NOTES BY THE EDITOR.

DEATH OF MR. JOSEPH COTTIER.

Among the special contributions to the current number of the MONTHLY WEATHER REVIEW is one that we esteem of much importance to those who are studying the fundamental problem of meteorology. This paper was sent us by Mr. Cottier on June 29, and we anticipated great pleasure in introducing Mr. Cottier and his subject to the readers of the MONTHLY WEATHER REVIEW. But, alas! our pleasure is turned to grief by the intelligence of Mr. Cottier's untimely death, from typhoid fever, on August 17, at Paris. Mr. Cottier was a young man of brilliant promise. He was about to enter upon the last year of a well-deserved fellowship in science in Columbia University, New York City. The memoir with which he honored the MONTHLY WEATHER REVIEW was his last work before starting on his vacation trip. It may be considered as a special application of a more general work on hydrodynamics that he had nearly finished, under the stimulus of Prof. R. S. Woodward, of Columbia. Doubtless this latter memoir will also be published, and both will serve to fix in the annals of science the name of one whose early death is a sad loss to meteorology.

DEATHS OF WEATHER BUREAU OBSERVERS.

Mr. B. S. Pague, local forecast official and section director for Oregon, sends us the following notes in connection with his report for July:

Mr. W. H. Goudy, voluntary observer, died at Hubbard, Oreg., on July 12, aged seventy-five years. He was a pioneer in Oregon, a successful farmer, and a highly respected citizen.

Prof. S. E. McClure, in charge of the meteorological work at the State University, Eugene, Oreg., was killed the night of July 27, 1897, while descending Mount Ranier, Wash. He accompanied the Mazama party and conducted the observations. In descending, his foot slipped and he was precipitated down a 300-foot incline and was instantly killed. He was thirty-five years old, highly intelligent, of good promise, popular, and respected. He was killed while pursuing scientific work. The Bureau has lost two valuable men.

RETIREMENT OF PROFESSOR HANN.

From the London Geographical Journal for September, 1897, we learn that Prof. Julius Hann has, at his own request, been relieved of the post of Director of the Central-Anstalt fur Meteorologie und Erdmagnetismus, which he held in conjunction with that of Professor of Terrestrial Physics at the University of Vienna, and has been appointed Professor of Meteorology at Gratz, in Styria. While recognizing the eminent merit of Professor Pernter, yet we are sure that the meteorologists of America will unite with those of Europe in regret that Professor Hann has been forced by sickness to seek a relief from his onerous duties in Vienna. One can but hope that he may be able to accomplish at Gratz even more than he has done at Vienna for meteorology.

CLOUD HEIGHTS AT TORONTO.

In the Monthly Weather Review of the Canadian Meteorological Service for the month of May the director, Prof. R. F. Stupart, publishes the first that we have seen of the results of the observations of the heights and velocities of clouds made at Toronto in accordance with the recommendations of the International Meteorological Committee. The published observations represent only seven days out of the thirty-one, but they are worth reproducing in order that our correspondents may obtain the earliest possible information with regard to the results of this important work. It is understood that the work done by the Weather Bureau and, possibly, also that of the Blue Hill Observatory will be published as a whole in one report.

In the following table we have rearranged the Toronto observations according to the heights of the clouds instead of the day of the month. The reader will, therefore, more easily perceive the range of altitudes through which clouds of any given class are observed, as also the slow rate of increase of velocity with altitude on any given day as contrasted with the rate for any given class of clouds. The table emphasizes the futility of any effort to ascribe an average height or velocity to any given class of clouds. For instance, there can be no doubt but what the cumulus clouds exist throughout such a wide range of altitude at Toronto (and throughout a much wider range if we consider both the tropical, the temperate, and the polar regions) that any system of nomenclature that ascribes to them specific altitudes must lead to great confusion. The present table shows us that cirro-cumulus exists at altitudes of 6,000 and 10,000 meters, while the cirrus proper come in between, at 7,000 or 8,000.

Cloud heights, Toronto, May, 1897.

Name of cloud.	Altitude.	Moving from—	Velocity, hourly.	Date.	Time.
	Meters.	°	*Miles*		*h. m.*
Cirro-cumulus	10,032	n. 17 w.	91.8	7	2 06 p. m.
Cirro-cumulus	7,626	s. 45 w.	42.9	15	10 57 a. m.
Cirrus	7,335	n. 42 w.	38.6	21	12 58 p. m.
Cirrus	7,089	n. 42 w.	38.7	21	12 43 p. m.
Cirro-cumulus	6,135	n. 6 w.	65.8	17	12 33 p. m.
Strato-cumulus	3,949	s. 65 w.	53.5	12	2 30 p. m.
Strato-cumulus	2,806	s. 35 w.	48.4	14	2 46 p. m.
Strato-cumulus	2,624	s. 41 w.	48.0	14	2 35 p. m.
Cumulus or alto-cumulus	2,302	s. 56 w.	33.6	13	3 01 p. m.
Cumulus	2,301	n. 41 w.	20.9	15	10 27 a. m.
Cumulus or alto-cumulus	2,283	s. 46 w.	33.6	13	2 45 p. m.
Cumulus or alto-cumulus	2,174	s. 47 w.	24.3	13	2 35 p. m.
Cumulus or alto-cumulus	2,030	s. 61 w.	32.8	13	2 50 p. m.
Cumulus	1,971	s. 44 w.	43.7	14	2 51 p. m.
Cumulus	1,936	s. 47 w.	36.8	14	2 22 p. m.
Stratus	1,042	n. 40 w.	21.7	21	12 58 p. m.

NOTE.—A few of the figures in the above table are open to some uncertainty, owing to defective type in the printed page from which the data are taken.

RAIN GUSHES IN THUNDERSTORMS.

Mr. Edgar Richardson, at Healdsburg, Colo., under date of July 27, says:

When living in West Virginia I used to observe that, during a thundershower, after every clap of thunder the rain would come down with increased quantity for a few moments and then let up again. The whole effect seemed to be caused by the thunder discharge letting loose an increased quantity of water above. I once saw an explanation of this, but have lost it. Will you kindly explain the cause, if possible?

Several plausible methods of explaining this phenomenon have been accepted from time to time in the history of meteorology, but the progress of our knowledge has successively dissipated these explanations as erroneous, but without, as yet, replacing them by something nearer the truth.

One of the oldest suggested explanations was that the commotion in the air produced by the thunder jostled the cloud particles together into larger drops that fell as rain. Generally the drops reach the ground so soon after the thunder, possibly even at the same time with it, that this explanation fails. Even the large drops would require ten seconds to fall 1,000 feet, and the clouds are much higher than that; moreover, no amount of noise, such as the firing of a gun into a small cloud of escaping steam, will produce any such formation of large drops. The idea that violent explosions can produce rain was thoroughly refuted by the famous experiments made by Dyrenforth a few years ago in Texas. Equally erroneous is the idea that has been widely believed in for several hundred years that explosions and cannonadings can break up and dissipate hailstorms, thunderstorms, and rain, when they are not wanted.

The rain from every cloud always comes down more or less intermittently, it may be in short, heavy showers, or in longer, gentle alternations. We do not know enough of the natural process by which rain is formed within a cloud to understand why this intermittent action should so generally occur, but any one watching the progress of a rain cloud from some height where he may command a broad landscape will observe it dropping its rain here and there as it moves along. Even if there were no connection, by way of cause and effect, between the noise of the thunder and the fall of the rain, yet there would always be some observers in the path of the rain cloud who would be able to say that the rain fell upon them just after they heard the thunder. There will, of course, be many more who will have observed that the rain came with or even before the thunder, and it will hardly do for us to attempt to explain the reasons why heavy rain follows the thunder until we have first satisfied ourselves that it does not equally often precede the thunder. It would take a very careful observer to accumulate the necessary statistics. He should give us the following numerical data, viz: How many times in the course of a year has heavy rain followed after the thunder within 1, 2, or .... 10 seconds and how many times has the rain preceded the thunder by 1, 2, or .... 10 seconds?

There can be no doubt but what thunder, which is formed simultaneously with the lightning, reaches the observer's ears some time after he sees the flash, and the Editor has always thought it likely that the special showers of rain have a direct connection with the flash rather than with the thunder. So far as his own observations go, the shower has always followed the flash and not the thunder; in fact, the thunder and shower often reach us at the same time. Some very accurate observations on thunder and lightning were recorded by Mr. Stillman Masterman, of Weld, Franklin County, Me., both at that place and at Stillwater, Minn. These are published in the Annual Report of the Smithsonian for 1855, pages 265–282. His records give the details of each individual flash of lightning and resulting thunder. In the storm of the afternoon of July 9, 1854, the details of over fifty flashes are given, and one case is noted in which a flash, whose thunder became audible within two seconds and was entirely over within five seconds, was preceded by the gush of rain. Similarly, in the storm of September 6, 1854, one flash was preceded by five seconds and another flash was preceded by one second, by the gush of rain. On June 14 and 15, 1852, Mr. Masterman says:

> I noticed that for several succeeding discharges of the electric fluid, there was in every instance a sudden and violent gush of rain, immediately *previous* to the flash of lightning. I have observed a like phenomenon on several previous occasions.

It is at present an open question whether the gushes of rain in any way bring about the formation of lightning, or whether the formation of lightning produces or accompanies the formation of the raindrops. In fact, both may be true, each under appropriate circumstances, but there is no reason to associate the thunder and the gushes of rain together as a case of cause and effect.

(1) When gushes of rain closely attend the lightning it is not improper to consider the falling rain as a mass of electrified drops conveying the electricity from the cloud region to the earth's surface; when they have approached the latter within "the striking distance," then the flash of lightning springs forth. The occurrence of the lightning is, therefore, in such cases due to the presence of a column of descending raindrops.

(2) When the rain precedes lightning by several seconds, as in the case observed by Mr. Masterman, this explanation, of course, does not apply.

(3) When the rain follows the lightning at an interval of several seconds the connection betwen them may be either accidental or casual.

(3*a*) In the first case, the rain started from the cloud independently of the lightning and reached the observer a few seconds later, partly because it took that time to reach the ground, and partly because it took time to be carried along horizontally by the wind as it fell to the earth. Both the vertical motion and the horizontal motion are involved in the time that elapses between leaving the cloud and reaching the observer.

(3*b*) If the connection is causal then, probably the lightning and the raindrops are formed at the same instant, and the time that elapses between the observer's observation of the flash and the shower is essentially the time occupied by the drops in falling to the earth's surface.

As the Editor has elsewhere said, a cloud is essentially a collection of particles of water condensed upon dust and other foreign matter as nuclei. These particles are surrounded by an atmosphere that is saturated with vapor but not yet condensed. As this saturated air cools it becomes supersaturated, and when this condition has proceeded to a point comparable with that which obtains in a state of unstable equilibrium, the vapor molecules from a comparatively large sphere of supersaturated space are, by their molecular attractions, suddenly brought together into heavy drops of warm water and descend rapidly from the clouds while the latent heat of condensation is communicated to the adjoining air and left behind in the cloud. At the same moment electricity, possibly due to the molecular disruption involved in the passage of vapor from the condition of extreme supersaturation to the sudden formation of large drops of water, or possibly of snow or ice, gives rise to the lightning flash.

All these suggestions looking toward an explanation of the connection between thunder, lightning, and gushes of rain must be understood to be merely so-called working hypotheses, which need to be tested by further experiment and corrected, and possibly entirely abandoned.

IMPORTANCE OF SOUND THEORIES.

It is very common to hear it said that "facts are more important than theories," by which we are to understand that untried theories or fanciful hypotheses are intended; the theories of a person who is not in touch with actual experience. Meteorologists, in their attempts to get at the laws of nature, have always suffered, from the fact that they can not experiment with the atmosphere on a large scale; we can even rarely collect enough observations to enable us to understand what is going on above and below over any large storm area. The history of our science has been, like the history of every other branch of science, marked by the formulation and destruction of a long series of hypotheses as we have proceeded step by step toward a better knowledge of the secrets of the atmosphere. The past forty years has been especially rich in a kaleidoscopic series of developments in the views of those who are leading our thoughts toward the rational and true mechanics of the atmosphere. It is no disparagement to an honest seeker to be told that he has learned something, and has been forced to change an opinion within the past ten years, but it is, on the contrary, rather to his disparagement to confess that he has seen no reason to make any change in his former belief, notwithstanding the results of the researches of the many energetic physicists who have devoted their time and thoughts to meteorology.

We have been led to these thoughts by reading the latest pamphlet published by Faye of Paris, entitled "New Studies on Hurricanes, Cyclones, Waterspouts or Tornadoes," and have been forced to coincide with the sentiment of the following quotation from an admirable article in our cotemporary, Nature, of July 29:

> As a general rule it is a matter of perfect indifference to the ordinary purposes of life whether we hold a correct or an incorrect theory