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The Johns Hopkins University and the Maryland Agricultural College.

CENTRAL OFFICE, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD.

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Ballooning.

PROF. HENRY ALLEN HAZEN.

To most readers it is probable the only thought in connection with this subject will be in the line of the popular song, "Up in a Balloon, Boys," or of an hour's enjoyment at some fair-ground, topped off with a balloon ascension and a parachute jump. On the other hand, the balloon is destined to be the most valuable adjunct to the meteorologist in his attempt to bring his intricate science out from its uncertainties, its complexities and its speculations into the full light of day, and ultimately into a fixed science like that of astronomy. Much has been accomplished already in proving the extreme value of this means of exploration and discovery of facts, but we have hardly passed the threshold, as yet, of the possibilities which have lain dormant these 100 years in this most simple contrivance.

An important question to be met with at the very outset is the safety of the balloon, for no one could contemplate with perfect serenity the acquisition even of the most important facts at the imminent risk of the loss of life. In one instance, when an attempt was made to obtain consent of a life insurance company to carry a policy over a balloon voyage, the reply was given that from a study of statistics the risk was about the same as for a whole year of ordinary insurance, and the policy would be carried for about that premium. Now the only way in which this result could have been obtained was by taking all the fatal accidents due to foolhardy persons jumping with parachutes and to extreme recklessness and carelessness in running unnecessary risks. On the other hand, we have only to instance the 450 voyages of Prof. Wise and the 300 of Prof. King to show the great safety in careful balloon manipulation. Undoubtedly, familiarity with the balloon and its possibilities breeds a rather remarkable feeling of safety in its use, and to this reason we must attribute the final untimely end of Prof. Wise, himself, who went up in a rotten balloon not far from Lake Michigan and was never heard from again.

The balloon over *terra firma*, as at present used, with its very long drag rope, its valve at the top and its rip cord, is about as safe a contrivance as one could wish, and one is surprised at its stability the moment he leaves the earth. In fact, there is absolutely no feeling of motion or of uneasiness, and you can only tell that you have left the earth by looking over the edge of the basket, and even then the sensation is as though you were on a solid foundation and the earth was simply moving away from you. In five balloon voyages, one of them to 16,000 feet, I have become perfectly satisfied of the undoubted security and safety of this method of exploration.

In the past, one of the great drawbacks to successful exploration of the atmosphere has been in the lack of a portable and rapid-acting apparatus for determining moisture and temperature. The ordinary stationary wet and dry bulb thermometers will not do at all. In one case the temperature at a point in a rapid ascent was 20° higher than at the same point a few minutes after on a descent; that is, the thermometer carried with it the temperature of the region it had just left and was altogether too sluggish. To obviate all difficulty of this kind, the sling psychrometer has been adopted and perfected so

as to leave nothing to be desired further. In several voyages it has given the temperature of the same stratum within two degrees going up and coming back, and it can be so readily handled that good observations can be made easily once a minute.

What has been accomplished? It is rather remarkable that the 4000 voyages thus far made have added so little to our knowledge of the motions and upheavals in this ocean of air just above our heads. These voyages have been made, generally, during clear weather and by men without instruments or means of recording accurately experiences of cold and heat, electric action and violent commotion in the air. Experiments on audibility have been made, and these have shown that in a balloon a voice at the earth can be heard rather distinctly up to 1600 feet; in the opposite direction it cannot be heard more than 360. It is a matter of great wonderment to amateur balloonists that they cannot make themselves understood by the loudest shouts of which they are capable at heights of only 300 feet, while they begin to hear every word plainly at 1500 feet. Of course, the earth reflects the sound in the latter case. Croaking of frogs has been heard at 3000 feet, barking of dogs at 6000 feet, and the whistle of a locomotive at 10,000 feet. This audibility, however, is dependent in large measure upon the state of the air and elements, and would pay abundantly for careful experiment. Sometimes in a cloud sounds seem to be a great deal louder than below it. Above 10,000 feet one enters another realm; absolute stillness reigns, and the observer is impressed with the sublimity of the scene, especially if snow-white clouds with billows, mountains high, stretch on all sides as far as the eye can reach.

In one voyage the temperature at 19,700 feet was 15° F., and in the next 3400 feet it fell to 39° below zero. Glaisher, who made a large number of scientific ascents in the early sixties, gives this summary of his results: "Within 100 feet of the earth there may be a decline of temperature of several degrees during the midday hours, and an increase under the same conditions at night. This decline varies near the earth with cloudiness, etc. Within the first thousand feet there is an average diminution of 1° for each 223 feet with a cloudy sky, and 162 feet in a clear sky. At 10,000 feet there is a decline of 1° in 455 and 417 feet, respectively, for the two states of the sky. Above 20,000 feet the decline was 1° in 1000 feet." This differs markedly from the usually accepted law of 1° per 300 feet. The diminution of 1° per 1000 feet at great heights over England is very significant and, in part at least, serves to explain the remarkably mild climate experienced in such northern latitudes, for England is 800 miles further north than New York, and yet has a far milder climate.

Careful observations of humidity have shown most extraordinary changes. At Washington, D. C., October 27, 1891, there was a drop in the relative humidity of 30% in 400 feet, and in 1887, in Philadelphia, of 45% in 1000 feet. In Stockholm, Sweden, a year ago, there was found a drop of 96% in 1800 feet. These results are very remarkable and show changes in a vertical direction hardly dreamed of up to the present. Here seems to be a most fruitful field for study, and possibly one that will ultimately yield to us the cause of rain. How do these layers of dampness change as rain comes on? How is it possible for moisture to collect in enormous horizontal layers and with such marked changes in so short distances? These and other similar questions might be put by the score, and the balloon alone can answer them.

The most memorable voyage on record is that of Prof. Wise, who sailed from St. Louis, Mo., on July 1, 1859, and landed in Henderson, N. Y., nineteen hours later. This rapid travel of 44 miles per hour was remarkable, and showed a continuity and velocity of air currents little thought of up to the present. Prof. Wise also added a great deal to our knowledge of thunderstorms. He rarely found this cloud above 5000 feet, and he proves that there is no rotation in a horizontal plane in this cloud. If this is substantiated, it will prove one of the most valuable facts given to us by balloons up to the present.

But it is in the line of observations of atmospheric electricity that Prof. Wise has given us some very valuable records. In one voyage, as he passed above a thunder-cloud, he noted the following facts: "Several times the surface of the lower stratum swelled up suddenly like a boiling caldron, and this swelling was immediately followed by the most brilliant ebullition of sparkling coruscations. Twice it swelled up, or rather shot up, like an immense pyramid, quickly followed by an evolution of promiscuous flashes, and then quickly disappeared again, as though it had dissolved." In still another similar voyage above a thunder-cloud he says: "The watery mass is brilliantly illuminated by the sunlight. And then it heaves and rolls about like the boisterous ocean. Ever and anon the vapor is suddenly projected upward above the general cloud-level like a great volcanic cone, followed by a discharge of electricity, dancing across it like diamonds upon a snow-bank. This as suddenly melts it down again, and then follows a dash of rain that sends back to the ear a sound resembling a cataract. The report of these electric discharges, as heard above the cloud, is not that of a deep, sonorous, rumbling sound, but of a snarling crash like the report of a rifle." In a thrilling account of his experiences in the center of a thunderstorm, Prof. Wise speaks sa

follows: "I was in hope, when being hurled rapidly upward, that I should escape from the top of the cloud; but, as in the former expectations of an opposite release from this terrible place, disappointment was again my lot, and the congenial sunshine, invariably above, which had already been anticipated by its faint glimmer through the top of the cloud, soon vanished with a violent downward surge of the balloon, as it appeared to me, of some hundred feet. The balloon subsided only to be hurled up again, when, having attained its maximum, it would again sink down with a swinging and fearful velocity, to be carried up again and let fall. This happened eight or ten times, all the time the storm raging with unabated fury." Again he says: "In passing through a thunderstorm he was always first carried through a dense cloud into an open space, with a second cloud hanging above him. Currents of air frequently moved transversely to the current below the lower cloud. He had repeatedly been carried along by this transverse current, and upon coming down through the cloud he had been caught by the ascending current and whirled up again. Between the two clouds there were constant flashes of lightning from the upper to the lower. These flashes were not explosive. The heat lightning, so often seen, is the electricity of the upper cloud descending to the lower. The explosive discharges are generally between the lower cloud and the earth. Between the two clouds hail is formed." A score of such quotations might be given, but I think enough has been said to show the intensely interesting character of the exploration of the cloud region. If such results as these can be obtained with no instruments, what may we not hope for with accurate instruments and observations by trained men?

I think that the paucity of reliable records must be painfully evident to every one, and the great need for a regular campaign to determine Nature's secrets in her own great laboratory. Some may say that mountain summits ought to give us facts regarding storms at vastly less expense and risk, but unfortunately this is not the case. The mountain is a point in the atmosphere, and from this point there is a constant stream of electricity rushing into the air and masking nearly all meteorological observations. The almost constant cloud-cap at certain seasons of the year is due to this electric action. The telephone on the summit of Mt. Washington is continually crackling and sputtering as it never does at the base, save when a violent storm of lightning and thunder is approaching.

The expense of such exploration need not be very great. There is no necessity of emptying all the gas from the balloon at the end of each voyage, as is now done, but the same gas may be used over and over again. The theory held by some, that pure hydrogen gets soggy, is entirely erroneous, and is due to the admission of air by the neck after an anchorage has been made. This may be easily obviated by tying the neck of the balloon while anchored. A balloon in England has been kept perfectly inflated for a month without the renewal of gas. The usual custom is to fill the balloon full before the start; as a consequence, one-half or two-thirds of the gas flows out in a high ascension and is lost. It is well known that if a balloon leaves the earth at all, it will rise to as high a point as it could possibly reach if fully inflated at the start; thus, by filling the balloon one-half or one-third full, we may reach 20,000 or 30,000 feet without any loss of gas.

I feel confident that with a perfectly tight balloon, made of gold-beater's-skin, the whole expense of 200 voyages need not be over $20 per voyage, and probably it would be very much less, each voyage reaching a height of 20,000 or 30,000 feet. The advantages which the science of meteorology would receive from such an exploration of the air during rain, snow, hot waves, cold waves, thunderstorms, etc., would be incalculable. Meteorologists are practically agreed in this country and abroad that at present we know next to nothing of the origin of these conditions, so familiar to us at the earth's surface. The first firm foundation-stone is yet to be laid for an exact science. Where is the Queen Isabella, who will immortalize her name by extending aid to this enterprise?

November 14, 1894.

[From STORM BULLETIN No. 3 of 1894, issued by the U. S. Department of Agriculture, Weather Bureau.]

The Tropical Hurricane of October 8 to 10, 1894.

This disturbance belongs to a type of tropical storms which originate over the east part of the Gulf of Mexico, or advance westward from the Caribbean Sea, and recurve over or near northern Yucatan. In the case of storms of the latter class the disturbances are generally of slight intensity until the recurve has begun, or their course is too far to the southward to admit of their passage being detected at the Cuban stations of observation.

In October during the last ten years, five storms have advanced from the Caribbean Sea over the Gulf of Mexico; of this number two reached the west Gulf coast, two recurved over the Florida peninsula, and one dissipated over the central Gulf. During the same period five storms apparently originated over the Gulf of Mexico, of which number three advanced northeastward to the middle Atlantic and south New England coasts, one passed eastward over the

Florida peninsula, and one dissipated over southern Alabama.

The approach of storms with advance from the Caribbean Sea is usually detected before or during the recurve by West Indian or Key West reports. In the case of storms which originate over the middle Gulf, however, an entire absence of reports from the region south of the Gulf coast and the small diameter of the storm areas render their approach to the Gulf coast difficult to foresee.

The first information relative to the storm which has just traversed the east Gulf and Atlantic coast States was contained in dispatches received from Habana and Key West the afternoon of the 4th, when evidences of cyclonic action central over the east Gulf were reported. During the next twenty-four hours there were no indications of the storm at Gulf stations, except at Key West, where the barometer fell 0.14 below the normal and the wind reached a velocity of 32 miles per hour.

At noon of the 5th, information signals were ordered on the Gulf and south Florida coasts, and shipping interests were warned of possible danger. At 12.30 p. m. southeast storm signals were ordered at Key West. On the morning of the 6th there was some indication of a disturbance in the Gulf southeast of Louisiana. In the evening observers on the middle and east Gulf and west Florida coasts were notified of the probable location of the storm, and were informed that vessels should not leave for central and east Gulf ports. At 11 p. m. northeast storm signals were ordered at Port Eads, and the observer was informed that a dangerous storm was central south of his station and that, if possible, all vessels should be held until the conditions were more favorable. By the evening of the 7th the hurricane center was approaching the middle Gulf coast, and the wind had reached a velocity of 60 miles per hour at the mouth of the Mississippi.

On the morning of that date the observers at New Orleans, Mobile, Pensacola, Cedar Keys, and Tampa were informed of the movement of the storm, and instructed to notify shipping and warn shipmasters not to leave port. Messages containing similar information were also sent to observers at Galveston, Jacksonville, Key West, Savannah, and Charleston, and to the secretaries of the Maritime Exchanges of New York and Philadelphia. At 10.59 p. m. the following message was sent:

Observer Charleston, Savannah, Jacksonville. Pensacola, Tampa, Titusville, Augusta, Mobile, Montgomery, Meridian, New Orleans, Atlanta, and Vicksburg: Tropical hurricane approaching Gulf coast, likely to pass over east Gulf and South Atlantic States, attended by heavy rain and high winds. Notify postmasters. HARRINGTON.

Messages were also sent to the New York and Philadelphia Maritime Exchanges, stating that the storm was approaching the east Gulf and would probably move northeast, causing dangerous gales along the south Atlantic coast. By the morning of the 8th the storm had reached the central Gulf coast, the center being near to and south of Pensacola. Dangerous northeast gales were reported on the east Gulf coast and the storm was apparently moving toward the south Atlantic coast. At 11 a. m. the following message was sent:

Secretaries New York and Philadelphia Maritime Exchanges, and observers Baltimore, Delaware Breakwater, and New York: The Gulf storm has reached the west Florida coast where dangerous gales are now reported. The indications are that the storm will extend over the south Atlantic coast to-morrow, causing dangerous northeast gales. Hourly reports have been ordered and further information will be furnished during the day.
HARRINGTON.

The observers at Charlotte, Raleigh, and Wilmington were instructed to warn postmasters of heavy rain and high wind over North Carolina. At 2.45 displaymen at West Point and Newport News were notified that dangerous gales would prevail on the south Atlantic coast Tuesday, and that it was unsafe for vessels sailing south to leave port. They were also instructed to communicate this information to shipping interests. At 3 p. m. the following message was sent to observers from New York to Jacksonville and secretaries of the Philadelphia and New York Maritime Exchanges:

Storm central near Pensacola at noon, with a wind velocity of 64 miles per hour from the northeast, and barometer 29.34 and falling rapidly. This storm will cause dangerous gales on the south Atlantic coast south of Norfolk Tuesday, and no vessel should leave port. It is dangerous for any vessel to leave any middle Atlantic port sailing south. All observers will promptly communicate this information to shipping interests.

By the morning of the 9th the storm had moved northeastward to southern Georgia, and was central near Savannah, where a barometer reading of 29.26 was recorded. The display of northeast storm signals was extended along the Atlantic coast to Woods Holl, Mass., and observers on the middle Atlantic and south New England coasts were informed of the location and character of the storm, and were directed to distribute this information widely among shipmasters. Messages were also sent to the secretaries of the Philadelphia and New York Maritime Exchanges, stating that it was not safe for any vessel to leave port, especially for the south. The following message was sent to the observer at Lynchburg and 24 selected points in Virginia:

Dangerous gales and heavy rains indicated for Virginia, attending tropical storm in Georgia moving northeast.
HARRINGTON.

The above message was also sent to the observer at Norfolk with instructions to notify postmasters in his section. In the early after-

noon the following message was sent to the observer at Boston:

Hoist northeast storm signals. Storm central near Charleston, moving northeast. Barometer 29.22. Conditions becoming more threatening for the New England coast to-morrow, and it is unsafe for vessels to leave port for the south. Distribute information widely, especially on the coast. HARRINGTON.

At 2.15 p. m. postmasters at Cape May, Sea Isle City, Ocean City, Absecon, Barnegat, Seaside Park, Ocean Grove, and Asbury Park, N. J., were warned of easterly gales and high tides for the middle Atlantic coast, attending tropical storm moving northeast from South Carolina, and requested to distribute this information.

By the evening of the 9th the storm had moved rapidly northeastward to North Carolina, with barometer 29.26 at Wilmington. The observer at Boston was instructed to notify postmasters in his section of a severe storm Wednesday or Wednesday night, and the observers at Portland and Eastport were informed that dangerous gales would prevail on the New England coast south of Portland and that it was unsafe for vessels to leave port. Information signals were ordered at Buffalo, Rochester, and Oswego, and the observers at those places were informed that the tropical storm was moving up the middle Atlantic coast and would probably cause brisk to high winds on Lake Ontario during Wednesday.

By the morning of the 10th the storm center had reached the New Jersey coast, with barometer 29.06, the lowest reading noted in connection with this storm, at Atlantic City. Observers on the New Jersey and south New England coasts were informed of the position, character, and probable movement of the storm. Northeast signals were changed to northwest on the middle Atlantic coast, and signals for northeast gales were ordered for Portland and Eastport and on Lake Ontario.

By the evening of the 10th the storm had reached Maine, and unusually severe gales had prevailed on the middle Atlantic and New England coasts. By the morning of the 11th the storm center had reached the lower St. Lawrence Valley, with clearing weather and winds decreasing in force over New England and along the middle Atlantic coast.

The following reports from observers of the Weather Bureau indicate the general character of the storm and the value of the warnings which were widely distributed by telegraph throughout the middle and east Gulf and Atlantic coast States far in advance of the storm's arrival. Following closely the storm of September 24 to 29, which was particularly destructive on the south Atlantic and Florida coasts and over Cuba, and whose course was so accurately forecasted, these warnings received special attention and were universally heeded.

NEW ORLEANS, *October* 11, 1894.

Three sea-going vessels scheduled to leave detained in port Sunday and Monday. All small craft, yachting parties, etc, obeyed warning and a number of lives were doubtless saved. A number of vessels anchored at mouth of river Saturday, Sunday and Monday on account of warnings.

MOBILE, ALA., *October* 11, 1894.

Five vessels valued at $200,000 delayed sailing. Warnings of incalculable value and implicitly heeded ashore and afloat. Timely information enabled every one to take greatest precautions. Encomiums of service profuse.

PENSACOLA, FLA., *October* 11, 1894.

Three vessels detained. Warnings saved $30,000 worth of property and $10,000 to shipping and fishing interests. Preparations made to withstand hurricane offshore wind saved shipping from destruction. Apalachicola reports $30,000 damage from terrific southeast gale. High water warnings timely and of great benefit.

JACKSONVILLE, FLA., *October* 11, 1894.

Three schooners, lumber laden, with cargoes valued at $117,000, heeded warnings and were probably saved, with 21 lives. Passenger steamer *Margaret*, valued at $50,000, with crew of about 12, bound to Tampa, remained at Fernandina until danger was over and was undoubtedly saved. Warnings enabled vsssels in port to prepare for storm, and prevented much loss.

SAVANNAH, GA., *October* 11, 1894.

Seven sailing vessels and 2 ocean tramp steamers detained; 2 sailing vessels, valued at $30,000, saved by warnings. Towboat, lighterage, and dredging companies made their property secure. Rice planters flooded their fields, preventing great damage by beating winds.

CHARLESTON, S. C., *October* 11, 1894.

Four barks, 11 schooners, 6 steamships, 9 coast steamboats, and entire fishing fleet detained Monday, Tuesday, and Wednesday. Forty-seven lives and much property saved. Everything portable liable to damage moved the day before.

WILMINGTON, N. C., *October* 11, 1894.

Clyde steamer and 4 schooners detained. All safe. River tugs sought safety here. Steam yacht and unfinished steamer escaped injury by changing their wharfage. Bark and schooner went ashore at mouth of river trying to get in. Crew saved. Bark will be a total loss; schooner will be saved.

NORFOLK, VA., *October* 11, 1894.

Twelve line steamers, 3 tramp steamers, and 104 coasting vessels all obeyed warnings and securely tied up. Nine coasting vessels and 3 ocean tows ready to proceed to sea warned and remained in port, estimated they were saved. At least 50 lives saved. No disasters reported. Shipping thoroughly prepared. Service much appreciated.

NEW YORK, N. Y., *October* 11, 1894.

Superintendent Maritime Exchange says warning very valuable and means of saving much property and probably many lives. Many vessels detained in port. Rough estimate places value of property saved at $1,000,000. Among the vessels that heeded the warning and remained in port were several regular ocean liners. An unfinished seven-story tenement house was blown down, killing and injuring a number of people.

NEW HAVEN, CONN., *October* 11, 1894.

All interests warned and duly prepared. About 30 vessels detained. No losses. Full force of storm not felt here.

NEW LONDON, CONN., *October* 11, 1894.

About 35 sea-going and 20 pleasure crafts heeded warning. All vessels prepared to receive the gale. No damage reported. Warning decidedly appreciated by mariners, and steps were taken to protect small craft, which otherwise would have been in dangerous positions.

BOSTON, MASS., *October* 11, 1894.
Warnings timely and of great benefit, especially to small craft. Estimated that 50 vessels, valued at about $1,000,000, were detained by warnings. Three hundred vessels, valued at about $5,000,000, with crews aggregating 300 to 500 men, were in port. Bureau highly commended by press and public.

PORTLAND, ME., *October* 11, 1894.
About 35 vessels, mostly coasters, averaging about 5 men to each vessel, also Boston steamers, remained in port.

The history of the two great storms which have visited the eastern sections of the United States within the last three weeks furnishes competent evidence of the importance and great value of the system of warnings recently adopted by the Weather Bureau. This system provides for the distribution, by telegraph from selected centers to all available important points and interests, of warnings of unusually heavy storms and exceptionally severe cold waves, and reports received indicate that the warnings telegraphed in advance of the storms above referred to, which were particularly destructive along our southern coasts, prevented the loss of many lives and prompted precautionary measures which resulted in a saving of millions of dollars to maritime and coast interests.

MARK W. HARRINGTON, *Chief of Bureau.*

Miscellaneous Notes.

Through the courtesy of the Weather Bureau officials at Philadelphia, Pa., and Norfolk, Va., we are furnished with the monthly reports of those stations. The data, used in comparison with our State Weather Service reports, are of decided value.

Mr. J. Edward Abbott, of the *Evening Capital*, Annapolis, Maryland, called at the central office on the 14th instant. Mr. Abbott has charge of the weather and storm signal displays at Annapolis, and the Service under his supervision has become very popular. He stated that the warnings of the September and October hurricanes proved of great value to shipping and other interests. A pole 80 feet high and costing some seventy dollars has been erected by the city for the display of the signals.

The office is indebted to Mr. F. C. D. McKay, the observer at Wilmington, Delaware, for a day's visit on November 15th. Mr. McKay also visited the Weather Bureau at Washington before returning to his home.

Review of the Month—October.

WEATHER.

Low and High Areas.—The month opened fair. A large area of high pressure was then central over the Ohio Valley, and was the cause of the clear weather that prevailed until the 3rd. The area was not so cold, relatively, as such areas ordinarily are at this season of the year, but, notwithstanding this, it caused a drop of five or six degrees in the average temperature. As the high area moved eastward, beyond the Atlantic coast, it was followed by a great area of low pressure, which came by way of the Lake Region. The temperature rose rapidly on the 3rd, and rain began falling the same day, a projection of the area having reached the Atlantic coast states. The rain on the 4th and 5th was due to this area. It passed over the St. Lawrence Valley on the 5th, and fair and colder weather followed with an extensive high area from the West.

From the 8th to the 10th, rains occurred partially as the result of the passage of another low area over the Lake Region and the St. Lawrence Valley, but they were due principally to the tropical hurricane which, from the 8th to the 10th, was passing over the Atlantic coast states, from Florida to Maine. No extended mention of this storm will be made here, as it is fully described under another heading. The temperature remained relatively low during the passage of the hurricane because, coming from the South, it caused a flow, over this section, of air from cold northern areas. As the hurricane gave place to a high area (which, between the 8th and 11th, traveled from the State of Washington to the Atlantic coast), the temperature continued low.

On the 13th, a storm from the Northwest was central over the province of Ontario. It was extensive in area and caused the rains of the 13th and 14th. There was a slight rise in temperature during the passage of this storm, but the coldest weather of the month followed immediately after. A cold area of high pressure, which made its appearance in the Northwest on the 11th, reached the Atlantic coast on the 14th, in the rear of the storm above mentioned, and on the morning of the 15th occurred the minimum temperatures of the month. The area was then central over Kentucky. The weather continued fair from the 15th to the 23rd, inclusive, with the exception of an occasional local shower. A reason for this at the beginning of the period was the presence, over the south Atlantic states, of the last mentioned high area. Instead of receding eastward in the path of its predecessors, it moved slowly southward. As a result, the next storm, which traveled over the Lake Region and St. Lawrence Valley on the 16th, passed so far to the northward that its rain area extended southward only to central New York. On the 16th this persistent high area apparently amalgamated with another area of the same character from the West, the new

formation being central over Louisiana on the 17th. On this date a still further addition was apparently made to the formation by the accession of a high area from the North, and on the 18th the total aggregation moved eastward as one area. The center in the morning was over West Virginia, but most of the country west of the Mississippi was covered by this great wave of air. By the evening of the 18th it had reached the coast, and there it remained until the 23rd, when it slowly gave way before low pressure areas from the West and South.

During the prevalence of the high pressure there was but little fluctuation of the temperature. The greatest variation occurred on the 17th, when the storm that passed to the northward caused a rise of from six to eight degrees above the normal. On the 23rd light rains occurred at several stations. They were heavier on the 24th and ended generally on the 25th. This precipitation was caused by a storm of slight energy from the West.

The center of the area passed further to the southward than the usual one. Apparently it extended across Maryland, and when the coast was reached, northerly winds prevailed, as the State was then lying to the westward of the storm center. The temperature varied but little from the normal.

The last mentioned low area was followed by a storm of greater energy, which took a still more southerly course than its predecessor. Record of this storm was first made on the 24th. It was then central north of Montana, moving east and southeast; its center reached the South Carolina coast on the morning of the 27th. From here it moved northward, disappearing in this direction on the 29th. The scattered rains of the 27th, 28th and 29th were doubtless caused by this storm.

On the 30th a low area, which had remained almost stationary over the Lake Region since the 27th, moved slowly westward to the St. Lawrence Valley, causing the rains which fell in Maryland and Delaware on the 30th and 31st. From the 27th to the 29th the temperature was slightly higher than the normal. No well-defined area of high pressure reached the middle Atlantic coast after the 22nd.

Temperature (degrees).—Monthly mean (for entire territory covered), 55.8, being 1.1 above the normal; highest monthly mean, 61.3, at Pocomoke City; lowest monthly mean, 48.4, at Oakland; highest temperature, 88, at Solomon's, on the 2nd; lowest temperature, 24, at Sunnyside, on the 15th; greatest local monthly range, 55, at Sunnyside and at College Park; least local monthly range, 41, at Fallston, Distributing Reservoir, D. C., and Pope's Creek; mean monthly range, 47.5; monthly mean maximum, 65.4; monthly mean minimum, 46.3.

There was considerable variation between the mean temperatures of the several stations, as is shown by the remarkable curvature of the isothermal lines (see map, page 55). The warming influence of the Chesapeake Bay is apparent, as indicated by the upward bending of the isotherms.

The lowest temperature occurred, naturally, as would be supposed, in the mountains of western extreme of Maryland; and another persistently cool spot is in northern-central Maryland, on the eastern slope of the Catoctin and Blue Ridge mountains. The Hagerstown Valley is comparatively warm, as we expect to find it, sheltered as it is by bordering ranges.

Precipitation (in inches).—Average, 3.65, being 0.87 above the normal; greatest amount, 5.90, at Darlington; least amount, 2.25, at Cumberland (b).

The map, on page 55, shows graphically the distribution of the month's rainfall. There was generally an abundance of precipitation, but eastern Maryland and Delaware were favored with the largest share. More than four inches fell over two-thirds of the "peninsula." A considerable portion of northern-central Maryland, also, was given rainfall exceeding this amount. From two to four inches fell in western and in southern Maryland. The table of daily precipitation, page 53, exhibits the distribution of the rainfall throughout the month. The alternation of the periods of fair and rainy weather is shown.

Wind.—Prevailing directions, southwest and northwest. Total movement in miles, Philadelphia, Pa., 7862; Baltimore, Md., 5808; Washington, D. C., 4929; Norfolk, Va., 6835.

Thunderstorms.—At Bachman's Valley, on the 24th; at Baltimore, on the 24th; at Burkittsville, on the 24th; at Cherryfields, on the 24th; at College Park, on the 24th; at Dover, Del., on the 10th, 31st; at Fallston, on the 24th, 31st; at Frederick (a), on the 13th, 24th; at Mardela Springs, on the 3rd, 24th, 31st; at Milford, Del., on the 24th; at Millsboro, Del., on the 3rd, 24th; at Mt. St. Mary's, on the 3rd; at Pocomoke City, on the 24th; at Seaford, Del., on the 24th; at Taneytown, on the 4th, 24th; at Wilmington, Del., on the 24th; at Woodstock, on the 4th, 24th.

Frost, killing.—At Bachman's Valley, on the 12th; at Boettcherville, on the 12th; at Darlington, on the 12th, 16th; at Grantsville, on the 7th, 12th, 14th, 15th, 16th; at Jewell, on the 15th, 16th; at Mardela Springs, on the 15th, 16th; at Milford, Del., on the 12th, 15th, 16th; at Millsboro, Del., on the 16th; at Mt. St. Mary's, on the 15th; at Newark, Del., on the 12th, 16th; at Oakland, on the 7th, 12th, 18th, 26th; at Pocomoke City, on the 17th, 19th; at Princess Anne, on the 12th, 15th, 16th; at Sun-

nyside, on the 7th, 12th, 15th, 19th, 26th, 28th; at Taneytown, on the 7th, 11th, 14th, 15th; at Wilmington, Del., on the 16th; at Woodstock, on the 16th; at Norfolk, Va., on the 16th.

Hail.—At Burkittsville, on the 13th, 24th; at Easton, on the 23rd; at Frederick (a), on the 13th.

Sleet.—At Oakland, on the 14th

Auroras.—At Millsboro, Del., on the 1st, 3rd, 6th, 21st, 31st; at Woodstock, on the 9th.

Fog, dense.—At Baltimore, on the 20th; at Charlotte Hall, on the 20th, 24th; at Solomon's, on the 21st.

Notes by Observers.

Bachman's Valley.—15th, temperature down to 31° at 7 A. M.; ice formed to a thickness of ¼ of an inch.

Fallston.—15th, ice formed.

Grantsville.—17th, very high winds—no damage. From 18th to 31st the weather was remarkably fine. Springs are lower than they have been for 20 years.

Monthly meteorological summary of observations taken at Baltimore, Md., during the month of October, 1894.

Mean barometer, 30.02. Highest barometer, 30.39; date, 12th. Lowest barometer, 29.65; date, 17th. Mean temperature, 57. Highest temperature, 85; date, 3rd. Lowest temperature, 36; date, 15th. Greatest daily range of temperature, 30; date, 16th. Least daily range of temperature, 4; date, 9th.

Mean temperature for this month in

1871...58	1877...59	1883...58	1889...52
1872...56	1878...58	1884...60	1890...57
1873...55	1879...62	1885...55	1891...55
1874...56	1880...56	1886...59	1892...56
1875...55	1881...63	1887...56	1893...57
1876...52	1882...62	1888...51	1894...57

Mean temperature for this month for 24 years, 57. Accumulated deficiency of daily mean temperature during the month, 19°; average daily deficiency, 0.6°. Accumulated daily excess of daily mean temperature since January 1st, 249; average daily excess, 0.8°. Prevailing direction of wind, N. W. Total movement of wind, 5808 miles. Maximum velocity of wind, direction and date, 32, N. W., 10th. Total precipitation, 3.80 inches. Number of days on which .01 inch or more of precipitation fell, 11.

Total precipitation (in inches) for this month in

1871...3.11	1877...5.22	1883...2.83	1889...4.12
1872...4.08	1878...4.41	1884...1.42	1890...5.73
1873...6.21	1879...0.75	1885...6.51	1891...2.76
1874...0.16	1880...2.64	1886...1.39	1892...0.26
1875...1.44	1881...4.06	1887...1.06	1893...3.44
1876...2.79	1882...0.86	1888...2.99	1894...3.80

Average precipitation for this month for 24 years, 3.00. Total excess in precipitation during month, 0.97. Total deficiency in precipitation since January 1st, 5.87. Number of clear days, 15; party cloudy days, 7; cloudy days, 9. Dates of frost, 12th, 15th, 16th.

Weather of December at Baltimore in past years.

The following data, compiled from the Weather Bureau records at Baltimore, Maryland, for the past 23 years for the month of December, should prove of value and interest in anticipating the more important meteorological elements, and the range within which such variations may be expected to keep for the coming month.

TEMPERATURE.

Mean or normal temperature, 38°. The warmest month was that of 1881 and 1889, with an average of 44°. The coldest month was that of 1876, with an average of 28°. The highest temperature was 73°, on the 4th, 1873. The lowest temperature was —3°, on the 30th, 1880. Average date on which first "killing" frost occurred in autumn, November 4th.

PRECIPITATION (rain and melted snow).

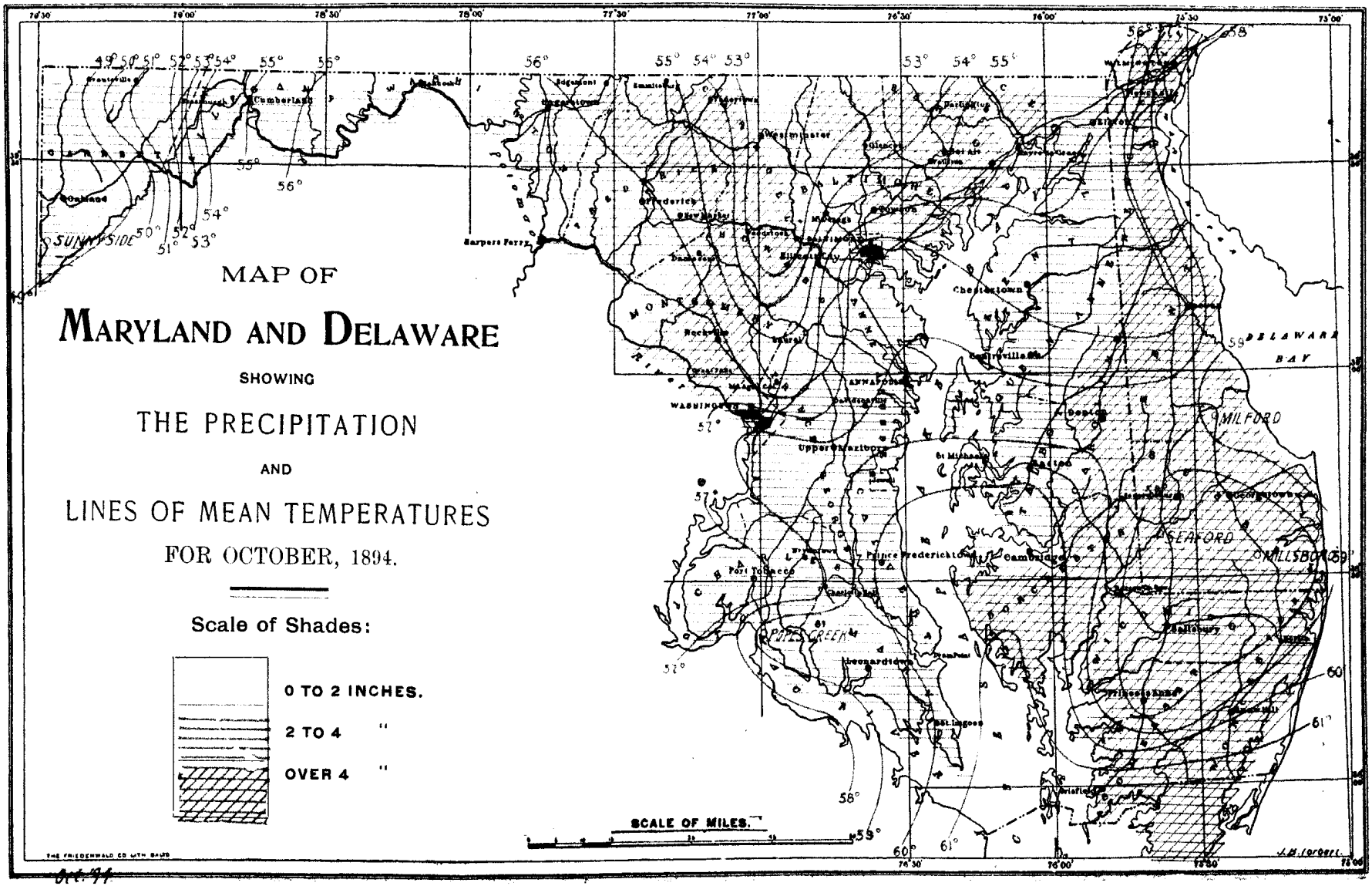
Average for the month, 3.10 inches. Average number of days with .01 of an inch or more, 11. The greatest monthly precipitation was 5.90 inches, in 1881. The least monthly precipitation was 0.61 inch, in 1889. The greatest amount of precipitation recorded in any 24 consecutive hours was on the 10th, 1878. The greatest amount of snowfall recorded in any 24 consecutive hours (record extending to winter of 1884-5 only) was 10.6 inches, on the 17th and 18th, 1887.

CLOUDS AND WEATHER.

Average number of clear days, 9; partly cloudy days, 12; cloudy days, 10.

WIND.

The prevailing winds have been from the northwest. The highest velocity of the wind was 40 miles, from the west, on the 11th, 1878, and from the north, on the 16th, 1891.


MAP OF
MARYLAND AND DELAWARE
SHOWING
THE PRECIPITATION
AND
LINES OF MEAN TEMPERATURES
FOR OCTOBER, 1894.
Scale of Shades:
0 TO 2 INCHES.
2 TO 4 "
OVER 4 "
SCALE OF MILES.
DELAWARE BAY
MILFORD
SEAFORD
MILLSBORO
Cumberland
Harpers Ferry
Frederick
Westminster
Chestertown
Rockville
WASHINGTON
Upper Marlboro
Prince Frederick
Cambridge
Port Tobacco
Princess Anne
Salisbury
Oct. '94

Meteorological and Weather Signal Display Stations of the Maryland State Weather Service.

Stations.	County.	Meteorological Observer.	Displayman.
Annapolis	Anne Arundel	J. E. Abbott.	W. M. Abbott.
Appleton	Cecil		W. C. Henderson.
Bachman's Valley	Carroll	J. M. Myers.	
Baltimore		G. N. Wilson. J. H. Donaldson. A. T. Brewer, *Ass't Editor of Monthly Report.* R. C. New. *Ass't Editor of Weekly Bulletin.*	
Bel Air	Harford		N. N. Nock.
Bel Alton	Charles	Walter Cox.	
Boettcherville	Allegany	F. F. Brown.	
Bradshaw	Baltimore		B. F. Taylor.
Buckeystown	Frederick		A. W. Nicodemus.
Burkittsville	Frederick	J. P. Slifer.	
Cambridge	Dorchester		Samuel Leman.
Charlotte Hall	St. Mary's	J. Francis Coad.	
Cherryfields	St. Mary's	J. Edwin Coad.	
Chestertown	Kent	Hon. M. deK. Smith.	
Cumberland	Allegany	Howard Shriver. E. T. Shriver.	
Darlington	Harford	A. F. Galbreath.	
Deer Park	Garrett	S. P. Specht.	
Delaware City, Del	New Castle		W. E. Reybold.
Denton	Caroline	F. C. Ramsdell.	
Dickerson	Montgomery		W. H. Dickerson.
Distributing Reservoir, D. C		Col. G. H. Elliot.	
Dover, Del	Kent	Jno. S. Jester	Philip Burnet.
Easton	Talbot	Henry Shreve	Henry Shreve.
Edgemont	Washington	Chas. Feldman.	
Fallston	Harford	G. G. Curtiss, A. M.	
Frederick (*a*)	Frederick	McClintock Young	W. T. Delaplaine.
Frederick (*b*)	Frederick	W. A. Lantz.	
Frederica, Del	Kent		Miss E. V. Newnom. Miss L. T. Frazier.
Garey P. O.	Howard		Walter Dorsey.
Glyndon	Baltimore		J. J. Dyer.
Grantsville	Garrett	J. S. Miller	T. H. Bittinger.
Great Falls	Montgomery	Col. G. H. Elliot.	
Hampstead	Carroll		H. H. Meals.
Hartly, Del	Kent		Miss C. A. Forde.
Havre de Grace	Harford		W. S. McCombs.
Kenton, Del	Kent		W. S. Arthurs.
Kirkwood, Del	New Castle	J. S. Carnagy.	
La Plata	Charles	J. S. Turner	J. S. Turner.
Laurel, Del	Sussex		E. D. C. Hegeman.
Lonaconing	Allegany		J. J. Robinson.
Mardela Springs	Wicomico	A. E. Acworth	L. A. Wilson.
Marshall Hall	Charles	F. H. Deal.	
McDonogh	Baltimore	H. Pender.	
Middletown	Frederick		G. C. Rhoderick, Jr.
Milford, Del	Kent	J. Y. Foulk	J. Y. Foulk.
Millsboro, Del	Sussex	Rev. L. W. Wells.	
Mt. St. Mary's	Frederick	J. A. Mitchell, A. M	Jos. H. Martin.
Newark, Del	New Castle	Wm. H. Bishop.	
New Market	Frederick	Miss Margaret D. Hopkins.	
Oakland	Garrett	J. Lee McComas, M. D.	J. L. McComas, M. D.*
Odenton	Anne Arundel		E. B. Watts.
Princess Anne	Worcester	Jas. R. Stewart.	
Pocomoke City	Worcester	R. M. Stevenson	R. M. Stevenson.
Pope's Creek	St. Mary's	George Dent.	
Receiving Reservoir, D. C.		Col. G. H. Elliot.	
Rising Sun	Cecil		E. A. Reynolds.
Rockville	Montgomery		Emmett Dove.
Salisbury	Wicomico		L. W. Gunby.
Seaford, Del	Sussex	H. L. Wallace	H. L. Wallace.
Smyrna, Del	Kent		A. D. Yocum.
Snow Hill	Worcester		Purnell & Vincent.
Solomon's	Calvert	W. H. Marsh, M. D.	
†Sparrow's Point	Baltimore		Md. Steel Co.
Sunnyside	Garrett	John G. Knauer.	
Sykesville	Carroll		J. S. Hyatt.
Upper Marlboro	Prince George's	J. B. Perrie.	
Washington, D. C		S. W. Beall.	
West Friendship	Howard		Postmaster.
Westover	Somerset		E. D. Long.
Wilmington, Del	New Castle	F. C. D. McKay	Wm. Lawton.
Woodsboro	Frederick		G. F. Smith.
Woodstock	Howard	T. J. A. Freeman, S. J.	
*Birdsnest, Va	Northampton	C. R. Moore.	
*Cape Charles, Va	Northampton	O. A. Browne.	
*Norfolk, Va	Norfolk		Jas. J. Gray.
*Warsaw, Va	Richmond	C. H. Constable.	

**Stations of the Virginia State Weather Service. †Whistle signals only.*

DAILY PRECIPITATION FOR OCTOBER, 1894.

STATIONS.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Tot
Sunnyside	...	...	.15	.02	.05	...	...	.09	†	.90	...	...	.36	.08	...	T	...	...	...	...	...	...	....	.01	...	...	...	...	...	†	1.16	2.82
Oakland	...	...	.10	.18	.08	...	...	.02	.08	.88	...	...	.28	.07	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.05	1.15	2.89
Deer Park	...	...	.10	....	....	...	...	...	.90	...	...	.14	...	...	...	...	...	...	...	...	...	...	....	...	...	...	...	...	1.17	....	2.31
Grantsville	.25	...	.30	....	.05	...	...	...	...	.75	...	...	.20	.10	...	...	...	...	...	...	...	...	...	.20	...	...	...	...	...	...	1.10	2.95
Boettcherv.	...	...	...	†	..	...	...	....	†	1.00	...	...	.10	...	...	...	...	...	...	...	...	...	...	.10	...	...	...	...	...	†	1.40	2.60
Cumb. (*a*)	...	...	...	....	....	...	...	....	....	....	...	...	.12	...	...	...	...	...	...	...	...	...	...	.75	...	...	...	...	...	...	....	.87
Cumb. (*b*)	...	...	...	....	....	...	...	...	1.00	....	...	.12	...	...	...	...	...	...	...	...	...	...	...	.15	...	...	...	...	...	.98	....	2.25
*Burk'tsvle	...	...	...	....	....	...	...	....	....	....	...	...	....	....	...	...	...	...	...	...	...	...	.03	.51	.01	...	...	....	T	T	1.44	1.99
Mt St.M'y's	...	...	...	.35	....	...	...	....	.01	2.00	...	...	....	.01	...	...	...	...	...	...	...	...	.08	.80	.06	...	...	.05	...	...	1.64	5.00
Fred'k. (*a*)	...	...	†	.25	.01	...	...	....	†	2.40	...	...	.28	.09	...	.02	...	...	...	...	...	T	T	...	.19	...	...	...	...	...	.90	4.15
Fred'k. (*b*)	.01	...	...	.29	....	...	...	....	...	1.00	...	...	.30	.13	...	...	...	...	...	...	...	...	...	.21	...	...	...	...	.06	....	85	2.85
Taneytown	...	...	.35	.18	....	...	...	2.40	...	....	...	...	.40	...	...	...	...	...	...	...	...	T	T	.70	T	...	T	...	T	T	1.32	5.35
Bach. V'y	...	...	.13	...	....	...	...	...	T	1.16	...	...	.19	...	...	T	...	...	...	...	...	T	....	.40	T	...	...	.28	.29	...	1.65	3.65
Woodst. Col	...	...	.55	T	T	...	...	T	2.65	...	...	...	.27	T	...	T	...	...	...	...	...	...	...	.40	.01	...	...	.17	...	...	.98	5.03
Baltimore	...	...	†	.24	.08	...	...	T	.01	1.80	...	...	.30	T	...	T	...	...	...	...	...	T	....	.14	.03	...	.01	.04	.08	T	1.07	3.80
Fallston	...	...	.23	.13	.02	...	...	....	2.29	....	...	...	.32	...	...	...	...	...	...	...	...	T	....	.31	.08	T	...	.36	T	...	1.17	4.91
Darlington	...	...	.29	.20	.03	...	...	....	2.50	....	...	...	.30	...	...	...	...	...	...	...	...	...	...	.58	.82	...	...	.09	....	...	1.09	5.90
Great Falls	...	...	...	.48	.13	.14	...	...	....	1.93	...	...	...	.29	...	...	...	...	...	...	...	...	...	....	.37	...	...	....	....	.31	.92	4.57
Annapolis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jewell	...	...	...	...	....	...	...	....	1.80	....	...	.15	...	...	...	...	...	...	...	...	...	...	...	....	.25	...	...	1.00	....	....	....	3.20
Dist. R., D.C	...	...	...	.21	....	.03	...	...	....	1.90	...	...	....	.20	...	...	...	...	...	...	...	...	...	....	.12	...	...	....	.25	....	.90	3.58
Rec. R., D.C	...	...	...	...	...	.05	...	...	...	2.19	...	...	...	.25	...	...	...	...	...	...	...	...	..	....	.16	...	...	....	.23	....	1.00	3.88
Wash., D. C.	...	...	...	.06	.01	...	...	T	.08	1.70	...	...	.19	.02	...	...	...	...	...	...	...	...	...	.08	T	...	...	.13	.02	...	.85	3.14
Col. Park	...	...	.13	.01	...	...	...	....	...	1.83	...	...	.28	T	...	...	...	...	...	...	...	...	...	.18	T	...	T	.11	T	...	.87	3.41
Up. Marlb.	...	...	...	...	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
La Plata	...	...	...	...	...	...	...	.30	1.50	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.40	....	1.10	.10	3.40
Bel Alton	...	...	...	...	....	...	...	....	...	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pope's Cr'k	...	...	...	...	...	...	...	...	†	1.75	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.15	....	....	.90	2.80
Solomon's	...	...	...	.24	....	...	...	.09	.32	2.00	...	...	.33	...	...	...	...	...	...	...	...	...	...	.02	T	...	...	.54	.03	.02	.68	4.27
Charl. Hall	...	...	...	T	....	...	...	....	1.98	....	...	...	....	...	...	...	...	...	...	...	...	...	T	T	....	...	...	.36	....	....	.81	3.15
Cherryfields	...	...	...	....	.36	T	...	....	.09	1.58	...	...	....	.20	...	...	...	...	...	...	...	...	....	...	....	T	.37	...	....	†	.69	3.29
Chestert'n.	...	...	...	.11	....	....	.10	....	2.05	....	...	...	...	...	...	...	...	...	...	...	...	...	.32	....	....	...	T	.05	....	....	.65	3.28
Denton	...	...	.54	....	....	....	...	.23	1.65	....	...	...	.24	...	...	...	...	...	...	...	.42	....	...	....	.14	...	...	...	1.00	....	....	4.22
Easton	...	...	...	.20	....	....	...	.24	†	1.64	...	...	.12	...	...	...	...	...	...	...	...	...	.20	...	...	...	...	†	†	.80	...	3.20
Mardela Sp.	...	T	...	...	.77	.03	...	...	....	2.19	...	...	.12	...	...	...	...	...	...	...	...	...	...	.04	T	...	...	....	.41	....	.79	4.35
Pri'cess An.	...	...	...	1.30	....	...	...	.57	1.43	...	...	...	T	...	...	...	...	...	...	...	...	...	...	.04	...	...	...	.68	....	.48	.27	4.77
Poc'm'k Cit	...	...	...	.54	....	...	...	T	.24	2.48	...	...	...	T	...	...	...	...	...	...	...	...	....	T	.02	.04	...	.98	...	.05	.80	5.15
Wilm't. Del.	...	...	...	.15	.02	...	...	...	....	2.15	...	...	.31	...	...	...	...	...	...	...	...	T	.27	.49	...	...	...	T	.12	T	.66	4.17
Newark, Del.	...	...	...	†	.25	...	...	....	†	1.65	...	...	.36	T	...	...	...	...	...	...	...	...	....	.27	.16	...	...	...	....	....	.87	3.56
Dover, Del.	...	...	...	.45	.10	...	...	†	†	2.11	...	...	.25	...	...	...	...	...	...	...	...	...	...	†	.36	...	...	.07	...	...	.81	4.15
Milford, Del	...	...	...	.86	.07	...	...	.28	....	2.12	.71	...	...	...	...	...	...	...	...	...	...	...	...	.18	.02	...	...	.16	.02	...	1.21	5.63
Seaford, Del	...	...	.18	.70	.03	...	...	.19	†	1.75	...	...	.25	T	...	...	...	...	...	...	...	T	....	.10	T	...	...	.19	T	....	1.01	4.40
Millsb'o. Del	...	...	...	1.43	....	...	...	.07	1.11	1.51	...	...	...	...	...	...	...	...	...	...	...	...	...	.29	.02	...	...	.44	.04	....	.74	5.65
Bs Nest, Va.	...	...	†	.25	....	....	...	†	.60	2.80	...	...	.10	...	...	...	...	...	...	...	...	...	...	...	..	...	†	.85	.35	.05	.55	5.50
Norfolk, Va	...	...	...	.34	T	...	...	.02	1.74	1.26	...	...	.01	.03	...	...	...	...	...	...	...	...	...	...	T	.01	.75	1.41	.20	...	.28	6.05
Warsaw, Va	...	...	...	.38	....	...	...	...	....	1.87	...	...	.18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	....	....	.55	.60	3.58
Phila. Pa	...	...	...	.21	.01	...	...	...	T	1.76	...	...	.56	T	...	...	...	...	...	...	...	T	....	.23	.58	T	...	.01	.07	.03	1.21	4.66

NOTE.—"T" indicates a trace of rain or melted snow. † Dates on which rain fell, but not measured until next observation.
* For last 15 days, only.

MONTHLY SUMMARY OF REPORTS FOR OCTOBER, 1894.

STATIONS.	COUNTIES.	Altitude above sea in ft.	Latitude.	Longitude.	TEMPERATURE. Monthly Mean.	Mean of Max.	Mean of Min.	Max. Degrees	Max. Date.	Min. Degrees	Min. Date.	Monthly Range.	Total Precipitation.	Clear Days.	Fair Days.	Cloudy Days.	Rainy Days. (.01 in. or more)	Prevailing Wind.
WESTERN MARYLAND.																		
Sunnyside	Garrett	.....	39°20′	79°21′	48.5	61.1	35.9	79	19, 20	24	15	55	2.82	18	4	9	9	S. W.
Oakland	Garrett	2380	39 24	79 18	48.4	59.7	37.1	73	19	25	11	48	2.89	15	13	3	10	S. W.
Deer Park	Garrett	2700	39 25	79 18	a 48.8	a 59.8	a 37.7	75	2.3.19.20,22	25	6, 14, 15	50	2.31	....	....	....	....	.....
Grantsville	Garrett	.....	39 41	79 12	51.4	62.2	40.5	78	19, 20 .21	28	15	50	2.95	13	8	10	8	.....
Boettcherville[1]*	Allegany	.....	39 39	78 48	54.2	....	.....	82	3	34	7,15, 18, 28	48	2.60	....	....	....	....	.....
‡Cumberland (*a*)[1]*	Allegany	650	39 39	78 46	55.5	.....	.....	78	3	33	15	45	.87	....	....	....	....	.....
Cumberland (*b*)	Allegany	700	39 39	78 45	55.0	64.2	45.8	78	3	34	12, 15, 16	44	2.25	19	8	2	4	.....
NORTHERN-CENTRAL MD.																		
‡Burkittsville**	Frederick	.....	39 25	77 35	R 56.8	p 64.2	R 49.4	77	17	40	18	37	1.99	4	4	7	4	S.W.
Mt.St. Mary's[1]*	Frederick	720	39 43	77 20	55.7	.....	.....	81	3	38	15	43	5.00	13	3	15	9	s.n.w
Frederick (*a*)	Frederick	280	39 24	77 18	56.4	65.4	47.5	84	3	34	16	50	4.15	....	....	....	....	.....
Frederick (*b*)	Frederick	280	39 24	77 18	57.2	66.0	48.3	83	3	36	15, 16	47	2.85	20	2	9	8	N.W.
Taneytown	Carroll	.....	39 40	77 9	.....	.....	.....	....	.....	....	.....	....	5.35	....	....	....	....	.....
Bachman's Val[1]*	Carroll	.....	39 37	76 55	52.8	.....	.....	80	3	31	15	49	3.65	17	6	8	6	S.
McDonogh	Baltimore	535	39 23	76 44	i 58.3	i 65.7	i 50.9	82	3	36	15	46	....	....	....	....	....	.....
Woodstock Col	Baltimore	400	39 19	76 51	52.7	64.1	41.3	81	3	30	16	51	5.03	8	15	8	7	S. E.
Baltimore	.....	179	39 17	76 36	57.4	65.2	49.6	85	3	36	15	49	3.80	15	7	9	11	N.W.
Fallston[1]*	Harford	450	39 31	76 24	54.6	.....	.....	76	3	35	15	41	4.91	....	....	....	....	.....
Darlington	Harford	300	39 39	78 45	56.0	65.2	46.9	80	9	33	15	47	5.90	19	1	11	9	N.W.
Great Falls[5]*	Montgomery	.....	39 0	77 14	57.0	.. ..	.....	82	3	35	16	47	4.57	....	....	....	....	.....
SOUTHERN MARYLAND.																		
Annapolis	Anne Arund'l	20	38 58	76 30	.....	.....	.....	.....	.....	.....	.....	.....	3.20	....	....	....	....	.....
Jewell	Anne Arund'l	....	38 45	76 37	L 59.7	L 66.2	L 53.2	82	3	39	12	43	3.20	....	....	....	....	.....
Dist. Res., D. C.[5]*	.....	.....	38 52	77 0	57.2	.....	.....	79	3	38	15	41	3.58	....	....	....	....	.....
Rec. Res., D. C.[5]*	.....	.....	38 52	77 0	57.3	.....	.....	81	3	37	16	44	3.88	....	....	....	....	.....
Washington, D. C.	.....	112	38 52	77 0	58.0	67.0	49.0	84	3	36	16	48	3.14	17	3	11	10	N.W.
College Park	Pr. George's	.....	38 58	76 56	55.4	65.8	45.1	84	3	29	16	55	3.41	....	....	....	7	.....
Upper Marlboro	Pr. George's	.....	38 47	76 45	.....	.....	.....	....	.....	....	.....	....	....	....	....	....	....	.....
Marshall Hall	Charles	.....	38 42	77 8	.....	.....	.....	....	.....	....	.....	....	....	....	....	....	....	.....
La Plata	Charles	.....	38 32	77 0	56.6	66.6	46.5	84	3	32	14	52	3.40	....	....	....	....	.....
Bel Alton	Charles	.....	38 26	77 1	.....	.....	.....	....	.....	....	.....	....	....	....	....	....	....	.....
Pope's Creek	Charles	....	38 22	77 1	59.4	68.5	50.2	86	2	35	11, 15, 31	41	2.80	....	....	....	....	.....
Solomon's	Calvert	20	38 19	76 27	60.9	68.6	53.2	88	2	40	15	48	4.27	14	3	14	10	N.W.
Charlotte Hall	St. Mary's	.....	38 28	76 38	a 58.0	68.3	47.8	86	2	33	15	52	3.15	13	3	5	3	nesw
Cherryfields[2]	St. Mary's	....	38 11	76 24	59.0	.....	...	..	.....	....	.....	....	3.29	12	13	6	6	N. E.
EASTERN MD. AND DELAWARE.																		
Chestertown	Kent	80	39 13	76 4	56.9	64.8	49.0	80	3	38	12	42	3.28	9	11	11	6	N. E.
Denton	Caroline	42	38 47	75 41	58.2	69.0	47.4	82	3	34	11, 14	48	4.22	....	....	....	....	.....
Easton	Talbot	35	38 42	76 6	60.0	70.4	49.5	80	3	37	12, 16	43	3 20	15	9	7	9	S.
Mardela Spr.	Wicomico	25	38 30	75 39	58.0	66.9	49.2	83	3	33	16	50	4.35	13	8	10	7	nesw
Princess Anne	Somerset	.....	38 10	75 35	57.6	68.5	46.8	83	3	30	16	53	4.77	14	8	9	8	S. W.
Pocomoke City	Worcester	37	38 5	38 38	61.3	72.6	50.0	85	3	34	16	51	5.15	15	8	8	8	S. W.
Wilmington, Del.	Newcastle	115	39 44	75 33	58.8	67.2	50.3	84	3	35	15	49	4.17	11	11	9	9	W.
Newark, Del	Newcastle	.....	39 40	75 37	55.5	64.2	46.8	81	3	31	16	50	3.56	13	9	9	6	S. W.
Kirkwood, Del.[2]	Newcastle	.....	39 35	75 41	e 57.4	.....	.....	....	.....	....	.....	....	....	....	....	....	....	.....
Dover, Del	Kent	40	39 10	75 30	57.0	64.0	49.9	82	3	38	15, 16	44	4.15	15	3	13	10	nwsw.
Milford, Del	Kent	20	38 45	75 25	59.7	68.6	50.8	85	3	34	16	51	5.63	12	7	12	11	W.
Seaford, Del	Sussex	.....	38 40	75 35	57.4	66.7	48.1	82	3	35	15, 16	47	4.40	....	....	....	....	.
Millsboro, Del	Sussex	.....	38 44	75 15	57.2	65.9	48.6	85	3	32	16	53	5.65	17	1	13	9	.....
‡VIRGINIA.																		
Birdsnest[1]*	Northampton	.....	.....	....	61.9	.....	.....	84	3	41	16	43	5.50	15	5	11	8	nwsw.
Norfolk	.....	.....	.....	.....	62.6	69.4	55.9	85	3	41	16	44	6.05	18	4	9	11	N. E.
Warsaw	Richmond	.....	.....	.....	57.6	66.6	48.7	84	3	36	16	48	3.58	14	8	9	5	E.
‡PENNSYLVANIA.																		
Philadelphia	.....	.....	.....	.....	57.2	64.5	50.0	82	3	37	15	45	4.66	11	8	12	10	N. E.
AVERAGES: Western Maryland		.....	.....	.....	51.0	61.4	39.8	...	.....	....	.....	49.2	2.64	16.2	8.2	6.0	7.8	S. W.
AVERAGES: Northern-Cent'l Md.		.....	.....	.....	55.8	65.3	47.4	...	.....	....	.....	47.0	4.52	15.3	5.7	10.0	8.3	N.W.
AVERAGES: Southern Maryland		.....	.....	.....	58.2	67.3	49.3	....	.....	....	.....	45.5	3.41	14.0	5.5	9.0	7.2	N.W.
AVERAGES: East. Md. and Del		.....	.....	.....	58.1	67.4	48.8	....	.....	....	.....	48.4	4.04	13.4	7.5	10.1	8.3	S. W.
AVERAGES: Entire territory		.....	.....	.....	55.8	65.4	46.3	....	.....	...	.....	47.5	3.65	8.8	14.7	6.7	8.4	swnw.

* Extremes of temperature from observed readings of dry thermometer. A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:
[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4. [2] Mean of 8 a. m. + 8 p. m. + 2. [5] Mean of 7 a. m. + 2 p. m. + 2.
The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers. Letters of the alphabet are used to denote the number of days that are missing from record; for instance, "a" denotes 1 day missing. An italic letter following the name of a station indicates that two or more observers, as the case may be, are reporting from the same station. ‡ Omitted in computing averages. ** For last 13 days, only.