

WINDS.

The most frequent directions of the wind during September, 1884, are shown on chart ii. by arrows flying with the wind.

In the lake region, New England, middle Atlantic and west Gulf states, southern slope, and in the Ohio, upper Mississippi and Missouri valleys, the prevailing winds were from southeast to southwest; in the south Atlantic and east Gulf states, they were from northeast to southeast; in the extreme northwest and northern slope, they were from southwest to northwest; on the California coast, they were westerly, except at Cape Mendocino, where they were from the north; in the plateau regions and on the north Pacific coast they were variable.

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.....	8,668	New Haven, Conn.....	4,047
Middle Atlantic states.....	Del. Breakwater, Del.....	10,607	Lynchburg, Va.....	1,860
South Atlantic states.....	Fort Macon, N. C.....	9,935	Augusta, Ga.....	2,861
Florida peninsula.....	Key West.....	9,337	Cedar Keys.....	6,281
Eastern Gulf states.....	New Orleans, La.....	4,479	Montgomery, Ala.....	3,730
Western Gulf states.....	Galveston, Tex.....	8,419	Little Rock, Ark.....	1,078
Rio Grande valley.....	Brownsville, Tex.....	4,822	Rio Grande City, Tex.....	4,580
Tennessee.....	Memphis.....	3,345	Chattanooga.....	2,075
Ohio valley.....	Louisville, Ky.....	4,152	Cincinnati, Ohio.....	3,210
Lower lake region.....	Sandusky, Ohio.....	8,167	Toledo, Ohio.....	5,731
Upper lake region.....	Grand Haven, Mich.....	7,930	Chicago, Ill.....	5,800
Extreme northwest.....	Fort Totten, Dakota.....	8,445	Bismarck, Dak.....	6,187
Upper Mississippi valley.....	Saint Louis, Mo.....	8,174	Dubuque, Iowa.....	3,750
Missouri valley.....	Huron, Dak.....	7,921	Leavenworth, Kans.....	5,585
Northern slope.....	Cheyenne, Wyo.....	8,595	Leadwood, Dak.....	2,532
Middle slope.....	Dodge City, Kan.....	11,295	Denver, Colo.....	4,544
Southern slope.....	Fort Concho, Tex.....	5,870	Fort Davis, Tex.....	3,302
Southern plateau.....	Prescott, Ariz.....	4,774	El Paso, Tex.....	1,580
Middle Plateau.....	Salt Lake City, Utah.....	3,844	Lewiston, Idaho.....	1,706
Northern plateau.....	Dayton, Wash. T.....	4,170	Olympia, Wash. T.....	1,641
North Pacific coast region.....	Fort Canby, Wash. T.....	5,767	Red Bluff, Cal.....	4,521
Middle Pacific coast region.....	Cape Mendocino, Cal.....	13,419	Los Angeles, Cal.....	3,583
South Pacific coast region.....	San Diego, Cal.....	4,195		

The total movements of the air on the summits of Mount Washington, New Hampshire, and Pike's Peak, Colorado, were 29,335 and 16,517 miles, respectively.

HIGH WINDS.

On the summit of Mount Washington, New Hampshire, maximum velocities of fifty miles or more per hour occurred as follows: 70, nw., 1st; 70, nw., 2d; 60, w., 3d; 78, w., 4th; 88, nw., 5th; 84, nw., 6th; 56, nw., 7th; 68, nw., 8th; 76, nw., 10th; 92, w., 11th; 91, w., 12th; 56, nw., 13th; 64, nw., 14th; 56, w., 15th; 90, w., 16th; 84, w., 17th; 50, nw., 18th; 96, nw., 20th; 93, nw., 21st; 64, w., 22d; 68, sw., 24th; 66, nw., 25th; 57, nw., 26th; 72, s., 27th; 70, w., 28th; 90, w., 29th; 70, w., 30th.

The following high velocities were reported from Pike's Peak, Colorado: 56, w., 2d; 60, w., 3d; 52, w., 6th; 52, w., 6th; 52, w., 20th; 52, w., 23d; 56, sw., 26th; 52, nw., 27th; 64, nw., 29th.

Other stations reporting velocities of fifty miles or more per hour are as follows:

Cape Mendocino, California, 62, se., 20th.

Fort Totten, Dakota, 51, w., 3d.

Delaware Breakwater, Delaware, 58, ne., 14th.

Fort Assinaboine, Montana, 50, nw., 3d.

Kitty Hawk, North Carolina, 50, ne., 13th.

LOCAL STORMS AND TORNADES.

Colorado.—Denver: between 3 p. m. of the 7th and 2.05 a. m. of the 8th high winds prevailed at this place. At 7 p. m. a maximum velocity of forty-eight miles per hour from the south was recorded; numerous trees in this city were blown down.

Dakota.—Huron: a tornado cloud was observed at a considerable distance northwest of this station at about daylight of the 1st; it moved southward and gradually disappeared, apparently not touching the ground. Reports from the Wessington

hills, about twenty-five miles southwest of Huron, state that several tornado clouds were observed to the southwest of that place at about the same time the tornado cloud was observed at Huron.

Meckling, Clay county: a tornado occurred at 5 p. m. on the 9th, and moved in a direction 45° east of north. Its path was twenty-five miles in length, and its width one hundred and sixty-five feet. The progressive movement of the tornado cloud was eighteen miles per hour. Some live-stock was killed and several buildings were destroyed. The damage to property is estimated at \$10,000.

Illinois.—Greenville, Bond county: a violent storm of wind, rain, and hail, causing a large amount of damage, occurred in this vicinity at about 11.40 p. m. on the 16th. In the town, trees and fences were blown down, and at the Vandalia railroad depot several cars were blown from the side track on to the main track. At points south and east the storm was much more severe, and caused great damage to the corn crop. Hail stones fell to depths of several inches, and in some places they remained on the ground eighteen hours after the storm.

Bunker Hill, Macoupin county: at 10.30 p. m., on the 16th, a destructive hail-storm passed four miles south of this station; considerable damage was done by lightning at this place.

Iowa.—Humboldt, Humboldt county: a severe thunder-storm occurred about ten miles west of station at about 9 p. m. of the 8th. Much damage was caused by wind and lightning.

Sioux City, Woodbury county: this city and vicinity were visited by a violent storm of rain, hail and wind on the 8th. Several barns were unroofed and other out-buildings were damaged. Reports from Boulinet, O'Brien county, state that several buildings at that place were demolished by the storm.

On the evening of the 9th, a tornado occurred in the Perry valley, twelve miles north of Sioux City. Its path was short and its width two hundred and fifty feet. Several buildings were destroyed. The course of the tornado was east 65° north.

Burlington: a severe storm occurred at about 7.45 p. m. on the 15th; the heavy rainfall flooded the streets and the wind blew down signs, etc., and caused other damage.

Dubuque: during a storm on the morning of the 23d, the wind attained a velocity of twenty-six miles per hour, causing no damage other than blowing down a few fences and signs. West of this place the storm was very destructive and was accompanied by very large hail. The Illinois Central Railroad track was badly washed, causing delay of trains.

Des Moines: storms of considerable severity prevailed in various parts of the state during the night of the 26th–27th. At Wall Lake, Sac county, buildings were unroofed by the high wind; slight damage was done at Odebolt, in the same county. In some places the storm was accompanied by hail.

Kansas.—Mr. J. W. Gregory, voluntary observer at Sherlock, Finney county, furnishes the following report of a destructive storm which prevailed at that place on the 8th, 9th, and 10th of August. Through an oversight this report was not published in the August REVIEW:

On the 8th a slight and unexpected shower from the southeast began at 3.36 p. m. and continued for fifteen minutes; an interval of one-half hour followed, and it again began to rain; another brief cessation occurred at about 4.45 p. m., after which rain set in and continued until 6 p. m. of the 10th. The rain was steady and quite heavy until the evening of the 9th, when it became light, but there were occasional heavy showers during the following night. The rain on the 10th was a succession of brisk showers and heavy and light mists. During the storm the wind blew steadily from the southeast, with the exception of one hour—from 2.30 to 3.30 p. m. on the 10th. No thunder or lightning accompanied the storm. The total amount of rainfall was 5.34 inches. The destructive nature of the storm was not realized until after it had ended. Herds of cattle and sheep were driven before the storm in spite of the efforts of the herdsmen to keep them back. In some instances sheep were driven for a distance of fifty miles, large numbers dying on the way; a few cattle and horses also perished. Although this storm continued for nearly three days, it seems to have been of a local character, no reports of it having been received from other points.

Massachusetts.—Malden, Middlesex county: a very severe thunder storm accompanied by high wind, occurred at 5.10

p. m. of the 11th. A large number of shade and fruit trees were blown down; many buildings at this place and in neighboring localities were struck by lightning.

Michigan.—Alpena: a thunder storm, accompanied by heavy rain, passed over this place from the west on the afternoon of the 10th; the wind attained a velocity of forty-eight miles per hour at 1.26 p. m. Considerable damage was done in this vicinity.

Minnesota.—Saint Paul: from 3.15 to 3.25 p. m. on the 8th, the wind blew at the rate of twenty-eight miles per hour. In the lowlands about one mile south of station, on the opposite side of the river, some temporary buildings and a number of chimneys were blown down.

Owatonna, Steele county: between 7 and 8 p. m. of the 8th a violent storm prevailed at this place.

Stillwater, Washington county: reports from Marine, in this county, state that from fifteen to twenty houses were wrecked by the storm on the evening of the 9th. A number of persons were injured. A large barn at Grant, in this county, was blown down. But little damage was done at Stillwater.

White Bear Lake, Ramsey county: at about 5 p. m. of the 9th, a tornado occurred at this place. The cloud was of the usual funnel shape, and of greenish color. The sheds of the Saint Paul and Duluth railroad company were demolished, and hundreds of trees were blown across the railroad between White Bear Station and Dellwood. This tornado began about one and one half miles north of Minneapolis, and extended to Price county, Wisconsin, passing through the following places: White Bear Lake and Marine, Minnesota; Star Prairie, Clear Lake, Clayton and Turtle Lake, Wisconsin. It began at 5 p. m., and moved east, 30° north. The length of path was one hundred and thirty miles, and its width 2,640 feet. The progressive movement of the tornado cloud was fifty miles per hour, and the shortest time in passing any one point was two minutes. The storm was very destructive to both life and property. Six persons were killed, and seventy-five wounded. Three hundred buildings were destroyed, and much live stock killed. The total valuation of property destroyed is estimated at \$4,000,000.

Mississippi.—Canton, Madison county: a destructive storm of wind and rain occurred on the evening of the 28th. Trees and fences were blown down, and considerable damage done to the cotton crop.

Missouri.—Grant City, Worth county: the most severe rain and wind storm of the season occurred at about 1 a. m. on the 19th. Fences were blown down and much damage was done to the stacked grain and hay and to the standing corn. Considerable hail fell in the western part of the county.

Columbia, Boone county: a tornado occurred at 5.30 p. m. on the 23d. It moved northeastward, the path being about three hundred feet wide. Several buildings were demolished.

New Jersey.—Sandy Hook: during a gale on the 16th the schooner "James Wentworth" grounded on Middle Ground Shoals, and the sloop-yacht "Lettie" dragged anchor in the bay.

New York.—Rochester: a violent thunder storm, accompanied by a light fall of rain, occurred during the afternoon and evening of the 10th. The electrical discharges were frequent and intense. In the southern part of the city the rainfall was much heavier than in the vicinity of the Signal office. At Geneva, Ontario county, the streets were flooded by the heavy rainfall. Near Moscow, in Livingston county, hail fell to a depth of two inches. A tank containing 30,000 barrels of oil at Orleans, Ontario county, was struck by lightning, resulting in a loss estimated at from \$30,000 to \$40,000. At Lima, Livingston county, and Pittsfield, Otsego county, the storm was also severe, while at a short distance north of Rochester no rain fell.

Wellsville, Allegheny county: the village of Shongo, in the valley of the Genesee river, and about eight miles south of Wellsville, was almost completely destroyed by a tornado about 6.20 p. m. of the 28th. Twenty-six buildings, some of

which were the most substantial structures of the place, were demolished; two persons were killed and about twenty were injured. The storm came from the west or southwest, and passed eastward. Its track was from forty to fifty rods wide and its duration very short. For a distance of one-half mile northwest of Shongo, the fields were strewn with household effects and various kinds of debris.

Elmira, Chemung county: a violent storm passed over the village of Wellsbury, about six miles east of this place, on the afternoon of the 28th. Dwellings, barns, and other outbuildings were unroofed and many fruit and shade trees were blown down. The storm was accompanied by a heavy rainfall which flooded the streets.

Savona, Steuben county: at about 7.30 p. m. of the 28th, a violent storm visited this section, blowing down buildings, fences, and trees. The storm first began its destruction at the village of Thurston, about six miles south of Savona, and moved northeastward, destroying buildings throughout its course.

Buffalo: a severe gale from the southwest began at 4.47 p. m. of the 28th, and continued until 1.17 a. m. of the 29th; a maximum velocity of forty-four miles was attained at 8.12 p. m.

Ohio.—Toledo: on the 24th, a high wind, blowing in gusts, prevailed from 7.06 a. m., until 2.30 p. m., a maximum velocity of thirty-eight miles per hour, from the south, being recorded at 9.54 a. m. In the surrounding country fences were blown down and the apple crop was badly damaged. Captains of vessels report that the storm on Lake Erie was the severest of the season. The steamer "Chief Justice Waite," bound for Put-in-Bay, was compelled to return to this port; and the propeller "Moseley" was driven against the schooner "E. R. Williams" and slightly damaged.

Columbus: on the 28th, a storm from the west set in at 12.56 p. m., and continued until 2.11 p. m. Very heavy rain fell, and the wind reached a velocity of thirty miles per hour. Considerable damage was done in the city and vicinity.

Winchester, Adams county: a severe storm of wind and rain occurred on the evening of the 28th; trees were blown down and other damage done.

Springfield, Clarke county: a severe storm of rain and hail occurred on the afternoon of the 28th; it lasted for three-quarters of an hour, the rainfall being the heaviest of the season. Considerable damage was done by the high wind and the heavy rainfall.

Dayton, Montgomery county: a wind and rain storm of unusual violence occurred about twenty-five miles north of this place on the 28th. The rain fell in torrents, causing the Miami river to rise five feet at Dayton, in a very short time. At Swift Run, two miles north of Piqua, in Miami county, the banks of the lakes connecting with the Piqua water supply, gave away, flooding the Miami river and Erie canal and causing a break in the latter. Four houses at Saint Paris, Champaign county, were damaged by lightning, and north of Mechanicsburg in the same county, houses and barns were blown down. At Dayton heavy rain fell for about one hour, flooding the lower part of the city.

Garrettsville, Portage county: a high wind prevailed at 3 p. m. on the 28th; no damage was done at this place, but at Freedom, five miles north, several houses were unroofed and fencing, trees, etc., were blown down.

Pennsylvania.—Bradford, McKean county: a tornado passed near Alton, in this county, at about 5 p. m. on the 28th. It passed near Riterville, but caused no damage at that place; thence it pursued a southwesterly course, striking the village of Alton, fifteen miles south of Bradford, its path being strewn with large trees. In Alton seven buildings were completely wrecked, and a bridge near that place was carried a distance of five rods. Along the Erie railroad, between Riterville and Big Shanty, trees were blown across the track and the telegraph lines were prostrated. The storm in this vicinity was of not more than three minutes' duration.

Wellsborough, Tioga county: the storm on the 28th was very severe at points twenty-five miles north of station, where trees and fences were blown down and buildings demolished.

Province of Quebec.—Quebec: a severe storm occurred during the night of the 17-18th; houses were blown down, trees uprooted, and other damage done.

Texas.—Fort Stockton: a thunder storm prevailed at this place from 11 a. m. to 4.20 p. m. on the 4th. Fifteen miles south, hail fell for forty-five minutes, the hailstones being as large as walnuts. The storm moved from southwest to northeast.

Rio Grande City: heavy rain began at 12.05 a. m. on the 10th and continued until noon, the total rainfall being 5.64 inches.

Indianola: a heavy rain and thunder storm occurred during the morning of the 28th. The rainfall for the thirteen hours ending at 10.40 a. m., was 5.08 inches. The lowlands in this vicinity were completely inundated.

Utah.—Nephi, Juab county: a destructive storm of rain and hail occurred at Circle Valley, Beaver county, on the 2d.

Virginia.—Lynchburg: a heavy rain storm occurred on the afternoon of the 11th; the rainfall was 1.22 inches, nearly all of which fell in forty minutes.

Wisconsin.—La Crosse: a very heavy rain storm occurred during the afternoon and evening of the 6th. From 5.07 to 11.35 p. m. 5.41 inches of rain fell, and 5.00 inches of this amount fell in less than three hours. The total rainfall for the day was 5.69 inches, which is the largest daily rainfall that has occurred since this station was established, in November, 1872. From 7.30 to 9.90 p. m. there was a continuous display of lightning and many buildings were struck. The heavy rainfall flooded the streets and cellars, causing a large amount of damage; several extensive washouts occurred on the railroads, resulting in delay of trains.

Clear Lake, Polk county: a tornado occurred at this place late in the afternoon of the 9th, leaving the greater part of the town in ruins and killing three persons. The damage caused by the storms is estimated at about \$150,000, about forty buildings in Clear Lake and vicinity having been destroyed.

At Clayton, about eight miles northeast of Clear Lake, about one-half of the lighter buildings of the village were destroyed. The storm struck Clayton about 6 p. m.

Eau Claire, Eau Claire county: a severe wind and rain storm passed over this town, from the northwest at 4.35 p. m. on the 9th, causing great damage to the grain and hay stacks.

Chippewa Falls, Chippewa county: the severest storm of season occurred during the night of the 9-10th. The heavy rainfall caused the Chippewa river to rise rapidly.

NAVIGATION.

FLOODS.

Eau Claire, Eau Claire county, Wisconsin: both the Chippewa and Eau Claire rivers began falling at about noon on the 11th, after having reached the unprecedented height of twenty-six feet above low-water mark. All of the bridges over the Chippewa river, ten in number, were washed away. It is estimated that the damage in the vicinity of Chippewa Falls and Eau Claire will reach \$1,500,000. Business houses on either side of both rivers were submerged. In Eau Claire nearly four hundred houses were either swept away or wrecked, and 2,000 persons were rendered dependent for shelter upon those living in the higher localities. At 9 p. m. of the 11th, the Chippewa river had fallen three feet below its maximum height, which was four feet and seven inches above the flood of 1880; and by the morning of the 12th it had fallen more than six feet.

Wausau, Marathon county, Wisconsin: the heavy rains preceding the 11th, caused a destructive flood in the Wisconsin river. On the above date the water reached a point within a few inches of the high water-mark of September 25, 1880. All of the lumber mills along the river were compelled to suspend

work, and a large quantity of lumber was under water. At Wausau the water covered the Chicago, Milwaukee, and Saint Paul railway switch, and the bridges near the Michigan Lumber Company's mill were secured by cables to prevent them from being washed away. The bridges in the vicinity of Merrill, Lincoln county, were washed away and all the tributaries to the Wisconsin river in the county were much swollen. With the exception of the Comstock Mills, all of the mills at Merrill were compelled to shut down on account of high water.

La Crosse, Wisconsin: the very heavy rains about the 6th of the month caused great damage in this state. Large quantities of heavy drift-wood, lumber, and broken rafts passed this place from the 14th to 25th. The Mississippi river rose from three feet and three inches on the 3d to eleven feet and ten inches on the 16th. This is the most rapid rise shown by the river record of this station. On the 16th the water reached the tops of the levees.

Rio Grande City, Texas: the very heavy rainfall of the 10th caused the Rio Grande river to rise rapidly on that date; it reached its maximum height, eighteen feet above low-water mark, at 1 p. m. The banks of the river were washed away and the low lands south of this place were flooded.

STAGE OF WATER IN RIVERS.

In the following table are shown the danger points at the various river stations, the highest and lowest stages for September, 1884, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark. September, 1884.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29 9	1	1 5	24	0 2	1 7
<i>Arkansas:</i>						
Little Rock, Arkansas.....	35 0	6	6 7	16, 17	3 6	3 1
Fort Smith, Arkansas.....		2	0 3	10	4 4	4 1
<i>Missouri:</i>						
Yankton, Dakota.....	20 0	1	15 9	30	10 9	5 0
Omaha, Nebraska.....	10 0	10, 11, 14	7 8	9	7 1	0 7
		15, 16				
Leavenworth, Kansas.....	21 0	1	10 4	25	7 9	2 7
<i>Mississippi:</i>						
Saint Paul, Minnesota.....	14 6	12	4 10	4, 7	3 1	1 9
La Crosse, Wisconsin.....	18 0	16, 17	10 2	1	2 1	8 1
Dubuque, Iowa.....	21 10	24, 25	14 6	1, 2	3 10	10 8
Davenport, Iowa.....	15 0	28	11 4	2	2 6	8 10
Keokuk, Iowa.....	14 0	30	10 4	5, 6	2 9	7 7
Saint Louis, Missouri.....	30 0	30	20 6	15	9 2	11 4
Caite, Illinois.....	40 0	30	14 3	23	7 1	7 2
Memphis, Tennessee.....	34 0	7	8 4	22, 26	3 4	5 0
Vicksburg, Mississippi.....	41 0	11, 12	9 9	30	5 1	4 8
New Orleans, Louisiana.....	2 0	5, 6, 7	12 1	19	12 11	0 10
<i>Ohio:</i>						
Pittsburg, Pennsylvania.....	20 0	19	4 1	11, 12	0 5	3 8
Cincinnati, Ohio.....	50 0	1	4 5	27	2 6	1 11
Louisville, Kentucky.....	24 0	1	3 5	24	2 7	0 10
<i>Cumberland:</i>						
Nashville, Tennessee.....	42 0	4	3 8	30	0 6	3 2
<i>Tennessee:</i>						
Chattanooga, Tennessee.....	33 0	1	3 2	28, 29, 30	0 7	2 7
<i>Monongahela:</i>						
Pittsburg, Pennsylvania.....	29 0	19	4 1	11, 12	0 5	3 8
<i>Sacramento:</i>						
Augusta, Georgia.....		12	6 7	25, 26, 29	4 6	2 1
<i>Willamette:</i>						
Portland, Oregon.....		11	5 5	30	0 6	4 11
<i>Sacramento:</i>						
Red Bluff, California.....		9, 10	0 11	1 to 8	0 10	0 1
		14 to 24		11 to 13		
Sacramento, California.....		13, 14	8 9	25 to 30	30	7 9
<i>Mobile:</i>						
Mobile, Alabama.....		6	18 1	12	15 10	2 3
<i>Colorado:</i>						
Yuma, Arizona.....						

* Below bench mark. † Below high-water mark of 1874 and 1883.

The Cumberland river at Nashville, Tennessee, was not navigable at any time during the month.

At Saint Paul, Minnesota, the Mississippi river reached a height sufficient to admit of the passage of large steamers on the 2d.

The Ohio river at Vevay, Indiana, was navigable for small steamers only on the 4th; on the 12th the river was lower than it has been at any time since 1881.

HIGH TIDES.

New River Inlet, North Carolina: high tides occurred on