	186	57	1953-63	all	P	3
Moroni	11°42' S	43°14' E	56	17	1940-43	all	P	22
Nagpur	21°06' N	79°03' E	1085	331	1953-60	all	RW	18
Nairobi	01°18' S	36°45' E	5900	1798	1959-63	all	RW	3
Nanyuki	00°01' N	37°04' E	6389	1946	1952-63	all	P	3
New Delhi	28°34' N	77°07' E	764	233	1950-60	all	RW	18
Poona	18°32' N	73°51' E	1940	591	1942-46	all	P	19
Porto Amelia	12°58' S	40°30' E	164	50	1961-64	all	P	24
Riyan	14°39' N	49°24' E	77	23	1961-63	all	P	16
Rodrigues	19°41' S	63°25' E	194	59	1964-66	all	P	17
Salalah	17°03' N	54°06' E	59	18	1960-62	all	P	16
Salisbury	17°50' S	31°01' E	4831	1472	1946-56	a.m.	P	14
Scusciuban	10°18' N	50°14' E	1127	344	1943-45	all	P	16
Sharjah	25°21' N	55°23' E	7	2	1960-63	all	P	16
Socotra	12°38' N	53°53' E	unknown		1942-45	all	P	16
St Brandon	16°27' S	59°33' E	13	4	1964-66	all	P	17
St Denis	20°53' S	55°31' E	39	12	1944-47	all	P	22
Tamatave	18°07' S	49°24' E	16	5	1933-39	all	P	22
Tananarive	18°54' S	47°32' E	4300	1310	1947 1953-59			
Trivandrum	08°29' N	76°57' E	210	64	1956-60	all	RW	18
Tulear	23°23' S	43°44' E	30	9	1940-47	all	P	22
Vacoas	20°18' S	57°30' E	1393	425	1962-66	all	RW	17
Vengurla	15°52' N	73°38' E	30	9	1942-46	all	P	19
Veraval	20°54' N	70°22' E	26	8	1957-60	all	RW	18
Voi	03°24' S	38°34' E	1837	560	1959-63	all	P	3
Zanzibar	06°15' S	39°13' E	69	21	1931-38	all	P/Pt	21

Method of wind measurement: RW, radar or radio-wind; P, pilot balloon; Pt, pilot balloon with tail.

The source of the data is indicated by the bibliography reference number.

APPENDIX II – DERIVATION OF MEAN WINDS AT SCUSCIUBAN, SOMALIA

Mean upper winds for the island of Socotra have been calculated from data collected in the years 1942–45 and these data have been sufficiently plentiful, because of the high constancy of the winds in the area, to provide relatively smooth profiles of the monthly mean north and east wind components. At Scusciuban, near the north-eastern tip of Somalia, pilot-balloon ascents were made during the years 1943–45 but with lesser regularity than at Socotra, and there were insufficient data to provide mean values for the months of July, September and October. The mean values of the wind components for both stations are plotted in Figure 17, wherein it is shown that linearly interpolated values for July, September and October are in accord with the profiles for Socotra which lies in the same wind régime. Values of the mean monthly winds for the missing months at Scusciuban have been deduced, therefore, from the interpolated components.

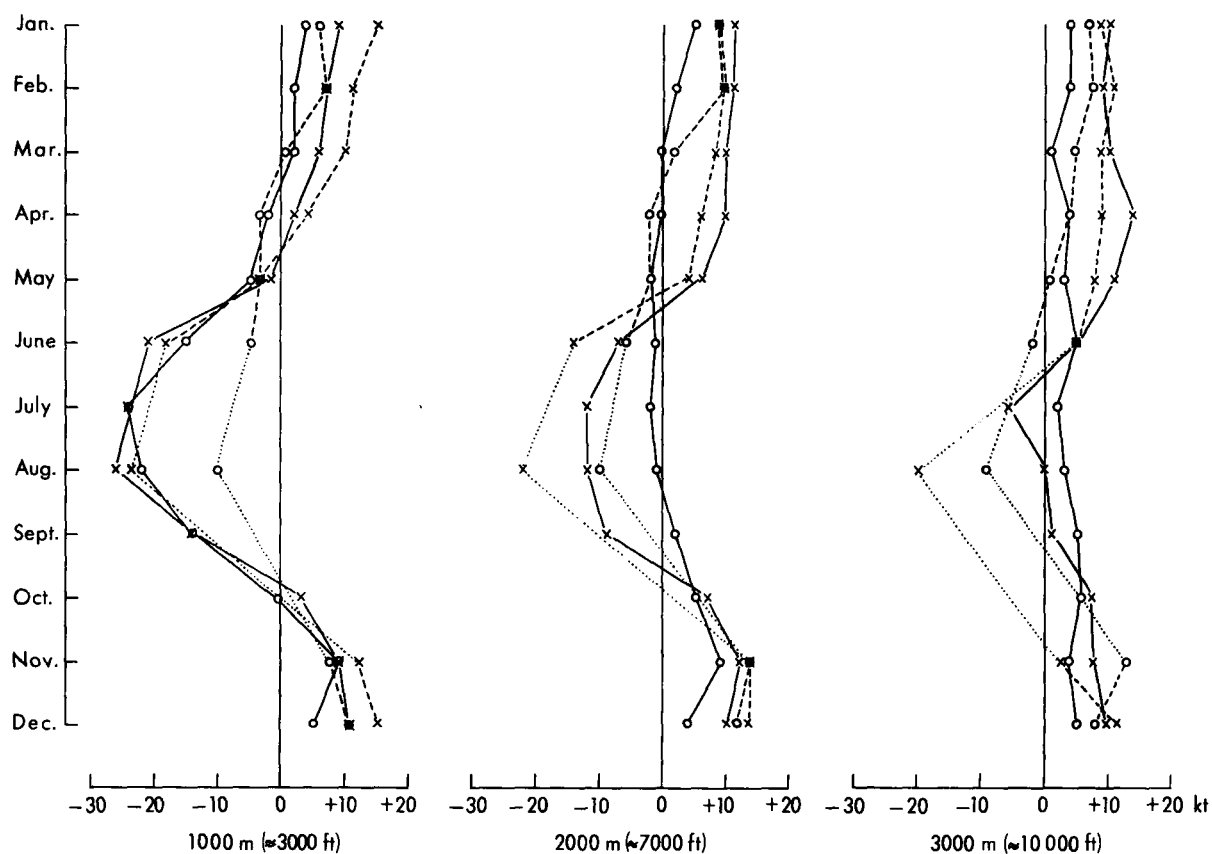


FIGURE 17. PROFILES OF MEAN MONTHLY NORTH AND EAST COMPONENTS OF UPPER WINDS AT SOCOTRA AND SCUSCIUBAN

Socotra: o—o north components x—x east components

Scusciuban: o---o north components x---x east components

..... Interpolated monthly values for Scusciuban in July, September and October.

APPENDIX III – TABLES OF MEAN MONTHLY UPPER WINDS

ADDIS ABABA Ethiopia					ADEN South Arabia				
Period unknown, but not less than 3 years Reference: Extracted from Ref. 10					Based on data from the years 1959–63 Reference: Computed from monthly summaries, Ref. 16				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	–	–	–	127/06	Jan.	075/12	065/10	055/08	035/06
Feb.	–	–	–	126/08	Feb.	075/12	075/10	075/07	070/06
Mar.	–	–	–	129/08	Mar.	080/11	080/08	095/05	070/06
Apr.	–	–	–	117/07	Apr.	085/11	095/08	110/07	080/07
May	–	–	–	107/09	May	115/03	110/02	085/03	050/11
June	–	–	–	106/05	June	225/04	240/02	315/01	040/09
July	–	–	–	306/01	July	265/08	280/08	295/07	015/05
Aug.	–	–	–	075/01	Aug.	260/08	280/08	290/07	030/04
Sept.	–	–	–	138/13	Sept.	245/04	265/03	290/01	045/07
Oct.	–	–	–	104/09	Oct.	095/09	080/09	055/10	030/15
Nov.	–	–	–	114/08	Nov.	085/15	070/14	065/14	055/10
Dec.	–	–	–	122/07	Dec.	080/12	065/11	060/09	025/05

AGALEGA ISLAND					ALLAHABAD India				
Based on data from the years 1964–66 Reference: Computed from monthly values, Ref. 17					Based on data from the years 1953–60 Reference: Extracted from Ref. 18				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	125/04	130/05	125/04	105/02	Jan.	284/06	275/11	275/16	273/21
Feb.	215/06	210/06	200/06	200/05	Feb.	293/10	287/14	283/18	282/24
Mar.	130/03	140/04	155/03	145/02	Mar.	294/10	282/12	280/15	280/20
Apr.	095/10	095/09	095/08	090/08	Apr.	298/12	290/14	284/16	280/18
May	115/17	115/13	115/12	115/13	May	303/10	294/12	286/15	281/18
June	125/19	125/14	135/10	135/03	June	307/05	302/06	295/08	299/11
July	125/24	125/19	125/11	120/06	July	083/01	105/01	120/01	086/02
Aug.	120/22	120/17	115/11	130/06	Aug.	099/01	120/02	115/02	102/04
Sept.	120/21	115/17	110/10	100/06	Sept.	048/02	035/01	039/01	066/03
Oct.	120/18	120/15	115/11	115/07	Oct.	333/03	302/03	296/04	286/05
Nov.	115/14	110/11	115/09	110/07	Nov.	304/07	305/09	307/11	300/13
Dec.	130/08	125/07	145/06	125/05	Dec.	298/08	293/11	292/14	287/18

BAHRAIN ISLAND Persian Gulf					BANDER KASSIM Somalia				
Based on data from the years 1959–63 Reference: Computed from monthly summaries, Ref. 16					Based on data from the years 1943–45 Reference: Computed from frequency tables, Ref. 16				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	295/06	285/08	280/10	275/18	Jan.	060/06	(060/09)	060/13	055/12
Feb.	290/08	290/11	270/14	265/22	Feb.	075/05	(065/08)	060/10	060/11
Mar.	295/08	280/12	270/16	265/24	Mar.	145/06	(110/06)	080/07	070/08
Apr.	300/05	280/08	275/12	270/17	Apr.	145/06	(115/04)	065/04	065/10
May	335/13	325/12	315/13	300/14	May	155/08	(135/04)	075/03	055/11
June	340/19	340/19	335/17	335/12	June	225/08	(255/08)	280/09	360/10
July	340/17	335/17	330/14	345/06	July	230/10	(260/12)	270/16	290/09
Aug.	345/14	340/14	340/12	355/05	Aug.	225/10	(250/11)	265/14	330/04
Sept.	345/14	340/13	335/10	340/05	Sept.	205/06	(245/06)	270/08	005/09
Oct.	345/09	345/08	350/07	360/07	Oct.	120/05	(070/07)	050/12	020/14
Nov.	320/07	310/07	300/08	285/11	Nov.	055/09	(050/13)	040/17	070/11
Dec.	315/06	300/07	290/09	285/14	Dec.	055/11	(050/11)	045/12	060/09

Values in brackets have been interpolated between levels

APPENDIX III - continued

BERBERA Somalia					BOMBAY India				
Based on data from the years 1931-32 Reference: Computed from daily values, Ref. 16					Based on data from the years 1954-60 Reference: Extracted from Ref. 18				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	070/06	070/08	060/10	080/13	Jan.	302/02	180/04	185/06	242/06
Feb.	085/07	100/04	075/08	040/10	Feb.	318/05	257/01	212/03	230/05
Mar.	135/06	125/06	130/02	040/04	Mar.	322/07	315/04	254/02	206/05
Apr.	115/07	095/08	090/07	065/09	Apr.	325/08	340/05	337/02	152/03
May	200/03	140/03	080/06	065/10	May	305/07	325/06	333/04	194/01
June	225/10	235/07	245/02	030/06	June	250/13	243/13	240/10	240/07
July	245/11	255/11	265/12	300/06	July	257/20	255/20	257/19	257/17
Aug.	265/11	255/13	260/11	310/02	Aug.	262/17	261/18	258/16	262/14
Sept.	220/10	230/08	010/02	050/10	Sept.	275/10	268/08	272/07	271/06
Oct.	080/04	065/09	050/11	035/10	Oct.	007/03	069/03	082/04	092/02
Nov.	075/11	060/15	035/09	035/05	Nov.	048/06	080/08	087/09	090/05
Dec.	060/12	050/15	060/11	070/09	Dec.	038/02	096/04	114/05	230/01

CAPE GUARDAFUI Somalia					CHILEKA Malawi				
Based on data from the years 1930-33 Reference: Computed from daily values, Ref. 7					Based on data from the years 1946-56 Reference: Extracted from Ref. 14				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	060/08	-	-	-	Jan.	-	071/04	075/02	184/02
Feb.	085/07	-	-	-	Feb.	-	070/04	076/02	114/01
Mar.	105/08	-	-	-	Mar.	-	083/05	105/05	131/03
Apr.	150/03	-	-	-	Apr.	-	101/07	103/06	117/06
May	240/02	-	-	-	May	-	128/08	132/07	160/05
June	280/09	-	-	-	June	-	138/08	141/06	143/03
July	280/10	-	-	-	July	-	119/07	123/06	124/05
Aug.	270/10	-	-	-	Aug.	-	102/07	096/06	120/07
Sept.	270/10	-	-	-	Sept.	-	068/11	064/10	109/06
Oct.	030/06	-	-	-	Oct.	-	053/15	054/17	103/08
Nov.	040/12	-	-	-	Nov.	-	050/12	043/14	060/04
Dec.	035/12	-	-	-	Dec.	-	050/09	042/08	041/03

COCHIN India					COLOMBO Ceylon				
Based on data from the years 1942-46 Reference: Computed from monthly values, Ref. 19					Based on data from the years 1956-60 Reference: Extracted from Ref. 20				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	030/02	060/04	080/06	070/04	Jan.	045/08	050/05	(060/06)	075/07
Feb.	050/04	070/08	060/10	070/08	Feb.	Calm	035/06	(060/08)	080/11
Mar.	360/02	055/04	060/12	060/16	Mar.	230/02	045/03	(050/04)	055/05
Apr.	320/06	330/04	025/06	060/14	Apr.	225/05	205/04	(Calm)	075/06
May	305/08	295/08	330/04	065/08	May	235/13	240/12	(225/07)	210/02
June	280/20	280/22	280/20	295/16	June	290/17	260/14	(270/16)	275/18
July	290/24	295/26	295/24	270/12	July	280/18	275/23	(275/28)	275/32
Aug.	305/20	305/20	305/22	315/12	Aug.	250/18	275/21	(275/18)	270/14
Sept.	305/14	300/16	295/12	305/08	Sept.	255/17	265/20	(260/14)	260/08
Oct.	290/04	275/02	355/02	330/02	Oct.	255/08	265/06	(270/06)	270/07
Nov.	080/04	075/04	075/04	095/04	Nov.	350/03	045/04	(Calm)	285/06
Dec.	050/04	070/04	085/04	090/08	Dec.	040/11	040/08	(055/08)	075/10

Values in brackets have been interpolated between levels

APPENDIX III - continued

DAR-ES-SALAAM Tanzania					DAR-ES-SALAAM Tanzania				
Based on data from the years 1960-63 Reference: Extracted from working papers for Ref. 3					Based on data from the years 1938-43 Reference: Computed from frequency tables, Ref. 21				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	-	004/09	(355/07)	341/05	Jan.	350/12	-	-	-
Feb.	-	346/08	(340/06)	325/04	Feb.	024/08	-	-	-
Mar.	-	121/01	(060/02)	040/04	Mar.	050/04	-	-	-
Apr.	-	140/09	(120/08)	098/09	Apr.	145/12	-	-	-
May	-	184/15	(190/09)	227/04	May	158/17	-	-	-
June	-	171/15	(180/10)	194/05	June	160/17	-	-	-
July	-	164/17	(165/13)	158/10	July	152/18	-	-	-
Aug.	-	161/16	(170/11)	198/08	Aug.	143/15	-	-	-
Sept.	-	145/15	(160/10)	190/06	Sept.	130/15	-	-	-
Oct.	-	121/11	(120/09)	116/08	Oct.	119/12	-	-	-
Nov.	-	109/07	(110/06)	113/06	Nov.	094/08	-	-	-
Dec.	-	006/08	(004/05)	002/02	Dec.	032/09	-	-	-

DIEGO GARCIA Chagos Archipelago					DIEGO SUAREZ Malagasy Republic				
Based on data from the years 1963-66 Reference: Computed from monthly values, Ref. 17					Based on data from the years 1933-47 Reference: Computed from wind roses, Ref. 22				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	280/05	270/05	260/05	250/02	Jan.	155/08	(163/08)	170/08	205/04
Feb.	285/12	280/12	280/11	270/09	Feb.	(146/12)*	(150/12)*	(155/10)*	(174/05)*
Mar.	275/10	270/11	270/10	260/07	Mar.	(138/16)*	(139/15)*	(140/13)*	(147/06)*
Apr.	105/04	110/03	110/03	105/04	Apr.	130/21	(128/18)	125/15	120/08
May	140/06	145/05	170/03	190/03	May	(132/24)*	(130/21)*	(127/18)*	(122/09)*
June	120/14	115/11	115/09	105/04	June	(133/27)*	(130/24)*	(129/21)*	(124/11)*
July	115/17	103/14	100/10	095/08	July	135/30	(132/27)	130/23	125/12
Aug.	125/17	115/12	105/07	110/03	Aug.	(132/29)*	(129/25)*	(126/21)*	(124/12)*
Sept.	117/14	110/11	115/08	115/06	Sept.	(128/27)*	(125/23)*	(123/19)*	(122/11)*
Oct.	120/12	120/08	140/03	085/03	Oct.	125/25	(122/21)	120/17	120/11
Nov.	115/07	115/06	115/04	130/06	Nov.	(135/20)*	(136/16)*	(137/14)*	(147/09)*
Dec.	250/02	180/01	180/01	135/03	Dec.	(145/14)*	(150/12)*	(152/11)*	(174/07)*

DJIBOUTI French Territory of the Afars and Issa					DODOMA Tanzania				
Based on data from the years 1957-61 Reference: Extracted from Ref. 23					Based on data from the years 1931-43 Reference: Computed from frequency tables, Ref. 21				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	-	105/12	(095/08)	070/05	Jan.	-	-	065/07	035/04
Feb.	-	100/12	(105/09)	115/05	Feb.	-	-	060/07	035/05
Mar.	-	110/12	(120/09)	135/05	Mar.	-	-	075/06	035/04
Apr.	-	120/13	(115/11)	100/10	Apr.	-	-	105/12	095/09
May	-	090/06	(060/07)	045/10	May	-	-	120/11	110/08
June	-	310/08	(335/09)	355/10	June	-	-	120/13	145/05
July	-	305/15	(320/15)	335/15	July	-	-	125/13	175/04
Aug.	-	295/15	(315/15)	335/15	Aug.	-	-	120/15	160/07
Sept.	-	280/07	(315/05)	360/05	Sept.	-	-	110/16	130/07
Oct.	-	095/12	(075/10)	050/10	Oct.	-	-	100/17	110/09
Nov.	-	095/18	(094/14)	075/10	Nov.	-	-	095/16	100/09
Dec.	-	100/13	(090/09)	055/05	Dec.	-	-	080/12	085/08

Values in brackets have been interpolated between levels

Values in brackets and marked * have been interpolated between months

APPENDIX III - continued

DZAOUDZI Comoro Islands					ENTEBBE Uganda				
Based on data from the years 1942-47 Reference: Computed from frequency tables derived from wind roses, Ref. 22					Based on data from the years 1959-63 Reference: Extracted from working papers for Ref. 3				
3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km	
degrees/knots					degrees/knots				
Jan.	295/04	(265/03)	240/04	230/01	Jan.	-	070/02	-	044/11
Feb.	(230/02)*	(175/02)*	(180/03)*	(110/03)*	Feb.	-	173/02	-	047/11
Mar.	(160/05)*	(140/05)*	(130/05)*	(100/06)*	Mar.	-	175/06	-	063/11
Apr.	150/09	(130/08)	115/08	095/10	Apr.	-	173/07	-	089/09
May	(150/11)*	(132/11)*	(118/11)*	(100/09)*	May	-	177/07	-	107/06
June	(150/13)*	(134/14)*	(121/14)*	(105/08)*	June	-	182/08	-	120/07
July	150/16	(137/16)	125/16	110/07	July	-	167/07	-	180/06
Aug.	(129/12)*	(122/13)*	(116/14)*	(110/07)*	Aug.	-	053/03	-	169/05
Sept.	(107/08)*	(107/10)*	(108/12)*	(110/08)*	Sept.	-	038/05	-	133/06
Oct.	085/04	(092/07)	100/10	110/08	Oct.	-	065/04	-	102/09
Nov.	(060/02)*	(090/03)*	(110/05)*	(115/06)*	Nov.	-	066/03	-	083/08
Dec.	(340/02)*	(090/01)*	(160/02)*	(130/02)*	Dec.	-	088/03	-	054/10
FORT DAUPHIN Malagasy Republic					GAN Maldiv Islands				
Based on data from the years 1933-47 Reference: Computed from frequency tables derived from wind roses, Ref. 22					Based on data from the years 1959-64 Reference: Computed from monthly summaries, Ref. 16				
3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km	
degrees/knots					degrees/knots				
Jan.	035/16	(032/11)	030/07	010/02	Jan.	320/05	285/05	275/07	265/06
Feb.	(038/15)*	(032/10)*	(026/06)*	(325/02)*	Feb.	340/06	310/07	295/08	280/07
Mar.	(041/14)*	(032/10)*	(023/06)*	(300/03)*	Mar.	310/04	305/04	295/04	290/03
Apr.	045/13	(032/09)	020/05	285/05	Apr.	255/05	265/05	270/05	255/03
May	(044/12)*	(031/09)*	(020/05)*	(300/04)*	May	260/14	265/16	265/17	265/15
June	(042/11)*	(031/08)*	(020/06)*	(310/03)*	June	250/06	270/10	275/12	270/11
July	040/10	(030/08)	020/06	330/03	July	185/02	275/05	280/09	275/12
Aug.	(039/10)*	(023/08)*	(007/05)*	(300/04)*	Aug.	160/01	305/04	300/08	290/09
Sept.	(037/11)*	(015/07)*	(353/04)*	(280/05)*	Sept.	245/05	270/08	270/09	255/06
Oct.	035/11	(007/07)	340/02	275/07	Oct.	270/13	270/15	265/14	270/11
Nov.	(035/13)*	(015/08)*	(357/04)*	(280/04)*	Nov.	275/07	275/07	275/07	275/03
Dec.	(035/15)*	(023/10)*	(014/06)*	(300/03)*	Dec.	305/06	295/07	285/07	275/04
GARISSA Kenya					GRAND REEF Rhodesia				
Based on data from the years 1962-66 Reference: Extracted from working papers for Ref. 3					Based on data from the years 1948-56 Reference: Extracted from Ref. 14				
3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km	
degrees/knots					degrees/knots				
Jan.	060/06	042/08	032/11	037/14	Jan.	-	063/06	065/04	150/03
Feb.	096/06	077/07	054/08	032/11	Feb.	-	066/07	084/06	125/04
Mar.	136/08	124/08	090/06	063/07	Mar.	-	077/08	109/07	146/08
Apr.	170/14	177/12	139/05	083/05	Apr.	-	073/07	118/05	156/09
May	184/24	190/24	189/15	205/03	May	-	077/05	132/05	175/06
June	184/26	183/28	182/21	172/11	June	-	092/05	142/05	141/08
July	186/26	185/29	187/25	201/13	July	-	084/07	124/06	167/06
Aug.	181/23	181/27	183/22	186/14	Aug.	-	072/07	114/04	148/07
Sept.	184/21	188/25	192/24	193/15	Sept.	-	059/08	089/05	155/09
Oct.	175/18	178/17	168/13	132/05	Oct.	-	064/11	064/09	126/06
Nov.	166/10	167/10	104/06	068/07	Nov.	-	059/10	053/05	131/03
Dec.	113/07	080/06	072/08	070/08	Dec.	-	056/07	055/06	130/03

Values in brackets have been interpolated between levels

APPENDIX III – continued

HAMBANTOTA Ceylon					HARGEISA Somalia				
Based on data from the years 1956–60 Reference: Extracted from Ref. 20					Based on data from the years 1944–47 Reference: Computed from frequency tables, Ref. 16				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	040/17	050/11	–	–	Jan.	–	–	060/09	040/09
Feb.	(050/13)*	055/12	–	–	Feb.	–	–	060/08	045/07
Mar.	060/10	075/10	–	–	Mar.	–	–	115/07	065/05
Apr.	250/07	025/04	–	–	Apr.	–	–	140/09	090/06
May	245/18	245/15	–	–	May	–	–	215/06	080/06
June	265/29	280/17	–	–	June	–	–	255/07	015/07
July	270/25	280/27	–	–	July	–	–	240/22	325/12
Aug.	265/24	270/23	–	–	Aug.	–	–	245/19	315/10
Sept.	265/29	265/28	–	–	Sept.	–	–	230/12	025/06
Oct.	270/13	270/13	–	–	Oct.	–	–	050/10	040/12
Nov.	288/07	320/04	–	–	Nov.	–	–	045/12	045/07
Dec.	040/13	040/09	–	–	Dec.	–	–	035/14	035/08

JIWANI West Pakistan					JODHPUR India				
Based on data from the years 1943–45 Reference: Computed from monthly values, Ref. 19					Based on data from the years 1956–60 Reference: Extracted from Ref. 18				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	290/04	285/07	295/12	295/21	Jan.	344/02	292/03	271/08	268/16
Feb.	280/08	285/09	285/13	290/18	Feb.	294/04	281/05	270/09	270/16
Mar.	280/09	290/10	295/13	300/17	Mar.	264/05	258/06	260/07	260/13
Apr.	285/10	290/09	300/06	315/03	Apr.	256/08	250/08	255/09	257/11
May	280/10	290/11	290/09	315/06	May	250/12	251/13	254/11	268/11
June	300/06	315/07	325/07	010/04	June	237/10	239/10	244/06	342/01
July	270/02	300/03	355/05	030/07	July	223/08	237/06	244/02	034/03
Aug.	290/01	350/04	360/07	030/10	Aug.	235/08	241/05	299/02	020/06
Sept.	355/02	010/04	350/06	350/07	Sept.	235/04	240/03	256/04	051/03
Oct.	340/05	010/05	030/07	035/11	Oct.	339/02	340/03	340/04	334/04
Nov.	010/02	040/02	040/02	315/03	Nov.	035/02	023/02	305/03	273/08
Dec.	340/03	320/04	290/06	280/13	Dec.	010/01	288/02	258/05	262/15

KARACHI West Pakistan					KASAMA Zambia				
Based on data from the years 1942–46 Reference: Computed from monthly values, Ref. 19					Based on data from the years 1946–56 Reference: Extracted from Ref. 14				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	360/06	320/04	310/06	280/16	Jan.	–	355/03	330/03	279/05
Feb.	295/04	285/06	285/08	285/12	Feb.	–	355/03	273/02	287/05
Mar.	305/10	300/08	320/08	295/08	Mar.	–	085/04	101/09	077/03
Apr.	295/14	290/12	300/08	320/06	Apr.	–	088/08	094/17	096/10
May	285/18	290/18	295/16	305/10	May	–	092/09	100/19	084/05
June	280/16	305/08	345/04	055/10	June	–	096/10	105/20	083/01
July	275/14	315/08	350/04	045/12	July	–	090/11	102/19	246/02
Aug.	280/10	360/06	030/12	040/14	Aug.	–	087/11	103/22	155/01
Sept.	275/10	335/06	010/06	035/12	Sept.	–	073/11	094/20	139/05
Oct.	285/06	340/04	350/02	035/08	Oct.	–	058/11	078/17	103/09
Nov.	330/02	355/02	040/02	345/02	Nov.	–	057/05	077/11	074/09
Dec.	020/04	355/02	325/04	280/10	Dec.	–	049/03	077/06	061/06

Values in brackets and marked * have been interpolated between months

APPENDIX III — *continued*

KISUMU Kenya					LAMU Kenya				
Based on data from the years 1952-63 Reference: Extracted from working papers, Ref. 3					Based on data from the years 1939-41 Reference: Computed from frequency tables, Ref. 21				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	—	162/01	041/04	043/08	Jan.	035/11	(010/12)	355/14	340/06
Feb.	—	192/01	039/03	040/09	Feb.	060/09	(030/07)	360/08	360/04
Mar.	—	259/01	059/03	051/10	Mar.	095/08	(045/07)	005/09	030/06
Apr.	—	197/02	080/02	065/09	Apr.	155/12	(135/09)	110/06	—
May	—	162/01	090/01	063/06	May	180/21	—	—	—
June	—	162/01	063/01	062/02	June	180/23	—	—	—
July	—	114/02	090/01	199/01	July	180/26	—	—	—
Aug.	—	111/02	055/01	228/01	Aug.	175/21	—	—	—
Sept.	—	115/02	045/03	062/04	Sept.	170/20	—	—	—
Oct.	—	145/01	072/03	075/06	Oct.	160/15	—	—	—
Nov.	—	128/01	063/05	068/07	Nov.	140/09	—	—	—
Dec.	—	135/01	051/05	056/08	Dec.	055/12	(035/11)	010/11	035/09

LILONGWE Malawi					LINDI Tanzania				
Based on data from the years 1946-56 Reference: Extracted from Ref. 14					Based on data from the years 1937-43 Reference: Computed from frequency tables, Ref. 21				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	—	070/05	042/04	Calm	Jan.	350/11	(335/08)	310/06	285/04
Feb.	—	073/05	054/06	057/01	Feb.	015/07	(360/04)	295/02	320/03
Mar.	—	107/09	086/08	128/02	Mar.	080/04	(120/01)	215/03	205/02
Apr.	—	101/12	087/14	108/07	Apr.	130/14	(125/13)	125/13	115/09
May	—	110/12	097/12	133/04	May	145/18	(145/16)	150/14	135/06
June	—	120/12	101/10	116/04	June	145/18	(155/16)	165/15	170/07
July	—	113/13	091/11	101/06	July	160/15	(160/15)	160/15	160/08
Aug.	—	099/15	083/16	095/10	Aug.	130/16	(140/16)	145/16	155/10
Sept.	—	089/15	074/17	111/09	Sept.	110/14	(120/14)	135/15	150/10
Oct.	—	075/16	067/21	090/13	Oct.	090/13	(110/14)	125/15	135/10
Nov.	—	074/13	061/18	070/10	Nov.	070/10	(095/10)	120/10	125/08
Dec.	—	075/10	055/12	050/07	Dec.	020/09	(050/07)	080/06	115/06

LODWAR Kenya					LUMBO Mozambique				
Based on data from the years 1952-63 Reference: Extracted from working papers, Ref. 3					Based on data from the years 1961-64 Reference: Computed from daily values, Ref. 24				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	113/10	111/16	105/17	087/15	Jan.	005/05	360/03	(360/02)	005/02
Feb.	112/09	110/15	106/16	091/14	Feb.	310/01	280/02	(Calm)	165/01
Mar.	104/09	109/14	105/17	089/17	Mar.	120/02	160/01	(Calm)	035/01
Apr.	098/09	113/12	112/14	094/16	Apr.	150/06	140/05	(130/04)	115/04
May	087/10	117/08	121/09	089/11	May	190/10	180/12	(170/07)	165/04
June	085/11	113/08	119/06	085/07	June	180/11	180/09	(175/06)	170/04
July	078/11	098/08	099/04	027/01	July	170/11	150/09	(135/07)	125/06
Aug.	080/11	101/08	109/04	013/01	Aug.	150/08	140/08	(130/07)	115/07
Sept.	085/12	109/09	125/07	089/06	Sept.	100/08	100/08	(100/07)	100/07
Oct.	095/13	111/12	113/12	094/12	Oct.	040/08	055/04	(070/04)	085/04
Nov.	106/12	111/15	104/17	091/16	Nov.	050/06	055/05	(070/04)	085/03
Dec.	117/10	111/15	103/17	084/15	Dec.	040/04	345/03	(335/02)	325/01

Values in brackets have been interpolated between levels

APPENDIX III - continued

MADRAS India					MAHÉ Seychelles				
Based on data from the years 1951-60 Reference: Extracted from Ref. 18					Based on data from the years 1942-43, 1963-64 Reference: Computed from frequency tables, Ref. 21, and means, Ref. 8				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	064/10	060/10	064/07	076/04	Jan.	295/06	265/07	245/09	260/09
Feb.	076/10	060/10	046/09	045/05	Feb.	307/07	285/10	270/08	250/06
Mar.	108/07	077/09	056/12	040/11	Mar.	290/06	265/06	257/06	310/01
Apr.	133/06	083/05	070/09	062/13	Apr.	250/05	265/05	265/05	240/03
May	210/05	070/03	056/05	032/05	May	137/11	150/07	210/04	205/03
June	255/13	270/16	276/17	281/16	June	140/18	140/14	155/09	185/07
July	265/13	276/18	280/19	282/21	July	140/20	145/19	150/16	200/10
Aug.	267/10	279/13	280/18	282/19	Aug.	135/18	128/14	125/08	195/05
Sept.	265/04	283/09	286/12	289/11	Sept.	135/16	128/13	140/08	115/07
Oct.	013/04	350/06	353/05	003/03	Oct.	147/09	175/07	208/06	183/04
Nov.	043/13	047/11	060/09	073/08	Nov.	185/04	225/04	243/05	140/01
Dec.	049/13	057/12	066/10	075/09	Dec.	250/07	245/07	245/06	170/04

MAINTIRANO Malagasy Republic					MAJUNGA Malagasy Republic				
Based on data from the years 1935-47 Reference: Computed from frequency tables derived from wind roses, Ref. 22					Based on data from the years 1933-47 Reference: Computed from frequency tables derived from wind roses, Ref. 22				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	025/04	(028/04)	030/05	050/05	Jan.	055/02	(075/02)	095/03	100/01
Feb.	(065/05)*	(058/05)*	(048/05)*	(050/04)*	Feb.	(074/04)*	(086/04)*	(098/05)*	(103/03)*
Mar.	(105/05)*	(088/05)*	(066/05)*	(050/04)*	Mar.	(092/07)*	(097/06)*	(102/07)*	(106/05)*
Apr.	145/06	(115/06)	085/05	050/03	Apr.	110/09	(108/09)	105/09	110/06
May	(141/06)*	(114/06)*	(085/05)*	(060/03)*	May	(112/11)*	(110/11)*	(108/10)*	(110/07)*
June	(138/07)*	(112/05)*	(085/05)*	(070/04)*	June	(114/14)*	(112/13)*	(111/12)*	(110/07)*
July	135/07	(110/05)	085/05	080/04	July	115/16	(115/15)	115/13	110/08
Aug.	(125/06)*	(101/04)*	(076/05)*	(085/04)*	Aug.	(110/15)*	(109/14)*	(109/12)*	(115/09)*
Sept.	(115/05)*	(091/04)*	(068/04)*	(090/03)*	Sept.	(105/13)*	(103/13)*	(102/11)*	(120/11)*
Oct.	105/03	(082/03)	060/04	095/03	Oct.	100/12	(098/11)	095/10	125/12
Nov.	(079/03)*	(064/03)*	(050/04)*	(080/04)*	Nov.	(085/09)*	(090/08)*	(095/08)*	(117/08)*
Dec.	(052/04)*	(046/04)*	(040/05)*	(065/04)*	Dec.	(070/06)*	(082/05)*	(095/06)*	(109/04)*

MAKINDU Kenya					MANDERA Kenya				
Based on data from the years 1939-43 Reference: Computed from frequency tables, Ref. 21					Based on data from the years 1953-63 Reference: Extracted from working papers, Ref. 3				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	degrees/knots					degrees/knots			
Jan.	-	-	032/12	015/10	Jan.	086/13	066/17	047/15	035/15
Feb.	-	-	055/10	057/11	Feb.	098/13	072/17	051/14	034/16
Mar.	-	-	052/10	040/09	Mar.	123/11	099/13	069/11	043/13
Apr.	-	-	115/06	088/07	Apr.	167/08	155/08	108/05	066/10
May	-	-	160/10	123/07	May	211/15	211/19	225/12	045/03
June	-	-	170/09	197/03	June	210/18	210/23	222/19	246/06
July	-	-	173/09	225/05	July	209/19	207/26	220/22	245/13
Aug.	-	-	172/13	220/06	Aug.	208/18	207/24	220/20	242/12
Sept.	-	-	167/11	170/02	Sept.	209/16	208/23	220/17	227/05
Oct.	-	-	130/10	114/06	Oct.	195/09	194/10	195/02	048/08
Nov.	-	-	109/07	094/07	Nov.	114/08	085/09	060/11	049/15
Dec.	-	-	052/11	057/09	Dec.	092/12	069/15	051/15	037/16

Values in brackets have been interpolated between levels

Values in brackets and marked * have been interpolated between months

APPENDIX III - *continued*

MANGALORE India					MASIRAH ISLAND Muscat and Oman				
Based on data from the years 1942-46 Reference: Computed from monthly values, Ref. 19					Based on data from the years 1964-67 Reference: Computed from daily values, Ref. 16				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	080/04	105/06	100/06	080/04	Jan.	060/07	050/06	050/05	355/05
Feb.	060/04	080/06	095/08	075/06	Feb.	110/02	300/02	295/05	300/09
Mar.	020/02	055/06	080/10	065/14	Mar.	190/03	050/01	020/03	325/07
Apr.	330/04	345/06	035/04	070/10	Apr.	245/06	270/07	275/06	285/08
May	110/08	320/06	350/04	075/10	May	265/07	280/04	335/02	335/04
June	270/16	275/18	270/16	290/06	June	265/08	320/06	345/07	020/07
July	280/24	285/24	280/22	275/28	July	280/08	310/08	340/09	360/07
Aug.	290/20	290/18	290/16	290/10	Aug.	265/06	330/05	355/06	020/07
Sept.	305/12	295/12	290/10	285/06	Sept.	280/01	030/09	035/12	050/13
Oct.	030/02	075/06	070/08	075/08	Oct.	075/01	050/07	060/10	080/13
Nov.	095/08	095/08	090/08	085/08	Nov.	060/10	050/12	060/13	060/08
Dec.	090/08	090/08	090/08	085/08	Dec.	035/07	025/09	015/07	330/05

MINICOY Laccadive Islands					MOGADISCIO Somalia				
Based on data from the years 1942-46 Reference: Computed from monthly values, Ref. 19					Based on data from the years 1943, 1965-67 Reference: Computed from frequency tables, Ref. 21 and daily values, Ref. 25				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	065/08	080/10	080/06	095/04	Jan.	080/15	075/16	075/19	080/15
Feb.	070/06	085/10	080/12	070/08	Feb.	080/17	070/16	065/14	040/12
Mar.	040/04	080/08	075/12	080/12	Mar.	085/14	075/12	060/12	105/08
Apr.	315/04	030/02	065/06	075/10	Apr.	145/09	143/05	150/02	090/08
May	295/10	300/06	345/04	070/08	May	210/14	212/13	217/13	230/11
June	275/26	277/28	280/26	265/16	June	210/20	214/22	215/20	227/14
July	280/26	285/30	285/28	275/20	July	208/21	217/22	219/21	225/14
Aug.	295/22	295/24	300/22	295/16	Aug.	203/19	207/18	205/17	210/14
Sept.	300/16	295/16	300/14	290/10	Sept.	205/19	212/17	214/18	215/16
Oct.	300/06	300/06	320/02	305/02	Oct.	185/13	190/10	200/08	205/08
Nov.	310/02	020/02	010/02	340/02	Nov.	098/08	080/06	050/04	055/03
Dec.	065/06	075/06	070/06	095/02	Dec.	072/18	065/16	062/14	052/13

MOMBASA Kenya					MORONI Comoro Islands				
Based on data from the years 1953-63 Reference: Extracted from working papers, Ref. 3					Based on data from the years 1940-43 Reference: Computed from frequency tables derived from wind roses, Ref. 22				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	031/10	004/11	003/11	012/07	Jan.	340/05	(340/03)	345/03	270/02
Feb.	048/08	013/08	003/10	014/08	Feb.	(340/02)*	(020/01)*	(040/01)*	(Calm)*
Mar.	098/06	062/03	016/05	023/06	Mar.	(070/01)*	(120/02)*	(110/03)*	(090/02)*
Apr.	169/12	164/09	146/05	101/05	Apr.	150/03	(130/04)	115/06	090/04
May	178/19	175/19	174/15	167/07	May	(152/05)*	(133/05)*	(117/07)*	(115/05)*
June	179/22	179/23	179/20	181/12	June	(154/07)*	(136/07)*	(119/07)*	(140/05)*
July	173/20	174/22	176/21	177/14	July	155/08	(140/08)	120/08	165/06
Aug.	167/18	169/21	173/21	186/14	Aug.	(154/07)*	(136/07)*	(116/07)*	(144/05)*
Sept.	162/15	166/18	170/17	188/09	Sept.	(152/05)*	(133/05)*	(113/07)*	(122/04)*
Oct.	155/13	160/12	160/10	142/04	Oct.	150/03	(130/04)	110/06	100/03
Nov.	125/07	115/04	098/03	100/05	Nov.	(070/01)*	(120/02)*	(110/03)*	(095/02)*
Dec.	041/09	013/09	009/09	031/06	Dec.	(340/02)*	(020/01)*	(040/01)*	(Calm)*

Values in brackets have been interpolated between levels

Values in brackets and marked * have been interpolated between months

APPENDIX III - *continued*

NAGPUR India					NAIROBI (Dagoretti) Kenya				
Based on data from the years 1953-60 Reference: Extracted from Ref. 18					Based on data from the years 1959-63 Reference: Extracted from working papers, Ref. 3				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	164/02	255/03	275/07	265/13	Jan.	-	-	062/10	062/10
Feb.	220/01	265/04	273/07	280/12	Feb.	-	-	061/12	057/12
Mar.	268/03	270/05	275/06	269/10	Mar.	-	-	064/12	062/13
Apr.	273/03	275/03	281/04	288/06	Apr.	-	-	079/09	080/11
May	300/06	300/06	303/07	310/07	May	-	-	115/06	088/06
June	277/08	283/08	291/08	310/07	June	-	-	125/07	097/06
July	278/12	284/13	287/13	291/11	July	-	-	141/07	144/04
Aug.	282/11	288/12	288/11	292/09	Aug.	-	-	134/06	158/04
Sept.	310/06	318/08	320/07	320/06	Sept.	-	-	111/08	110/07
Oct.	044/05	032/06	017/06	348/04	Oct.	-	-	081/11	088/11
Nov.	054/05	029/06	005/07	334/06	Nov.	-	-	070/11	076/12
Dec.	060/03	355/04	330/07	298/08	Dec.	-	-	063/11	064/11

NANYUKI Kenya					NEW DELHI India				
Based on data from the years 1952-63 Reference: Extracted from working papers, Ref. 3					Based on data from the years 1950-60 Reference: Extracted from Ref. 18				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	-	-	041/06	044/11	Jan.	313/05	296/07	281/08	274/12
Feb.	-	-	048/05	058/14	Feb.	307/09	300/10	294/11	286/16
Mar.	-	-	050/04	055/15	Mar.	310/08	300/10	287/12	280/15
Apr.	-	-	176/03	060/08	Apr.	315/09	306/11	293/12	282/15
May	-	-	181/02	054/06	May	311/10	302/11	295/13	286/16
June	-	-	190/04	042/02	June	302/05	296/08	296/10	302/13
July	-	-	191/04	329/02	July	125/04	184/01	288/02	331/03
Aug.	-	-	191/04	333/02	Aug.	152/01	320/01	330/03	345/05
Sept.	-	-	183/05	043/03	Sept.	346/02	318/03	318/04	330/05
Oct.	-	-	174/04	062/07	Oct.	332/06	317/08	307/09	308/09
Nov.	-	-	063/03	057/10	Nov.	315/09	310/11	308/11	302/12
Dec.	-	-	045/05	051/13	Dec.	311/06	304/08	294/09	285/13

POONA India					PORTO AMÉLIA Moçambique				
Based on data from the years 1942-46 Reference: Computed from monthly values Ref. 19					Based on data from the years 1961-64 Reference: Computed from daily values, Ref. 24				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	110/06	155/06	185/06	240/06	Jan.	040/09	045/08	(055/07)	070/06
Feb.	085/04	125/04	185/04	240/06	Feb.	030/02	010/03	(055/02)	100/04
Mar.	015/06	030/06	075/02	195/04	Mar.	065/04	090/04	(110/04)	(125/05)*
Apr.	320/08	350/10	350/06	165/02	Apr.	145/08	150/08	(150/07)	155/07
May	305/10	340/10	340/08	100/02	May	185/13	170/13	(170/11)	165/09
June	260/14	265/14	270/06	140/04	June	165/13	165/14	(160/13)	155/12
July	260/20	260/28	265/22	265/20	July	135/12	130/11	(135/11)	140/11
Aug.	260/18	260/22	265/20	275/08	Aug.	155/12	150/13	(145/14)	140/15
Sept.	275/10	285/10	270/02	080/02	Sept.	125/11	110/11	(110/11)	105/10
Oct.	075/08	080/12	075/10	065/06	Oct.	060/08	060/10	(080/10)	100/10
Nov.	105/12	105/12	090/08	060/06	Nov.	090/08	100/04	(095/05)	090/06
Dec.	110/10	120/10	125/06	270/02	Dec.	030/06	020/06	(035/06)	050/06

Values in brackets have been interpolated between levels

Values in brackets and marked * have been interpolated between months

APPENDIX III - *continued*

RIYAN South Arabia					RODRIGUES ISLAND				
Based on data from the years 1961-63 Reference: Computed from frequency tables, Ref. 16					Based on data from the years 1964-66 Reference: Computed from monthly values, Ref. 17				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	040/03	(025/05)	010/08	020/09	Jan.	085/12	090/10	090/09	095/07
Feb.	090/05	(080/05)	070/05	060/09	Feb.	090/13	090/12	095/09	095/07
Mar.	085/03	(090/04)	090/05	070/06	Mar.	095/13	100/10	120/06	105/06
Apr.	115/03	(130/03)	140/03	080/04	Apr.	085/16	085/14	085/08	100/06
May	185/01	(070/01)	045/03	020/13	May	(100/17)*	(100/14)*	(120/11)*	(160/09)*
June	220/05	(235/03)	325/02	030/11	June	105/11	110/09	105/06	210/03
July	230/05	(260/04)	285/04	350/07	July	105/18	095/16	100/10	115/07
Aug.	235/05	(270/03)	305/04	050/07	Aug.	100/19	100/17	115/13	105/10
Sept.	220/06	(240/03)	260/02	020/09	Sept.	100/16	100/13	115/11	130/09
Oct.	100/05	(065/06)	040/08	025/13	Oct.	100/15	105/13	120/09	125/05
Nov.	095/05	(065/05)	035/07	050/09	Nov.	100/13	100/11	115/09	180/03
Dec.	015/02	(010/05)	010/08	005/06	Dec.	085/14	095/11	090/08	095/06

SALALAH Muscat and Oman					SALISBURY Rhodesia				
Based on data from the years 1960-62 Reference: Computed from frequency tables, Ref. 16					Based on data from the years 1946-56 Reference: Extracted from Ref. 14				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	015/03	(020/05)	030/07	015/06	Jan.	-	069/05	066/06	126/04
Feb.	120/01	(085/02)	050/04	025/06	Feb.	-	069/06	076/08	126/05
Mar.	180/03	(135/02)	090/03	030/03	Mar.	-	075/06	087/08	133/06
Apr.	200/05	(180/04)	160/04	075/03	Apr.	-	068/07	096/07	131/07
May	230/04	(Calm)	025/05	015/11	May	-	080/07	097/07	142/04
June	225/03	(290/01)	350/03	010/06	June	-	086/07	100/06	123/06
July	220/04	(240/04)	255/05	360/07	July	-	074/07	097/07	121/07
Aug.	230/07	(270/02)	015/04	030/07	Aug.	-	069/09	087/09	122/07
Sept.	270/04	(310/02)	010/06	010/10	Sept.	-	062/11	070/10	136/09
Oct.	090/02	(070/05)	045/10	050/15	Oct.	-	058/12	053/14	116/07
Nov.	030/04	(030/06)	035/08	065/06	Nov.	-	058/09	051/11	080/04
Dec.	005/05	(010/07)	010/09	330/06	Dec.	-	053/08	051/09	115/03

SCUSCIUBAN Somalia					SHARJAH Trucial States				
Based on data from the years 1943-45 Reference: Computed from frequency tables, Ref. 16 (See also Appendix II)					Based on data from the years 1960-63 Reference: Computed from monthly summaries, Ref. 16				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	070/16	(060/15)	045/13	050/11	Jan.	270/03	(275/04)	280/05	280/14
Feb.	060/13	(050/14)	045/14	050/13	Feb.	250/04	(260/06)	270/09	280/16
Mar.	085/10	(080/09)	080/09	060/10	Mar.	270/08	(270/11)	270/14	280/22
Apr.	110/04	(110/05)	110/06	070/10	Apr.	270/05	(270/08)	270/10	270/17
May	230/05	(140/02)	115/04	080/08	May	280/05	(285/06)	290/07	290/07
June	255/19	(250/17)	245/15	110/05	June	280/04	(285/04)	290/03	220/03
July	(250/25)*	(250/23)*	(245/21)*	(235/10)*	July	210/03	(260/01)	310/03	060/01
Aug.	250/25	(245/24)	245/24	245/22	Aug.	180/04	(190/02)	210/01	050/02
Sept.	(250/13)*	(250/13)*	(250/13)*	(265/16)*	Sept.	290/01	(295/01)	300/02	090/03
Oct.	(360/02)*	(010/04)*	(010/06)*	(320/10)*	Oct.	340/02	(290/01)	200/01	120/05
Nov.	060/15	(050/17)	045/18	010/13	Nov.	230/01	(260/02)	270/04	280/06
Dec.	055/19	(050/18)	050/18	055/14	Dec.	260/01	(265/02)	270/04	280/11

Values in brackets have been interpolated between levels

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APPENDIX III — *continued*

SOCOTRA ISLAND					ST BRANDON ISLAND				
Based on data from the years 1942-45 Reference: Computed from frequency tables, Ref. 16					Based on data from the years 1964-66 Reference: Computed from daily and monthly values, Ref. 17				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	065/10	(065/11)	065/12	070/11	Jan.	090/11	090/10	090/07	090/06
Feb.	070/07	(075/09)	080/11	065/10	Feb.	100/13	100/11	095/09	115/07
Mar.	070/06	(080/08)	090/10	085/10	Mar.	110/15	110/11	110/08	100/06
Apr.	140/03	(100/06)	090/10	075/14	Apr.	090/16	090/14	080/14	080/12
May	205/05	(150/04)	100/06	075/11	May	110/20	110/16	120/12	130/07
June	235/26	(240/16)	265/07	050/07	June	115/18	115/14	115/08	225/01
July	225/34	(235/22)	260/12	295/05	July	115/21	115/16	110/12	110/09
Aug.	230/34	(240/23)	265/12	005/03	Aug.	110/22	110/20	105/15	110/11
Sept.	225/19	(245/12)	285/09	010/05	Sept.	105/21	110/16	105/13	095/07
Oct.	095/03	(065/06)	055/09	050/09	Oct.	110/18	110/14	105/11	125/06
Nov.	055/13	(055/14)	055/15	060/08	Nov.	115/18	115/14	120/09	125/05
Dec.	065/12	(065/11)	070/11	065/11	Dec.	100/12	100/10	100/08	090/06

ST DENIS Réunion Island					TAMATAVE Malagasy Republic				
Based on data from the years 1944-47 Computed from frequency tables derived from wind roses, Ref. 22					Based on data from the years 1933-39, 1947 Reference: Computed from frequency tables derived from wind roses, Ref. 22				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	110/11	(110/10)	110/09	115/05	Jan.	090/03	(087/03)	085/03	050/04
Feb.	(115/10)*	(115/08)*	(115/06)*	(115/03)*	Feb.	(108/04)*	(104/04)*	(100/04)*	(070/03)*
Mar.	(120/09)*	(120/06)*	(120/04)*	(120/01)*	Mar.	(126/05)*	(121/05)*	(115/05)*	(090/02)*
Apr.	125/08	(125/05)	125/01	285/02	Apr.	145/06	(137/06)	130/06	135/02
May	(119/10)*	(119/07)*	(116/03)*	(350/02)*	May	(135/06)*	(129/07)*	(125/08)*	(138/04)*
June	(112/12)*	(112/09)*	(108/04)*	(025/02)*	June	(125/07)*	(122/08)*	(120/10)*	(141/06)*
July	105/14	(105/10)	100/06	045/03	July	115/07	(115/09)	115/11	145/07
Aug.	(102/15)*	(107/11)*	(107/06)*	(085/02)*	Aug.	(102/07)*	(108/08)*	(111/10)*	(139/08)*
Sept.	(098/15)*	(109/11)*	(114/07)*	(150/02)*	Sept.	(091/06)*	(100/07)*	(108/08)*	(132/10)*
Oct.	095/16	(110/12)	120/07	170/04	Oct.	080/06	(092/06)	105/07	125/11
Nov.	(100/14)*	(110/11)*	(117/08)*	(150/04)*	Nov.	(083/05)*	(091/05)*	(098/06)*	(100/08)*
Dec.	(105/12)*	(110/11)*	(114/08)*	(130/04)*	Dec.	(086/04)*	(089/04)*	(091/05)*	(075/06)*

TANANARIVE Malagasy Republic					TRIVANDRUM India				
Based on data from the years 1953-59 Reference: Extracted from Ref. 26					Based on data from the years 1956-60 Reference: Extracted from Ref. 18				
	3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km
	<i>degrees/knots</i>					<i>degrees/knots</i>			
Jan.	—	113/03	(085/02)	057/03	Jan.	044/05	052/09	055/06	084/04
Feb.	—	121/04	(090/03)	060/04	Feb.	031/03	050/10	052/11	068/07
Mar.	—	133/04	(125/03)	115/02	Mar.	051/01	050/09	051/15	060/10
Apr.	—	128/07	(124/05)	120/03	Apr.	278/01	057/06	063/10	070/11
May	—	126/07	(120/06)	114/05	May	294/10	300/09	308/06	300/04
June	—	131/07	(110/04)	090/04	June	292/20	292/22	290/22	283/20
July	—	123/06	(105/04)	089/03	July	303/22	301/25	298/24	287/22
Aug.	—	119/07	(122/05)	124/04	Aug.	308/23	307/24	300/23	292/19
Sept.	—	118/05	(130/04)	141/05	Sept.	307/19	305/19	297/18	290/17
Oct.	—	113/05	(133/06)	152/07	Oct.	301/09	310/07	312/06	299/06
Nov.	—	117/03	(140/03)	163/04	Nov.	012/02	050/04	050/05	065/04
Dec.	—	110/02	(100/01)	095/01	Dec.	043/07	054/08	064/08	077/08

Values in brackets have been interpolated between levels

Values in brackets and marked * have been interpolated between months

APPENDIX III – continued

TULEAR Malagasy Republic					VACOAS Mauritius				
Based on data from the years 1940–47 Reference: Computed from frequency tables derived from wind roses, Ref. 22					Based on data from the years 1962–66 Reference: Computed from monthly values, Ref. 17				
3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km	
degrees/knots					degrees/knots				
Jan.	060/05	(052/04)	045/04	345/02	Jan.	085/10	080/12	070/06	060/06
Feb.	(077/05)*	(072/03)*	(025/03)*	(330/02)*	Feb.	085/15	080/12	070/09	070/07
Mar.	(094/05)*	(092/03)*	(005/02)*	(310/02)*	Mar.	100/17	100/13	095/09	095/06
Apr.	110/05	(110/02)	345/01	295/02	Apr.	110/13	100/11	135/03	200/05
May	(118/05)*	(118/02)*	(339/01)*	(280/02)*	May	115/14	120/10	145/05	225/04
June	(126/05)*	(126/02)*	(332/01)*	(260/02)*	June	120/12	115/09	110/06	180/01
July	135/05	(135/02)	325/01	240/02	July	105/18	105/14	110/10	120/04
Aug.	(129/05)*	(130/02)*	(311/01)*	(265/03)*	Aug.	105/19	105/16	110/11	110/05
Sept.	(122/05)*	(125/02)*	(299/01)*	(275/04)*	Sept.	105/19	105/16	105/11	090/07
Oct.	115/05	(120/02)	285/01	285/05	Oct.	100/16	100/13	110/10	120/05
Nov.	(096/05)*	(097/03)*	(325/02)*	(295/04)*	Nov.	095/12	095/08	100/05	145/01
Dec.	(078/05)*	(072/03)*	(005/03)*	(310/03)*	Dec.	095/11	095/08	110/05	125/03
VENGURLA India					VERAVAL India				
Based on data from the years 1942–46 Reference: Computed from monthly values, Ref. 19					Based on data from the years 1957–60 Reference: Extracted from Ref. 18				
3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km	
degrees/knots					degrees/knots				
Jan.	060/02	135/06	140/06	255/02	Jan.	011/06	348/04	285/05	269/11
Feb.	040/04	130/02	150/04	145/02	Feb.	334/06	340/06	307/07	282/12
Mar.	005/06	010/04	085/04	105/06	Mar.	323/07	342/07	300/05	263/08
Apr.	345/10	355/12	360/06	100/06	Apr.	300/07	323/06	306/04	235/05
May	325/08	340/10	355/08	060/04	May	285/10	308/06	298/05	275/05
June	265/14	275/14	275/10	090/01	June	250/14	250/09	263/05	338/02
July	275/22	285/20	290/20	290/24	July	260/22	257/18	256/15	257/10
Aug.	275/20	285/16	290/12	300/16	Aug.	269/17	268/14	278/11	295/07
Sept.	300/12	300/10	300/04	265/04	Sept.	277/12	276/08	265/07	273/04
Oct.	070/08	080/10	080/10	070/08	Oct.	348/02	037/05	038/07	054/04
Nov.	095/10	095/10	090/08	085/08	Nov.	080/04	068/05	045/05	293/03
Dec.	100/08	105/08	105/06	085/02	Dec.	020/04	340/01	243/03	260/08
VOI Kenya					ZANZIBAR ISLAND Tanzania				
Based on data from the years 1959–63 Reference: Extracted from working papers, Ref. 3					Based on data from the years 1931–38 Reference: Computed from frequency tables, Ref. 21				
3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km		3000 ft 0.9 km	5000 ft 1.5 km	7000 ft 2.1 km	10 000 ft 3.0 km	
degrees/knots					degrees/knots				
Jan.	030/07	360/08	015/09	015/07	Jan.	010/14	(005/13)	360/12	020/06
Feb.	030/05	030/08	020/14	040/14	Feb.	010/10	(360/09)	350/09	340/07
Mar.	130/02	080/04	030/06	040/08	Mar.	080/04	(045/03)	010/03	360/05
Apr.	220/05	160/10	120/04	090/07	Apr.	150/12	(150/10)	150/08	110/04
May	180/10	140/07	130/07	215/09	May	160/12	(160/13)	160/13	120/08
June	200/17	185/22	180/22	200/09	June	190/18	(190/17)	190/16	180/09
July	200/16	180/25	175/20	190/10	July	150/19	(160/18)	170/18	180/10
Aug.	160/09	185/22	180/16	215/08	Aug.	140/19	(150/18)	160/18	170/13
Sept.	185/12	175/20	170/18	195/05	Sept.	120/15	(135/13)	150/11	160/10
Oct.	170/07	165/12	145/07	090/03	Oct.	110/11	(125/12)	140/12	140/08
Nov.	155/03	135/05	080/04	080/04	Nov.	070/08	(085/08)	100/07	110/08
Dec.	020/10	010/18	055/16	020/06	Dec.	020/09	(020/08)	020/07	060/06

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