The period of damaging frosts in the interior of the South Atlantic and Gulf States extends from November to April. Damaging frost is likely to occur in Florida from the middle of October until nearly the middle of April. Freezes of a character to injure oranges and orange trees in Florida, are, however, practically unknown in March.

NOTES BY THE EDITOR.

SNOW CRYSTALS.

On page 541 of the MONTHLY WEATHER REVIEW for December, 1900, we have referred to the extensive collection of snow crystals accumulated by Mr. W. A. Bentley, of Nashville, Vt., by the process of micro-photography. Mr. Bentley has kindly promised that the readers of the MONTHLY WEATHER REVIEW shall be favored with a very complete series of photographs and notes, and the Editor hopes by this publication to contribute to the foundation of our knowledge of the formation of clouds and rain. In Appleton's Popular Science Monthly for May, 1898, Mr. Bentley published a first account of some of his general deductions from the study of the snowflakes and the weather that is associated with them. By permission of the editor we reproduce some paragraphs from that work:

Careful examination of the illustrations will soon convince one that, great as is the charm of outline, the internal ornamentation of snow crystals is far more wonderful and varied. Many of the specimens, we might almost say all of them, exhibit in their interior most fascinating arrangements of loops, lines, dots, and other figures in endless variety. So far as is known to the writer, the illustrations are the first that have been published which show in any adequate manner these interior figures, and surely they add greatly to our interest and delight as we study snow crystals. So varied are these figures that, although it is not difficult to find two or more crystals which are nearly, if not quite the same in outline, it is almost impossible to find two which correspond exactly in their interior figures.

It is asserted by some observers that many of the lines or rods seen in the interior of snow crystals are really tubes filled with air.

Perfect crystals are by no means always common in snowstorms, most of the forms produced being more or less unsymmetrical or otherwise imperfect. It rarely happens that during a single winter there are more than a dozen good opportunities for securing complete crystals, and there may not be half so many. The greater number of perfect crystals is found in widespread storms or blizzards, while the local storms produce most often granular or imperfect forms. So marked is this distinction that very often the character and extent of a storm may be in general determined by an examination of the crystalline forms obtained. Extensive storms produce smaller crystals, more uniform in size, less clustered in flakes, and in greater variety than local storms. When the temperature is very low while a local storm is raging, its crystals resemble those of the blizzard more closely.

Some forms are common to both classes of storms. Probably because identical conditions do not occur frequently, the crystalline forms of each storm during a winter may differ from each other, one type appearing abundantly in one storm, a different type in the next, and so on. Conversely, the types most common in a given storm may reappear after an interval of months or years.

Not only do different storms afford different types of crystals, but different parts of the same storm, if it be general, give different forms. In this region the northern and western portions of the storm area produce more perfect crystals than the southern and eastern, and from this we infer a difference in the atmospheric conditions in these portions, the former being more quiet and otherwise favorable to crystallization.

In what has been called granular snow we find only loose, irregular subcrystalline forms, which are larger and heavier than others. This is formed in the middle or lower cloud layers, and when these are disturbed by wind or otherwise rendered unsuitable for crystallization. Sometimes, perhaps always, these granular masses have nuclei of true crystals. Granular snow may explain the origin of the great raindrops which often fall during a thundershower. It is probable that such drops have a snow origin. Most, if not all, hailstones also originate in granular snow, as their thin, opaque centers and concentric rings of opaque, snowlike ice show.

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It is unfortunate that the depth and solidity seen in some crystals, when the photographs are mounted as stereoscopic views, can not be in some adequate manner reproduced in engravings, for this adds not a little to an understanding of the manner in which the crystals have been formed. * * * A careful study of this internal structure not only reveals new and far greater elegance of form than the simple outlines exhibit, but by means of these wonderfully delicate and exquisite figures much may be learned of the history of each crystal, and the changes through which it has passed in its journey through cloudland. Was ever life history written in more dainty hieroglyphics? It is well known that crystals which form in a low temperature are smaller and more compact than those formed in a warmer atmosphere. As the higher cloud strata are colder than those nearer the earth, the snow crystals which originate there are smaller and less branched than those from lower clouds. * * * The small compact crystals of the upper clouds do not always remain of their original form and size, for, as they fall through layer after layer of clouds, each layer subjecting them to its own special conditions, they may be greatly modified, and by the time they reach the earth they may closely resemble the crystals from lower clouds, though they can usually be distinguished from them by an examination of the internal structure, as well as by, in some cases, their general form. All crystals falling from high cloud strata, the cirrus or cirro-stratus, are not changed; especially is this true in a great storm, or when the temperature of the lower clouds is low, and in any case some are much more completely transformed than others. One crystal may pass through cloud layers not very unlike that from which it came, and of course will not be greatly changed. Another may encounter here a quiet cloud layer and there a tumultuous layer; here a lower, there a higher temperature; here a dense and there a thin cloud mass; and by all of these conditions may be affected. * * * Total transformation, such as the change from one type into another, does not often occur. The nucleus retains its original form, to which various additions are made during the downward passage. Composite crystals may, however, be formed during the passage through diverse cloud layers, though they are not common. Usually, however, the tabular, compact, small crystals of the high clouds continue their development at lower levels upon the original plan, though becoming larger and more complex by the addition of branches at the angles. The triangular forms are less common than the others figured, and occur usually in the greater storms. A very unique composite crystal, which beginning in the higher clouds as a simple hexagon, received the peculiar additions which are well shown in one of the figures. An exceedingly unusual figure is that of a composite crystal formed from two, each of which has been in some way broken apart, and the portions then so brought in contact as to unite and form a single crystal of very nearly the original form of each of its parts.

CHARTS OF ATMOSPHERE HUMIDITY.

At the last meeting of the British Association for the Advancement of Science Dr. E. G. Ravenstein read a paper on the geographical distribution of relative humidity, a summary of which was given in the annual report of the association for 1900, page 817, about as follows:

Dr. Ravenstein stated that the importance of relative humidity as a climatic factor was fully recognized. Having illustrated its influence upon organic life, upon agriculture and human industries, he expressed his regret that neither in number nor in trustworthiness did humidity observations meet the requirements of a person desirous of illustrating its distribution over the globe by means of a map. This was owing largely to defects in the instruments employed, incompetence of the observers, and unsuitability of the hours chosen for the observations. As to the humidity over the ocean, we were still dependent upon the observations made on board passing vessels, and he was afraid the time had not yet come when floating meteorological observatories would be stationed permanently throughout a whole year at a few well-chosen localities in mid ocean. Notwithstanding this paucity of available material, he had ventured, in 1894, to publish in Philip's Systematic Atlas a small chart of the world showing the distribution of humidity. The subject had not been lost sight of by him since then, and he now placed the results before this meeting. He did so with some diffidence, and over cautious meteorologists might condemn his action, but they must remember that when Berghaus, in 1838, acting upon suggestions made by Zimmermann and Humboldt, published the first isothermal chart, the observations on temperature were even less numerous than those on humidity were at present. His charts, of course, must be looked upon as sketches, but he felt confident that they brought out the broad features of the subject, and to reduce the sources of error he had limited himself to indicating four grades of mean annual humidity, the upper limits of which were, respectively, 50 per cent (very dry), 65 per cent, 80 per cent, and 100 per cent (very damp). The relative humidity over the ocean might exceed 80 per cent, but in certain regions (horse latitudes) it was certainly much less, and in a portion of the Southern Pacific it seemed not to exceed 65 per cent, a feature seemingly confirmed by the salinity of that portion of the ocean which exceeded 3.6 per cent.

His second chart exhibited the annual range of humidity, viz, the difference between the driest and the dampest months of the year. In Britain, as in many other parts of the world, where the moderating influence of the ocean was allowed free scope, this difference did not exceed 16 per cent, but in the interior of the continents it occasionally exceeded 45 per cent, spring or summer being exceedingly dry, whilst the winter was excessively damp, as at Yarkand, where a humidity of 30 per cent in May contrasted strikingly with a humidity of 84 per cent in December.

This great range directed attention to the influence of temperature (and of altitude) upon the amount of relative humidity, for during temperate weather we were able to bear a great humidity with equanimity, whilst the same degree of humidity accompanied by great heat, such as is occasionally experienced during the "heat terms" of New York and recently in London, may prove disastrous to men and beasts. Hence, combining humidity and temperature, the author suggested mapping out the earth according to sixteen *hygrothermal types*, as follows:

1. Hot (temperatures 73° and over) and very damp (humidity 81 per cent or more): Batavia, Camaroons, Mombasa.
2. Hot and moderately damp (66–80 per cent): Havana, Calcutta.
3. Hot and dry (51–65 per cent): Bagdad, Lahore, Khartum.
4. Hot and very dry (50 per cent or less): Disa, Wadi, Halfa, Kuka.
5. Warm (temperature 58° to 72°) and very damp: Walwisch Bay, Arica.
6. Warm and moderately damp: Lisbon, Rome, Damascus, Tokio, New Orleans.
7. Warm and dry: Cairo, Algiers, Kimberley.
8. Warm and very dry: Mexico, Teheran.
9. Cool (temperature 33° to 57°) and very damp: Greenwich, Cochambo.
10. Cool and moderately damp: Vienna, Melbourne, Toronto, Chicago.
11. Cool and dry: Tashkent, Simla, Cheyenne.
12. Cool and very dry: Yarkand, Denver.
13. Cold (temperature 32° or less) and very damp: Ben Nevis.
14. Cold and moderately damp: Tomsk, Pikes Peak, Polaris, House.
15. Cold and dry.
16. Cold and very dry: Pamir.

The actual mean temperature of the earth amounted, according to his computation to 57° F., and this isotherm, which separated types 8 and 9, also divided De Candolle's "Mikrothermes" from the plants requiring a greater amount of warmth.

The author fully illustrated his paper by a number of diagrams giving the curves of the temperature, rainfall, and humidity, and also by a chart of the world exhibiting the number of rainy days.

J. BROWN HICKLIN.

We regret to announce the death of Mr. J. Brown Hicklin on March 21, 1901. Mr. Hicklin entered the Weather Bureau on February 1, 1897, by transfer from the Government Printing Office. His entire service in the Bureau was performed at the Denver, Colo., station. The reports from the official in charge at that point were invariably favorable to Mr. Hicklin. He was industrious, painstaking, and reliable in every respect.—*D. J. C.*

NORMALS FOR MANILA.

The Manila Observatory has lately published, in a convenient pamphlet form, its normal climatological data. The pressure, temperature, and humidity data are based upon the years 1883–1898, during which period hourly observations have been made night and day. The rainfall data represent the longer period, from 1865–1898. The barometric record has been reduced to sea level, but it is not definitely stated that the mean values have been reduced to standard gravity. The latitude of Manila is 14° 35′ N., and the mean height of the barometer is 759.31 millimeters, or 29.89 inches, the correction for gravity is, therefore, —1.77 millimeters, or —0.070 inch, which correction is probably still to be applied to the figures given in the table below in order to conform to the rules of the International Meteorological Congress and Committee.

TABLE 1.—*Normal atmospheric pressures at Manila*, 1883–1898.

Month.	Mean.	Highest mean.	Lowest mean.	Absolute maximum.	Absolute minimum.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	29.97	30.06	29.91	30.21	29.71
February	29.98	30.04	29.89	30.19	29.68
March	29.95	30.02	29.85	30.15	29.65
April	29.90	29.95	29.88	30.06	29.67
May	29.86	29.92	29.82	30.08	29.88
June	29.85	29.88	29.81	30.02	29.59
July	29.82	29.87	29.76	30.00	29.43
August	29.83	29.87	29.80	30.02	29.53
September	29.83	29.90	29.77	30.03	29.23
October	29.88	29.93	29.82	30.05	29.45
November	29.90	29.98	29.81	30.16	29.27
December	29.96	30.02	29.88	30.16	29.54
Annual	29.89	30.06	29.76	30.21	29.23

TABLE 2.—*Normal temperatures at Mani.a*, 1883–1898.

Month.	Mean.	Highest mean.	Lowest mean	Absolute maximum.	Absolute minimum.
	° *F.*	° *F*	° *F.*	° *F.*	° *F.*
January	77.0	78.4	74.5	93.0	62.1
February	77.7	79.5	75.9	95.7	61.0
March	80.4	81.9	79.0	95.9	63.3
April	82.9	84.9	81.1	99.0	66.0
May	83.8	86.5	81.7	100.0	71.1
June	82.0	85.1	80.6	97.0	70.9
July	80.8	81.5	79.0	94.8	70.0
August	80.8	81.9	79.5	94.3	69.1
September	80.4	81.7	79.3	93.7	70.5
October	80.4	81.5	79.0	94.8	68.7
November	79.0	80.2	77.7	92.1	64.9
December	77.4	78.8	75.4	91.9	60.3
Annual	80.2	86.5	74.5	100.0	60.3

TABLE 3.—*Normal atmospheric moisture at Manila*, 1883–1898.

Month.	Relative humidity.			Vapor pressure		
	Mean.	Maximum	Minimum.	Mean.	Absolute maximum.	Absolute minimum.
	Per ct.	*Per cent.*	*Per cent.*	*Inches.*	*Inches.*	*Inches.*
January	77.7	100.0	40.0	0.713	1.024	0.469
February	74.1	100.0	33.0	0.697	0.992	0.382
March	71.7	100.0	31.5	0.736	1.142	0.390
April	70.9	100.0	33.0	0.784	1.138	0.472
May	76.9	100.0	32.0	0.866	1.122	0.508
June	81.5	100.0	36.0	0.886	1.067	0.587
July	84.9	100.0	52.5	0.882	1.075	0.677
August	84.4	100.0	52.0	0.882	1.063	0.689
September	85.6	100.0	51.0	0.886	1.071	0.614
October	82.6	100.0	46.0	0.850	1.051	0.559
November	81.6	100.0	39.0	0.799	1.016	0.441
December	80.7	100.0	39.5	0.752	1.055	0.453
An ual	79.4	100.0	31.5	0.811	1.142	0.382

TABLE 4.—*Normal rainfall at Manila*, 1865–1898.

Month.	Mean.	Highest mean.	Lowest mean.	Greatest Daily.
	Inches.	*Inches.*	*Inches.*	*Inches.*
January	1.193	7.685	0.020	7.827
February	0.413	1.559	0.000	1.496
March	0.736	3.945	0.000	2.362
April	1.142	5.370	0.000	1.724
May	4.197	10.114	0.000	6.567
June	9.622	25.807	0.976	9.949
July	14.567	31.882	5.276	11.421
August	13.866	43.134	5.150	8.917
September	14.925	57.862	2.000	13.228
October	7.536	23.217	1.555	6.772
November	5.126	15.662	1.173	7.110
December	2.134	13.658	0.008	3.543
Annual	75.457	57.862	0.000	13.228