MONTHLY WEATHER REVIEW

Editor, EDGAR W. WOOLARD

VOL. 70, No. 8
W. B. No. 1371

AUGUST 1942

CLOSED OCTOBER 2, 1942
ISSUED NOVEMBER 2, 1942

STREAM LINES OF NEW ENGLAND

By V. CONRAD

[Harvard University, Cambridge, Mass., April 1942]

A rather strong correlation exists between the frequency of winds from a given direction and their average velocity; the more frequent the direction, the greater the average velocity—the strongest winds come mostly from the most frequent direction. The assumption can be made that the average velocity of the winds from a particular direction is approximately in linear proprotion to the frequency of the direction. Thus the resultant wind direction can be calculated from Lambert's formula in cases when only frequency statistics are published. These resultant directions for different stations may be plotted on a map in the usual way, and stream lines drawn in accordance with the principle that the wind arrows are tangent to these lines.

Stream lines represent the state of air motion at a particular moment, and must be carefully distinguished from *trajectories* or actual paths. *Climatological* stream lines derived from the *average* directions of the resultant winds for any particular epoch are analogous to arithmetical means. The more the variability of a quantity, the more fictitious the arithmetical mean; similarly for average resultant wind directions and average stream lines. In some tropical regions with a well-developed steady trade wind, stream lines give an actual picture of the air flow. A calculation of the persistence of the wind would be a desirable supplement to every representation of stream lines.

Frequency statistics of wind direction, at regular and cooperative stations of the U. S. Weather Bureau, were available for 19 New England stations for the five-year period, 1923–1927.[1] This number is rather small in comparison with the large area of New England, which amounts to 66,000 square miles; but for a preliminary study, without any attempt at an investigation of details, the material may be sufficient. The observations are exceedingly good, and stream lines may be drawn from them; but in drawing the individual curves, it is sometimes necessary to use personal judgment regarding the details. Physical considerations relating to the distribution of pressure are especially valuable for the interpolation of the trend of the stream lines. However, the main features as shown on the maps are undoubtedly correct, and give a good general indication of the average motion of the air during the given months. The mountain masses between stations undoubtedly have considerable influence; but, in the absence of observations, these effects are disregarded.

January.—The map which represents the stream lines for the month characteristic of winter shows a broad and powerful air current which originates from the interior of the continent and flows over New England. The direction is from *northwest* to *southeast.*[2] The trend of the stream lines is in good accord with the pressure distribution over North America.[3] The air current indicated by the lines is a portion of the great cyclonic circulation around the intense low pressure region south of Greenland.

July.—Also in midsummer a very uniform current exists, but it is now directed from *southwest* to *northeast.* The low pressure area shifts westwards from winter to summer, and lies in July close to the coast of North America in high latitudes. Therefore the trend of the isobars together with that of the stream lines is changed accordingly. The source region of the air masses in summer is either the interior of the continent or the tropical southwestern Atlantic Ocean.

Thus the stream lines indicate the most characteristic features of the climate of New England. On the average only continental or continentally-modified air masses flow over New England the year round, and cause the cold winters and warm summers—i. e., the *continental climate.*

On the average, the wind shifts clockwise only 55° from summer to winter so that it is not justifiable to speak of monsoon winds in this section.

The stream lines of *April* and *October* show transitional conditions; they indicate an average shifting of the azimuth in April counterclockwise in comparison with the average direction in winter, and in October clockwise in comparison with summer. In respect to the wind direction, April and October belong much more to the winter type. Only on the islands off the south coast of New England do the winds in April have a weak southerly component. In October a much greater proportion of the stations have winds with a northerly component.

[1] Data for Concord, N. H., from R. DeC. Ward and C. F. Brooks, The Climate of North America, p. J 235, Köppen-Geiger *Handbuch der Klimatologie,* Berlin, 1936; for Worcester, Mass., tabulated by Myrtle Cash; for the cooperative stations in Maine tabulated by Edward Sable, and for other stations tabulated by K. G. McCasland from tables in the Annual Report of the Chief of the Weather Bureau.

[2] The SE wind at Burlington, Vt. seems to be a local downslope, land-lake wind, and so has been disregarded.

[3] C. F. Brooks, A. J. Connor, and others, Climatic Maps of North America, Harvard University, 1936.

485806—42——1