PENNSYLVANIA.

Temperature.—The mean was 3.1 above the normal; maximum, 91, at Coatesville, 9th; minimum, 17, at Hollidaysburg and Smethport, 31st; greatest monthly range, 69, at Coatesville and Lagonia; least monthly range, 42, at Altoona.

Precipitation.—The average was 0.22 below the normal; greatest monthly, 6.58, at Blue Knob; least monthly, 1.18, at Bloomsburg.

Wind.—Prevailing direction, northwest.—*Under direction of the Franklin Institute, Philadelphia; W. P. Tatham, director; T. F. Townsend, Local Forecast Official, Weather Bureau, assistant.*

SOUTH CAROLINA.

Temperature.—Maximum, 90, at Trial and Kingstree, 10th; minimum, 25, at Greenville, 31st.

Precipitation.—Greatest monthly, 8.16, at Hardeeville; least monthly, 0.72, at Greenwood.

Wind.—Prevailing direction, northeast.—*J. W. Bauer, Observer, Weather Bureau, Columbia, director.*

SOUTH DAKOTA.

Temperature.—The mean was 0.5 below the normal; maximum, 90, at Oelrichs, 21st; minimum, 2, at Webster and Wentworth, 29th; greatest monthly range, 81, at Webster; least monthly range, 50, at Bear Valley.

Precipitation.—The average was 0.33 below the normal; greatest monthly, 4.70, at Forest City; least monthly, trace, at De Smet.

Wind.—Prevailing direction, northwest.—*S. W. Glenn, Local Forecast Official, Weather Bureau, Huron, director.*

TENNESSEE WEATHER AND CROP SERVICE.

Temperature.—The mean was 0.6 below the normal; maximum, 90, at Covington, 21st; minimum, 22, at Jacksboro, 30th, and at Harriman, 31st; greatest monthly range, 65, at Springdale; least monthly range, 41, at Bethel Springs.

Precipitation.—The average was 0.89 below the normal; greatest monthly, 5.85, at Johnson City; least monthly, trace, at Bethel Springs.

Wind.—Prevailing direction, north.—*J. B. Marbury, Local Forecast Official, Weather Bureau, Nashville, director.*

TEXAS.

Temperature.—The mean was 0.5 above the normal; maximum, 101, at Fort Ringgold, 2d, and at Sulphur Springs, 9th; minimum, 22, at Fort Hancock, 26th and 28th; greatest monthly range, 69, at Sulphur Springs; least monthly range, 27, at Galveston.

Precipitation.—The average was 1.81 below the normal; greatest monthly, 3.09, at Llano; least monthly, 0.00, at a number of stations.

Wind.—Prevailing direction, south.—*D. D. Bryan, Galveston, director; I. M. Cline, Local Forecast Official, Weather Bureau, assistant.*

UTAH.

Temperature.—Maximum, 92, at Fillmore, 8th; minimum, 5, at Scofield, 11th; greatest monthly range, 71, at Fillmore; least monthly range, 47, at Castle Gate and Salt Lake City.

Precipitation.—Greatest monthly, 1.46, at Lake Park; least monthly, 0.00, at Loa and Green River.

Wind.—Prevailing direction, southeast.—*G. N. Salisbury, Observer, Weather Bureau, Salt Lake City, director.*

VIRGINIA.

Temperature.—Maximum, 89, at Ashland and Avon, 9th; minimum, 19, at Big Stone Gap, Lexington, and Marion, 30th; greatest monthly range, 63, at Big Stone Gap; least monthly range, 35, at Cape Henry.

Precipitation.—Greatest monthly, 12.61, at Avon; least monthly, 2.10, at Cape Henry.

Wind.—Prevailing direction, northeast.—*Dr. E. A. Craighill, Lynchburg, director; J. N. Ryker, Observer, Weather Bureau, assistant.*

WASHINGTON.

Temperature.—Maximum, 83, at Davenport, 26th; minimum, 12, at Waterville, 23d; greatest monthly range, 70, at Davenport; least monthly range, 16, at Tatoosh Island.

Precipitation.—The average was 0.59 above the normal; greatest monthly, 11.44, at Neah Bay; least monthly, 0.19, at Bridgeport.

Wind.—Prevailing direction, south.—*H. F. Alciatore, Observer, Weather Bureau, Olympia, director.*

WEST VIRGINIA.

Temperature.—Maximum, 86, at Buckhannon and New Martinsville, 12th, and at Point Pleasant, 11th; minimum, 16, at Marlinton, 31st; greatest monthly range, 66, at Central Station; least monthly range, 50, at Ella.

Precipitation.—Greatest monthly, 7.22, at Bluefield; least monthly, 2.95, at Grafton.

Wind.—Prevailing direction, west.—*W. W. Dent, Observer, Weather Bureau, Parkersburg, director.*

WISCONSIN.

Temperature.—The mean was 2.0 above the normal; maximum, 89, at Prairie du Chien, 8th; minimum, 7, at Haywood, 29th.

Precipitation.—The average was 0.50 below the normal; greatest monthly, 5.22, at Ashland; least monthly, 1.37, at Manitowoc.

Wind.—Prevailing directions, south and southwest.—*W. L. Moore, Local Forecast Official, Weather Bureau, Milwaukee, director.*

WYOMING.

Temperature.—Maximum, 82, at Fort Yellowstone, 16th; minimum, 9, at Laramie, 26th; greatest monthly range, 60, at Cheyenne; least monthly range, 51, at Saratoga.

Precipitation.—Greatest monthly, 2.20, at Saratoga; least monthly, 0.18, at Fort Washakie.

Wind.—Prevailing directions, west.—*E. M. Ravenscraft, Observer, Weather Bureau, Cheyenne, director.*

OBSERVATIONS ON THE GREAT LAKES.

REPORTS FROM VESSELS.

The Lake Marine Section of the Forecast Division has received a number of reports for October from the captains of 39 vessels navigating the Great Lakes. The following miscellaneous items are extracted from their reports.

Capt. Frank D. Root, s. s. "Maritana," reports on October 14, p. m., at the entrance to Detroit River, water so low could not go up the river.

Capt. F. A. Graves, s. s. "Maton," navigating Lakes Michigan and Superior, reports October 5, northeast gale continuing over to the 6th, and northwest gale October 7. Also a north-northwest gale October 14–15.

Capt. Thos. Hackett, s. s. "Volunteer," Saginaw Bay, on October 5, reports northern lights shone very plainly from 10 p. m. till midnight. On October 1 he states that "the Bell buoy off Point aux Barques in my judgment is of much benefit to boats passing in the thick weather and dark nights, and I think more of them could be used on the Lakes with good results, one off Sturgeon Point, and one off Middle Island reef, Lake Huron, would be of much benefit to passing boats, and one off Wangoshanee light, and wherever boats have to pass close to shoal places they are of much benefit."

Capt. Hugh O. Miller, s. s. "Conemaugh," on Lake Erie, reports October 6, noon, barometer the lowest I ever saw it.

Capt. J. W. Morgan, s. s. "Australasia," on Lake Michigan, October 6, aurora very bright 8.30 p. m.

Capt. Edward Mooney of the s. s. "Wa-Wa-Tam," on Lake Superior, reports October 5, northern lights from 3 a. m. until 4 a. m.

Capt. R. E. Gain, s. s. "W. H. Sawyer," on Lake Michigan, reports October 3, 11 p. m., bright flashing northern lights. Reports also important obstacle in the channel just west of waterworks crib, abreast of Buffalo.

Capt. James Parsons, s. s. "Charles Hebard," on Lake Michigan, reports on October 1, 10 p. m., a most beautiful and well-defined aurora visible, not a cloud in the sky although the wind was blowing 7 miles from southeast at the time. October 13th and morning of 14th, the barometer the lowest that it has been with us in 7 years.

Capt. John Lowe, s. s. "Kalliyuga," on Lake Huron, reports an important obstruction north of Ashtabula Piers; also another southwest from Point Pelee, Ont., and another southeast from Bar Point, Lake Huron.

Capt. C. W. Woodgrift, s. s. "F. R. Bull," on Lake Michigan, reports an obstruction, the mast of str. "Wocokin," 6 miles above Long Point and about 3 miles from shore.

Capt. Hourigan, s. s. "Hecla," reports frost on the morning of the 10th at Ogdensburg. On the 13th he sailed into Lake Ontario into a heavy sea and southeast gale; his barometer falling rapidly to 28.54. The "Hecla" rolled her smoke stacks out, could not make steam, parted hawsers and went ashore 2 miles east of Wellington. Capt. Hourigan claims that he did not have due notice of this storm or he might have avoided it.

Capt. C. W. Lockwood, s. s. "Bennington," reports October 11, Ashland, Mich., on Lake Superior, thunder and lightning and heavy rain. On the the 14th, in the morning, near Whitefish Point, northwest hurricane and heavy cross seas; barometer 28.75 (aneroid, approximately, reduced to sea level). 15th and also 29th, at the lower end of Lake Superior, squalls of snow and hail.

Capt. Fred Howe, s. s. "Aztec," October 11, 8 p. m., to 12th, 8 a. m., on Lake Erie, reports clouds heavy with sheet lightning in the northwest.

REPORTS FROM U. S. LIFE-SAVING STATIONS.

Through the kind co-operation of the General Superintendent of the Life-Saving Service and the Secretary of the Treasury, the Weather Bureau has received 454 weekly transcripts of journals for the month of October from the keepers of 39 U. S. Life-Saving stations on the Great Lakes. The mean pressures, temperatures, and winds will be useful in

the compilation of monthly summaries and charts. The following special notes by the respective keepers are extracted from these reports:

Big Sandy Creek, Lake Ontario.—10th, during the fore part of this night the northern lights were very brilliant; 14th, much damage by gale.

Manistee, Mich.—24th, sea was high and rough all day, but did not notice any current.

Middle Island, Lake Huron. — 1st, northern lights 8 p. m.; 5th, northern lights about 8 p. m.; 9th, 8.30 p. m., northern lights; 11th, northern lights; 17th, northern lights 11.30 and continued after midnight; 18th, northern lights continued to 2 a. m.

Oswego, N. Y.—3d, had dim northern lights from 12 midnight to 5 a. m.; 9th, northern lights were plainly visible from 10 p. m. to midnight; 10th, bright northern lights from 12 midnight until 5 a. m.

Point aux Barques, Mich.—14th, barometer from 8 a. m. until 3 p. m. at 28.11, is the lowest it has ever been since being in use at this station (about 8 years); 28th, 11 a. m., first snow of the season.

Point Betsey, Lake Michigan.—17th, bright northern lights from 10 to 12.

Sturgeon Point, Harrisonville, Mich.—18th, a heavy fog hung over the lake all day, the worst of the season.

Vermillion Point, Lake Superior [Post office, Whitefish Point, Mich.].—S. F. Bernier, keeper, reports, October 2d, at 3 p. m. the water in the Lake went down all at once 8 inches, and remained so for 15 minutes and then began to rise, and it rose 10 inches above the level and remained so for a few minutes (3 or 4), and then went down to its level and remained so for 30 minutes and again rose to 14 inches above the level and went down almost as quick and fell 18 inches below the level and it continued so till 8 o'clock that evening; the wind was southeast, fresh by spells, weather cloudy and occasionally rain, the wind shifting to the northwest, light at first at 8.30 p. m., thence increased to a gale by 12 o'clock, midnight. Barometer was falling very fast during the afternoon. 14th, this was the worst storm that we have had for years; the strongest wind and the biggest sea in my sixteen years on this station. 15th, the highest sea that ever was, it washed a solid bank of sand for one-quarter of a mile on to the land—took away our breakwater, pump-house, and look-out. 18th, white geese and ducks going south.

NOTES BY THE EDITOR.

THE COLD WEATHER STORMS OF INDIA AND AMERICA.

The cold waves that flow over the United States from the Northwest during the cold season, November to March, are analogous to the cold weather storms that occur in India during December, January, and February. These latter have been made the subject of study by the meteorological office at Calcutta, and an extensive memoir on the subject by J. Eliot, the superintendent of that office, has just been received, which will be of value to the students of American weather, and from which we extract the following paragraphs:

In India these storms occur during the prevalence of the northeast monsoon and they are of great economical importance, as the snowfall of the Himalayas occurs chiefly during their existence; they also give more or less rain to northern India. The character and value of the wheat and other crops of northern India largely depend upon the amount and distribution of the rainfall during these storms of the cold weather months. In some years the number of these storms is much less than usual and the rainfall scanty, and consequently the wheat crop fails more or less in the unirrigated regions; the more elevated the district the greater the failure. In other years these storms are of frequent occurrence and give moderate to heavy showers at short intervals; in such years the wheat crop of northern India is generally generous and there is usually a surplus available for export to Europe.

The cold weather storms originate during a period when dry land-winds prevail in India and when the lower atmospheric strata over northern India contain only from one-half to one-third the amount of moisture which is present in the air during the rains or southwest monsoons. A great variety of these storms march in an easterly direction across northern India, or in the opposite direction to that in which the cyclonic storms of the southwest monsoon period usually advance across northern India. They sometimes enter India from Baluchistan on the northwest and advance east or east-southeast across the whole breadth of India into Burmah, where they disappear either by filling up or by advancing into farther India where there are no meteorological observations at present available. They never enter India from the adjacent seas. On the other hand, the cyclonic storms of the rainy season generally enter India from the Bay of Bengal and move westward.

After giving a full description of all the more important cold weather storms during the sixteen years, from 1876 to 1891, Mr. Eliot says:

Cyclonic storms may originate under various combinations of circumstances, and any attempt to formulate a theory for all will necessarily fail to explain many important features of a special class. He arranges the storms of India as follows: (1) cyclonic storms of the southwest monsoon season; (2) cyclonic storms of the cold weather or northeast monsoon season; (3) storms of the hot season, including tornadoes, "nor'westers," thunderstorms, hailstorms, duststorms, etc.; these are usually of very small extent and rarely last more than a few hours.

The prominent features of the first class of storms are as follows:

A. They form over the Indian Sea, and especially the Bay of Bengal.

B. They move toward the west and north, and sometimes northeast, the mean direction being west-northwest.

C. The central barometric depression is frequently very large and the winds very violent.

D. They give excessive rain, total falls of 15 to 20 inches being by no means unusual in the districts over which they pass.

E. The temperature changes are also small and are due to the rainfall.

The characteristics of the second class or cold weather storms are:

a. They form in northwestern India or advance into that region from the plateaus and mountains of Persia, Afghanistan, and Baluchistan.

b. They advance toward the east and east-southeast with great uniformity.

c. A large proportion of the storms give rise to subsidiary depressions in the Punjab with very marked cyclonic features.

d. The barometric depression in the primary disturbances is always small in amount, and the rainfall in the plains of northern India due to these storms is usually moderate in amount, rarely exceeding 3 or 4 inches.

e. The changes in temperature and humidity accompanying these storms are usually very marked. Every storm of importance is preceded in its advance across India by a warm wave and is followed by a cool and dry wave.

The first indication of a cold weather storm is usually a local fall of the barometer in Baluchistan, on the west frontier, and is followed by the appearance of a shallow depression on the northwest frontier; this latter drifts across northern India to the east or east-southeast and either fills up in northeastern India or passes farther eastward into Burmah. There is usually a considerable increase of temperature in front of the advancing depression; these depressions usually give light or moderate rain in their eastern and northern quadrants; little or no rain falls in the central area, and still less in the south quadrant. The effects of these storms are restricted to northern India, viz., from the north of the Deccan (between N. 20° and 35°).

In the majority of cases the appearance of barometric depressions on the west frontier is followed by the formation of deeper and smaller depressions to the northward in central and northern Punjab; these latter are usually almost usually stationary and fill up as rapidly as they form, while the previously existing shallow depressions to the southward are moving east to Bengal; the barometric changes in the Punjab, due to these deeper depressions, are occasionally very large and rapid; evidently the latter depend for their formation upon some atmospheric action connected with the eastward advance of the shallow depressions to the southward; they are, therefore, to be considered as secondary and subsidiary to them.

The subsidary depressions in the Punjab are invariably accompanied by more or less heavy snowfall in the western Himalayas and in the Afghan mountains, and by moderate rain in the north and east Punjab; during their existence the heaviest and most extensive snowfalls in the hill districts of upper India, and the most general rain during the cold weather season in the plains of northern India usually occur. Out of a total of fifty-five primary storms or shallow depressions during the years 1876–1891, thirty were accompanied by secondary storms or depressions in upper India. The secondary are definitely related to the primary depressions, forming and disappearing during a well-defined stage in the progress of the latter, and their formation is almost certainly the result of special actions set up in the Punjab by the primary disturbances.

When there is a general decrease of pressure over the Indian area of northeast monsoons then the shallow primary depressions appear in northwestern India. There is an oscillation in the general pressure over this region which has a period of about five days in the cold weather season; this oscillation was particularly well marked in November and December, 1892, and was at that time almost simultaneous and uniform over a region extending a thousand miles in latitude and three thousand in longitude; hence the oscillations have the character of fairly regular pulsations and are not the result of any abnormal conditions, and are not likely to be due to the passage of waves of high and low pressure. Out of forty-four storms during the years 1878–1891, thirty-one formed or appeared in the northwestern frontier districts during that portion of barometric oscillation over the whole of India in which the barometer was falling, and only thirteen storms occurred when the barometer was rising, so that it is probable that the oscillatory decrease of pressure is favorable to the formation of the primary depressions of the cold weather storms; and, in fact, that these storms form within the areas of oscillatory depressions and probably, as a rule, not farther west than Baluchistan. An examination of the observations made in Persia shows that about one-third of these primary depressions are the continuation of depressions that had passed over central Persia three or four days before reaching the northwest frontier of India, so that in general out of forty-four storms during the years 1878–1891, seven apparently originated west of Baluchistan, nineteen in Baluchistan, and eighteen in upper or northwest India. Of those that have been traced back to central Persia, none can be clearly traced so far as Europe, and it is probable that the cold weather storms of India are not the continuation of European storms.

One of the most remarkable features of these storms is that a very large