

the North Carolina coast, the south wind at Burlington, Vt., and the east winds at Oswego and Grand Haven ; opposing northerly and southerly winds have prevailed from Texas to Colorado and thence to Arizona. Northerly winds in California and southerly winds from Oregon to Utah and thence northward.

Total Movements of the Air.—The following are the *largest* monthly movements recorded at the Signal Service stations, viz : Pike's Peak, 21,218 miles ; Sandy Hook, 13,101 ; Cape Lookout, 12,901 ; Cape May, 12,772 ; Woods Holl, 12,435 ; Indianola, 11,101 ; Barnegat, 10,161 ; Cape Hatteras, 10,095 ; Eastport, 9,722 ; Sandusky, 9,596 ; Cheyenne, 9,501 ; Breckenridge, 9,199 ; Milwaukee, 8,723 ; Grand Haven, 8,529. The *smallest* : Deadwood, Dak., 1,726 miles ; Visalia, Cal., 1,977 ; Nashville, 2,591 ; Los Angeles, Cal., 2,607 ; Walde, Tex., 2,635 ; Fredricksburg, Tex., 2,948 ; Indianapolis, 3,029 ; Lynchburg, 3,105 ; Ft. Craig, N. M., 3,178 ; San Diego, 3,294 ; Salt Lake City, 3,336 ; Ft. Davis, 3,429 ; Dubuque, 3,473 ; Augusta, 3,475 ; Shreveport, 3,500.

Local Storms.—Tornado at Riverdale, Caddo Parish, La. *February 10th* about 5 p. m. a black cloud resembling a water spout was observed moving from the *EW.* to *SE.* along the southern horizon apparently reaching to the ground and accompanied by thunder and lightning, hail and a terrible rumbling noise. The storm left a very clean path averaging about 100 yards in width, uprooting and in many places twisting off at the stump trees of from three to four feet in diameter. It prostrated at least 3,000 panels of fence, demolished two cabins carrying a portion of one of them across the river and scattering the remainder a distance of 100 yards. The tornado then crossed the river throwing the water to a great height. On the Sunny Point Plantation it blew a dwelling house off the blocks on which it rested, carrying it ten feet and setting flat on the ground. Cabins, dwelling and gin house damaged to the amount of \$1,000. The large gin house was twisted into two parts one of which was carried across the river on the Hamilton Plantation, and the other blown into the river. A new wagon was snatched up by the whirling storm and smashed into pieces ; a piece of hewn timber ten by sixteen inches and forty feet long was carried a quarter of a mile. On the Hamilton plantation two cabins were demolished and two persons injured, the storm then disappeared in the swamp.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather Indications with the telegraphic reports for the succeeding twenty-four hours, show the general percentage of omissions to be 0.9 per cent., and of verifications to be 92.2 per cent. The percentage of verifications for the four elements have been : weather, 95.9 ; wind, 93.6 ; temperature, 91.9 ; barometer, 90.2. The percentage of verifications by geographical districts have been : New England, 93.8 ; Middle States, 94.1 ; South Atlantic States, 92.3 ; East Gulf States, 92.7 ; West Gulf States, 90.9 ; Lower Lake Region, 94.1 ; Upper Lake Region, 92.5 ; Tennessee and the Ohio Valley, 95.8 ; Upper Mississippi Valley, 92.1 ; Lower Missouri Valley, 91.4 ; Northern Pacific coast Region, 91.1 ; Central Pacific coast Region, 96.4 ; Southern Pacific coast Region, 83.9. Of the 3,437 predictions that have been made, 76 or 2.2 per cent. are considered to have entirely failed ; 52 or 1.5 per cent. were one-fourth verified ; 237 or 6.9 per cent. were one-half verified ; 36 or 1.1 per cent. were three-fourths verified ; 3,036 or 88.3 per cent. were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary Signals.—143 Cautionary Signals were displayed, of which 135, or 94.4 per cent. were justified. 110 Cautionary Off-shore Signals were displayed, and of these 109 or 99.1 per cent. were justified as to direction ; 98 or 89.1 per cent. were justified as to velocity. Of the Cautionary Off-shore Signals, 72 were changed from Cautionary. 253 signals of both kinds were displayed, of which 233 or 92.1 per cent. were fully justified. The above does not include signals ordered at 45 display stations where the velocity is only estimated and not measured. 40 cases were reported of winds of 25 miles or over where signals were not ordered.

NAVIGATION.

In the table, on right side of chart No. III, are given the highest and lowest readings, on the Signal Service river-gauges, during the month with dates of same.

Ice on Rivers and Lakes. *Missouri.*—Omaha, 28th, river frozen during month, ice giving away along banks, teams have ceased to cross, but foot passengers cross daily with safety. Leavenworth, 7th, ice in river weakening ; 10th, ice gorge below city broke in the afternoon ; 11th, 26th, river full of floating ice. Brunswick, river has been frozen over since December 20th ; February 7th, ice began to move, melted gradually and caused no damage ; river closed seven miles above here. *Kansas River.*—Kansas City, Mo., 1st to 9th, floating ice ; 10th, river clear ; 14th, ice moving until 4 p. m., then closed ; 19th, river open ; 26th and 27th, floating ice ; 28th, river clear. *Magnaketa River.*—Monticello, Iowa, 1st, ice in river twenty-four inches thick. *Mississippi.*—Muscatine, Ia., 10th, 12th, 14th, teams crossing on the ice, this has continued for the past fifty days. Keokuk, 24th, ice above the bridge nearly all broken and heaping up along the shores ; ice south of the bridge yet solid. St. Louis, heavy ice in river 1st, 2nd, 12th, 13th, 15th to 18th, 27th ; light ice 3rd, 11th, 19th to 21st, 28th ; river clear, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 22nd to 26th ; 14th, river full of floating ice, navigation temporarily suspended ; 27th, heavy ice in river and running slowly ; 18th, navigation resumed. La Crosse, 28th, river frozen during month, teams crossing continually. St. Paul, river frozen during month, teams crossing every day. Cairo, 15th, 16th, 17th, floating ice in river. *Ohio.*—Wellsburg, West Va., 1st, navigation resumed ; 6th, large quantities of shore ice, river almost clear of floating ice ; 7th, clear of ice ; 15th to 18th, full of floating ice, navigation suspended ; 19th, full of floating ice, but steamers of the first class running ; 22nd, navigation suspended except to first

class steamers; 28th, river rising and full of floating ice. Cincinnati, 2nd, drift-wood and floating ice in river; 14th, canal frozen over, shore ice forming along river; 18th, small quantities of soft ice in river; 19th, some ice in river but not enough to obstruct boats; 20th, considerable ice in river, boats found difficulty in forcing their way through it; 21st, heavy floating ice in river; 22nd, 23rd, small quantities of floating ice. *Tennessee River*—Chattanooga, 2nd, thick ice in river. *Miami River*—Cincinnati, 14th, floating ice in river. *Licking River*—Cincinnati, 14th, floating ice in river. *Alleghany River*—Pittsburg, 15th, 26th, 27th, 28th, large quantities of floating ice in river. *Monongahela River*—Morgantown, West Va., 16th, large quantities of floating ice in river. Pittsburg, 26th, 27th, 28th, floating ice in river. *Susquehanna River*—Catawissa, Pa., north branch closed during the month, ice eight to ten inch thick. *Delaware River*—Trenton, N. J., ice in river broken up, having been closed for 46 days; 15th, river frozen again. *Hudson River*—Garrisons, N. Y., 28th, river still closed with ice. *New Jersey Coast*—Long Branch, 11th, the vast field of ice which has filled the "Horseshoe" for over a month has been moving away gradually for the past two days. Last night the remaining portion, containing many thousand acres, moved slowly out with the tide. *Flushing Bay*—Flushing, N. Y., 13th, bay open, tug boat passed through with cargo of coal; 15th, bay closed; 26th, reopened by a channel being sawed through the ice, tug boat arrived with coal; 28th, another boat arrived with coal. *Deerfield River*—Rowe, Mass., 12th, ice passed out. *Ottawa River*—Woodstock, Vt., 12th, breaking up; 13th, river clear. *Lake Superior*—Duluth, 1st to 5th, harbor frozen over, and also lake as far as the eye can reach, average thickness fourteen inches; Marquette, 5th, ice in harbor. *Lake Michigan*—Grand Haven, 26th, lake frozen as far as the eye can reach, though the Milwaukee boats still keep a channel through it. *Grand Traverse Bay*—Northport, Mich., bay all open outside of harbor. *Grand River*—Grand Haven, Mich., river still full of floating ice. *Lake Geneva*—Bloomfield, Wis., 4th, ice twenty-five inches thick. *St. Clair River*—Port Huron, Mich., 13th, ice so thick that the Grand Trunk R. R. Co. are compelled to blast it by exploding sunken torpedoes, in order to make a passage for their ferry boats. *Detroit River*—Detroit, 2nd, ice along the shore. *Lake Erie*—Cleveland, 1st, large floes of floating ice moved toward the shore by the prevailing N.W. winds; 2nd, floating ice as far as the eye can reach; 4th, lake covered with floating ice; 8th, lake frozen out to a great distance, very thick near shore; 11th, ice firm on lake; 12th, ice breaking up; 15th, lake frozen; 17th, ice still firm; 18th, lake covered with ice; 22nd, ice breaking up. *Sandusky Bay*—Sandusky, 28th, ice in middle of bay twenty inches thick, loaded wagons and sleds crossed over to the Peninsula and Johnson's Island. *Lake Champlain*—West Charlotte, Vt., 1st, lake frozen over; 2nd, crossing on the ice; 4th, ice boats crossed; 10th, lake open near Four Brothers' Islands; 12th, open from Hillsboro Point, N. Y., to Hill Point, Vt., and north to the Islands; 15th, lake closed, people crossing; 16th, teams crossed for first time; 25th, cutting ice twelve inches thick. *Mt. Desert Sound*—Mt. Desert, Me., 1st, frozen over.

High Tides.—Cape Lookout, N. C., 8th, 19th.

TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth when observations were taken, are given in table on chart No. II. At Alpena, Buffalo, Burlington, Cleveland, Escanaba, Grand Haven, Sandusky and Toledo no observations were made on account of ice. At the following stations observations were only made on the dates indicated: Chicago, 1st, 13th, 17th to 25th, 28th; Detroit, 1st; Duluth, 1st to 5th; Marquette, 1st to 4th; Milwaukee, 8th to 17th; New York City, 6th to 13th, 20th, 21st and 26th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—7th, Fla. 8th, Fla. 9th, Miss. 10th, Mo., Miss., La., Tex. 11th, Fla., W. Va., Ga., N. C. 14th, Idaho. 16th, Tex. 17th, Fla., Ala., La., Ga. 18th, Ala., Ga., La., N. C., Fla., S. C. 22nd, Ala., Ind., La., Miss., Tex., Mo., Ill., Tenn., Ky. 23rd, Fla., Miss., Tex., Ala. 25th, Ill., Ind., Tenn., Miss., La. 26th, Miss., Tex., Va. and Conn.

Auroras.—Monticello, Iowa, 22nd; Topeka, Kan., 2nd; Mechanic's Falls, Me., 13th; Cambridge, Mass., regularly looked for each evening at 8 p. m., except the 10th, but none seen; observations hindered by clouds on the 3rd, 5th, 6th, 11th, 16th to 20th, 22nd, 23rd, 25th, 26th; partially cloudy in the north, 1st, 13th, 27th; moonlight, 1st, 2nd, 4th, 7th, 8th, 27th, 28th; evenings on which the aurora might have been seen, if present, 9th, 12th, 14th, 15th, 21st, 24th; Atco, N. J., 28th; Cape Vincent, N. Y., regularly looked for each evening at 8 p. m., but none observed; Pembina, Dak., 11th, 14th; Coalville, Utah, 13th.

OPTICAL PHENOMENA.

Solar Halos.—1st, Iowa, Me., Ind. Ty. 2d, Iowa, Fla., Conn. 3d, Iowa, Me., Neb., Pa., Utah, Dak. 4th, Ind., Mich., Pa., Dak., Ohio, Ga. 5th, Ill., Iowa, Me., Mass., N. H., N. Y., Dak. 6th, Conn., Me., Mass. 7th, Conn., Me., Tex., Dak., Tenn. 8th, Kan., Utah, Dak., Tex., Min., N. M. 9th, Ind., Iowa, Mich., Miss., Ohio, N. C., Ga. 10th, Ill., Ind., Mich., Miss., N. J., N. Y., Ohio, Pa., Tex., Iowa, Dak., Ga., N. C., Va. 11th, Iowa, Me., Dak. 12th, Kan., Iowa, Neb., Dak., Minn., Ga. 13th, Ill., Iowa, Mich., Minn., Ga. 14th, Ill., Ind., Iowa, Miss., Neb., Tex., Dak. 15th, Ind., Iowa, Ill. 16th, Conn., Ia., N. J., N. Y., Pa., Ohio, Va. 17th, Me., Mich., N. Y., Vt., Dak. 18th, Mich., N. Y. 19th, Ill., Iowa, N. Y., Dak., Minn., Ga. 20th, Utah, Ohio, Ga. 21st, Neb., N. H., Nev., Iowa. 22d, Conn., Me., Miss., N. H., N. Y., Utah, Tex., Iowa, Ohio. 23d, Ill., Kan., Mass., Neb., N. H., Tenn., Dak., Iowa, N. C., Me. 24th, Ind., Mich., N. H., Ohio, Dak, Ga. 25th, Iowa, Neb., N. H., Dak., Ohio, Ga. 26th, Ill., Iowa, Neb., Tenn., Tex. 27th, Iowa, Ohio, Va., Neb., Tex., Tenn., Ga., Conn. 28th, Ill., Ind., Iowa, Mich., Ohio, Va., Dak., Tex., Tenn.