

between 4 and 5.20 p. m. of the 8th, during which considerable hail fell. At a point of five miles west of this place the hailstones are reported to have been as large as hens' eggs, and caused much damage to corn and wheat.

Clear Creek, Saunders county, Nebraska.—A severe hail storm occurred five miles south of this place on the 13th, causing much damage to the growing corn.

Bismarck, Dakota.—Heavy hail fell at this station between 5.38 and 5.40 p. m. of the 18th. At points north and east of here considerable damage was done to the grain fields.

Niagara, Dakota.—A severe hail storm occurred south of this place at about 4 a. m. of the 19th. The storm passed from the southern edge of Devil's lake northeastward between this place and Larimore. The wheat crop suffered serious injury on Forest river and in Elk valley.

Very large hail accompanied the storm of the night of the 7-8th, in Iowa, which is described under the heading "local storms."

Hail storms of less severity have been reported from the various states as follows:

- Arizona.—Fort Thomas, 9th; Fort Grant, 25th.
- Arkansas.—Lead Hill, 1st.
- Colorado.—Fort Garland, 23d, 25th.
- Connecticut.—Southington, 1st, 8th, 19th, 23d.
- Dakota.—Alexandria, 17th; Deadwood, 14th; Fort Hale, 8th; Fort Sisseton, 28th; Fort Totten, 17th, 18th.
- Georgia.—Atlanta, 13th.
- Iowa.—Guttenburg, 10th.
- Minnesota.—Moorhead, 27th.
- Nebraska.—Clear Creek, 8th; De Soto, 7th; Utica, 8th, 11th.
- New Hampshire.—Contocookville, 20th.
- New Mexico.—Fort Union, 12th.
- New York.—Albany, 19th; Ardenia, 13th; Friendship, 18th; New York City, 19th.
- Pennsylvania.—Wellsboro', 23d.
- Tennessee.—Austin, 15th; Milan, 1st, 15th.
- Texas.—Fort Concho, 22d.
- Wisconsin.—Beloit, 27th.

SNOW.

Fort Collins, Colorado.—Light snow fell at this place during the early morning of the 1st.

Fort Shaw, Montana.—Heavy rain fell during the afternoon of the 21st, changing to snow at 6.15 p. m., which continued for thirty-five minutes.

Snow fell on the summit of Pike's Peak, Colorado, on the 2d, 3d, 4th, and from the 9th to 12th.

SLEET.

On the summit of Pike's Peak, Colorado, sleet was reported on the following dates: 1st to 5th, 8th, 9th, 11th, 12th, 15th, 25th, 27th, 28th.

Table of rainy and cloudy days, relative humidity, and dew-point for Aug., 1883.

Districts.	Rainy days.	Cloudy days.	Rel. humidity. %	Dew-point.
			Percentages.	° °
New England.....	From 7 to 12	From 1 to 6	From 66.6 to 79.6	From 55.1 to 62.2
Middle Atlantic states.....	" 5 " 10	" 3 " 4	" 60.8 " 83.2	" 54.4 " 66.8
South Atlantic states.....	" 10 " 17	" 2 " 12	" 61.6 " 82.6	" 61.3 " 73.7
Florida peninsula.....	" 10 " 18	Three	" 71.3 " 77.1	" 72.1 " 72.8
East Gulf.....	" 8 " 16	From 0 to 3	" 69.1 " 77.1	" 68.5 " 74.3
West Gulf.....	" 4 " 10	" 0 " 6	" 65.0 " 75.6	" 66.2 " 73.8
Ohio valley.....	" 8 " 13	" 3 " 5	" 61.6 " 65.9	" 54.9 " 59.6
Tennessee.....	" 9 " 12	" 3 " 4	" 72.1 " 76.4	" 62.1 " 66.4
Lower lakes.....	" 9 " 17	" 3 " 6	" 64.7 " 72.1	" 54.2 " 57.5
Upper lakes.....	" 5 " 13	" 1 " 8	" 67.1 " 77.9	" 49.9 " 57.1
Extreme northwest.....	" 9 " 11	" 3 " 5	" 66.7 " 81.8	" 55.4 " 54.2
Upper Mississippi valley.....	" 5 " 12	" 2 " 9	" 66.0 " 71.4	" 56.8 " 62.3
Missouri valley.....	" 8 " 16	" 4 " 7	" 68.4 " 78.1	" 50.8 " 62.7
Northern slope.....	" 2 " 15	" 1 " 14	" 40.6 " 72.2	" 35.0 " 59.2
Middle slope.....	" 8 " 15	" 0 " 9	" 48.6 " 68.0	" 47.5 " 56.8
Southern slope.....	" 4 " 8	" 0 " 5	" 50.7 " 66.5	" 57.8 " 61.0
Southern plateau.....	" 5 " 20	" 0 " 5	" 42.3 " 65.6	" 53.6 " 59.8
Northern plateau.....	" 1 " 2	none	" 46.9 " 48.3	" 45.9 " 49.0
North Pacific.....	" 1 " 4	From 0 to 7	" 63.0 " 71.9	" 48.6 " 52.8
Middle Pacific.....	" 0 " 1	" 0 " 6	" 33.7 " 89.2	" 45.2 " 54.4
South Pacific.....	" 0 " 5	" 0 " 3	" 49.8 " 76.4	" 38.6 " 67.4
Mt. Washington, N. H.....	Sixteen	none	92.0	41.6
Pike's Peak, Col.....	Fifteen	One	73.5	30.3
Salt Lake City, Utah.....	Seven	Three	35.4	45.6

* Relative humidity corrected for altitude.

COTTON REGION REPORTS.

Temperature and rainfall observations in the cotton region were continued during August, 1883. The averages for the various districts are determined from observations made at the stations, as shown on chart vi., issued with the REVIEW for April, 1882. For the purpose of comparison, the averages for August, 1882, and those for August, 1883, with the departures, are given in the table below:

Meteorological Record of the Cotton Districts for the months of August, 1882 and 1883.

Districts.	Average rainfall in inches.			Temperatures.						Extremes for Aug., 1883.	
	1882.	1883.	Departures.	Mean of the maxima.			Mean of the minima.			Max.	Min.
				1882.	1883.	Change.	1882.	1883.	Change.		
New Orleans.....	8.38	2.70	- 5.68	89.8	90.9	+ 1.1	72.0	70.4	- 1.6	103	50
Savannah.....	6.21	5.64	- 0.57	90.6	91.0	+ 0.4	71.0	71.4	+ 0.4	105	62
Charleston.....	6.12	5.66	- 0.46	90.4	90.0	- 0.4	68.9	68.5	- 0.4	100	54
Atlanta.....	5.99	5.03	- 0.96	85.7	89.0	+ 3.3	67.5	67.0	- 0.5	99	51
Wilmington.....	6.24	2.90	- 3.28	87.8	88.7	+ 0.9	67.8	67.5	- 0.3	108	49
Memphis.....	4.30	3.41	- 0.89	87.1	87.5	+ 0.4	67.2	65.0	- 2.2	98	50
Galveston.....	5.44	0.93	- 4.49	91.7	96.3	+ 4.6	70.2	73.4	+ 3.2	106	61
Vicksburg.....	4.66	2.60	- 2.06	89.1	92.5	+ 3.4	69.6	69.8	+ 0.2	99	55
Montgomery.....	4.01	3.16	- 0.85	88.6	92.2	+ 3.6	68.7	68.7	0.0	99	47
Augusta.....	4.26	3.13	- 1.13	88.4	90.4	+ 2.0	68.8	68.1	- 0.7	102	51
Little Rock.....	3.44	3.41	- 0.03	88.3	91.9	+ 3.6	65.3	65.6	+ 0.3	103	54
Mobile.....	3.96	2.32	- 1.64	90.2	93.7	+ 3.5	70.0	68.9	- 1.1	103	48

From the above table it will be seen that, as in the preceding month, the average rainfall of August, 1883, is below that of August, 1882, the deficiencies being largest in the districts of New Orleans and Galveston, where they are 5.68 and 4.49, respectively. The means of the maxima temperatures for August, 1883, have been higher in all districts except for the district of Charleston, while the means of minima temperatures differ but little from those of August, 1882.

WINDS.

The most frequent directions of the wind during the month of August, 1883, at the Signal Service stations are shown on chart iii., by arrows flying with the wind. Over the greater part of the country they were variable; in Tennessee, the south Atlantic and east Gulf states, they were mostly from the northeast; in Texas and the Ohio valley, they were southerly; on the north Pacific coast, they were northerly; and on the California coast, they were from the west and northwest.

TOTAL MOVEMENTS OF THE AIR.

[In miles.]

In the following table are given the stations reporting the largest and smallest total movements of the air in each of the various districts:

Districts.	Stations reporting largest.	Miles.	Stations reporting smallest.	Miles.
New England.....	Block Island, R. I.....	9,452	New London, Conn.....	3,233
Middle Atlantic states.....	Barneget City, N. J.....	10,046	Lynchburg, Va.....	2,240
South Atlantic states.....	Hatteras, N. C.....	11,301	Augusta, Ga.....	2,329
Florida peninsula.....	Cedar Keys.....	5,492	Sanford.....	3,641
East Gulf.....	Pensacola, Fla.....	4,631	New Orleans, La.....	2,275
West Gulf.....	Indianola, Tex.....	6,710	Fort Smith, Ark.....	2,401
Ohio valley.....	Louisville, Ky.....	4,660	Indianapolis.....	3,545
Tennessee.....	Memphis.....	3,512	Chattanooga.....	3,087
Lower lakes.....	Sandusky, Ohio.....	7,597	Cleveland, Ohio.....	4,985
Upper lakes.....	Milwaukee, Wis.....	7,093	Duluth, Minn.....	4,239
Extreme northwest.....	Fort Buford, Dak.....	6,696	Saint Vincent, Minn.....	4,296
Upper Mississippi valley.....	Saint Louis, Mo.....	5,347	Dubuque, Ia.....	3,237
Missouri valley.....	Huron, Dak.....	6,420	Omaha, Neb.....	1,621
Northern slope.....	North Platte, Neb.....	6,000	Deadwood, Dak.....	2,533
Middle slope.....	West Las Animas, Col.....	5,583	Denver, Col.....	4,409
Southern slope.....	Fort Stockton, Tex.....	5,976	Coleman City, Tex.....	4,056
Southern plateau.....	Fort Apache, Ariz.....	4,138	El Paso, Tex.....	2,694
Northern plateau.....	Dayton, Wash.....	3,771	Spokane Falls, Wash.....	2,557
North Pacific.....	Portland, Oregon.....	2,289	Olympia, Wash.....	1,371
Middle Pacific.....	San Francisco, Cal.....	9,029	Red Bluff, Cal.....	3,695
South Pacific.....	Los Angeles, Cal.....	3,924	Yuma, Arizona.....	3,524

On the summits of Mount Washington, New Hampshire, and Pike's Peak, Colorado, the total movements of the air were 25,550, and 9,268, miles, respectively.

HIGH WINDS.

On the summit of Mount Washington, New Hampshire,

maximum velocities of fifty miles or more per hour occurred on the following dates: 1st, 2d, 3d, 4th, 5th, 6th, 7th, 8th, 13th, 14th, 20th, 21st, 22d, 23d, 24th, 26th, 27th. The highest velocities recorded were as follows: 72, nw., 4th; 80, nw., 5th; 94, nw., 6th (maximum for month); 80, nw., 21st; 72, nw., 22d; 76 nw., 24th; 76, nw., 26th; 76, nw., 27th.

On the summit of Pike's Peak, Colorado, the highest velocity recorded was 48, w., 17th.

Other stations reporting velocities of forty miles or more per hour, are as follows: Sandy Hook, New Jersey, 55, e., 2d; Fort Assiniboine, Montana, 52, sw., 16th, and 43, w., 20th; Fort Bennett, Dakota, 51, nw., 16th; Block Island, Rhode Island, 47, ne., 29th; Cape May, New Jersey, 47, nw., 2d; New York City, 45, e., 2d; North Platte, Nebraska, 44, e., 10th; Indianola, Texas, 43, ne., 17th; Barnegat City, New Jersey, 40, n., 2d; Delaware Breakwater, Delaware, 40, s., 2d; Fort Benton, Montana, 40, s., 26th.

LOCAL STORMS.

Galveston, Texas.—A despatch from Midlothian, Ellis county, on the 3d, stated that a violent wind and rain storm occurred there on the evening of that date, during which a hotel and livery stable were blown down, and the contents of a lumber yard were scattered great distances over the prairie. The hotel was completely destroyed, and several persons were buried beneath the ruins.

Paris, Bourbon county, Kentucky.—The heavy rain and wind storm of the 10th caused considerable damage to the crops in this locality.

Wall Lake, Sac county, Iowa.—The storm on the night of the 7-8th was the severest that has been experienced in this county during the present year. The wind blew with great force, and was accompanied by a heavy fall of rain and hail. Bridges were washed out in various parts of the county, and the creeks and streams rose to unusual heights. Damage to the extent of thousands of dollars was done to the crops and other property in this county. A large quantity of window-glass was broken, and small animals and poultry were killed, by the hail. In some localities the grain was so completely destroyed that no attempt will be made to harvest it.

Des Moines, Iowa.—During the night of the 7-8th a hail storm of great severity passed through the valley of the Nishnebotene river, along the Audubon branch of the Chicago, Rock Island & Pacific railroad. All crops in the path of the storm, which was about four miles wide, were almost completely destroyed. Several houses were blown down, and a number of cars were lifted from the track. At Gray, Audubon county, it is reported that the hail covered the fence tops, and the trains were delayed until the hail was cleared from the track. Twenty-one of a herd of cattle were killed near Gray, where hailstones were found that measured thirteen inches in circumference. Seven miles north of Audubon, a dwelling was blown down, killing one of the inmates. The approach of the storm was preceded by a deafening roar.

Mr. F. W. Bowen, a volunteer observer of the Signal Service, at Humboldt, Iowa, reports that a remarkable hail storm occurred in Sac county, in that state, on the 8th. The hailstones were unusually large, and covered the ground to a great depth. Two days after the storm there remained, in places, large quantities of the unmelted hailstones.

Chattanooga, Tennessee.—On the afternoon of the 15th a destructive local storm passed over this city. There were two distinct tornado formations—one coming from the northwest, and the other from the northeast, uniting over the East Tennessee railroad depot, and afterwards continued its course for a distance of about one-half mile. The full force of the storm was of about four minutes' duration, from 5.18 to 5.22 p. m. Before uniting, the length of the tracks was about one and one-half miles, and its average width was two hundred yards. Hail fell during the storm, some of the hailstones measuring three-fourths of an inch in diameter. The damage to property was comparatively small, and is estimated at \$3,000.

Galveston, Texas.—A despatch, dated August 18th, from Waco, McLennan county, states that on the afternoon of the 16th a tornado struck the village of Oglesby, destroying the station house and a store, and scattering their contents over the prairie.

Duluth, Minnesota.—The high northwesterly winds of the 19th and 20th caused considerable damage at Agate Bay. Several small boats were driven ashore, and a scow laden with lumber was completely wrecked, and the lumber lost.

Toronto, Ontario.—A severe storm visited northwestern Ontario on the 19th. At Listowell the streets were covered with water to a depth of two feet. Several buildings and bridges were washed away and other property destroyed. At Wingham the river rose twelve feet, and a bridge and the railroad track at that place were washed away. Large quantities of standing grain were destroyed.

Winnipeg, Manitoba.—A severe storm visited this region on the 20th. A number of buildings in the suburbs were blown down, and several in the city were damaged.

At about 6 p. m., of the 21st, the town of Rochester, Minnesota, was visited by a most violent and destructive tornado, which destroyed a large part of the town. Throughout the day the weather had been unsettled, but it was not unusually threatening. At 3 p. m. a dark cloud arose in the west, which passed over, accompanied by high wind and a slight fall of rain. At 5 p. m. a low bank of cloud was observed in the southwest, which rose rapidly, but it presented only the appearance of an ordinary thunder-cloud. As it neared the city it assumed a threatening appearance, the whole sky becoming tinged with green. In the upper part of the city the darkness was not great, but in the lower part it became as dark as night. The approach of the tornado cloud was preceded by the usual roaring sound, which served as a warning to many persons, who sought protection in the cellars of the houses and escaped without injury. In Rochester one hundred and thirty-five dwellings were completely destroyed, together with their contents, and a large number of others were unroofed or otherwise damaged. Thirty-one persons were killed and about one hundred were more or less seriously injured. A train on the Rochester and Northern division of the Chicago & Northwestern railroad, while running at a high rate of speed, was blown from the track and wrecked between Rochester and Zumbrota, Minnesota. A number of the passengers were killed, and nearly every one on the train sustained bodily injury. The path of the tornado was from west to east, and its length was about eighteen miles. A relief committee was organized, and issued circulars appealing for contributions for the aid of the sufferers. The committee, after having examined the condition of fifty farms in the track of the storm, reported that every house and barn on them was demolished, and that much valuable stock was killed, farming implements wrecked, and thousands of bushels of grain were destroyed. The loss to the farmers in Olmstead county is estimated to be not less than \$200,000.

Swanwick, Perry county, Illinois.—A violent thunder-storm, coming from a northwesterly direction, occurred here on the 22d, during which the lightning struck numerous objects and caused considerable damage.

Marquette, Michigan.—Several roofs, chimneys, signs, and fences in this city were blown down during the storm of the 22d. Vessels report the storm to have been very severe on Lake Huron on that date.

Ottawa, Ontario.—A storm swept over this vicinity during the night of the 22-23d, which caused serious damage to buildings and crops.

NAVIGATION.

STAGE OF WATER IN RIVERS.

No high stages of water occurred in any of the rivers during the month.

At the most northerly stations on the Mississippi river the highest water was observed on the 1st, and also at Vicksburg, Mississippi, and New Orleans, Louisiana, on that date. The