551.55 : 551.576 (468.5)

THE DIRECTION OF WIND AND CLOUD OVER TENERIFFE

[Translation by B. M. Varney of the summary of a paper under the above title by H. von Ficker in *Festschrift der Zentralanstalt für Meteorologie und Geodynamik, zur Feier Ihres 75-Jährigen Bestandes im Jahre 1926.* Issued 1926 by the Akademie der Wissenschaften, Wien.]

[NOTE.—Von Ficker's discussion is based on data from the following stations in the Canary Islands:
Puerto de Orotava, altitude 100 meters, on the north coast of Teneriffe; observations for 1905–1913.
El Guimar, 370 meters, above the southeast coast of Teneriffe; 1912–1916.
Laguna, 547 meters, in eastern Teneriffe; 1911–1923.
Las Palmas, 12 meters, on Gran Canaria; 1911–1920.
Cañadas, 2,100 meters, in the crater of the Peak of Teneriffe; 1910–1915.
Izaña 2,367 meters, in an open exposure on the crater's edge, Peak of Teneriffe; 1916–1923.]

In the lower situations on Teneriffe (Orotava and Guimar) wind direction is very markedly affected by local influences (land and sea breezes). From this fact results, for instance, on the north coast, an extraordinary great frequency of northeast winds, even outside of the true trade wind period. The trade wind period is here marked by the fact that the northeaster is the dominating wind of both morning and evening, and suppresses the land wind. On the southeast coast, one finds in the wind shadow of the high mountains of the island an easterly to southeasterly wind, counterpart of the trade wind flow. Its frequency outside of the true trade wind period is due to the sea breeze, and at that period [during the absence of the trade]—in contrast to the summer—it is confined to the warmest days only.

The northeast direction of the trade wind is not found at Las Palmas and Laguna. There the trade blows as a northwest or north wind, while at Mogador on the adjacent African coast the northeast wind dominates entirely. Whether in the region of the Canaries on the open sea the trade wind flows more from north and northwest than from northeast can not be told from the material dealt with.

While Orotava, Guimar, Las Palmas and even Laguna lie in the region of the lower, true trade wind stream, the antitrade (southwest) blows throughout the year at those heights in which the formation of alto-cumulus is most frequent. In the antitrades are to be included the south and southeast winds, which are considerably more frequent in summer. Winds which carry air to lower latitudes are, in the region of the A–Cu, much more rare than in the Ci level, where, besides the almost completely dominant antitrade, west and especially northwest winds are much more frequent than at the A–Cu level.

Between the lower trade wind stream and the antitrade lies the "mixture layer" or "transition zone," discovered and given this name by Hergesell. In this zone lie the stations of Izaña and Cañadas. The view that the winds in this zone are among the most changeable in the atmosphere is amply confirmed by the distribution of wind directions at Cañadas and by the trajectories of Cu and N, since the southwest wind is nearly as frequent as the southeast. That is to say, we must conclude that these altitudes lie alternately in the realms of trade and antitrade. But, at Izaña, heavy northwest winds predominate the whole year through, to such an extent that they represent the most stable flow of all the layers up to the cirrus. In the region of the Canaries, at no height is there a flow which better deserves the name of trade wind than this northwest stream at Izaña, than which only the southeast wind of winter is more frequent.

Since we can not well doubt the existence of this flow from the northwest, it must be regarded as an important member of the trade-wind system. According to the masterly presentation by Sverdrup [1] the transition from trade to antitrade is completed by means of a left-hand turning of the wind, so that in the boundary layer between the two streams the northwest winds blow. If, following this interpretation, we regard the northwest wind at Izaña as the transition member between trade and antitrade, we must simply renounce the view that the transition layer is a region of very changeable winds. With respect to the origin of this northwest wind, Sverdrup adheres to the view of Wenger, who ascribes the transition to the interchange of mass between trade and antitrade. Plausible as this conception becomes as a result of Sverdrup's calculations, three difficulties arise, nevertheless, in connection with the view that Izaña's wind conditions may be taken as representative of this boundary region.

First, the northwesterly movement in the so-called transition layer occurs much more frequently than the movements above or below; that is, the flow from the northwest in the transition layer predominates much more strongly than does the trade below or the antitrade above.

Second, the northwesterly movement at Izaña is dominant throughout the year, even when the trade wind stream is either not present below or is very weakly developed.

Third, the velocity of the northwest wind is strikingly great. If this velocity were the result of the transfer of mass between trade and antitrade, one would expect a low velocity in the boundary region; but, according to the observations at Izaña, the velocity of the northwest wind is at least as great as that of the trade on the open sea.

These three items are not proof that Sverdrup's and Wenger's conclusion is incorrect, but merely indicate a certain difficulty in accepting them. I personally incline to the belief that this strong flow from the northwest, since it is present throughout the year, constitutes the chief member of the trade-wind system in the region of the Canaries, provided always that this northwest wind is as frequent and strong in the free air as it is at Izaña. That the northwest wind is but poorly shown by the movements of the Cu and N clouds, agrees well with the conception that this wind, so far as it is to be called a part of the trade-wind system, is a descending wind in which clouds can neither form nor exist. Only in connection with the forward thrusting of cold air masses can the trade wind temporarily function in cloud formation,[2] and to such disturbances may be ascribed the fact that over 14 per cent of the Cu and N over Cañadas come from the northwest. As to the Cu and N in general, their formation takes place here only under the influence of atmospheric disturbances, when the trade is temporarily displaced by them.[3]

[1] Sverdrup, H. U., Der Nordatlantische Passat. Veröffentl. des Geophysikal. Inst. der Universität Leipzig, Band II, Heft 1, Leipzig, 1917.

[2] The true "trade wind cumuli" as a rule float at a lower altitude than Cañadas and are therefore not involved in this consideration.

[3] See also Knoch, R., in Publ. no. 335 of the Prussian Meteorological Institute (Berlin, 1926). Under the title: "Rainsqualls of the Atlantic Trade Wind Region," this material was presented in a note in Mo. Wea. Rev., April, 1926, p. 167–168, by B. M. Varney.