conserve ice. In the morning I noted a temperature of −19° C. [−2.2° F.].

From these experiments I am convinced that 0° F. is not "the lowest temperature obtainable with ice and salt." Just what the "lowest temperature" is I am unable to state, having failed to secure a greater lowering than −21° C. Theoretically the lowest temperature should be the cryohydric point (−22° to −23° C.), where the cryohydrate, ice and salt, containing 23.6 per cent of NaCl, separates.

523.745

THE MOTION OF THE SOLAR ATMOSPHERE.

Meteorologists have long been interested in the studies of the solar atmosphere by astronomers; hoping therefrom to derive some suggestions that may contribute to our knowledge of the earth's atmosphere. One of the most interesting points of resemblance between the atmospheres of the sun and the earth has recently been published by the Observatory of Zurich.[1] It is an elaborate study by Wilhelm Brenner on the proper motions of groups of sun spots, which perhaps is the same thing as the motion of the sun's atmosphere within a region of sun spots. He first determines the accuracy of the heliographic positions of the spots within that region. Of course, the general movement of the region has long been understood as corresponding to that of our hurricanes in our Northern and Southern Hemispheres. But within each group of spots there is a divergence of motion among the individual spots corresponding very closely to the outflow of atmosphere from our own regions of high pressure. In other words, the fragments diverge from each other, separating as they are removed from the center of the region, and also rotating anticlockwise in the Northern Hemisphere. Every new increase in the activity of any given group is accompanied by an increase in the divergence of the spots, but this increase is rather feebler than it was when the group of spots first began to develop. This was true in 90 per cent of the groups investigated.

It seems probable that the strength of the divergence depends upon and may be proportional to the energy of the development of the group. In fact Brenner has every reason to believe that there is no connection between the magnitude of the divergence within any spot and the activity of the so-called 11-year period, or with the heliographic latitude.

The possible connection between Brenner's results and certain analogous phenomena consists in the interesting fact that his results agree with the hypothesis that each spot, large or small, and each group of spots, is an eruption or boiling up from within the solar atmosphere. This causes a heaping up over the boiling region, above which the solar gases with their dark and bright spots, flow slowly outward and downward with the anticyclonic whirl without seriously affecting the general motion of the group across the solar surface.—[C. A.]

551.594.22

LIGHTNING AT MOUNT WILSON OBSERVATORY.

By WENDELL P. HOGE, Night Assistant.

[Dated Mount Wilson, Cal., Mar. 30, 1914.]

Yesterday, Sunday, March 29, at 3:30 p. m., the mountain top [elevation, 5,886 feet] was in the midst of a severe snowstorm following a light rain during the forenoon. Fog covered the mountain. Temperature about 31° F.; wind 12 to 15 miles from the southeast. The wind had risen from very light to brisk about 1 p. m. I was sitting near a window in a one-story concrete metal-roofed building known as the observatory laboratory and study. While the snow was falling quite rapidly in moderate-sized flakes, a rather bright flash of lightning came, followed after an interval of between one-fourth to one-half of a second by a single, short, sharp report quite similar to that of a .22 rifle shot. Then absolute silence. In about five minutes a second flash came, much brighter than the first. This was accompanied instantly by a rather faint very sharp crack, very similar in sound to the spark frequently produced in the laboratory. Then silence again. No more flashes were noticed. Such bright flashes of lightning with such exceedingly wild reports following, I have not before experienced.

POPULAR MISCONCEPTIONS.

Nearly every day brings to the attention of the Editor renewed evidence of the need of education; the abundance of ideas, the rashness of hasty statements, in conversation, in the daily press, and in letters from fellow citizens who wish their ideas to be tested by some expert. In general, these crude notions have occurred to active minds who wish to inquire into the ways of Nature and yet are not willing to accept the principles of research—principles and axioms that have been long since well established. It would seem that a large fraction of mankind is still in the condition of mind that characterized the world before the days of Copernicus, Galileo, and Isaac Newton. It was Columbus who first practically endeavored to verify his theory that the world was not flat but a sphere, and Magellan completed the demonstration. It was Copernicus who maintained that the earth revolved daily on its axis and annually around the sun, and gave a satisfactory demonstration of the truth of his theory. It was Galileo who maintained that bodies fall toward the earth by gravitation and demonstrated the accuracy of his idea. It was Sir Isaac Newton who maintained that this gravitation was universal and that the sun held the earth in its annual orbit, and that the earth held her moon in its monthly orbit, and gave a satisfactory demonstration of the correctness of this idea. And so we might trace the progress of knowledge from those early days down to the present time. Step by step those who have climbed the hill of science have perceived the possibility of some deeper insight into Nature and have been able to demonstrate some new principle. In every case, however, it has been necessary for the respective discoverer to appreciate whatever had already been discovered bearing on the points that he was especially interested in, before he could feel prepared to make additional progress in our knowledge of Nature. The consciousness that we are but beginners in the study of an almost infinite series of problems should make one very modest in his assertions as to how Nature must operate, or how the world was made, or what the possibilities of Nature ought to be. The pathway of science within the past 300 years is strewn with tens of thousands of suggestions that have fallen by the wayside and are long since forgotten; they have helped to show us what does not take place and what is not true and have thus paved the way, and eased the path, of those who have discovered what is true.

Our numerous correspondents must not be surprised or chagrined if in reply to the theories that seem to them

[1] Publikationen der Sternwarte des eidg. Polytechnikums zu Zurich. Bd. 5.

very plausible, they learn that we can not accept them, or that they are contrary to experience, or inconsistent with well established principles, or can only be of local and temporary importance. For example, if one man addresses the President of the United States claiming that the evaporation from plowed land in Kansas and Nebraska produced evaporation and haze until eventually rain fell and that nothing will produce rain except evaporation, he must not be surprised to have his communication referred to the Weather Bureau and to learn that the evaporation from Nebraska could only have produced a very small part of the rain, if indeed it had anything at all to do with the rain that fell over Kansas and Nebraska. If the same correspondent enthusiastically addresses the Secretary of the Interior as to the need of conserving the waters of the Platte River and increasing the reservoirs of water so as to stimulate evaporation, he must be told by the Director of the Geological Survey that rains which are to produce any appreciable good effect generally result from conditions of such great extent that the water contributed by evaporation in Kansas and Nebraska would not be appreciable. Evidently such a persistent advocate of his own ideas is scarcely willing to accept as a finality the opinions of recognized experts. Why then should he not reason out the matter to suit himself; why ask a specialist to investigate the value of a crude idea whose value he could easily have settled to his own satisfaction by his own personal study? It would take him but a few minutes to figure out the quantity of rain that fell and the preceding quantity of moisture evaporated from the soil and, according to his theory, necessary to furnish that rain, e. g., if 8 inches of rain fell on a soil that had received no rain for three months and from which scarcely an inch in depth of water could have evaporated, then this 1 inch could not have produced those 8 inches.

Almost the same course of reasoning applies to a correspondent from Alabama, who maintains that carbonic-acid gas is increasing in the atmosphere and causing the climate to change toward the tropical conditions of earlier ages. Of course he has no observations to show that there was an extra amount of carbonic-acid gas in the atmosphere in past geological ages, and certainly there is nothing to show an appreciable increase in carbonic-acid gas in the free atmosphere during the past century. The so-called theory on which he bases his "Warning Number 2" is based upon his own idea as to the use of coal, petroleum, etc. He entirely ignores what we already know about counteracting influences that counterbalance the increasing danger that he anticipates, and that require the officials in Washington to dismiss his "theory" of the weather as wholly illusory.

The term *theory* is employed quite improperly in such cases. These correspondents are offering suggestions, well meant indeed, but not of sufficient importance to be called well considered theories. A *theory* with regard to any natural phenomenon is a plan or scheme based on principles that are verifiable by experiment, observation, and analysis; a rational explanation that agrees with all the facts and disagrees with none. It is only a very loose and popular error to speak of a *theory* when we mean merely a *hypothesis* or *speculation*. A proposed explanation, or a working hypothesis, is framed in order to account for any fact that is not well understood, and it is only after this hypothesis has been well established or, if necessary, replaced by successive approximations, that one is eventually justified in building up a rational theory. Speculations, hypotheses, and suggestions should not be called theories until one or more of them have been successfully demonstrated by experiment and by observation.

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Another class of correspondents and newspaper writers are as apt to ignore the history of the progress of science as the above-mentioned writers ignore the philosophy of science. Thus, from one author we understand that the idea of the general adoption of rational meteorological units in this country is the result of the initiative taken by Prof. McAdie in 1908, whereas, his proposition of that year was but one of many that had been under discussion in all the weather bureaus of the world for many years previous, and, in fact, ever since the conception of the metric system of units. We are very glad that at Blue Hill Observatory Prof. McAdie will introduce the system advocated by Bjerknes and his followers.—[C. A.]

CONTINUOUS PICTURES OF THE WEATHER.

Among the many suggestions received by the Weather Bureau from well-meaning correspondents interested in the progress of the study of the atmosphere considered as a branch of physics and dynamics rather than as a branch of climatology, one correspondent desires a picture of weather changes and their relations to each other to be presented as a series of small daily maps, nine to a page, and continuous for a month and showing isobars, isotherms, rise or fall of temperature, the direction and force of the wind, cloudiness, rainfall, thunderstorms and tornadoes, and perhaps some other items, especially the absolute moisture, which latter can perhaps be given approximately for the total column of atmosphere over any station. Of course such a series of maps would have some value, but something similar has been published for many years by various European weather services, and now in place of this series of small maps the U. S. Weather Bureau has taken a far more important step by publishing that daily map of atmospheric temperature and pressure over the whole Northern Hemisphere that has for some years past proved so very useful in its long-range weather forecasts.

We are convinced that it is only by the study of atmospheric conditions over the whole Northern Hemisphere, as if photographed daily, that we shall ever be able to appreciate the preponderating influence of the diurnal rotation of the earth and the general circulation of the atmosphere as compared with the minor influence of sunshine, radiation, and moisture. That is to say, these last three influences that start the atmosphere in motion are completely overshadowed by the effect of that motion combined with the swift rotation of the earth. The relative importance of these influences on the atmosphere as a whole is quite analogous to their relative importance in the case of a hurricane, where sunshine, moisture, heat, radiation, all come into play and would of themselves start the atmosphere into direct lines of motion toward a center of low pressure; whereas the rotation of the earth turns that radial movement into an almost perfect circle. The relative importance is analogous to the influence of gravity on a bowlful of water escaping at the outlet, where the least deviation from symmetry converts the straight line into a circular motion.

Atmospherics is not merely a study of the physics of the atmosphere on the scale of a laboratory experiment; it is a problem in terrestrial physics in which the overpowering influence of the earth considered as a small planet must be fully considered. The lower layers of the atmosphere being resisted by continents and highlands move almost independent of the upper layers that have scarcely any connection with the lower layers, by way