

stations, in noways represents the true conditions on the lake surfaces during windy weather. The lake surface is increased to a considerable extent by wave action and the contact with constantly changing air and spray blown from waves make conditions which almost render the problem indeterminate.

Mr. Wisner adds:

The run off above given is that which, from a personal knowledge of the country, seems reasonable to me. The discharge of the St. Marys, 72,600, is, I think, very nearly correct. The discharge of the St. Clair River for mean conditions does not, in my opinion, exceed 200,000 cubic feet per second. In this connection I wish to call attention to the fact that the discharge of Lake Huron depends on both the stage in Lake Huron and in Lake St. Clair. Owing to the fluctuation of Lake Erie being greater than for Lake Huron, the minimum slope of the St. Clair River occurs at the high stage of the lakes, and the maximum slope at the minimum stage, a condition which has not been heretofore considered, and which plays an important part in the fluctuations of both lakes. The St. Clair River is only 750 feet wide at its head, and a large part of any change of slope is concentrated in the rapid at the foot of Lake Huron, which simply means that the maximum discharge is not necessarily at the maximum stage of Lake Huron.

We are now making additional observations for the discharge of Niagara River at a higher stage than when observations were made last fall, which may change the result obtained then.

I feel quite confident now that the discharge for mean stage will likely fall between 230,000 and 240,000 cubic feet.

OCEANIC AND SEISMIC NOISES.

The following extract from the English journal, *Nature*, for June 9, 1898, Vol. LVIII, page 130, is of interest in connection with the article on page 152 of the MONTHLY WEATHER REVIEW for April which was published almost simultaneously, and without knowledge of the Italian article referred to by our contemporary:

The mysterious phenomenon known as "Barisal guns," or "Mist poeffers," forms the subject of a useful paper by Dr. A. Cancani, in the last *Bollettino*, Vol. III, No. 9, of the Italian Seismological Society. The observations on which his discussion is founded are collected from places in or near the inland province of Umbria, where the noises are known as "marina," it being the popular belief that they come from the sea. The sound is quite distinct and easily recognized; it is longer than that of a cannon shot, and though more prolonged and dull, it is not unlike distant thunder. It invariably seems to come from a distance, and from the neighborhood of the horizon, sometimes apparently from the ground, but generally through the air. The weather, when the "marina" is heard, is calm as a rule, but that it often precedes bad weather is shown by the common saying, "Quando tuona la marina o acqualo vento o strina" (when the ocean thunders, expect rain or wind or heat). The interval between successive detonations is very variable, sometimes being only a few minutes or even seconds. They appear to be heard at all times of the day and year, the experience of observers differing widely as to the epochs when they are heard most frequently. With regard to the origin of the "marina," Dr. Cancani concludes that they can not be due to a stormy sea, because "mist-poeffers" are frequently observed when the sea is calm; not to gusts of wind in mountain gorges, for they are heard on mountain summits and in open plains. If their origin were atmospheric they would not be confined to special regions. Nor can they be connected with artificial noises, for they are heard by night as well as by day, and in countries where the use of explosives are unknown. There remains thus the hypothesis which Dr. Cancani considers the most probable, that of an endogenous origin. To the obvious objections that there should always be a center of maximum intensity, which is never to be found, and that they are so rarely accompanied by any perceptible tremor, he replies that, in a seismic series, noises are frequently heard without any shock being felt, and of which we are unable to determine the center.

ELECTRICAL STORMS IN KANSAS.

Mr. T. B. Jennings, Section Director of the Kansas Section of the Climate and Crop Service, reports that—

The western counties of that State are occasionally swept by a wind-storm, denominated by the plainmen as an "Electrical storm," though no thunder or lightning occurs and the weather is generally clear; it is a broad wind, blowing with great force; a person exposed to it soon becomes filled with electricity, and on approaching a stove electric sparks will pass from his hands to the stove; the housewife wraps her hands up in rags to handle the stove utensils. It is difficult to realize the conditions in such a windstorm until one experiences them; the electrical conditions are not uniform but confined more to currents or streaks; growing grain and foliage on trees exposed to

these conditions become more or less scorched, and sometimes the grain crop is completely killed. Such winds (electric storm) are most frequently from the northwest.

The mountains of Colorado, and doubtless other parts of the country, frequently experience electrical storms that appear to be very similar to those described by Mr. Jennings. The wind blows severely from the west; the air is sometimes quite dry but more often filled with the finest forms of vapor condensation; a steady stream of electrical discharges flows from every sharp point, whether of rock, or plant, or dwelling; the observer feels a tingling and cooling sensation, precisely similar to that experienced when taking an electrical bath treatment, and hears the singing due to the thousands of discharges going on all around him. Occasionally our observers on Pikes Peak have had too intense an experience; flashes and balls of lightning have played all around them within the observing station and the iron stove has been ablaze with continuous electrical discharges, yet nothing serious occurred. On a neighboring summit the field party sent out by the Coast and Geodetic Survey, in 1893, (?) reported far more serious storms of several hours' duration on successive days, entirely preventing work and injuring the instruments.

It is not yet satisfactorily ascertained whether the electricity of such storms originates in the earth or in the atmosphere or in the space beyond. If the latter, then we may trace it to the sun; if it comes from the air, we must attribute the origin of the electricity to some peculiarity in the processes of evaporation and condensation; if it comes from the earth, then it must originate in the compressions and shocks and friction that attend earthquakes and the outflow of lava. We do not see our way clear to indorse the popular idea that the electricity is generated by the wind or by the friction of particles rolled along by the wind, or by the melting of snow crystals, as suggested by Mr. Couch. In fact, the problem is evidently too difficult for our present limited knowledge.

The first step to be taken in investigating the true nature of these electric storms must consist in a collection of data showing the places and dates of their occurrence, and the collection must be sufficiently exhaustive to show when and where they do not occur as well as where they do. It is also necessary to distinguish between the injury done to plants by electricity and that done by the drought and the evaporation that accompany hot, dry winds in Kansas and the western plains. Reports of the occurrence of these storms will be very acceptable. A graphic account of the storm of October 27, 1894, is given on p. 120, *American Meteorological Journal*, Vol. XII, August, 1895.

METEOROLOGICAL SUPERSTITIONS.

The tendency of mankind to regard any unusual meteorological phenomenon as a special message from on high, announcing the speedy occurrence of some event of importance either to the individual or to the whole human race, is well illustrated by a note in the April report of Mr. Earl Flint, at Rivas, Nicaragua. With reference to the halo recorded by him on April 26, he says: "Many called my attention to the halo as they saw three extra suns. Last year for a similar occurrence at St. George the town was called out, believing it a forerunner of some calamity; but here at Rivas, they made it the precursor of the earthquake."

An inclosed slip from the *Managua Daily* gives a long series of connections between halos and both good and bad events in the history of the world. Of course, any one familiar with chronological tables could pick out a thousand more such coincidences without demonstrating any connection between halos and the history of the human race further than the general principle that remarkable events are continually occurring both in the heavens and on the earth, and that an

event in either of these classes is preceded by one in the other class, so that it is quite as proper to say that human events are forerunners of remarkable celestial phenomena as it is to reverse this statement. The article in the Managua Daily gives the proper optical explanation of the nature of the phenomena of halos as formed by the action of ice needles in thin cirrus clouds upon the beams of light from the sun; it also shows that halos are as often followed by good events as by evil, but it fails to bring out as clearly as is desirable the great principle that men must banish from their thoughts every tendency to imagine that meteorological phenomena have even the slightest value as prophetic signs or prognostics of future events among mankind.

FROST FORMATIONS AND ICE COLUMNS.

We are indebted to Prof. D. T. MacDougall, of the University of Minnesota, at Minneapolis, for the following references to recent publications on this subject, in continuation of the short notes published in the MONTHLY WEATHER REVIEW for May and July, 1897:

- MacDougall, D. T. Science, 1893, Vol. XXII, p. 851.
- MacDougall, D. T. Botanical Gazette, 1894, XIX, p. 120.
- Ward, Prof. Lester F. Botanical Gazette, April, 1893.
- Bay, J. C. Botanical Gazette, 1894, XIX, p. 321.

Professor MacDougall states that he expects to carry on some experimental work on plant life in the San Francisco mountain range near Flagstaff, Ariz., during the coming season. Any person in that vicinity who keeps meteorological records will confer a favor by corresponding directly with him. It is hoped that some one in that region or some institution will maintain a continuous thermograph record.

PRAIRIE SKIES.

The following extracts are from a recent letter by E. J. Couch, voluntary observer at Cornlea, Nebr.:

Our prairies have rains principally in spring and summer. A general absence of cloud in the surface current gives opportunity to observe the upper air currents. Observation leads to certain generalizations. The rains seem to have their origin principally in the air currents at moderate elevations. The surface clouds are generally fog, scud, or squall. In spring the whole upper atmosphere seems to lift; and the air currents bring moisture from an easterly or southerly direction which falls as rain at the front of a low or with a sudden fall in temperature. The summer rains at times are similar, but they arise often from thunderheads.

When thunderheads project into a current above that is calm, the cloud spreads out forming the anvil cumulus. In most cloud areas we note two or more motions. A roll or rotating motion and a forward motion; clouds expand or contract with advancing or closing day, or with increase or decrease in evaporation.

A NEW GAS IN THE ATMOSPHERE.

Prof. William Ramsay and Mr. Morris W. Travers announced to the Royal Society at London on June 9, and to the Academy of Sciences at Paris on June 6, their discovery of a new constituent of atmospheric air to which they propose to give the name "Krypton," referring to the fact that it has been so long concealed from our knowledge. On the other hand the French chemist Berthelot suggests the name "Eosium" on account of the distinctive bright green line in the spectrum of this new element. This line is in almost the same position as the green line in helium and, as was suggested by Professor Schuster as well as independently by Berthelot, this line also agrees with the green line of the aurora borealis. As physicists are agreed that the light of the aurora must come from an incandescent gas, although its temperature is low as compared with most of the incandescent substances that are dealt with in our laboratories, it would seem certain that the incandescence of "Krypton" does contribute to the brilliancy of the aurora. The following table

gives approximately some idea of the relative proportions, both by volume and by weight, of the gases that have thus far been discovered in the lower portion of our atmosphere.

Near sea level, under a standard pressure of 760 mm. of mercury at 0° C. and standard gravity, the dry gases of the atmosphere have densities, volumes, and pressures as follows:

	Volumes.	Pressures.	Densities.	Weights.
	<i>Per cent.</i>	<i>Mm.</i>	<i>Kg. p. m³.</i>	<i>Per cent.</i>
Oxygen	20.95	159.22	1.10563	23.16
Nitrogen	79.02	600.55	0.97137	76.77
Carbonic acid gas	0.03	0.23	1.5201-	0.046
Dry air	100.00	760.00	1.29322	99.976

The remaining constituents, argon, helium, krypton, and ammonia, represent quantities far less than carbonic acid gas. What these proportions may become 10 miles above the earth's surface can hardly be stated as yet. The relative density of the new gas, taking hydrogen as unity and oxygen as sixteen, is as follows:

Krypton, 32.321 cubic centimeters at pressure 521.85 millimeters and temperature 15.95° C. weighed 0.04213 gram, or a density of 22.47. A second determination gave 22.51.

Like argon and helium, krypton is probably monatomic; it is heavier than argon and less volatile than nitrogen, oxygen, and argon. But Professor Ramsay states that its density is at present problematic, and it may be that the gas belongs to the helium series and has a density of 40, with an atomic weight of 80. The spectrum of the gas is characterized by two very brilliant lines in the yellow besides the brighter green line before mentioned and a somewhat weaker green line. In order to obtain a small quantity of this gas for their observations, the authors state that they obtained about 750 cubic centimeters of liquid air; all but 10 cubic centimeters were allowed to evaporate away slowly; the residue was secured in a gas holder and after removing the oxygen and the nitrogen, there was left 26 cubic centimeters of a mixture of argon and krypton.

The authors conclude by saying: "We have already spent several months in preparation for a search for a gas lighter than nitrogen that may possibly be found in the air and will be able to state ere long whether this supposition is well founded."

SAMUEL E. BLACK.

Mr. Samuel E. Black, observer, Weather Bureau, died May 21, 1898. Mr. Black entered the meteorological service by detail from the Office of Director of Experimental Stations, Department of Agriculture, August 21, 1894, and July 31, 1895, was transferred to the Weather Bureau. He was assigned to duty as assistant at the station at Colorado Springs, Colo., until September 17, 1894, following which he served in the same capacity at Denver, Colo., until September 5, 1896, and then at Santa Fe, N. Mex., until the date of his death.

NOTES FROM THE REPORTS OF THE CLIMATE AND CROP SECTIONS.

ARIZONA.

Mr. Henry M. Gee, voluntary observer at Tombstone, notes that during May, "day after day the wind was easterly in the morning, south about noon, and southwest the rest of the day." Nearly all the other observers in Arizona report that the month has been very windy at least in the daytime, and in general they report that the prevailing direction was southwest.

If the diurnal change in the direction of the wind was at other stations similar to that at Tombstone, which is in the northeast corner of Arizona, it would constitute a general