U. S. DEPARTMENT OF AGRICULTURE, WEATHER BUREAU,

CO-OPERATING WITH THE

# MARYLAND STATE WEATHER SERVICE

Established by an Act of the General Assembly of the State of Maryland, 1892,
and Maintained in Connection with

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, MAY, 1892. NO. 2.

## Soil Investigations at Clifton.

The Maryland State Weather Service has been organized to study and report on the climatic conditions which prevail in the State. Records will be kept in all parts of the State of the temperature and rainfall, and maps will be published showing the areas of equal temperature and of equal rainfall; but more than this is needed, and more than this is planned, for the agricultural interests of the State.

The Maryland Agricultural Experiment Station has undertaken a systematic study of the soils of the State, with a view of determining the relation of these soils to moisture and heat and to study what may be called *underground* meteorology.

There is a certain mean annual rainfall in the State, fairly well distributed throughout the year; and a certain mean temperature. This rain, falling on a stiff clay soil, moves downward very slowly by reason of the exceedingly fine texture of the soil; and by judicious cultivation, to prevent evaporation from the surface, a sufficient supply of water may be maintained in the soil for a crop of wheat. The same quantity of water moves downward so quickly through a light sandy soil that the proper water supply cannot be maintained, and a crop of wheat cannot, therefore, be successfully produced.

It is well known that the *season* has a very great effect on the crop. That is just why a study is going to be made of the climate of this State. The season has more effect on crop production and development than any combination of manures. We may, however, have very uniform conditions of temperature and rainfall over two soils, but if the soils themselves differ in texture we will have very different conditions of moisture and heat *within* the soil, and this may account for the local distribution of crops.

The average yield of wheat per acre in the different sections of the State, as given in the 10th Census, is as follows:

| Section. | Aver. Yield per Acre. | Highest Average Yield for any County. |
|---|---|---|
| Southern Maryland ....... | 8.2 bushels. | 9.0 bushels. |
| Eastern Shore ........... | 10.6 " | 14.8 " |
| Northern and Western Md. | 14.8 " | 18.0 " |

The difference in temperature and rainfall is not sufficient to account for the differences in yields in these different sections; and, besides, this local distribution of crop does not agree with the areas of uniform temperature or rainfall, but it corresponds very closely with the different soil-formations shown on a geological map of the State. It is not that these soils differ in the amount of plant-food they contain, for these soils do not differ very materially in their chemical composition, and it has been repeatedly shown that no addition of mere plant-food will enable a good wheat crop to be produced on a light sandy soil, unless the *texture* of the soil is so changed as to make the soil more retentive of moisture. I have shown in a report to the Experiment Station that the soils of Southern Maryland are, as a rule, lighter in texture and less retentive of moisture than the soils of Western Maryland, and that with the same amount of rainfall they cannot maintain as regular or as abundant a water supply for the crop.

It is through a study of these physical properties of soils and their relation to moisture and heat that we hope to show the cause of the local distribution of plants, and the deterioration of agricultural lands. It is well known that in the artificial conditions of greenhouse culture different classes of plants require different conditions of moisture and heat, and we expect to find the conditions in each of our great soil-formations particularly adapted to the needs of certain classes of plants. When these conditions change, as they are known to change by injudicious fertilization, cultivation and cropping, the fertility of the land is impaired and it becomes "worn out" and may be abandoned. On the other hand, it has long been known that the judicious use of fertilizers and manures, for example stable manure and lime, has a most important effect on the physical condition of the soil, and its relation to moisture and heat. It would appear from our own work and from deductions from facts well known to practical farmers, that the most important effect of fertilizers is their physical effect on the soil, changing its relation to moisture and heat, so that these conditions will be better adapted to the needs of a particular class of plants.

With this view of the matter, a worn-out soil is not necessarily deficient in plant-food, and very barren soils have been shown, by chemical analysis, to have an abundant supply of food-material; but the conditions of moisture and heat in the soil are so changed that the vitality of the plant is impaired and it cannot properly make use of, or assimilate, the food-material with which it is surrounded. It is a very common practice in greenhouse culture to force a plant to maturity, before it has attained any considerable size, by a judicious control of the moisture and heat. On the other hand the ripening period may be indefinitely postponed, and the plant developed to a very large size, with an abundant and luxuriant foliage, by maintaining different conditions of moisture and heat.

Now, in field culture we may have uniform conditions of temperature and rainfall over adjoining fields, but the texture of the soils may be so unlike that the actual conditions of moisture and temperature within the soil, at the disposal of the plant, may be quite as different as in the artificial conditions of greenhouse culture. The conditions in a soil may be so unsuited to the normal growth and development of a plant that it will not develop in the desired way, and at the same time the vitality of the plant may be so impaired that it is much more liable to disease and insect ravages than the crop on the adjacent soil, where the conditions are better suited to the needs of the particular kind of plant.

This, then, is the problem the Agricultural Experiment Station has undertaken to solve: to determine the relation of our great soil-formations to moisture and heat; to see what becomes of our annual rainfall and mean annual temperature after they enter the soil, and what conditions of moisture and heat are maintained by the different soils for the use of the crop. Having determined the conditions existing in our typical soil-formations, such, for example, as the grass and wheat lands of the limestone soils, the lighter wheat and tobacco soils and early-truck lands of Southern Maryland, we may compare the conditions existing in any local soil and see how they should be changed; that is, whether the soil should be made more or less retentive of moisture to conform more closely to the type-soils; or, by comparing the type-soils with one another, show what kind of treatment is needed to increase the production of the less fertile soils.

Two illustrations may be used to show the practical bearing and importance of this work.

The texture of the soil is largely determined by the amount of clay, and the way the grains of clay are arranged in the soil. The subsoil of the pine barrens has not more than 2 to 4 per cent of clay, and is hardly more than a coarse, sharp building-sand, so coarse and open in texture that water flows through it with great rapidity and the proper water supply cannot be maintained for a crop. The subsoil of the early-truck lands has from 4 to 10 per cent of clay, but they are still too light in texture for profitable wheat production. The subsoil of the best type of tobacco lands of Southern Maryland has from 14 to 18 per cent of clay. The subsoil of good wheat land has usually over 20 per cent of clay, and of grass land, the strongest clay soils we have, from 30 to 50 per cent.

A sample of a subsoil from Southern Maryland has been examined and shown to contain nearly 27 per cent of clay. The sample represents a large area of land in Southern Maryland which is too light for wheat and which appears to be a typical truck soil. The country has some evidence of former prosperity, but the lands now appear worn-out and generally neglected. The analysis shows that the soil has sufficient clay to give a basis for a good wheat land, and, as has since been learned, the lands were once considered strong and fertile wheat lands. They have become exhausted from some cause and are now considered too light for profitable wheat production. The soil is loose, light and loamy in texture and is not very retentive of moisture. It cannot maintain a sufficient water supply for wheat.

The changes which have occurred in the deterioration of this land can readily be determined, and are being determined, by comparing the conditions in this soil with the conditions in the best wheat lands of that region. The ordinary fertilizers and manures are known to have a great effect on the texture of the soil by changing the arrangement of the soil grains and so changing the relation of the soil to water. We will be able, therefore, when the conditions prevailing in this worn-out soil are carefully determined, by a long series of observations, to tell what treatment the land requires to change these conditions and to make the soil as productive as the better class of wheat soils of that locality.

Another illustration may be given to show the practical bearing and importance of this work. The subsoil of a good strong grass land from a limestone formation has from 40 to 50 per cent of clay. We have analyzed two samples of clay from a pottery near Clifton: one sample used in burning tile, the other for the hardest stoneware. Neither of these samples has over 50 per cent of clay. A sample of red clay, used for puddling and diverting water from the gutters in the repair of our city streets, has only 42 per cent of clay. These samples of impervious pipe-clay, in which nothing can be grown, *owing to the physical texture of the soil*, contain no more real "clay" than the permeable, fertile grass land of the limestone formation. They have the same amount of sand, but the grains of sand and clay have a different arrangement. In the puddled pipe-clay the grains are all very evenly arranged, and the spaces between the grains, through which the water moves, are of nearly uniform size and so exceedingly small that water circulates through the soil very slowly. In the limestone soil the relative proportion of clay and sand is about the same as in these tight pipe-clays, but the grains are differently arranged; they are granulated, so to speak,—that is, the grains of clay are held close up against the grains of sand, making some of the spaces in the soil larger, and others exceedingly small. Water moves much more readily through such a soil than in a soil where the spaces are all of uniform size.

It would be quite easy to puddle the limestone soil and bring it into a condition so impervious to water as to make it quite unsuited to vegetation. On the other hand, it would be quite possible, although much more difficult, to make a good wheat land of the pipe-clay, through judicious cultivation and manuring, by rearranging the grains of sand and clay so that water can circulate more readily through the soil.

A single illustration may be used to show the important effect of fertilizers and manures on the texture of the soil and influence on the rate of circulation of water.

Lime is considered the "best fertilizer" on the light soils of Southern Maryland; but there must be sufficient organic matter in the soil for the lime to act on or it will "burn out" the land and may be decidedly injurious. An inch in depth of water will pass through six inches in depth of the coarse sandy subsoil of the pine-barrens in about five minutes. A little lime added to this soil will slightly diminish the time necessary for the water to flow through. A filtered extract of stable manure, without the lime, passes through without materially affecting the rate of flow; but if the lime is first added to the soil and then the solution of organic matter is passed through, the organic matter is precipitated from solution within the soil by the lime, in light, flocculent masses, and the liquid comes through quite colorless, and the rate of flow becomes slower and slower, until this coarse sand may become almost impervious to water.

The trouble with the soil originally was that it was not sufficiently retentive of moisture. When rain falls on the surface of such a soil it sinks quickly down into the lower depths of the subsoil, and sufficient supplies cannot be drawn up from below for the needs of the crop. On such a soil, deficient as it is in both lime and organic matter, the application of lime alone would not have the desired effect of making the soil more retentive of moisture, but rather the reverse; nor would the organic matter alone have the desired effect. Either used alone might readily injure the land. There must be sufficient lime, iron or similar substance in the soil for the organic matter to have its best effect, and there must be sufficient organic matter for the lime "to act on" for this substance to have its best effect. With a judicious application of both lime and organic matter to such a barren sand, the soil may be made more retentive of moisture and better able to maintain the proper water supply for a crop. There is sufficient plant-food in the soil, but the physical conditions of growth must be adapted to the proper development of the plant to enable it to assimilate this food and build it up into living tissues.

It is for such a study as this, to keep track of the rainfall and heat after they enter the soil, so as to see exactly what conditions prevail in our great soil-formations that the Experiment Station has undertaken the classification and study of the soils of the State. The rain does the crops little good until it enters the soil, so that a continuous record of the rainfall *after it enters the soil* will give an added value to the ordinary meteorological data and be of direct practical value to agriculture. It is hoped that a few Stations may be equipped this summer, in several of the most important soil-formations, to keep, in addition to the ordinary meteorological records, a record of the moisture and temperature conditions in the soils, under a uniform system of cropping and cultivation.

*MILTON WHITNEY.*

## MONTHLY SUMMARY OF REPORTS, MAY, 1892.

| Stations. | Counties. | Altitude above Sea in feet. | Latitude. | Longitude. | † Barometer. Monthly Mean. | Maximum. Height. | Maximum. Date. | Minimum. Height. | Minimum. Date. | Temperature. Monthly mean. | Mean of Maximum. | Mean of Minimum. | Maximum. Degrees. | Maximum. Date. | Minimum. Degrees. | Minimum. Date. | Monthly Range. | Total Precipitation. | Clear Days. | Fair Days. | Cloudy Days. | Rainy Days, (.01 inch or more). | Prevailing Wind. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltimore | .... | 179 | 39°17′ | 76°36′ | 29.986 | 30.318 | 9 | 29.593 | 19 | 63.4 | 72.6 | 54.3 | 87 | 2 | 46 | 8 | 41 | 6.35 | 9 | 16 | 6 | 15 | N.W. |
| Barron Ck. Springs, | Wicomico | 25 | 38°30′ | 75°39′ | .... | .... | .. | .... | .. | 63.3 | 72.6 | 54.0 | 85 | 4 | 43 | 9 | 42 | 3.44 | 15 | 13 | 3 | 12 | S. W. |
| Boettcherville | Alleghany | .... | 39°39′ | 78°48′ | .... | .... | .. | .... | .. | 61.8 | 71.4 | 52.3 | 86 | 3 4 6 | 35 | 9 | 51 | 4.70 | .... | .... | .... | 16 | .... |
| Cumberland *b* | Alleghany | 700 | 39°39′ | 78°45′ | .... | .... | .. | .... | .. | 62.3 | 70.7 | 53.9 | 84 | 6 | 41 | 9 | 43 | 3.31 | 14 | 9 | 8 | 13 | .... |
| Distributing Res | Dist. Col | .... | 38°52′ | 77° 0′ | .... | .... | .. | .... | .. | 64.6 | .... | .... | 86 | 4 | 49 | 9, 23 | 37 | 4.32 | .... | .... | ... | 10 | .... |
| Dover, Del | Kent | .... | 39° 9′ | 75°31′ | .... | .... | .. | .... | .. | 61.9 | 72.2 | 53.5 | 86 | 4 | 44 | 8 | 42 | 5.59 | 18 | 7 | 6 | 8 | S. W. |
| Easton | Talbot | 35 | 38°42′ | 76° 6′ | .... | .... | .. | .... | .. | 64.8 | 74.5 | 55.2 | 89 | 4 | 44 | 9 | 45 | 5.05 | 9 | 18 | 4 | 11 | S. |
| Fallston | Harford. | 450 | 39°31′ | 76°24′ | .... | .... | .. | .... | .. | 60.2 | .... | .... | 85 | 2 | 41 | 8 | 44 | 6.10 | .... | .... | .. | 11 | .... |
| Frederick | Frederick | 280 | 39°24′ | 77°18′ | .... | .... | .. | .... | . | 63.6 | 74.1 | 52.7 | 87 | 6 | 41 | 9 | 46 | 2.16 | 15 | 6 | 10 | 12 | .... |
| Great Falls | Montgomery | .... | 39° 0′ | 77°14′ | .... | .... | .. | .... | .. | 64.6 | .... | .... | 86 | 4 | 44 | 1 | 42 | 3.74 | ... | .... | .... | 12 | .... |
| Jewell | Anne Arundel | .... | 38°44′ | 76°46′ | .... | .... | .. | .... | .. | 63.7 | .... | .... | 79 | 31 | 51 | 8 | 28 | 4.75 | 16 | 10 | 5 | 7 | .... |
| Kirkwood, Del | New Castle | .... | 39°35′ | 75°40′ | .... | .... | .. | .... | .. | 62.8 | .... | .... | 82 | 31 | 50 | 8, 21, 22 | 32 | .... | .... | .... | .... | .... | .... |
| McDonogh | Baltimore | 535 | 39°23′ | 76°44′ | .... | .... | .. | .... | .. | 62.3 | 68.4 | 54.4 | 80 | 31 | 43 | 8 | 37 | 3.92 | .... | .... | .... | 14 | .... |
| Mt. St. Mary's | Frederick | 720 | 39°41′ | 77°21′ | 30.065 | 30.404 | 9 | 29.646 | 19 | 61.8 | 71.4 | 52.3 | 87 | 3 | 41 | 1 | 46 | 3.17 | 6 | 15 | 10 | 12 | S.W. |
| New Market | Frederick | 500 | 39°23′ | 77°18′ | 30.042 | 30.294 | 1 | 29.656 | 19 | 61.9 | .... | .... | 88 | 2 | 48 | 28 | 40 | 5.55 | 11 | 8 | 12 | 12 | S.W. |
| Receiving Res | Dist. Col | .... | 38°52′ | 77° 0′ | .... | .... | .. | .... | .. | 64.4 | .... | .... | 85 | 2 | 48 | 9 | 37 | 4.81 | .... | .... | ... | 10 | .... |
| Seaford, Del | Sussex | .... | 38°40′ | 75°35′ | .... | .... | .. | .... | .. | 63.3 | 73.9 | 52.7 | 90 | 4 | 43 | 8 | 47 | 3.15 | .... | .... | .... | 11 | .... |
| Solomon's | Calvert | 20 | 38°19′ | 76°27′ | .... | .... | .. | .... | .. | 64.7 | 72.8 | 56.6 | 84 | 16 | 47 | 8, 9, 24 | 37 | 2.99 | 11 | 8 | 12 | 9 | S. E. |
| Taneytown | Carroll | .... | 39°40′ | 77° 9′ | .... | .... | .. | .... | .. | .... | .... | .... | .. | .... | .. | .... | .. | 5.37 | .... | .... | .... | 14 | .... |
| Washington, D. C. | .... | 112 | 38°52′ | 77° 0′ | 30.010 | 30.340 | 9 | 29.580 | 19 | 63.8 | 73.8 | 53.9 | 89 | 4 | 44 | 9 | 45 | 4.07 | 12 | 11 | 8 | 13 | S. |
| Woodstock | Howard | 392 | 39°20′ | 76°49′ | 30.021 | 30.356 | 1 | 29.628 | 19 | 62.1 | 72.7 | 51.5 | 89 | 6 | 39 | 9 | 50 | 4.78 | 12 | 14 | 5 | 10 | N.W. |
| *Norfolk, Va. | .... | 43 | 36°51′ | 76°17′ | 30.021 | 30.407 | 1 | 29.638 | 19 | 67.0 | 76.6 | 57.4 | 93 | 6 | 46 | 1 | 47 | 3.76 | 17 | 11 | 3 | 8 | S. |
| Averages | .... | .... | .... | .... | 30.025 | .... | .. | .... | .. | 63.1 | 72.4 | 53.6 | .. | .... | .. | .... | 41.1 | 4.37 | 12.3 | 11.2 | 7.4 | 11.6 | .... |

* Omitted in computing averages. † Readings reduced to sea-level.

## DAILY PRECIPITATION FOR MAY, 1892.

| STATIONS. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltimore | .... | .01 | .... | .05 | .... | .15 | .... | .... | .... | .08 | .52 | .... | .... | .44 | 1.83 | .02 | .... | 05 | 1.53 | T | .42 | T | .04 | .... | .... | .46 | .72 | .... | .03 | T | .... | 6.35 |
| Barron Crk. Spr | .... | .13 | .... | .05 | .... | .04 | .... | .... | .... | * | 1.20 | .... | .... | .35 | .... | .... | .... | .... | .34 | .... | .33 | .52 | .38 | .... | .... | .... | .15 | .... | T | ... | .... | 3.44 |
| Boettcherville | .... | .40 | .... | .10 | .... | .30 | .... | .... | .... | .40 | .20 | .... | .... | .60 | .30 | .... | .... | .... | 1.00 | .... | .50 | .... | .20 | .... | .... | .20 | .10 | .... | .... | .40 | .... | 4.70 |
| Cumberland *b* | .... | .15 | .... | .... | .... | .19 | .... | .... | .... | .43 | ... | .... | .24 | .12 | .21 | .... | .... | .65 | .... | .46 | .17 | .... | .... | .... | .20 | .20 | .01 | .... | .28 | .... | .... | 3.31 |
| Denton | .... | .... | .... | .... | .... | .70 | .... | .... | .... | 1.00 | .76 | .... | .... | 1.00 | .... | .... | .... | .... | 1.10 | .... | .... | .50 | .... | .... | .... | .... | .33 | .... | .... | .... | .... | 5.39 |
| Dist. Res. D. C | .... | .... | .20 | .... | .... | .... | .... | .... | .... | .... | .22 | .35 | .... | .35 | .45 | .... | .... | .... | .... | .37 | .... | .21 | .08 | .... | .... | .... | 2.04 | .10 | .... | .... | .... | 4.32 |
| Dover, Del | .... | .08 | .... | .... | .... | .12 | .... | .... | .... | * | 1.17 | .... | .... | .62 | 1.77 | .... | .... | .... | .34 | .... | * | * | .90 | .... | .... | * | .59 | .... | .... | .... | .... | 5.59 |
| Easton | .... | .05 | .... | .... | .... | .23 | .... | .... | .... | .05 | 1.64 | .... | .... | .33 | .43 | .... | .... | .... | 1.25 | .... | .22 | .11 | .31 | .... | .... | .... | .43 | .... | .... | .... | .... | 5.05 |
| Fallston | ... | .10 | .... | .... | .... | .02 | .... | .... | .... | .... | .43 | .... | .... | .... | 1.15 | .... | .... | .16 | 2.26 | .... | .40 | .... | .02 | .... | .... | 1.81 | .12 | .... | .13 | .... | .... | 6.10 |
| Frederick | .... | .03 | .... | ... | .... | .05 | .... | .... | .... | * | .18 | .... | .... | .26 | .06 | .... | .... | .... | .01 | * | .65 | .... | .... | .... | .... | .58 | .07 | .... | T | .... | .30 | 2.16 |
| Great Falls | .... | ... | .14 | .... | .... | .... | .... | .... | .... | .... | .26 | .64 | .... | .23 | .40 | .23 | .... | .... | .... | .25 | .20 | .13 | .04 | .... | ... | .... | 1.06 | .16 | .... | .... | .... | 3.74 |
| Jewell | .... | T | .... | T | .... | T | .... | .... | .... | * | 1.25 | .... | * | .75 | .... | .... | .... | .... | .50 | .... | * | .75 | T | .... | .... | 1.50 | T | .... | .... | .... | .... | 4.75 |
| McDonogh | .... | .20 | .... | .... | .06 | .07 | .... | .... | .... | .15 | .28 | .... | .... | .26 | .27 | .... | .... | .17 | .85 | .28 | .... | .... | .... | .... | ... | .60 | .60 | .06 | .07 | .... | .... | 3.92 |
| Mt. St. Mary's | .... | .22 | ... | ... | .06 | .17 | .... | .... | .... | .27 | .08 | .... | .... | .28 | .... | .... | .... | .... | .72 | .... | .86 | .... | T | .... | .... | .... | .20 | .... | .18 | .01 | .12 | 3.17 |
| New Market | .... | .13 | .... | ... | .... | .32 | .... | .... | .... | * | .20 | .... | .... | .41 | .76 | .... | .... | .... | 1.35 | * | .68 | .... | T | .... | T | 1.27 | .31 | .... | T | .... | .12 | 5.55 |
| Rec. Res. D. C | .... | .... | .09 | .... | .... | .... | .... | .... | .... | .... | .28 | .56 | .... | .21 | .38 | .... | .... | .... | .... | .47 | .... | .24 | .06 | .... | .... | .... | 2.43 | .09 | .... | ... | .... | 4.81 |
| Seaford, Del | .... | .21 | .... | .... | .05 | .31 | .... | .... | .... | * | 1.15 | .... | .... | .29 | .... | .... | .... | .... | .21 | .... | .14 | .60 | .09 | .... | ... | .... | .09 | .... | T | .... | .... | 3.15 |
| Solomon's | .... | T | .... | .... | T | .... | T | .... | .... | .05 | 1.26 | T | .... | .22 | .... | .09 | .... | .... | .24 | .... | .40 | .18 | .36 | .... | .... | .... | .19 | .... | T | .... | .... | 2.99 |
| Taneytown | .. | .15 | .... | .... | .... | .21 | .... | .... | ... | .02 | .10 | .... | .05 | .16 | .75 | .... | .... | .... | 1.60 | .70 | .... | .... | .... | .... | .03 | .51 | .36 | .... | .... | .21 | .49 | 5.37 |
| Washington, D. C. | .... | .07 | T | .... | .... | .04 | T | .... | ... | .10 | .47 | .... | .... | .58 | .01 | .42 | T | .21 | .03 | .04 | .... | .... | .92 | 1.17 | .. | T | .... | T | .... | .... | .... | 4.07 |
| Woodstock | .... | .... | .... | .... | .... | .07 | .... | .... | .... | ... | .30 | .... | .... | 1.34 | .64 | .... | .... | .... | .77 | .... | .39 | .03 | .02 | .... | .... | 1.20 | .02 | .... | .... | .... | .... | 4.78 |
| Norfolk, Va | .... | .... | .... | .... | .... | .... | .28 | .... | .... | T | .64 | .... | .... | .... | .... | .... | .... | .... | .24 | .... | 1.67 | .60 | .04 | .... | .... | .... | .05 | .... | .... | .19 | T | 3.76 |

NOTE.—"T" indicates a trace of rain or snow. * Amount included in next measurement. *W. D. W.*

## Monthly Summary.—May, 1892.

**Temperature** (degrees).—Mean monthly, 63.1. Highest monthly mean, 64.8, at Easton. Lowest monthly mean, 60.2, at Fallston. Highest temperature, 90, at Seaford, Del., on the 4th. Lowest temperature, 35, at Boettcherville, on the 9th. Greatest local monthly range, 51, at Boettcherville. Least local monthly range, 28, at Jewell. Mean monthly range, 41.1. Mean maximum, 72.4. Mean minimum, 53.6.

**Precipitation** (in inches).—Average, 4.37. Greatest amount, 6.35, at Baltimore. Least amount, 2.16, at Frederick.

**Wind.**—Prevailing direction, southwest. Total movement in miles, Baltimore, 5987; Norfolk, Va., 7363; Washington, D. C., 5252.

**Thunderstorms.**—At Baltimore, on the 4th, 6th, 11th, 15th, 18th, 26th, 27th; at Barron Creek Springs, on the 2nd, 6th, 11th, 12th, 14th, 15th, 23rd, 26th, 27th; at Cumberland[b], on the 15th; at Dover, Del., on the 2nd, 6th, 11th, 14th, 15th, 21st, 23rd, 26th; at Easton, on the 2nd, 6th; at Frederick, on the the 2nd, 6th, 26th, 27th, 31st; at Jewell, on the 19th, 26th, 27th; at Mt. St. Mary's, on the 2nd; at Solomon's, on the 14th, 21st, 27th; at Taneytown, on the 14th, 19th, 31st; at Woodstock, on the 14th, 15th, 18th, 24th, 31st; at Norfolk, Va., on the 8th.

**Hail.**—At Baltimore, on the 23rd; at Dover, Del., on the 15th, 23rd; at Frederick, on the 27th; at New Market, on the 27th; at Woodstock, on the 14th.

**Halos.**—At Baltimore, on the 9th; at Barron Creek Springs, on the 1st, 6th, 16th, 17th; at Easton, on the 1st.

**Aurora** —At Baltimore, on the 18th; at Woodstock, on the 9th.

Average number of cloudless days, 12; partly cloudy days, 11; cloudy days, 7; rainy days (.01 of an inch or more), 12.

Local verification of weather and temperature signals for May, reported by Displaymen (see list of):

| | |
|---|---|
| Weather - - - - - | 82.8 per cent. |
| Temperature - - - - | 88.5 " " |
| Average - - - - - | 85.6 " " |

## Notes by Observers.

**Baltimore.**—1st, lunar halo. 2nd, wind-squall and rapid fall in temperature. 9th, lunar halo. 18th, faint aurora.

**Barron Creek Springs.**—1st, lunar halo; catbirds seen. 2nd, a heavy blow most of last night; squall S. W.; thunder and diffuse lightning. 3rd, fish-hawks seen. 6th, solar halo. Two S. W. squalls dividing one by S. and E. to N. E., the other by W. and N. to N. E., where they apparently united. 11th, distant thunder followed by rain. 13th, slight rising fog: dewberries blossoming. 14th, distant thunder and diffuse lightning. 16th, 17th, solar halo. 20th, locusts and roses bloom. 23rd, distant squall N. W. 26th, distant thunder. 27th, squall N. W. 30th, corona.

**Easton.**—6th, thunderstorm moving eastward, preceded by heavy blow from N. W., lasting about ten minutes. Clouds seen shooting upward. 14th, heavy gust lasting five minutes.

**Solomon's.**—14th, thunderstorm 3.30 P. M., S. W. to S. E.; 21st, 9 A. M., N. to N. E.; 27th, 5 P. M., N. W. to N. E.

**Woodstock College.**—2nd, catbirds here. 4th, A. M., very foggy. 5th, lilacs in bloom. 9th, aurora. 14th, thunderstorm with hail. 18th, distant thunder. 23rd, sudden shower and high wind. 31st, thick fog in morning; 7.15 P. M., distant thunder and lightning in S. W.

**Norfolk, Va.**—21st, ice storm; chunks five inches in diameter.

## Relative Coldness of Three Seasons.

The following table, showing the relative coldness of the past three winter seasons, prepared for the Johns Hopkins Hospital, may be of interest to coal dealers and consumers.

The figures indicate mean temperature which is the average of the daily maximum and minimum.

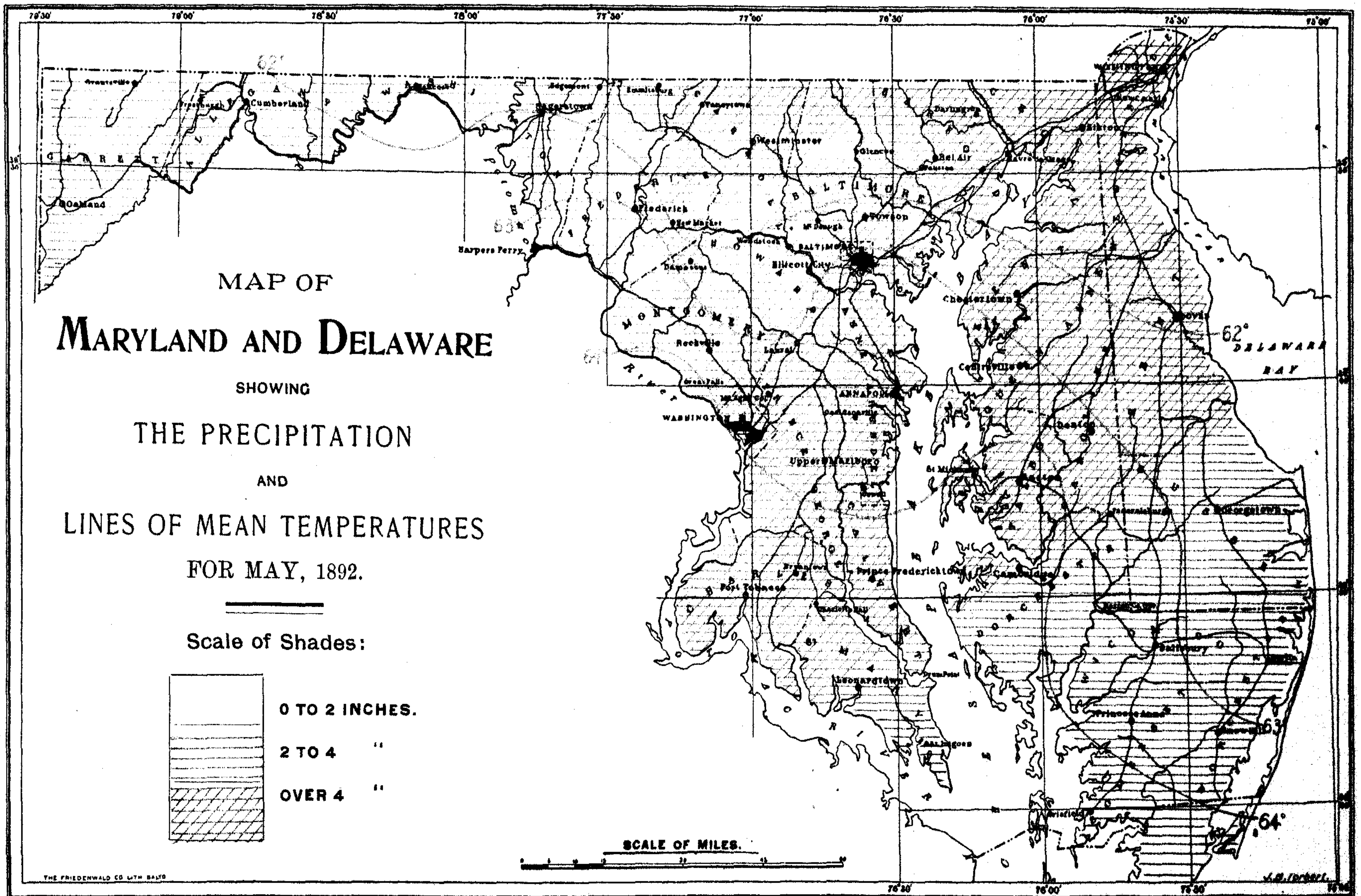
| | October. | November. | December. | January. | February. | March. | April. | Average. |
|---|---|---|---|---|---|---|---|---|
| 1889–90 | 53.8 | 47.7 | 46.0 | 44.0 | 43.4 | 41.6 | 54.0 | 47.2 |
| 1890–91 | 57.0 | 48.2 | 34.6 | 37.6 | 41.4 | 38.6 | 56.0 | 44.8 |
| 1891–92 | 54.8 | 44.2 | 43.7 | 31.8 | 36.8 | 37.4 | 51.6 | 42.9 |

It will be noticed that the mean temperature during each month of the season of 1891–92, from October to April inclusive, was, with the exception of December, from one to twelve degrees below that of the corresponding months in the two previous seasons. This is a remarkable difference, and it shows the past season to have been much colder, on the whole, than those preceding.

A difference of one degree in the mean temperatures of several seasons means, of course, a much greater difference than the variation between mean temperatures of several days. The difference of one and nine-tenths degrees between the last two seasonal means, if distributed, would make each day of the latter season one and nine-tenths degrees colder than the corresponding day in the former; and compared with 1889–90, four and three-tenths degrees colder. *C. P. C.*

## Meteorological Stations reporting to the Maryland State Weather Service.

| Stations of Observation. | County. | Observer. |
|---|---|---|
| Agricultural College | Prince George's | W. H. Zimmerman, A. M. |
| Annapolis | Anne Arundel | Walter Hay, M. D. |
| Baltimore | | G. N. Wilson, W. D. White, A. T. Brewer. |
| Barron Creek Springs | Wicomico | Albert E. Acworth. |
| Boettcherville | Alleghany | F. F. Brown. |
| Charlotte Hall | St. Mary's | R. W. Silvester. |
| 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 | S. P. Minnick. |
| Edgemont | Washington | Chas. Feldman. |
| Fallston | Harford | G. G. Curtiss. |
| 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. |
| 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. |
| Upper Marlborough | Prince George's | F. Sasscer. |
| Woodstock College | Howard | T. J. A. Freeman, S. J. |
| Norfolk, Va | | A. J. Davis. |
| Washington, D. C. | | S. W. Beall. |


MAP OF
MARYLAND AND DELAWARE
SHOWING
THE PRECIPITATION
AND
LINES OF MEAN TEMPERATURES
FOR MAY, 1892.
Scale of Shades:
0 TO 2 INCHES.
2 TO 4 "
OVER 4 "
SCALE OF MILES.
Cumberland
Oakland
Hagerstown
Harpers Ferry
Frederick
Westminster
Towson
Baltimore
Ellicott City
Rockville
Washington
Annapolis
Upper Marlboro
Port Tobacco
Prince Frederick
Leonardtown
Chestertown
Centreville
Cambridge
Salisbury
Princess Anne
Dover
DELAWARE BAY
62°
63
64°