

Climatological Data for December, 1909.
DISTRICT No. 4, LAKE REGION.

Prof. HENRY J. COX, District Editor.

INTRODUCTION.

December, 1909, in the Lake region was in many respects a remarkable month. Steady cold over the southern and western portions after the first few days, with brisk to high winds and heavy and frequent snows unprecedented in localities, deficiency in sunshine and increased humidity, combined to render the weather of the month similar to that of the "old-fashioned" winters. Good sleighing was continuous after the first snowfall, while the frequent storms caused great delays to transportation, and seriously interrupted business over telegraph and telephone wires. By the end of the month much of the ice needed for next summer's consumption had been harvested, and the demand for coal and fuel of all kinds was largely increased. Gas and electric light companies were pushed to extra efforts in order to supply their customers, as a result of the marked increase in cloudiness. Many of the stations of the district, especially those to the lee of the lakes, reported more than 25 cloudy days each, and at Grand Haven, Mich., 30 consecutive cloudy days occurred with 27 days of snowfall.

TEMPERATURE.

The mean temperature of the month was far below the normal over the southwestern portions of the district, extreme departures being reported as follows: Oshkosh, Wis., -8.8° ; Appleton and Milwaukee, Wis., -7.1° ; Chicago, Ill., -7.6° ; South Bend, Ind., -8.2° ; Findlay, Ohio, -7.1° . Northeastward from this line of greatest departure around the western and southern shores of Lake Michigan, however, the deficiency decreased quite uniformly to the line of no departure. Beyond the no departure line, covering the greater portion of the Canadian Provinces lying within the St. Lawrence Basin, the mean temperature was above the normal, the departure amounting to more than $+6^{\circ}$ in the Saguenay Valley.

With the exception of the first day in the valleys of Vermont, the month opened with warm weather in all portions of the district. The highest temperature occurred generally on the 1st in the northwest, on the 5th over the middle sections, and on the 6th in the extreme east. During this period temperatures of 44° occurred in the western Superior region, while at many stations in southern Michigan, northern Indiana, and northern Ohio readings of higher than 60° were recorded, the extreme being 67° at Vickery, Ohio, on the 5th. In the portion of New York State in District No. 4 the maximum did not exceed 59° , and in northern Vermont the highest temperature was 45° at Cornwall, on the 5th.

An area of cold weather which developed in the extreme northwest on December 3 reached the western confines of the district on the 5th, and by the 8th had overspread all portions to the eastward. After the 8th the only instance in which the minimum temperature did not fall to freezing or below in any portion of the district was at Burlington, Vt., on the 14th, when the minimum thermometer showed 33° . Temperatures of zero or below were frequent, especially over the northwest.

From the 10th to the 15th and from the 20th to the 25th areas of somewhat higher temperature crossed the district. The relief, however, was but slight, and the cold may be regarded as practically continuous after the first week of the month. Following the latter of these periods, the cold intensified, and the bitterest weather of the month prevailed generally. Extremely low temperatures were reported as follows: Mount Iron, Minn., -23° ; Stephens Mine, Minn., -22° ; South Bend, Ind., -13° ; Charlotte, Mich., -22° ; Medina, Ohio, -15° ; Old Forge, N. Y., -25° ; Nehasane and Carvers Falls, N. Y., -22° ; Enosburg Falls, Vt., -18° .

PRECIPITATION.

The precipitation was normal along the Lake Huron side of the southern peninsula of Michigan. To the eastward, with the exception of areas on the southern shore of Lake Ontario, the precipitation was deficient; to the westward, the amount was greater than the average. Rain fell generally in the sections of the district west of Lake Michigan during the first 5 days of December, but only light and scattered showers occurred over the remaining portions. After the cold weather had overspread the region, however, precipitation in the form of snow was frequent, and the ground was covered continuously, the blanket deepening gradually to the end of the month. The Ohio and Indiana borders of the district had generally the lightest covering, but the depths increased uniformly toward the west, north, and northeast. At the close of the month the covering ranged from 7 inches in northern Ohio to 30 inches and more in Upper Michigan, and in the regions to the leeward of the lakes. The depth was greatest on the eastern shore of Lake Ontario, where, at Adams Center, N. Y., 35 inches lay on the ground, and 94 inches had fallen during the month.

The severest storm of December passed over the district from the 24th to the 26th. High winds drifted the heavy snowfall badly in many localities of Wisconsin, Illinois, Indiana, southern Michigan and Ohio, and the losses resulting from interrupted train service and wire communication were considerable. The stoppage of the movement of coal, together with the increased demands due to the continued cold weather, caused a serious depletion of the visible supply in some of the larger cities, although by the end of the month famine conditions had not yet been reached. The difficulties of transportation were still further increased by the softening of the snow on the ground, due to the slight rise in temperature of this period, so that the severe cold which followed hardened the covering into a compact and crusted mass.

The passage of this storm eastward across the New England portions of the district was also marked by general and, in places complete, interruption of communication by both wire and rail.

The successive storms of the month followed each other so rapidly that in many of the larger cities and towns the removal of the snow was impossible, and the hardening mentioned above left the streets almost barricaded by piles of solid snow.

A severe wind storm preceded the first appearance of cold weather over the central portions of the district, and caused considerable damage in localities. The Section Director of Michigan says in his report: "High southwesterly winds prevailed over most of the Lower Peninsula during the afternoon and night of the 5th, maximum velocities of 50 to 56 miles per hour being recorded at Weather Bureau stations in the southern counties. At Saginaw, W. S., the wind unroofed a brick building causing a damage amounting to about \$500." The following Buffalo despatch, reprinted from the *Ithaca Daily News* of December 8, indicates the severity of the storm in that section:

Following close upon the heels of the heavy blow which raged over the lower Lake region Sunday night and Monday morning, a 72-mile an hour gale fell upon the city last evening. Much damage and discomfort ensued.

Shortly after 5 o'clock the whole city was plunged in darkness, due to the breaking of the transmission line between Buffalo and Niagara Falls, and down town department stores and office buildings were cut off from light. The gale blew down telegraph poles and unroofed freight cars.

At the foot of Porter avenue, in the Niagara River, the dredge Pocantico, with 7 men aboard, was tossed by the wind and careened so that she was swamped and sank, the men having barely time to reach the roof of the cabin. They were 400 feet from shore and the waves were so high that no craft in the harbor could reach them.

Two of the men jumped overboard and reached the shore after a hard battle, and Captain Greiser, of the life-saving station, after a long struggle of several hours, succeeded in rescuing the remaining 5.

This morning the wind has decreased and there are flurries of snow with much lower temperature.

MISCELLANEOUS.

The following extracts from the reports of Weather Bureau officials will furnish information of interest relative to miscellaneous data not incorporated above, as well as to the ice conditions of the district:

Minnesota.—The ground was covered with snow from the 5th to the end of the month, but there was little frost in the ground underneath, a condition which seriously interfered with logging in the northern woods.—*U. G. Purssell, Section Director, Minneapolis.*

Illinois.—The snowfall of December, 19.1 inches, at Chicago, exceeded all former records for that month.—*Local Annual Summary of Chicago.*

Indiana.—The rivers were frozen during most of the month, and considerable ice cutting was done during the latter part, the ice having attained a good thickness.—*V. H. Church, Section Director, Indianapolis.*

Michigan.—Ice began to form on the rivers and harbors during the latter part of the first decade, but, despite the cold weather, did not gain rapidly in thickness on account of the heavy snow covering. In the eastern part of the southern counties, where the snowfall during the early part of the month was not so great, the ice acquired a thickness of 6 to 8 inches during the second decade and 9 to 10 inches during the third decade.—*C. F. Schneider, Section Director, Grand Rapids.*

The total snowfall at Grand Haven exceeded all prior records, but much of it was very downy in character, and settled rapidly.—*C. H. Eshleman, Observer, Grand Haven.*

Ohio.—Light sleet was fairly general on the 7th and 12th. The snowfall was heavier than usual, ranging from 8 to 26 inches, and most of it fell on the 25-26th. The rivers were all frozen at the end of the month.—*M. W. Hayes, Section Director, Columbus.*

The month was the coldest December, with one exception, since 1896. Except for a partial break on the 15th, the Maumee River was frozen over after the 9th, the ice reaching a thickness of 9 inches on the river and 10 to 12 inches on Maumee Bay. Navigation closed here on the 13th and was considerably impeded before that time by ice. The wind movement exceeded that of any previous month except April, 1909, and there were gales on the 5th, 6th, 7th, 8th, 13th, 14th, 17th, and 18th.—*W. S. Currier, Local Forecaster, Toledo.*

New York.—The month in Rochester was characterized by steady weather. There were no great extremes of heat or cold.—*L. M. Dey, Local Forecaster, Rochester.*

Vermont.—Yesterday's low temperature (December 27) made the first impression on Lake Champlain, and by evening the water was steaming in a midwinter manner. The heavy fall of snow has done much to reduce the temperature of the water, and every indication points to an early freezing over of the lake.—*J. K. Hooper, Local Forecaster, Burlington.*

THE LAKE REGION—GENERAL FEATURES.

J. H. ARMINGTON, Local Forecaster.

Climatological District No. 4 comprises the country drained by the St. Lawrence River and its tributary lakes and streams, an area of approximately 530,000 square miles, including about 95,300 square miles of water surface. About 93,900 square miles of the latter area are occupied by the Great Lakes and their connecting streams, the remainder being the water surface of the river system below the outlet of Lake Ontario. The

lakes, however, receive the drainage of only about 40 per cent of the entire basin. The foregoing table shows the chief measurements of the system.

The whole region is simply a shallow basin of general eastward and northeastward slope, with a series of secondary depressions, occupied by the five great lakes of the area, lying near its southwestern rim. Prior to the formation of these lakes, the St. Lawrence seems to have extended as a trunk stream along an escarpment now submerged near the southern shore of Ontario, thence northwestward through the region occupied by the Georgian Bay and Lake Huron, finally curving westward into Lake Michigan. This trunk stream apparently had two large southern tributaries, the upper flowing in a northeasterly direction entirely across the present southern peninsula of Michigan through Saginaw Bay, and the lower traversing the present bed of Lake Erie. The region then had an elevation of about one-third of a mile greater than is now the case. The lakes appeared at the close of the glacial epoch, when the drift left by the ice sheets covered the original rocks, filled some valleys, dammed others, and completely changed the surface characteristics.

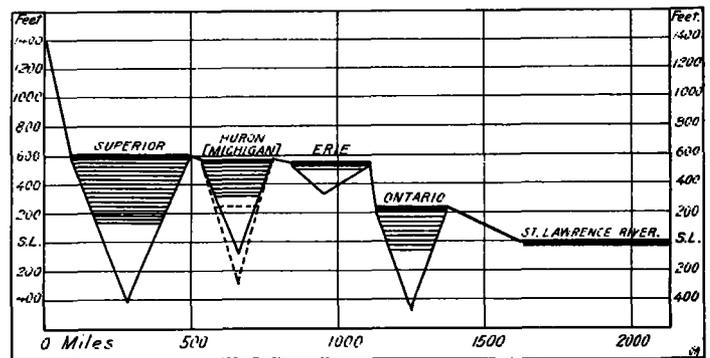


FIG. 1.—Elevations of the Great Lakes.

The present elevation of the lakes and their connecting streams is shown in fig. 1. Superior lies at an altitude of 602 feet above sea level. Its discharge descends 21 feet through the St. Marys River to the level of Lakes Michigan and Huron, 581 feet. Practically the entire fall is accomplished within three-quarters of a mile at Sault Ste. Marie, and lock canals are necessary for the passage of shipping. From Huron to Erie the difference of level is only 8 feet, but from Erie to Ontario, a distance of 30 miles, the descent is 326 feet, there being a sheer drop of 160 feet at the Falls. Below the outlet of Ontario the St. Lawrence reaches sea level in about 250 miles, and the remainder of its extent forms an estuary of increasing width until it opens into the sea through the gulf of its own name.

The average as well as the extreme depth of each of the lakes is also shown in fig. 1, the shaded areas representing the average depths, and the apexes of the inverted triangles indicating the deepest soundings. Lake Michigan is shown by dotted lines. It will be noted that Lake Erie alone lies entirely above sea level, and the dangers of navigation thereon are increased considerably by its shallowness.

The rim of the St. Lawrence basin is of but moderate elevation, even along its higher portions at the southeastern side of the depression. Indeed, in places along its extent through the country to the north and east of Lake Superior it becomes rather indistinct, and there are several low and easy portages of only a few miles, over which for a long time merchandise has been carried to and from the trading posts in the region of the Hudson Bay.

In general, the divides hug the lake shores closely, the only broad valleys being those of the Ottawa and Saguenay rivers in the Canadian Provinces below the lake chain. The charts of District No. 4 indicate the divides separating the various drainage areas of the American side of the basin, while

	Altitude of surface above sea level.			Greatest depth.			Surface area.	Area drained.	Basin area.	Length.	Width.
	Feet.	Feet.	Feet.	Sq. mi.	Sq. mi.	Sq. mi.					
Lake Superior.....	602	1,008	475	31,200	54,000	85,200	420	167			
St. Marys River.....				150	800	950					
Lake Michigan.....	581	870	325	22,450	37,700	60,150	300	75			
Lake Huron.....	581	730	250	22,322	31,700	54,022	250	155			
St. Clair River.....				25	3,800	3,825					
Lake St. Clair.....				410	3,400	3,810					
Detroit River.....				25	1,200	1,225					
Lake Erie.....	573	210	70	9,900	22,700	32,600	245	50			
Niagara River.....				15	300	315					
Lake Ontario.....	247	738	300	7,400	21,600	29,000	185	60			
St. Lawrence River.....				1,403	257,500	258,903					
Total system.....				95,300	434,700	530,000					