Letter to the Editor

On the Role of the Tropics in the General Circulation of the Atmosphere

Dear Sir:

In a recent issue of Tellus (Vol. 2, No 1) Mr Herbert Riehl published an interesting article on the subject indicated above, bringing new results and valuable information concerning the structure of the tropical atmosphere. My own meteorological and aerological observations in Mogadiscio (Italian Somaliland, Lat. 2°02′03″ N, Long. 45°21′20″ E) during the International Polar Year 1932—1933 appear to have considerable bearing on the problems discussed by Mr Riehl. Since these observations have not yet been printed in extenso, even though some partial results have been published, I shall take the liberty of calling attention to two groups of deductions from the Mogadiscio data, both related to Mr Riehl's analyses.

1. The steadiness of the airflow in the "subcloud" or ground layer in the tropics can be seen quite nearly from the surface winds, whenever the relief is slight or non-existent, as in Mogadiscio, where the shore is quite flat. The observations were made with a Universal Anemograph of the Dines-Fuess type, at a height of 20 m. above sea level, and the records were carefully studied with respect to lateral turbulence. Fig. 1 (not published previously) represents in the lower half the hours of the Polar Year 1932—1933 with nearly laminar structure of the surface winds, i. e. quasi-uniform flow without lateral turbulence. The upper portion represents the hours with anomalous wind directions.

From this figure it is readily seen that there are *two* transition periods from one monsoon to

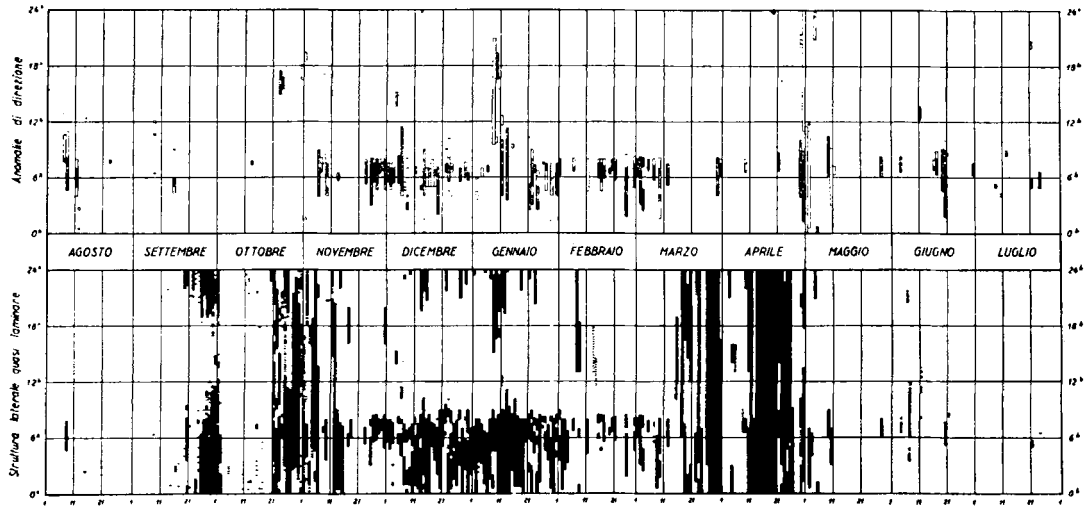

Fig. 1. Lower half: Dark areas or lines indicate hours with quasi-uniform flow in the surface layers (absence of lateral turbulence). Note that transition periods from winter to summer monsoon and vice versa have a double structure, suggesting in each case the passage of two Intertropical Convergence Zones.
Upper half: Shaded areas or vertical lines indicate hours with anomalous wind direction.
Both diagrams are based on surface wind observations (20 m above sea level) from Mogadiscio, Italian Somaliland, during the International Polar Year 1932—1933.

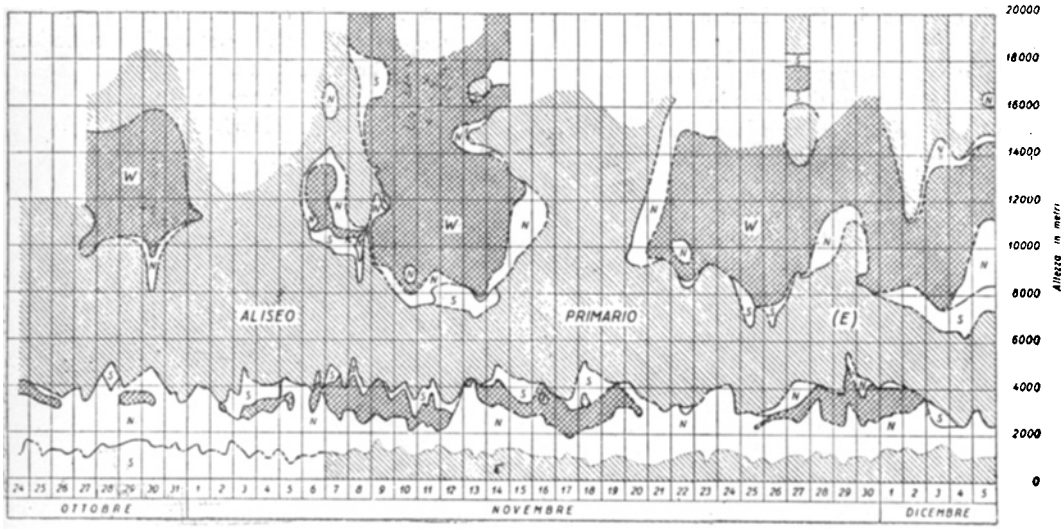

Fig. 2. Distribution of Basic Easterlies (Urpassat Aliseo Primario) and of other dominating upper winds during the period of maximum heights and maximum density of the pilot balloon observations made at Mogadiscio, October 24—December 5, 1932 (second part of the transition period).

the other, with the clear result that both transition periods (spring and fall) are characterized by *two* Intertropical Convergence Zone (ICZ) passages (see also the discussion by H. Flohn, 1949, Zeitschrift für Meteorologie, 3, pp 240—246), indicating a double structure of the ICZ, both in spring and in fall. During the transition periods the main wind direction is nearly the same as during the preceeding monsoon (the wind speed is less); hence, from this view point the principal ICZ is always the second one.

During the early morning hours, especially during the winter months of the Northern hemisphere (NE monsoon), the presence of a temperature inversion at low levels has the effect of giving the land breeze a quasi-uniform (laminar) structure. During the transition periods between the monsoons a similar inversion appears, again resulting quasi-uniform (laminar) flow, as shown in the lower portion of Fig. 1.

2. More than 1300 pilot-balloon ascents were made at Mogadiscio during the International Polar Year and from these data the mean picture of the tropospheric wind field has been deduced. The results were some time ago published (Zeit. f. Geophysik, 10, 1934, pp 360—368). However, it is only quite recently that some detailed inferences were made public (Geofisica pura e appl., XIV; 1949, pp 108—119), particularly with regard to the period October 24—December 5, 1932, this time interval being especially propitious for pilot balloon observations to great heights. The results obtained for this period show quite clearly, besides the evident steadiness of the ground layer and of the middle troposphere (Easterlies = Urpassat = Aliseo), the variability of the low part of the advection layer and particularly the fluctuations of the upper troposphere, where the easterlies intermittently are replaced by west winds. The time scale of the order of twelve to fifteen days is in accordance with Mr Riehl's indication "roughly two to three weeks". While the maximum speed observed in the upper troposphere easterlies was of the order of 50 m. p. s., at 14 km above sea level, in January, the greatest velocity observed in the westerlies was only about one half of this value or 26 m. p. s., at 15 km above sea level, at the end of November. Although the ascents in other months seldom reached as great heights as during this special period, it seems possible to infer that the upper troposphere westerlies are most frequent in the months from September to December, absent in March and rare in June, July, August (SW-Monsoon). Interesting is also the result that in Mogadiscio *no easterlies* are present in September, at least not below the tropopause level. This suggests that Mr Riehl's scheme for the

zonal currents in low latitudes needs some amplification.

In the 1949-paper referred to above I have already pointed out the great importance of the upper tropospheric currents in equatorial regions for the "steering" of weather also in middle latitudes. It is to be hoped that an increased number of stations for systematic observations soon may be organized in the tropics.

Very truly yours
Mario Bossolasco

Milano June 6th, 1950.

CORRIGENDUM

February issue of Tellus 1950, H. Riehl: "On the Role of the Tropics in the General Circulation of the Atmosphere."

The author has advised that unfortunately figs. 2 and 13 have been reversed and so have figs. 10 and 11.