year period.) Omitting July, 1916, the record becomes quite similar to that for August.

In September and October there is a backward swing to maximum rainfall during easterly winds, September, northeast, east, southeast, 53.8 per cent, and October northeast, east, southeast, 58.9 per cent, with even the maximum as far around as northeast in October, namely, 21.8 per cent; but during November and December the heaviest rains again occur with southeasterly winds.

The most frequent rain-bearing winds for the year are northeast, east, and southeast, with a total of 62.1 per cent in February, and the driest winds are south, southwest, and west, with 19.3 per cent in January.

It is rather remarkable that the intensity of the rainfall is so nearly the same for each direction of the wind, ranging only from 0.04 inch an hour during east winds to 0.06 per hour during northwest winds, with an average for all other directions of 0.05 inch. Excluding "traces," the hourly intensity (total rainfall divided by the number of hours with 0.01 inch or more) is 0.08 inch.

TABLE 4.—*Wind directions with which occur the average maximum and the average minimum percentage of the total monthly precipitation, 12 months, Atlanta, Ga., together with direction of rain-bearing wind showing average maximum velocity*

	Rainfall and wind directions		Direction showing average maximum wind velocity (m. p. h.)
	Maximum percentage	Minimum percentage	
January	E, 29.5 NE.+E.+SE., 58.4	SW., 4.5 S.+SW.+W., 19.3	W., 14.6.
February	SE., 23.0 NE.+E.+SE., 62.1	N., 5.3 N.+NW.+W., 20.3	NW., 14.7.
March	SE., 24.0 E.+SE.+S., 55.7	N., 4.7 N.+NW.+W., 27.5	NW., 14.2.
April	SE., 22.8 E.+SE.+S., 52.5	N., 3.3 NW.+N.+NE., 25.6	SE., 13.0.
May	NW., 17.6 E.+SE.+S., 49.9	N., 3.2 E.+NE.+N., 26.6	W., 12.3.
June	NW., 18.6 SW.+W.+NW., 44.2	S., 7.5 SE.+S.+SW., 30.1	NW., 11.4.
July	SE., 27.3 E.+SE.+S., 53.4	N., 4.2 NW.+N.+NE., 22.7	W., 10.8.
August	NW., 18.6 SW.+W.+NW.,44.2	N., 4.1 N.+NE.+E., 26.1	NW., 18.6.
September	SE., 21.4 NE.+E.+SE., 53.8	S., 7.2 S.+SW.+W., 24.3	E., 10.7
October	NE., 21.8 NE.+E.+SE., 58.9	N., 5.7 S.+SW.+W., 23.5	SE., 11.1.
November	SE., 25.5 E.+SE.+S., 58.6	N., 4.8 SW.+W.+NW., 24.2	W. and SE., 12.2.
December	SE., 23.9 E.+SE.+S., 57.8	N., 4.3 SW.+W.+NW.,24.9	NW. and SE.,13.2.

Maximum wind velocities during rain.—The record of maximum velocities during rain shows a very pronounced crest for west and northwest winds. Of the total number of maximum velocities exceeding 24 miles an hour during precipitation 52 per cent occurred with west and northwest winds and 30 per cent with east and southeast winds.

During the period of 20 years from 1905 to 1924 maximum wind velocities exceeding 24 miles an hour with and without rain occurred 10,761 times. Computed in percentages of the monthly totals, it appears that 72.6 per cent of the maximum winds occurred without precipitation, and 27.4 per cent during rains. But the distribution by months is rather peculiar and bears out the explanation why the maximum rainfall occurs during summer with northwest winds. During the period from September to May, inclusive, the percentage of maximum winds occurring without precipitation is 83.2 per cent and with precipitation, 16.8 per cent, while during the three summer months the percentage of maximum winds without rains is only 41, and with rains 59. The fact may also be noted that considering the extremes of wind movement or the highest velocities for each month of the year at Atlanta (1879–1924) only four, those for January, July, August, and December, were dry winds; during the remaining months of the year the highest velocities all occurred while rain was falling, including the maximum velocity registered, namely, 66 miles northwest, March 24, 1909.

Duration in hours of rain-bearing winds.—A study of the duration in consecutive hours of rain-bearing winds at Atlanta shows that during precipitation the winds are extremely variable. On the average during the year the wind blows from the east for only three consecutive hours and from all other directions for only two consecutive hours. The maximum average for single months is only 4 hours with east winds during January, February, and November. A summary of the total consecutive hourly periods shows that 88 per cent of the rain-bearing winds last for only 1, 2, or 3 consecutive hours, and only 1 per cent for over 12 hours. There are, of course, a few extreme records, as for example: east winds, February, 1908, 42 consecutive hours with, however, only 1.22 inches of precipitation; east winds, March, 1909, for 25 hours with 2.20 inches of precipitation, and southeast winds in July, 1916, for 38 hours with 4.27 inches of precipitation; but these are the only cases on record in 20 years when the rain-bearing winds lasted for more than 24 hours from the same direction.

NOTES, ABSTRACTS, AND REVIEWS

PRECIPITATION IN THE FORM OF ICE SPICULES AT TEMPERATURES NEAR FREEZING

By FRED H. WECK

(Springfield, Illinois)

On Saturday, November 7, 1925, there occurred at Springfield a light fall of snow that was somewhat out of the ordinary.

It had been raining all day and the pressure started to rise at 4:00 p. m., with the wind changing from northeast to northwest. At 6.25 p. m., with a temperature of 34°, small irregular-shaped particles of ice began falling with the rain. It was sleet. About 7:45 p. m., the temperature being 29°, the sleet was mixed with ice needles. They were examined at intervals until about 8:30 p. m., when all the precipitation falling was in the form of the spiculæ, the temperature having fallen to 27°. They were observed under a glass and were found to be of different lengths, some of them nearly one-sixteenth inch long, but most of them approximately one thirty-second inch or less. They were neither clear nor perfectly white, but when piled up looked at a distance of a few feet like ordinary snow. Each needle had very minute feathery projections on the sides. Care was taken to find some hexagon-shaped flakes but none were discovered. * * *

The above observation was submitted to Mr. Wilson A. Bentley, of Jericho, Vt., who commented as follows:

> I have observed and photographed the ice spiculæ form of snow crystal, many times here in Jericho, although they are relatively rare. They usually fall during mild temperature and always, so so far as I have observed, from low-lying clouds. They seem very similar to the needle form of cloud frost that forms apparently from cloud droplets, and attach themselves to tree twigs, etc., on mountain tops. My belief is that this form of snow crystal is subcrystalline in nature, and due to the joining of many fluid cloud droplets one to another to form a rod-shaped ice spicula.

Milham says:

If the temperature is very low—at least below zero Fahrenheit—fine ice needles are formed instead of snowflakes.[1]

In Davis' Elementary Meteorology we read:

When precipitation occurs in the polar regions at temperatures lower than −5° to −10° small ice needles and not snowflakes are formed.[2]

The observation on November 7, and Mr. Bentley's experience, show that the ice needle form of snow crystal does occur at temperatures considerably higher than is generally supposed. * * *

PHYSICAL OCEANOGRAPHY AND MARINE METEOROLOGY OF THE PACIFIC

At the Scripps Institution of Oceanography, La Jolla, Calif., on November 6 and 7, 1925, was held a conference for the discussion of the bearing of the physical oceanography and marine meteorology of the Pacific upon the climate of the western United States. Dr. T. W. Vaughan, Director of the Scripps Institution, outlined in effect the objects of the conference as follows:

The object of the conference is to bring together for mutual benefit representatives of those interested in the study of the physical features and the meteorology of the northeastern part of the Pacific and those wishing to apply results of such studies to investigations of the climate of the western part of the United States. Special attention is directed to the problem of fog forecasting and seasonal rainfall forecasting. Therefore representatives of the United States Navy, Coast and Geodetic Survey, Weather Bureau, of those engaged in hydroelectric power development, the use of water for irrigation, farm management, and forest protection were invited to join with the institution staff to consider problems of mutual concern. * * * The conference should also help prepare the American representatives for their part in the science congress to be held in Japan during October and November, 1926.

Progress in obtaining ocean water temperatures in the Pacific was outlined by Dr. G. F. McEwen, an abstract of whose paper follows:

PRELIMINARY REPORT ON OCEANOGRAPHIC OBSERVATIONS FURNISHED BY THE UNITED STATES NAVY DURING RECENT MANEUVERS IN THE PACIFIC

A program was planned involving hourly measurements of sea temperatures by means of thermometers already attached to condenser intakes for the use of engineering departments. Opportunities were provided for calibrating the thermometers with which the destroyer fleet of 30 ships are equipped. During the maneuvers of the fleet in the Pacific from April to October, 1925, over 22,000 temperature observations were made, over 1,000 water samples, and about 260 plankton catches were collected. During April there were 6,400 temperatures and 400 water samples taken on a cruise from San Diego southwest 200 miles to Guadaloupe and return; San Francisco to Hawaii, 7,500 temperatures and 650 water samples; Hawaii to Australia and New Zealand, returning by way of Samoa, 6,600 temperatures, 160 water samples, 200 plankton catches. A preliminary examination of part of the data indicated a very good agreement between the results. Such intensive data are well suited to give detailed information on horizontal temperature gradients of interest in certain meteorological problems. Such information also constitutes a basis for estimating the rate of flow in ocean currents. The practicability of making such observations having been thus demonstrated, similar programs will probably be arranged in the future, thus providing an ever-increasing amount of intensive observations and collections at the surface that could not be obtained in any other way.

The outlook for solving the problem of fog forecasting was discussed by Mr. Dean Blake, meteorologist of the San Diego station of the Weather Bureau, who pointed out that correlation of data from land, sea, and air may yield rules that should improve the percentage of accuracy of fog predictions. Maj. E. H. Bowie, district forecaster at San Francisco, dealt with "The Northeast Pacific Anticyclone and Its Relation to California Climate." Doctor McEwen reviewed his work of the past nine years on the relation between ocean temperatures and seasonal rainfall. (See his paper in this Review.) A. Wilstam, of the southern California Edison Co., in a paper on the application of Doctor McEwen's seasonal rainfall forecasts to forecasting the seasonal water supply for hydroelectric plants, showed that:

The summer ocean temperature data supplied by the Scripps Institution are found to be closely enough correlated with the following seasonal rainfall to be given consideration in preparing the yearly budget of the Southern California Edison Co.; 7 to 8 indications out of 9 have proved to be in the right direction.

Edgar Alan Rowe discussed "The Value of Long Range Rainfall Forecasting to Irrigation and Water Supply Projects in Southern California from an Engineering Standpoint"; James G. France, "Seasonal Forecasting and its Value to the Agriculturist in San Diego County"; and J. E. Elliott, "Seasonal Forecasting and its Bearing on Forestry Problems." Abstracts of the four papers last mentioned appear in the December, 1925, issue of the Bulletin of the American Meteorological Society.—*B. M. V.*

TORNADO NEAR SALEM, IN THE WILLAMETTE VALLEY, OREG.

Mr. E. L. Wells, meteorologist in charge of the Portland, Oreg., station of the Weather Bureau, sends a detailed account of his investigations into the reported occurrence of a tornado in the Willamette Valley on November 11, 1925. The following paragraph gives his conclusions:

It is quite evident that the storm was a rather poorly defined tornado, which reached the ground at a few places in a path extending from a point north of Independence to a point in the Liberty district, southwest of Salem, a distance of about 5 miles; at no place was the path well outlined, as for the most part damage was confined to old, weak structures, and others escaped injury; the destruction was mostly confined to the right side of the path, where the whirl was moving in the same direction as the whole storm, and therefore most of the wreckage was carried forward.

Mr. Wells states that this appears to be the first tornado observed west of the Cascade Range in Oregon.—*B. M. V.*

METEOROLOGICAL SUMMARY FOR SOUTHERN SOUTH AMERICA, NOVEMBER, 1925

By Senor J. B. NAVARRETE

[El Salto Observatory, Santiago, Chile]

[Translated by B. M. V.]

The month of November was characterized in general by a relatively stable condition of the atmosphere, in which the southern anticyclone was frequently the dominating feature, favoring rising temperatures and hot waves in the central zone.

The early days of the month had generally good weather, but with violent winds between the coasts of Chiloe and Arauco, with fairly high temperatures in the interior of the Provinces of Aconcagua, Santiago, O'Higgins, Colchagua, Curico, and Talca. The high-pressure center was situated during this period between Chiloe and Cape Raper, fluctuating about a mean value of approximately 770 mm. (1,026 mb.).

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[1] Milham's Meteorology, p. 241.
[2] Davis' Elementary Meteorology, p. 286.