

## VERIFICATIONS.

*Indications.*—The detailed comparison of the tri-daily indications for January, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 82.7 per cent. The percentages for the four elements are: Weather, 90.1; Direction of the Wind, 79.7; Temperature, 81.4; Barometer, 78.4 per cent. By geographical districts they are: for New England, 80.5; Middle States, 84.0; South Atlantic States, 86.2; Eastern Gulf States, 78.0; Western Gulf States, 82.2; Lower Lake region, 84.0; Upper Lake region, 86.5; Tennessee and the Ohio valley, 81.9; Upper Mississippi valley, 84.1; Lower Missouri valley, 78.2; Northern Pacific coast region, 84.0; Central Pacific coast region, 90.0; Southern Pacific coast region, 93.0. There were 264 omissions to predict out of 3,813 or 6.92 per cent. Of the 3,549 predictions that have been made, 144, or 4.06 per cent. are considered to have entirely failed; 140, or 3.94 per cent. were one-fourth verified; 523, or 14.74 per cent. were one-half verified; 416, or 11.72 per cent. were three-fourths verified; 2,326, or 65.54 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

*Cautionary Signals*—147 Cautionary Signals were displayed during the month, of which 124, or 84.3 per cent., were fully justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 37 Off-shore Signals were displayed, of which 31 or 83.8 per cent, were fully justified, 35 or 94.6 per cent, justified as to direction and 32 or 86.4 per cent were justified as to velocity. Fifteen of the Off-Shore were changed from Cautionary. 184 Signals of both kinds were displayed, of which 155 or 84.2 per cent, were fully justified. The above does not include signals ordered at display stations on the New England coast, where the velocity is only estimated. Eleven signals were ordered late.

## NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed on the Signal Service river-gauges, during the month of January, 1881. The Arkansas, and the Mississippi at St. Louis, experienced but little change during the month. There was a marked rise in the Red, and that portion of the Mississippi from Cairo to Vicksburg, from 25th to 31st, reaching the highest water on the latter date at all stations except Cairo, where it occurred on the 28th. In the Ohio, Cumberland, Tennessee and Savannah rivers, the highest stage was reached between the 20th and 25th, and as early as the 8th, in the Monongahela, at Morgantown. The Willamette, at Portland, Or., rose very rapidly on the 14th and 15th, flooding lower portion of city and a large section of the surrounding country. The Sacramento, at Sacramento, rose suddenly on the 29th, and by 11 a. m. of the 31st, reached 26 feet above low water mark; 0.5 inch higher than ever before recorded. At Red Bluff, the river rose rapidly on the 14th and 29th, but reached its highest stage on the 31st, twenty-four feet above low water mark.

*Ice in Rivers and Harbors.*—The following items show the condition of the navigable waters throughout the United States, during the month of January, 1881, in respect to the formation of ice. The Missouri and that portion of the Mississippi River from Keokuk northward have remained frozen over during the month. At all stations on the lakes ice has accumulated to a considerable thickness and extends to long distances from shore, prohibiting all navigation. From other sources the following notes are given in detail: *Columbia River.*—Portland, 22nd, navigation closed between city and Cascado because of ice, but open again on the 31st; 24th, considerable floating ice in lower portion of river; 25th, large quantities of ice gorged at Willow Bar. *Umatilla River.*—Umatilla, navigation closed during month because of floating ice. *Snake River.*—Lewiston, Idaho, 1st, full of floating ice. *Clear Water River.*—Lewiston, Idaho, 1st, full of floating ice; 17th, considerable floating ice. *Mississippi River.*—St. Paul, 31st, ice 30 inches thick. Dubuque, 31st, ice 18 to 32 inches. Keokuk, 17th, teams crossing on ice, first time this season. Clinton, Iowa, 31st, ice 24 to 30 inches. St. Louis, 1st, river south of bridge kept clear of ice by tugs; north of bridge ice 14 inches thick. Cairo, floating ice, 24th to 26th; clear of ice, 29th. Memphis, floating ice, 1st to 31st; on the 10th so heavy as to practically close navigation; 14th, steamer loaded with cotton and valued at \$139,000, was sunk at wharf; supposed to be caused by floating ice. *Ohio River.*—Cairo, 15th, ice gorge broke; 19th, navigation resumed, boat left for Cincinnati. Louisville, 9th, ice breaking up; 10th to 15th, floating ice, heaviest for many years; 20th, breaking away from banks and large quantities passing down river; 21st, full of ice from breaking of gorge at Madison and from the Licking and Kentucky rivers; 22nd, two steamers attached to docks "stove in" by floating ice; 23rd, canal open and boat came from Portland; 28th to 31st, full of floating ice. Cincinnati, 8th, ice broken up, carrying away many coal barges; causing a loss estimated at \$60,000; 13th, navigation resumed; 14th to 20th, small quantities of floating ice; 21st, filled with ice by breaking up of gorges from above. Vevay, Ind., 3rd, frozen over, people crossing in large numbers; 8th, ice soft and unsafe for crossing; 11th, breaking up and running out; 12th, full of floating ice; 17th, first steamer since breaking up of ice passed down the river; 20th, very heavy floating ice, difficult for boats to pass; 23rd, boats running quite regularly. Portsmouth, 1st, teams crossing on ice; 7th, broke up with considerable destruction to shipping; 8th to 20th, heavy floating ice

impeding navigation. Wellsburg, W. Va., 8th, ice broke up about midnight. Pittsburg, 21st, general breaking up of ice in early morning; water rising 6 to 8 inches an hour; several pike bridges gave way and were destroyed. *Big Miami River*.—Piqua, Ohio, 20th, in many places frozen solid to the bottom. *St. Clair River*.—Port Haron, 1st, frozen over; people crossing on foot; 12th, teams crossing to Canadian shore. *Lake Michigan*.—Milwaukee, 30th, steamer "St. Albaus," of Northern Transit Line Co., sunk by floating ice at a point about 20 miles northeast of station; crew and passengers saved, cargo and vessel a total loss. *Lake Geneva*.—Bloomfield, Wis., 31st, ice 30 inches in thickness. *Grand River*.—Ft. Gibson, 11th, frozen over; teams and people crossing. *Kansas River*.—Lawrence, 17th, ice 14th to 20 inches thick. *Arkansas River*.—Little Rock, 1st, frozen over; 6th, ice breaking up; 19th, clear of ice and rising very rapidly. Pine Bluff, 1st, steamer "Plow Boy" sunk by floating ice, and steamer "Katie Hooper" frozen in. Fort Smith, 3rd, frozen over; people crossing. *Poteau River*.—Fort Smith, Ark., frozen over; people crossing. *Red River*.—Shreveport, 1st, shore-ice formed. *Monongahela River*.—Morgantown, 1st to 5th, frozen over; 6th, ice broke up and gorged heavily; 7th, gorge gave way and destroyed river gauge; 27th, frozen over again; 31st, still frozen. Elizabeth, Pa., 18th, ice gorge started and carried away large portion of dam. *James River*.—Richmond, Va., 11th, schooner "Ella H. Barnes" parted anchors and was carried down by the ice. *Core Sound*.—Cape Lookout, 1st, considerable ice formed; a very unusual occurrence. *Delaware Bay*.—Del. Breakwater, 1st, floating ice in harbor; 2nd, harbor packed with floating ice, causing vessels to drag anchor; telegraph cable broken; 3rd, ice passing out; 5th to 31st, floating ice. Cape May, 28th, floating ice. *Little Egg Harbor, N. J.*—3rd, ice breaking up in Sound; 23rd, heavy floating ice; 24th, ice in lower portion of bay remains solid; 25th, ice forming in bay and cove; 27th, bay and cove blocked with ice. *Chincoteague Bay*.—Chincoteague, 29th, frozen over. *Delaware River*.—Philadelphia 31st, obstructed by ice throughout month, seriously interrupting navigation. *Susquehanna River*.—Catawissa, Pa., 31st, north branch remained closed during the month, ice 19 inches in thickness. *Chesapeake Bay*.—Baltimore, 1st, ice very heavy as far down as Sandy Point, channel in bay and harbor kept open by ice boats; 4th, oyster trade suffering severely, owing to ice, dredging almost entirely suspended; 8th, very large number of oyster boats frozen in at different points, crews suffering severely from cold and scarcity of fuel; 12th, ice blockade broken up, no longer any obstruction; 15th, ice nearly all passed out; 19th, large quantities of drift ice obstructing river and harbor; 20th, navigation still dangerous, owing to floating ice; 22nd, winds and tides blocked up river and harbor with ice, stopping navigation; 23rd, nearly clear; 24th, river and harbor free, but smaller towns down the bay are in a critical condition from blockade, creeks and rivers emptying into the Bay are completely closed, imprisoning large fleets of oyster boats; 28th, new ice formed in harbor and river to a depth of two inches, channel kept clear by ice boats. Portsmouth, Va., 20th, incoming boats report immense fields of ice in Bay, seriously obstructing navigation. *Hudson River*.—Ardenia, N. Y., 31st, ice 18 to 20 inches in thickness. Poughkeepsie, N. Y., 1st, river for miles south frozen solid. *Long Island Sound*.—Sandy Hook, 14th, 1000 feet of wharf carried away by the battering of out flowing ice; ocean frozen solid from point of the Hook to the main ship channel, ice 12 to 14 inches thick; navigation extremely perilous owing to endless mass of floating ice. New Haven, Conn., 1st, steamers arriving report great difficulty in forcing their way through the ice at upper portion of Sound; one continuous ice floe from Sands Point to Hell Gate; from Greensport to Sag Harbor a solid field of ice. *Narragansett Bay*.—Newport, R. I., 29th, ice forming rapidly in harbor; 30th, frozen over, channel free during afternoon; 31st, large quantities of floating ice, sailing vessels frozen in, steamers made usual trips with great difficulty. *New Haven Harbor*.—New Haven, 1st, frozen over, first time since February, 1875; serious obstruction to navigation, large fleet of vessels frozen in; navigation closed to all but steamers; oyster famine threatened; 31st, harbor still blocked with ice, but channel kept clear by tugs. *Connecticut River*.—Hartford, Conn., 31st, ice 18 inches in thickness. *Buzzard's Bay*.—Wood's Holl, 4th, ice covers eastern portion of bay. *Boston Harbor*.—Boston, 3rd, portion of harbor between city proper and south Boston frozen over, people crossing; 8th, ice extends over a considerable portion of harbor; 28th, great quantities of floating ice. *Lake Champlain*.—Burlington, Vt., 1st, inside of breakwater frozen over; 3rd, harbor closed; 4th, the broad part of lake frozen in many places; 10th, heavy floating ice outside of harbor; 13th, ice in lake passed out; 16th, lake entirely frozen over; harbor closed from 3rd to 31st. Charlotte, Vt., 16th, lake partly frozen over, ice moving slowly; 17th, ice passed out; 18th, entirely closed over except a few open spots; 20th, entirely closed, ice boats out, good crossing on foot; 25th, ice strong enough for teams to cross; 31st, little or no travel on ice because of deep snow.

*Floods*.—Destruction of property and serious interruption to travel and telegraphic communication, from heavy precipitation and the sudden melting of heavy snow, has been quite a marked feature of the month in portions of the South Atlantic and East Gulf States, in the Ohio valley and in the Northern Plateau and Pacific coast regions. Portland, Or., 11th, heavy rains, telegraph lines all down; 12th, Willamette river rising  $\frac{1}{2}$  inches per hour, immense amount of driftwood passing; heavy drift in the Molalla river and several bridges carried away; 14th, Columbia river rising rapidly covering nearly all of the lower portion of the city, at Pacific Docks \$40,000 of wheat damaged; 15th, river still rising and filled with driftwood, large portion of country inun-

dated by overflow of Willamette river, telegraph lines still useless; 18th Klamath and other rivers higher than during the big flood of 1861, mails packed on foot, roads impassable to animals, several bridges washed away on the Scott and Kalmath rivers, great loss to individuals and companies. Mehama, Or., 11th, Santiam river highest for 8 years, bridges washed away, all communication stopped; trees uprooted along the banks and carried into the channel, which soon became a floating mass of wrecks and logs. The Dalles, Or., 13th, great quantities of logs, railroad ties and debris of wrecked bridges floating down the Columbia river. Salem, Or., 13th, several bridges and buildings swept away, roads impassable. Harrisburg, Or., 13th, water within six inches of the high-water mark of 1861, town completely flooded; twenty families routed out of their houses and large number of animals drowned; general destruction of fences and bridges and many large sections of railroad track carried away. Pomeroy, Wash. Ty., 11th, Pataha creek rose 15 feet during day, carrying away fences, corded wood and buildings, several families compelled to seek higher ground for safety. Umatilla, Or., 13th, rapid rise in Umatilla river; at a point 20 miles south of station, whole country submerged; people compelled to flee from their dwellings; great loss to property. Roseburg, Or., 12th, stages and trains delayed by high water; railroad bridge across North Umpqua river washed away; all telegraph lines down; railroad travel ceased; 14th, water reached its highest point, within 3 feet of the flood of 1861. Lewiston, Idaho, 11th, rivers and creeks overflowed; stage routes impassable; Snake river rose 3 feet in 10 hours; several bridges carried away. Sacramento, Cal., 18th, river full of driftwood; 29th, river rose rapidly, reaching 12 feet above low-water mark at 1 p. m.; 30th, 24.5 feet above; 31st, 26 feet at 11 a. m.; during night levees two miles below city broke, flooding all ranches in vicinity; at Washington, on the opposite side of the river, levees broke both above and below, overflowing all the tule lands. San Jacinto, Cal., 18th, highest water in 12 years. San Francisco, 29th, heaviest storm of rain ever known here; immense pressure of water upon sewers, causing much damage; in lower sections of city cellars and basements flooded and nearly all business houses between Sanson street and the Bay, north of California street, filled with water; no damage to shipping, but all railroad and telegraphic communication along the coast suspended; several miles of the Santa Cruz R. R. washed away and the towns of Napa, Watsonville and Marysville flooded. 30th, the town of Comp Capito, on Saquel Creek, in Santa Cruz Co., washed out to sea, only four houses left standing; the Oroville railroad submerged a long distance; at Windsor, Sonoma Co., 13 inches of rain fell in 70 hours; at Placerville, Eldorado Co., 7.61 inches fell in 24 hours; on the Southern Pacific railroad, eight men were buried alive by a huge land-slide, caused by washing away of embankment. Yosemite Valley, Cal., 30th, very heavy rains, Yosemite Falls and Bridal Veil rose to about their highest points in 48 hours. Visalia, Cal., 30th, all streams rapidly rising, many of which are impassable; 31st, Mill Creek overflowed banks, submerging immediate country. Red Bluff, Cal., 14th, mountain creeks rose suddenly, carrying away bridges and overflowing bottom lands; 22d, river rose rapidly, reaching the 22-foot mark; 31st, river reached highest point of season, viz: 24 feet above low water mark, all low lands flooded, cellars filled with water, fences and bridges washed away, telegraph lines down in all directions, great washouts along railroad tracks and immense land-slides filling up railroad cuts and stopping all communication. Dayton, Ohio, 20th, all streams throughout the Miami valley bank-full, and in many cases overflowing the low lands. McKeesport, Pa., 18th, heavy land-slide, carrying away 100 yards of railroad track. Mingo, Pa., 18th, trestle-work washed away. Greensburg, Pa., trestle-work washed away, and at Davidson's Station railroad track destroyed, all passengers and baggage transferred. Hawkinsville and Monroe, Ga., 20th, roads impassable. Forsyth, Ga., 20th, roads in terrible condition, river rising rapidly and full of floating debris. Macon, Ga., 20th, lower portion of city submerged, people moving about in boats. Rome, Ga., serious washouts. Athens, Ga., 20th, highways impassable, trains blocked by extensive land slides and washouts. Elberton, Ga., 20th, incessant rains for four days, streams overflowed, roads impassable, business suspended. Gainesville, Ga., 20th, almost the whole country roundabout covered by a solid sheet of water. West Point, Ga., 20th, portion of city under water, people passing about in boats. Hamburg, Ga., 20th, town nearly submerged. Richmond, Va., 21st, all mountain streams overflowed, causing considerable damage. Lynchburg, Va., 20th, James River 5 feet above ordinary level; at Columbia the river rose 9 feet, and at Charlottesville 6 feet. Moreauville, Avoyelles Parish, La., 4th, roads impassable, all communication suspended, sugar crop seriously injured and will show a deficit of 25 per cent.

*Droughts.*—Springfield, Ill., 20th, wells and cisterns drying up; 31st, river so low that it has become nearly stagnant and gives forth a bad odor; farmers have been hauling water from city for past two weeks; drought has been general and very severe in the central portion of the state. Peoria, Ill., 25th, much suffering from want of water. Holton, Kan., 31st, month remarkably dry. Lawrence, Kan., 31st, very dry, rain-fall 0.99 inches below the average for the past 13 years. Yates Center, Kan., 31st, driest within the memory of the oldest settler; streams and wells very low; stock driven three miles for water. Creswell, Kan., 31st, wells and springs almost exhausted. "Missouri Weather Service" reports a monthly rain-fall at the central station of 0.39 inches, the smallest recorded since 1837; lowest previous rain-fall was 0.41 inch in 1857 and only twice since 1839 has the January rain-fall been less than 0.50 inch. Mendon, Mass., 31st, much need of

rain, wells and cisterns dry. Auburn, N. H., 31st, wells and cisterns dry in many localities. Woodstock, Vt., 31st, drought throughout month and still continues without abatement; but two families in the city have sufficient water for household purposes; farmers compelled to haul water for stock from long distances.

*High Tides.*—San Francisco, 29th, at 10.30 a. m. 6 inches higher than any previous record.

*Low Tides.*—Newport, R. I., 29th, unusually low, steamer grounded at dock. New London, Conn., 29th, very low, steamship "Massachusetts" went aground in her dock at Stonington; old sailors remark that it is the lowest water for many years.

## TEMPERATURE OF WATER.

*The temperature of water*, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. III. Owing to ice and breakage of instruments, observations are wanting as follows: Alpena, Buffalo, Chicago, Cleveland, Detroit, Duluth, Escanaba, Grand Haven, Marquette, Milwaukee, Sandusky and Toledo, from 1st to 31st: Burlington, Vt., 2d to 4th, 6th to 31st; Charleston, 3d to 12th; Delaware Breakwater, 1st to 3d, 11th, 12th, 19th, 21st.

## ATMOSPHERIC ELECTRICITY.

*Auroras.*—Faint auroral displays were observed at St. Vincent, Minn., (the most northerly of Signal Service stations) on the 2nd, 21st, 22nd, 23rd, 24th, 26th and 29th. With these exceptions, no display was observed outside New England or south of the 42nd parallel save that of the 31st. The aurora of the 31st was more than ordinarily brilliant and was observed throughout New England and west of the 92nd meridian to western Montana and north of the 45th parallel. The prevalence of cloud in the entire Lake region and Ohio valley, probably prevented its observation in these regions. The following descriptive notes are of interest: Burlington, Vt., "at 7.35 p. m. a most remarkable auroral display was noted. The dark segment extended 25° above the northern horizon, above which the arch of light was seen, being of a white color, deepening into a pale sea green; a faint rose color was noted in the extreme west-northwest. The principal feature of the display was a white, hazy light, deepening, near the eastern horizon, to a pale straw color, and extending from the eastern horizon to the zenith, and ending in the west-northwest, covering half of the heavens with a white canopy. One or two streamers were observed in the north-northwest. The eastern terminus passed to the south of east, and looked not unlike the light seen when the harvest moon is rising. By 8.15 the display had faded away, and only the dark segment and the arch of light remained. At 9 p. m. the sky was overcast, and only a faint green light was to be seen on the northern horizon. At 11 p. m., with a nearly clear sky, a faint emerald green light was seen on the northern horizon, with several streamers in the north-northwest. At midnight these features were still present." The observer at St. Vincent states that it lasted all night, beginning at 7.30 p. m. of the 30th as a bright streak low down, with a faint arch surmounting it, and increasing in extent and brightness till morning, when it showed magnificent streamers like great brushes, with the dark segment high and pronounced. It was again observable during the entire night of the 31st, though mostly obscured by clouds. The observer at Ft. Missoula reports that it extended over about one-fourth of the horizon with an altitude of 45°. It began at 11 p. m., appeared brightest at midnight and ended at 2 a. m. The sky presented the appearance of a fiery dome, bright and very luminous; flames shooting from nearly every part, similar to those issuing from a burning building. Auroras were also observed in the New England States on the 23rd, 24th, 25th, 26th and 27th, but deserve no special mention.

*Atmospheric Electricity Interfering with Telegraphic Communication.*—Accompanying the very severe snow-storm of the 6th, which prevailed over a space of about 800 miles in width along the line of the Union Pacific R. R., between Omaha and Ogden, there was experienced a very positive display of electrical disturbance. For 24 hours the telegraph wires were rendered useless, the intensity being shown by the fact that when the telegraph key was opened a steady electric light burned at the connecting points. According to the records kept by the chief operator of the U. P. R. R. telegraph lines there is but one exception in the past 12 years to the regular yearly occurrence of similar storms between the 5th and 7th of January. At Fort Apache, Ariz., on the 16th, wires could not be worked for a considerable time.

*Zodiacal Light.*—St. Vincent, Minn., 1st, 2nd, 3rd, 6th, 7th, 8th, 21st, 22nd, 24th, 26th, 29th; Little Rock, 25th; Springfield, Ill., 2nd, 17th, 26th, 27th; Nashville, Sth, 25th to 28th; Southington, Conn., 24th; New Corydon, Ind., 1st, 2nd, 11th, 17th; Clinton, Iowa, 26th; Cresco, Iowa, 1st, 17th, 18th; Lawrence, Kan., 1st, 3rd, 12th; Manhattan, Kan., 3rd; Yates Center, Kan., 2nd, 22nd, 24th, 26th, 27th; Somerset, Mass., 16th to 18th, 20th, 22nd to 31st; Cambridge, Mass., 1st, 17th, 18th, 20th, 24th to 29th; Clear Creek, Neb., 1st, 2nd, 3rd, 18th, 25th; Oregon, Mo., 1st, 2nd; Pierce City, Mo., 23rd; Atco, N. J., 19th; Bellefontaine, Ohio, 25th to 28th.

*Thunder-storms.*—None were reported from the northern sections of the country, and but a small number from the southern districts, as will be seen from the following dates: Florence, Tuc-