

averaging of frost dates for the same number of years. The actual dates of last frost are dispersed over at least two months in the spring, so that, for instance, the average for the four years 1888-1891 inclusive is June 17, and for 1897-1900 inclusive, May 21; the variability of

minimum temperature is much less erratic, so that ogee curves drawn like Figure 2 for various other periods of four years would all check fairly closely with that one, drawn for 1918-1921.

#### DUST OVER THE NORTH ATLANTIC.

By WILLIS EDWIN HURD.

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On the 12th of May, 1922, the Dutch cargo steamer *Yildum* was about 250 miles off the west African coast, in approximately 14° north latitude, 21° west longitude. For more than three days the vessel had experienced winds from north to northeast, force 1 to 5, with a hazy atmosphere. At daybreak of the 12th the *Yildum* was found to be covered with a deposit of reddish-brown dust, a sample of which was forwarded to the Weather Bureau with his meteorological report by the observer, Second Officer W. Mulder. A microscopic examination of the dust particles furnished by the *Yildum* was made by the U. S. Bureau of Soils. Their geographical source was not definitely determined, but it is assured that they are not of volcanic origin.

The Dutch S. S. *Hagno* was in latitude 8° 11' N., longitude 50° 5' W., at 8 p. m. of May 13, when a reddish mist or haze was observed along the horizon. The haze continued throughout the 14th, wind constantly from a northeasterly direction, force 4 to 5. On the afternoon of the 15th, in latitude 5° 21' N., longitude 45° 2' W., a heavy shower and sudden change of wind cleared the air, the rain bringing down a "kind of red sand or dust."

Mr. G. MacGregor, second officer of the British S. S. *Dundrennan*, made the following report in a similar connection:

11th to 15th May: Lat. 7° 47' N., long. 44° 26' W., to lat. 18° 44' N., 53° 22' W. (L. M. noon). The hazy weather recorded was apparently due to the fact that the air was laden with a very fine reddish-brown sand similar to that found in the Harmattan winds experienced off the west coast of Africa.

The observed winds during the period were E. by S. to E. by N. force 4 to 7.

The British S. S. *Parima* noted the prevalence of a fine white haze while en route from St. Kitts and other islands to Barbados, May 13 to 18. It was sometimes so dense as to obscure land 1 to 2 miles distant. The observer concluded that as Mount Pelee was said to have been in slight eruption (the writer has been unable to obtain any confirmation of such recent activity), the haze might thus be accounted for.<sup>1</sup>

The citations given are the only ones thus far received by the Weather Bureau in which dust was actually reported over the north Atlantic during May, 1922, or in which abnormal haze conditions were given especial notice. Observations from a number of vessels, however, indicate a vast area over which haze occurred between the 9th and 23d of the month. The easternmost known limit of observation of the haze or dust was about the 21st meridian, in 14° or 15° north latitude; the westernmost, in the Caribbean Sea and the Gulf of Mexico.

The latitudinal width of the haze area seems to have been greatest about mid-ocean, between the 5th and 35th parallels. The American S. S. *Harvester* observed haze

as early as the 9th in 35° north latitude, 41° 17' west longitude. This date is the same as that of the first observation reported from the African coast area. The *Harvester* noted haze daily until the 13th, when in lat. 33° 40' N., long. 53° W. The Dutch S. S. *Hagno* reported the most southerly observation.

Concluding from the foregoing data, the assured fact is that a considerable quantity of dust was very early in the month, if not actually late in the preceding month, derived from some African desert region, carried to sea, and there caught up in the northerly and easterly winds of the trades belt, where in some cases it was observed positively as dust; in others noted only as haze. From the 6th to the 10th of the month the area of high pressure was considerably disrupted by cyclonic conditions, which in all probability were instrumental in carrying the dust so abnormally to the northwestward beyond the trades, where it was observed by the *Harvester*.

This is the second recent instance of observations of dust at sea being reported to the Weather Bureau by its marine observers. The previous instance is that given by the American S. S. *Santa Rosalia*, April 15, 1921, in the Yellow Sea, coincident with the passage of a severe extratropical cyclone over the Mongolian Desert. The dust carried by the northwesterly winds of this disturbance fell over an area extending eastward at least as far as Japan. In the Yellow and Eastern Seas visibility was so reduced as to interfere with navigation.

Soil history in its relation to erosion and stratification is replete with world-wide instances of the movements of dust material by the winds. The drier the locality of course the more rapidly is this surface accumulation wind-blown and distributed. The deposition of soil dust in some localities is local and considerable in a brief period; in other regions there is a slower, steadier, and more widespread carrying on of this condition. The total amount of dust swept by the sirocco from the Sahara Desert to Europe year after year during the last 30 centuries has been calculated<sup>2</sup> as equivalent to an average of at least 5½ inches, less over the British Isles and northern Germany, but more than that over the southern countries. Indeed, the Sahara dust has been distributed not only over Europe but over parts of Africa, Asia, and the Atlantic Ocean. Dust from Australia has been borne a distance of about 1,500 miles to New Zealand, and the yellow detritus from interior China has likewise been transported far to sea.

Severe major cyclonic storms are likely to catch up many tons of fine material and carry much of it as they progress. In cases of violent local storms like desert whirlwinds a quantity of dust may be taken far aloft, where it passes from the brief control of the ascensional currents and spreads out into the great horizontal wind systems.

It is a dispersion of the former type that is instanced in the dust observations of April, 1921, in the western Pacific, and quite possibly a dispersion of the second type which has been herein especially discussed as affecting so great an area of the north Atlantic.

<sup>1</sup> Since writing the foregoing, the writer has seen a copy of *The Meteorological Magazine* of London for July which contains an extract from the *Barbados Advocate*, May 23, 1922. Attention is there called to the extraordinary "prevalence of a low hanging mist which has shut off the horizon" over the Caribbean Sea from Barbados to St. Kitts and almost to Demarara. The idea that the phenomenon was due to volcanic dust, at first prevailing, was later discarded. But "no scientific explanation of the phenomenon has yet been offered."—W. E. H.

<sup>2</sup> Free, E. A.: Movement of soil material by the wind. *Bulletin No. 68*, Bureau of Soils, 1911, p. 99.