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The Johns Hopkins University and the Maryland Agricultural College.

CENTRAL OFFICE, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD.

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VOL. II. MONTHLY REPORT OF OBSERVATIONS, DECEMBER, 1892. NO. 9.

The Production of Rain.

BY PROF. H. A. HAZEN.

The recent papers on this subject have aroused a great deal of interest, and it seems advisable not to let the matter drop without a still farther statement. In the early part of 1889, experiments in a laboratory in this country showed that an aggregation of vapor molecules into fine drops might be made, even in a dust-free air, by causing an explosion in the jar containing the vapor. This possibility was also admitted by Prof. John Aitken, who says: "It is possible to produce condensation in dust-free air. It is done by drawing out the air-pump very rapidly and accompanying the process with a shock" (*Scientific American*, Oct. 31, 1891, p. 277). It is not necessary to inquire just the process by which this agglomeration was effected. It seemed to be a purely mechanical effect aided by a great reduction of temperature. The best way to secure the transparent drops is to compress air to about 1½ atmospheres in a Wolf bottle and, after waiting a short time, allowing the air to rush out violently. The mist produced is fine, probably not more than $\frac{1}{400}$ or $\frac{1}{500}$ inch diameter, and can be seen only by allowing it to fall between the eye and a bright light. A beautiful phenomenon is produced when a large rubber cork in the Wolf bottle is suddenly blown out by the compressed air. Instantly the whole bottle to the very edge is filled with an opaque white cloud, of exceedingly fine particles probably not more than $\frac{1}{3000}$ inch diameter. The principal point to be noted is that this aggregation takes place in an absolutely dust-free air. In fact, I have no sympathy with the view that every cloud particle must have a dust particle as a nucleus. The dimensions of cloud particles are variously given as from $\frac{1}{1000}$ to $\frac{1}{7000}$ inch diameter, and a little computation will show that with particles $\frac{1}{3000}$ inch diameter it would require more than 400,000,000 to make a single drop of rain. It is incredible that such an enormous number of dust particles would not make their presence known to the sight. On Mt. Washington, day and night for weeks at a time, there is a continued rush of cloud, 40 and 50 miles an hour, and thousands of feet thick. I do not believe it is possible for such an enormous amount of dust to find its way to this height of 6300 feet. It is an interesting question in this connection, and the verity of the phenomenon has been accepted by many on the *ipse dixit* of a single experimenter. I would like to see a few gallons of rain-water boiled away and the residuum collected. We are taught that except for a little ammonia our rain is as pure as the purest distilled water.

It is a remarkable fact that the formation of rain in our laboratories is an exceedingly doubtful phenomenon. Prof. Curtiss, in the November issue, speaks of having seen snow when very cold air was let into a room filled with vapor (steam) on washing day. I do not quite understand this. I have tried the experiment, with saturated air but not with steam, without success. It is barely possible that with a saturated air outside, a sudden gust into a room filled with steam would cause a slight precipitation at the junction between the steam and the saturated air, but it would not be general over the room, and the whole effect would be exceedingly evanescent. In fact, computation does not show an appreciable precipitation except as the cloud particles are driven together. Saturated air at 80° F. contains about 11 grains of moisture per cubic foot, and at 30°, 2 grains: a cubic foot of the mixture would contain 6.5 grains if none were precipitated, but a cubic foot at 55° would contain 4.86 grains. This

would appear to give nearly 2 grains to be precipitated, but the condensation of this moisture would liberate latent heat enough to heat the air to over 65°, and at 65° a cubic foot of air will hold 6.8 grains. In fact, unless we can get rid of this latent heat, by conversion into electricity, or in some other way, we can have no rain at all, according to theory. This suggestion was made three years ago in *The American Meteorological Journal* for July, 1889. Prof. Dolbear, of Tufts College, has just published a book, "Matter, Ether, and Motion," in which, p. 185, he suggests that condensation of moisture would very quickly cease unless the latent heat were transformed into electricity, and he thinks it not improbable that this is the source of atmospheric electricity.

I have dwelt thus at length upon this experiment given by Prof. Curtiss, because it may lead to some very important results if closely followed up. It is to be hoped that others may be led to experiment with steam-filled rooms. We want to know the temperature of the outer air and its dew-point; also the temperature of the air in the room. We ought to learn whether the snow, or precipitation, occurs uniformly over the whole room or only at the plane of junction of the cold and warm air. If a jar of saturated air be suddenly immersed in a pail of water 40 degrees colder than itself, no cloud will be formed in the center, but the moisture will collect on the sides of the jar and trickle down to the bottom. If a piece of ice be immersed in such a jar of saturated air, at a temperature of 80°, no cloud will be formed about the ice, but a beautiful white stream of cloud will descend from the ice. Why may not the cold air, as it strikes the warmer, saturated air, draw to the plane of junction sufficient moisture to cause precipitation at that plane?

Turning now to the recent experiments in Texas, and Washington, D. C., I think there are one or two very significant facts which have been ignored by many writers. Prof. G. E. Curtiss, the meteorologist to the Texas expedition of last year, says of those experiments: "In several instances, when a dense, threatening cloud was overhead, a sharp detonating explosion was followed after an interval of 20 or 30 seconds by a spatter of rain, or, if it was already sprinkling, the blast was followed by a very noticeable momentary increase of the drops" (*Engineering Magazine*, July, 1892, p. 548).

On the early morning of Nov. 3, 1892, twelve ground explosions of a chlorate powder were made on the west bank of the Potomac, not far from Washington. Professor Curtiss was about three miles from these explosions, and he testifies that each of the earlier ones was followed within an interval of from 2 to 30 seconds by marked splashes of rain. The peculiarity of these drops was their size, not unlike the large drops that fall so often after a clap of thunder.

Another interesting point in connection with these explosions was a marked clearing of the sky. The moon and stars began to appear after the seventh concussion, and before the last the sky was largely cleared. If this effect was due to the explosions, it was certainly remarkable and sets at rest at once the question of the utility of such methods of rain production. In fact, the one result brought out more strongly than any other in all these explosions, was the entire impotence of man in producing rain economically. Granting this, however, it still appears that there were some extraordinary results which theory does not account for. We are told that the utmost movement of the air at a quarter of a mile would be only .0001 of an inch, and such an effect would be inappreciable in agglomerating cloud particles into rain-drops. On the other hand, it is certain that these explosions caused windows to rattle at distances of four and even five miles, and, if so, it does not seem incredible that they should have caused other effects. No rain was noted on November 3, at a distance of eight miles from the city in one direction, so that it cannot be said that this was an universal rain over this whole region. Was the effect in all these cases purely mechanical, or was it brought about, indirectly, through a change in the electric potential or in any other way? Was there a well-defined interval between the explosion and the resultant rain at different distances? This would seem a very favorable field for study, though it must be said that the methods thus far followed are altogether too crude and expensive to be carried on any farther. Science cannot favor the expenditure of $35,000 with so meager results and under such conditions as have been adopted. As has been said over and over again, what meteorology needs more than anything else to-day, is an exploration of the cloud region on all sides of our storms and, above all, in the region where rain is falling. The expense of such exploration need not be great; a sum of $5000 would enable us to make 100 ascensions to heights very much greater than any yet attained in this country, and by conserving the gas it is probable that 200 ascensions may be made. It would be difficult to tell the enormous advantage that would accrue from such an exploration. Where is the Queen Isabella who will aid such an enterprise in this Columbus year?

Cumberland and its Environs.

By Howard Shriver.

Regarding Cumberland as a central point, we have around us every variety of climate embraced between 80 degrees above and 20 below zero. These, it is true, may be regarded as the extremes, yet they represent accurately the great diversity that may exist in comparatively small distances.

As a result of this, while we are sweltering in summer heat in the city, a ride of five minutes will place you in the "Narrows," an immense gorge, where it never grows so hot, and which is usually of a pleasant coolness. Frostburg, less than a dozen miles distant, but at an elevation a quarter of a mile above us, is entitled to its name much more truly after Jack Frost than the old hunter who christened it; while a few miles beyond is a climate where summer evenings are only enjoyable before a cheerful wood-fire.

The points around Cumberland, to the east and west, may be regarded as the first step to the crest of the Alleghanies, which extend in breadth to the Ohio River. The mountain sides are covered with various pines and hardy trees, approaching an Alpine growth, while the mountains themselves represent, geologically, some of the most interesting formations. Ascending from the lower (red) Medina in the Great Gorge, which is wholly composed of white Medina, you run against the upturned edges, in succession, of the white Medina, the Clinton, the Niagara and Salina, the famous Oriskany, the Marcellus and, lastly, above all, the Hamilton; and this in the distance of exactly one mile. A few miles in the opposite direction carries you up to the Carboniferous, and places you among the beds of the richest and best bituminous coals in the world. It is needless to do more than mention this coal, the reputation of which is world-wide. The mines are as inexhaustible as the coal is excellent. A hundred daily trains find employment in conveying their loads of black diamonds into the city of Cumberland, while others, in less number, move in toward other points of the compass. The valued abundance of this coal is now making itself felt in a geometrical ratio, as evidenced by the various industries springing up all around this mountain metropolis.

The city of Cumberland has not grown to unusual size for the plain reason that the whole country around it is filled with towns and villages, constantly increasing in number, and mainly drawing their supplies from the metropolis. One is surprised to see, in a town of scarce 15,000 people, so large a wholesale trade and so many manufactories, until he understands that it must needs be to supply the constant draught made upon it by these numerous members of the family. To express it differently, these neighboring towns and villages are but offshoots of the city proper (the depots being placed according to the demand), and practically and properly are to be regarded as part and parcel of what we should most truly term the metropolis.

The country is not properly agricultural. The mountainous and mineral character of it necessitates manufactures. Farming is done to the full extent of the limited area; but the market of Cumberland is supplied greatly from abroad. It cannot be otherwise. A country instinctively develops its most valuable traits, which here are mining and, consequent upon a coal supply and minerals, manufactures. Agriculture, therefore, is a subordinate necessity. We must not be understood as disparaging the efforts of our farmers. No finer apples, peaches or pears can be produced than those which are the products of their orchards. Corn, wheat, buckwheat and oats are raised, and the three latter are, notably, of the most excellent quality. The place of agriculture is inferior to that of mining and manufacturing only on account of the limit of arable ground. Mining is so all-absorbing and so unexceptionably valuable that other interests are dwarfed in the comparison. The gold mines of California were rich, but are not now. The coal, aptly termed the black diamond, lies in its mountain bed, a treasure not to be exhausted. This recalls the great "waterlime" range (Helderberg formation) which crosses almost the very center of the city of Cumberland. It is tapped in three different points, from which immense supplies of cement are drawn and distributed to the four points of the compass. Analysis sets this cement at the head of United States cements, in some points only yielding to the celebrated Portland, which is used to a moderate degree because the Cumberland has commanded the market in this country.

But let us deviate from the pecuniary value of this part of Maryland. If it be summer, let us step aside from the thoroughfares and follow up the brook, coming down the mountain-side, beautiful with its repeated cascades, now tumbling headlong and now spreading out over the face of a mossy rock, and trickling down in a hundred tiny streams, among which are the delicate plants that have never seen the sunlight, overshadowed as they are by the whole family of ferns, the pawpaw, the bladder-nut, and retired plants and trees that love a cool, moist, shady retreat. Here we are beyond noise of steam whistles and rolling cars, and feel that these unfrequented spots are the ones that nature truly loves. But now we are on the Potomac, walled in by inaccessible cliffs lightly ornamented with occasional dwarf pines or, perchance, with white rhododendron, clumps of kalmia, wild roses, pink or fragrant white azaleas, bitter-sweet, or hundreds of crag and crevice-loving wild flowers of the more diminutive sort. Lastly, we climb to the summit of some peak of Will's Mountain—Savage or Dan—to allow the vision to take in the wide array of mountain ranges and peaks, then descend to the celebrated Narrows, and lift our eyes to the mile of cliffs that overhang the great city entrance. Train after train comes in loaded, and train after train goes out empty to the mines. The whistles shriek and the black volumes of smoke rise, but we still gaze on the mighty ledges, hundreds of feet above us, laid there by the hand of the Almighty, their rough gray faces relieved by the stunted pines that have claimed every crevice furnishing a little soil, or by the sparsely leaved branches of aged pines whose roots start at the

bottom of a ledge and that stand there emulating the sublimity of the ledge itself. Below, we note the inclined bed of rocks, debris of the upper ledges, wedged in among each other as though they had never fallen there. Loose among them are shrubs and vines, obeying the behest of the Almighty to cover up deformities with beauty. Jefferson said that to behold Harper's Ferry was worth a voyage across the Atlantic. We believe him, and had he ever stood on the bank of Will's Creek and raised his eyes to the cliffs of Will's Mountain, the grandeur of the view would have inspired even stronger praise.

Review of the Month.

WEATHER.

Storms and Cold Waves.—The month, in Maryland, the District of Columbia and Delaware was ushered in with fair weather and a nearly normal temperature. A low area storm had but just passed to the northeast, and its invariable follower, an area of high barometer, was close at hand to the westward. This area of high barometer, in its rapid passage eastward, kept the weather fair, in the Chesapeake region, on the 1st and 2nd. The area of low pressure which followed, though so ill-defined that it was scarcely recognisable, brought a little rain to Northern Maryland and Delaware. Fair weather followed on the 4th and 5th, as may be seen from the table of daily precipitation, page 74, the temperature remaining close to the normal. The absence of precipitation on the above dates was due, almost as a matter of course, to the area of high barometer then embracing this region. Like its predecessor, it was merely a carrier of fair weather.

The first important change of the month began on the 6th, with the approach of a storm through the Lake region. It caused some rain on the 6th, and passed rapidly to the eastward, closely followed by its secondary. Between these two storms was the interval of a day's fair weather. The second storm was in the Upper Lake region on the 8th, and moved rapidly northeast. On that day the rain was quite general, though light, and the highest temperature of the month occurred, as the result of the storm's passage.

From the 9th to the 18th, two areas of low and two areas of high pressure passed from west to east over the country, the low areas bringing the usual moist snows and rains and warmer weather, and the high areas the colder and fair weather. The temperature and rainfall during this time, though fluctuating slightly, averaged close to the normals. On the 19th and 20th, however, a low storm area swept from the southwest over the South and Middle Atlantic States, drawing into its vortex cold northerly winds, and causing quite a heavy fall of snow in the Chesapeake region. The temperature fell rapidly, and to the close of the month it remained far below the normal.

The very cold weather that prevailed during the closing 10 days of the month resulted from the passage eastward, during that time, of two great areas of high pressure which occupied nearly the whole country, to the exclusion of all areas of a low character. The presence of these great areas also accounts for the almost total absence of precipitation, from the 21st to the 31st. On the 25th and 26th, a storm developed in the South Atlantic States, but it was quickly pushed into the Atlantic, and but little snow fell in the Middle Atlantic States.

Precipitation (in inches).—Average, 2.24. Greatest amount, 3.02, at the Distributing Reservoir, D. C. Least amount, 1.37, at McDonogh.

The map, page 75, exhibits the distribution of the month's rain and snow throughout Maryland, the District of Columbia and Delaware. It is seen that between 2 and 4 inches fell over the entire territory embraced, with the exception of a small area surrounding Westminster, Northern Central Maryland. The table of daily precipitation, page 74, exhibits the distribution of the precipitation throughout the month. It is seen that nearly the whole amount fell between the 13th and 20th, inclusive. Considerably less than the normal was reported from nearly every section.

Temperature (degrees).—Mean monthly, 32.3. Highest monthly mean, 36.0, at Solomon's. Lowest monthly mean, 29.4, at Kirkwood, Del. Highest temperature, 68.0, at McDonogh. Lowest temperature, 6.0, at Boettcherville and Woodstock, on the 28th and 29th, respectively. Greatest local monthly range, 58, at Boettcherville, Great Falls and Woodstock. Least local monthly range, 42, at Kirkwood, Del. Mean monthly range, 51.8. Mean maximum, 39.3. Mean minimum, 26.3. The isotherms on the map, page 75, will assist to a comparison of the mean temperatures of the different sections.

Wind.—Prevailing direction, northwest. Total movement in miles, Baltimore, 5567; Norfolk, Va., 5942; Washington, D. C., 4644.

Thunderstorms.—At Darlington, on the 8th.

Hail.—At Barron Creek Springs, on the 6th; at Leonardtown, on the 19th; at Mt. St. Mary's, on the 13th; at Penn's Grove, N. J., on the 13th.

Sleet.—At Cumberland (H. Shriver), on the 13th; at Mt. St. Mary's, on the 13th and 14th.

Halos.—Lunar. At Barron Creek Springs, on the 2nd; at Darlington, on the 5th, 26th, 27th; at Fenby, on the 27th, 30th; at Mt. St. Mary's, on the 27th, 30th; at Penn's Grove, N. J., on the 26th, 27th, 30th.

Solar. At Barron Creek Springs, on the 26th; at Norfolk, Va., on the 8th.

Corona.—At Barron Creek Springs, on the 2nd, 28th.

Polar Bands.—At Cumberland (H. Shriver), on the 2nd, 8th, 12th, 21st, 28th.

Meteors.—At Barron Creek Springs, on the 5th; at Cumberland (H. Shriver), on the 9th; at Penn's Grove, N. J., on the 6th; at Solomon's, on the 7th.

Aurora.—At Cumberland (H. Shriver), on the 4th; at Darlington, on the 4th; at Fallston, on the 4th.

Average number of clear days, 12.4; fair days, 9.3; cloudy days, 9.4; rainy days (.01 of an inch or more), 7.2.

CROPS.

Col. Lemuel Malone, of Salisbury, Wicomico county, sends the following report, made December 31st:

Wheat looks bad in consequence of the cold, dry weather, and bids fair for a short crop. The corn crop is, usually, large, after a dry, cold winter. The thermometer has ranged lower for ten days than it has even for 20 years, for so many consecutive days. Average, 31° for that time.

Mr. Geo. B. Pfeiffer, of Westwood, Prince George county, reports (December 31st) that wheat is exposed and looks well.

Notes by Observers.

Barron Creek Springs.—2nd, halo and corona of moon, 9 P. M. 3rd, cold wave; heavy frost; rainbow in N. W., 7 to 8 A. M.; red sunset; frost; meteors seen, 5.30 P. M. to 7 P. M. 6th, unusually heavy frost; snow; hail; rain; rainbow in N., 2 to 4 P. M. 9th, cold wave; clouds flying N. E., 2 P. M. 11th, very heavy frost; meteors going S. E., 8.30 P. M. 16th, frost; smoke; rain; hail; snow. 18th, heavy fog, 7 A. M.; frost. 20th, cold wave. 21st, heavy white frost; prevalent cold wave. 22nd, heavy white frost; Barron Creek frozen over. 23rd, snow here yet; parhelion of sun, south side, 8.15 P. M. 24th, wind storm, 9 P. M. to 3 A. M. 26th, heavy wind storm from N. W., 12 M. to 3 P. M.; halo of sun with two parhelia, 9 A. M.; snow not gone; Barron Creek frozen over at bridge. 28th, Nanticoke river blocked up above and below Athel wharf; steamboats stopped; corona of moon, 9 P. M. 29th, 30th, 31st, heavy white frost and cold wave.

Cumberland.—(H. Shriver).—2nd, disc around moon; S. W. polar bands. 3rd, 8 and 9 P. M., white meteor went directly to ground. 8th, polar bands. 9th, meteor as large as Jupiter, color white, with comet-like tail. 12th, polar bands. 13th, sleet; snow; rain. 20th, sunset beautiful red, overlaid with a black heavy cloud. 21st, polar bands. 25th, wind storm. 26th, about 5 inches of ice on river. 28th, polar bands. 30th, dark reddish-brown ring around the moon, like a rainbow; outside of this was another azure ring; expecting to examine it more closely after calling a friend, it had disappeared on my return. 31st, river and creeks closed; splendid skating for a week; great ice harvest, the first in four or five years.

Fenby.—18th, 19th, mill ponds frozen over. 24th, ice-cutting began, and many houses were being filled; the ice was of a good quality, and from 7 to 8 inches thick; the wheat fields have been protected by the snow during the cold term; the snow lies on the ground about 3 inches deep. 31st, snow began at 2.30 P. M.

Woodstock.—5th, 6th, 7th, 8th, 10th, 14th, 16th, fog. 24th, Patapsco river frozen over. 25th to 31st, skating on the Patapsco river; ice cut 8 inches thick.

Miscellaneous Notes.

Mr. Wm. T. Wilson, voluntary observer of the U. S. Weather Bureau and New Jersey Weather Service, at Penn's Grove, N. J., has kindly volunteered to forward monthly meteorological reports to the Maryland Service. The situation of Penn's Grove, on the Delaware River immediately opposite Wilmington, makes the reports of considerable value to the Maryland Service, particularly in the drawing of isotherms passing through northern Delaware. Mr. Wilson's reports are models of excellence.

Mr. William Fenby, of Fenby, Carroll county, Md., forwarded a meteorological record for December, and the results of his observations are included in this Report. His data are carefully recorded, and his work shows his interest in the subject of meteorology.

Cambridge, Dorchester county, Md., has been added to the list of Maryland State Weather Service Stations, with Mr. Calvert Orem as observer. Mr. Orem states that he began observations January 1st, so that a report from his station is expected for the next issue of this publication. Mr. Orem has also been appointed Weather Signal Displayman by the Chief of the Weather Bureau.

Mr. William M. Abbott, editor of the *Evening Capitol*, Annapolis, Md., Weather Signal Displayman for that city, has consented to render meteorological reports. From the central location of the city of Annapolis, his reports will be a decided addition to the Monthly Reports of Observations.

Benedict, Charles county, Md., will become a meteorological reporting station, beginning February 1st. The observer will be Mr. Thomas Berry.

Meteorological forms for January are expected from two stations in Garrett county, Md., the observers being Mr. James D. Hamill, of Oakland, and Mr. John G. Knauer, of Sunny Side.

MONTHLY SUMMARY OF REPORTS, DECEMBER, 1892.

Stations.	Counties.	Altitude above Sea in feet.	Latitude.	Longitude.	‡ Barometer.					Temperature.								Monthly Range.	Total Precipitation.	Clear Days.	Fair Days.	Cloudy Days.	Rainy Days. (.01 or more.)	Prevailing Wind.
					Monthly Mean.	Maximum. Height.	Maximum. Date.	Minimum. Height.	Minimum. Date.	Monthly Mean.	Mean of Maximum.	Mean of Minimum.	Maximum. Degrees.	Maximum. Date.	Minimum. Degrees.	Minimum. Date.								
Baltimore		179	39°17′	76°36′	30.106	30.632	12	29.581	25	33.4	39.0	27.7	64	8	14	27	50	2.28	13	8	10	8	N.W.
Barron Ck. Springs	Wicomico.	25	38°30′	75°39′						33.0	40.7	25.2	67	8	11	29, 31	56	2.3	13	10	8	10	N.W.
Boettcherville	Alleghany		39°39′	78°48′						31.5			64	7	6	28	58	2.10					
*Cumberland (a)	Alleghany	700	39°39′	78°46′	30.102	30.651	12	29.579	25	33.6	38.3	27.8	60	7	12	26	48	1.64					
Cumberland (b)	Alleghany	700	39°39′	78°45′						31.6	37.0	26.2	56	7	9	30	47	1.73	11	7	13	6	
Darlington	Harford	300	39°39′	76°14′						30.4	38.3	22.5	61	8	8	26	53	2.23				6	N.W.
§Denton	Caroline	42	38°47′	75°41′						33.1			66	8	12	29	54	1.93					
Distribut'g Res., D.C.			38°52′	77° 0′						32.6			63	8	10	29	53	3.02					
Dover, Del	Kent		39° 9′	75°31′						32.9			67	8	12	29	55	2.60	15	7	9	9	N.W.
Easton	Talbot	35	38°42′	76° 6′						30.1	34.9	25.3	55	8	12	29	43	2.32	11	6	14	6	N.W.
Fallston	Harford	450	39°31′	76°24′						30.7			58	8	10	26	48	2.21	9	14	8	6	N.W.
Fenby	Carroll	950	39°36′	77° 5′						31.1			63	8	8	24, 26, 27	55	1.60	10	14	7	4	N.W.
Frederick	Frederick	280	39°24′	77°18′						32.4	38 5	26.3	58	8	11	27	47	2.04	15	9	7	9	
Great Falls	Montgomery		39° 9′	77°14′						32.2			65	8	7	29	58	2.94					
Jewell	Anne Aru'del		38°44′	76°36′						31.4								2.25	15	7	9	6	
Kirkwood, Del	New Castle		39°35′	75°40′						29.4			50	8	8	26	42						
Leonardtown	St. Mary's		38°18′	76°40′						34.6			65	8	14	29	51	2.50	14	7	10	5	N.W.
§McDonogh	Baltimore	535	39°23′	76°44′	30.099	30.640	12	29.588	25	34.4	41.2	27.7	68	8	14	21	54	1.37					
Mt. St. Mary's	Frederick	720	39°41′	77°21′						31.2	38.6	23.8	63	8	9	26, 30	54	2.00	13	13	5	8	N.W
New Market	Frederick	500	39°23′	76°27′						30.4			58	8	9	29	49	2.57	15	8	8	7	N.W.
Penn's Grove, N. J.	Salem		39°50′	75°33′						34.4	40.0	28.9	65	8	14	26, 27	51	2.13	9	15	7	7	N.W.
Receiving Res., D. C.			38°52′	77° 0′						32.4			63	8	11	29	52	2.79					
Seaford, Del	Sussex		38°40′	75°27′						33.4	42.0	24.8	66	8	10	30	56	2.51					
Solomon's	Calvert	20	38°19′	76°27′						36.0	42.1	29.9	64	8	16	25	48	2.44	10	8	13	7	N.
Taneytown	Carroll		39°40′	77° 9′														1.77					
Washington, D. C.		112	38°52′	77° 0′	30.120	30.640	12	29.590	25	33.2	40.2	26.1	67	8	13	29	54	2.82	13	7	11	8	N.W.
Woodstock	Baltimore	392	39°20′	76°49′	30.109	30.632	12	29.581	25	31.0			64	8	6	29	58	2.32	12	8	11	11	N.W.
†Norfolk, Va.		34	36°51′	76°17′	30.128	30.641	12	29.644	25	40.1	46.5	33 6	72	8	19	25	53	3.91	11	9	11	8	N.
Averages					30.107					32.3	39.3	26.3					1.8	2.24	12.4	9.3	9.4	7.2	N.W.

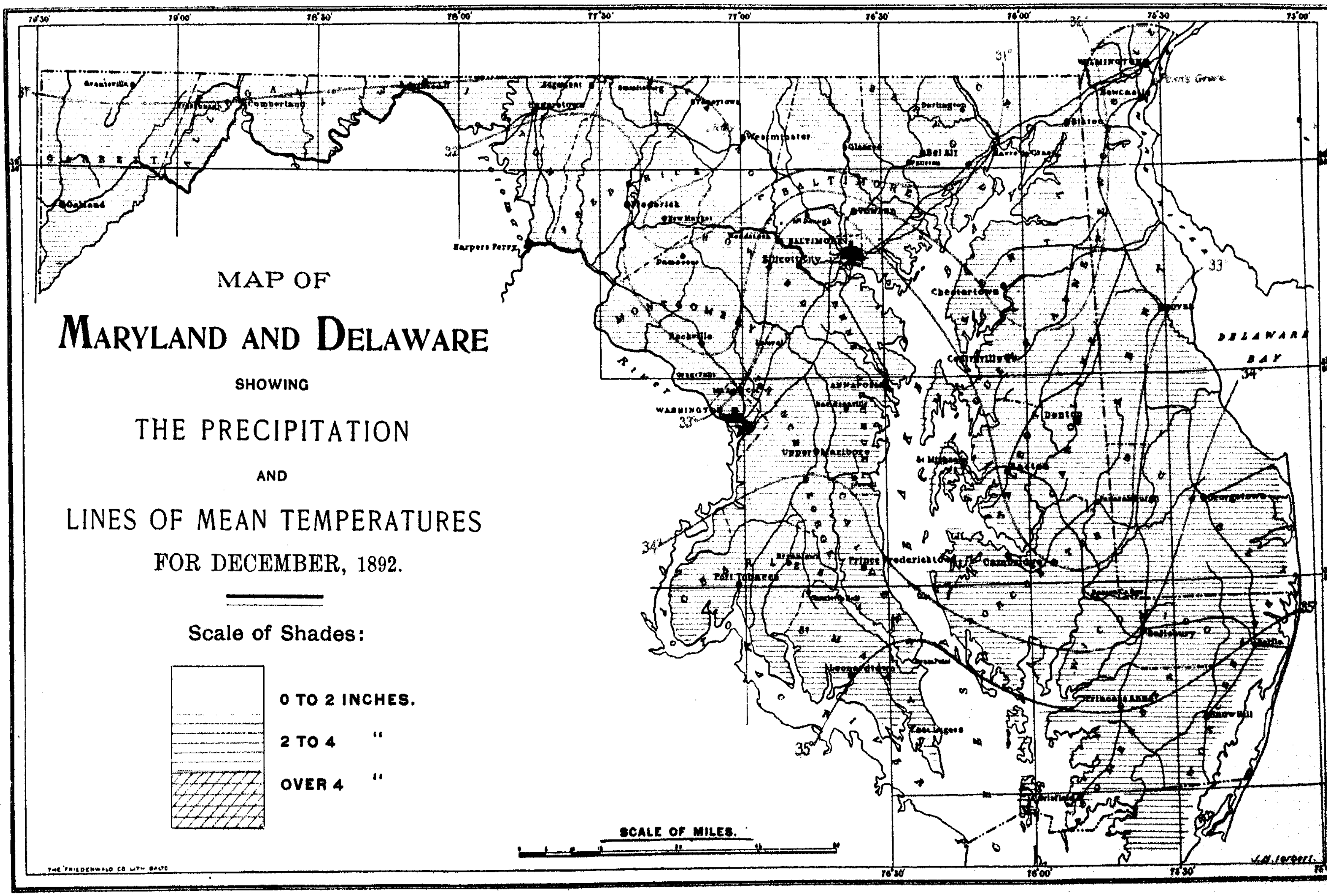
*3 days missing. †Omitted in computing averages. ‡Readings reduced to sea-level. §5 days missing.

DAILY PRECIPITATION FOR DECEMBER, 1892.

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	Total.
Baltimore						.01		.07	T				.88	.51		T	.15	T	T	.67			T		.02	T					.02	2.28
Barron Crk. Spr.						T		.06		.08				.81			.33			.85			T									2.13
Boettcherville						.20					T		T	1.40			.20	T		.10		T	T	T	T	T					.20	2.10
Cumberland (a)						.15							.60	.40					.13	.16											.20	1.64
Cumberland (b)						.12						.06	.97		.08				.25												.25	1.73
Darlington								.25					1.20				.11		T	.51					.08						.05	2.23
Denton													1.40							.53		T									1.93
Dist. Res. D. C.													2.05			.30	.06		.55	.04						.02					3.02
Dover, Del			.02					.04		.01				1.45			.15			.43											2.60
Easton														1.23		.18			.55	.91											2.32
Fallston			T			T		.20					1.20				.20								.04					.02	2.21
Fenby						T							.06	.40			.30			.40											1.60
Frederick						.08		.06					.83	.81			.20			.36											2.04
Great Falls								.10						1.70	.06		.25	.13		.70											2.94
Jewell									T					1.87			.33			.50											2.25
Leonardtown						T							.81				1.18			.51											2.50
McDonogh								T					.60				.28			.48						.01					1.37
Mt. St. Mary's			.03			.02		.01					.87	.35			.16			.36											.20	2.00
New Market			T		T									1.75			.23			.59			T	T	T						2.57
Penn's Grove, N.J.								.03					.79	.47			.07			.68					.04					.05	2.18
Rec. Res. D. C.							.04	.03						1.77			.20	.09		.60	.08					.03					2.79
Seaford, Del			.03					T		.16				1.01			.20			1.11											2.51
Solomon's						T		T		.02			.88	.42		.33	.14		.02	1.13			T								2.41
Taneytown								.52					.10	.98		.17				T										T	1.77
Washington, D. C.						.02		.04					1.06	.70		.10	.23		T	.65			T		.02	T				T	2.82
Woodstock													1.20			.05		T		1.00					.07					T	2.52
Norfolk, Va.								.05	T	.54				.04		.10	.05	T		1.27						T	1.75	.11				3.91

NOTE.—"T" indicates a trace of rain or snow.

A. T. B.



MAP OF

MARYLAND AND DELAWARE

SHOWING

THE PRECIPITATION

AND

LINES OF MEAN TEMPERATURES

FOR DECEMBER, 1892.

Scale of Shades:

0 TO 2 INCHES.

2 TO 4 "

OVER 4 "

Meteorological Stations reporting to the Maryland State Weather Service.

Stations of Observation.	County.	Observer.
Baltimore		G. N. Wilson, A. T. Brewer, H. D. Steuart.
Barron Creek Springs	Wicomico	Albert E. Acworth.
Boettcherville	Alleghany	F. F. Brown.
Cumberland (*a*)	Alleghany	Howard Shriver.
Cumberland (*b*)	Alleghany	E. T. Shriver.
Darlington	Harford	A. F. Galbreath.
Denton	Caroline	F. C. Ramsdell.
Distributing Reservoir, D. C.		Lieut.-Col. Elliot.
Dover, Del	Kent	Jno. S. Jester.
Easton	Talbot	G. W. Minnick.
Edgemont	Washington	Chas. Feldman.
Fallston	Harford	G. G. Curtiss.
Fenby	Carroll	Wm. Fenby.
Frederick	Frederick	G. Ernest Bantz.
Great Falls	Montgomery	Lieut.-Col. Elliot.
Jewell	Anne Arundel	Jos. Plummer.
Kirkwood, Del	New Castle	W. C. L. Carnagy.
Leonardtown	St. Mary's	G. W. Joy.
McDonogh	Baltimore	W. W. Walker.
Mt. St. Mary's (Emmitsburg)	Frederick	J. A. Mitchell, A. M.
New Market	Frederick	H. H. Hopkins, M. D.
Penn's Grove, N. J.	Salem	Wm. T. Wilson.
Receiving Reservoir, D. C.		Lieut.-Col. Elliot.
Seaford, Del	Sussex	H. L. Wallace.
Solomon's	Calvert	W. H. Marsh, M. D.
Taneytown	Carroll	C. W. Weaver, M. D.
Washington, D. C.		S. W. Beall.
Woodstock College	Howard	T. J. A. Freeman, S.J.
Norfolk, Va		A. B. Crane.

Stations Displaying Weather Signals.

Stations.	County.	Displaymen.
Annapolis	Anne Arundel	W. M. Abbott.
Appleton	Cecil	W. C. Henderson.
Barron Creek Springs	Wicomico	L. A. Wilson.
Bel Air	Harford	N. N. Nock.
Bradshaw	Baltimore	B. F. Taylor.
Bridgeville, Del.	Sussex	T. J. Gray.
Buckeystown	Frederick	A. W. Nicodemus.
Cambridge	Dorchester	Calvert Orem.
Chestertown	Kent	J. S. Vandegrift.
Darlington	Harford	A. F. Galbreath.
Delaware City, Del.	New Castle	W. E. Reybold.
Dickerson	Montgomery	W. H. Dickerson.
Easton	Talbot	G. W. Minnick.
Emmitsburg	Frederick	J. A. Mitchell, A. M.
Frederick	Frederick	W. T. Delaplaine.
Frostburg	Alleghany	C. J. Conner.
Grantsville	Garrett	A. L. Gnagey.
Greensboro	Caroline	Plummer & Plummer.
Havre de Grace	Harford	W. S. McCombs.
Hyattsville	Prince George's	E. B. Rowell.
Lonaconing	Alleghany	J. J. Robinson.
Middletown	Frederick	G. C. Rhoderick, Jr.
Milford, Del.	Kent	J. Y. Foulk.
Odenton	Anne Arundel	E. B. Watts.
Ridgely	Caroline	J. A. Sigler.
Salisbury	Wicomico	L. W. Gunby.
Seaford, Del	Sussex	Dr. Hugh Martin.
Snow Hill	Worcester	Purnell & Vincent.
*Sparrow's Point	Baltimore	Md. Steel Co.
St. Michael's	Talbot	E. M. Jefferson.
Westminster	Carroll	W. S. Myer & Bro.
Wilmington, Del.	New Castle	Wm. Lawton.

*Whistle Signals only.