

LETTERS TO THE EDITOR.

Reversal of Temperature in Lows and Highs.

DR. HANN of Vienna has taken serious exception to some of the views advanced in *Science* for June 6, 1890, and has published an article in the September *Austrian Meteorological Journal* in which he forcibly advances his views. I shall have no time for a controversy on this question, but it seems to me that its importance demands a passing notice of this last discussion. It is possible that we are not fully agreed as to the question at issue. I give my understanding of it. Is there a reversal of temperature in the centre of our lows and highs as we ascend in them? I use the terms "low" and "high" to replace exactly "cyclone" and "anticyclone," the words used in Europe. "Cyclone" was first applied by Piddington to severe West India and other tropical storms, and should be reversed for that purpose, as is carefully done by our Signal Service. The word "anticyclone" is very awkward, and should be discarded. The words "low" and "high" represent exactly what we see on our maps, and have been applied to these phenomena now these twenty years. I make this explanation, because I find that our discussions are being read in Europe, and they may not be entirely plain. The word "cyclone" is probably the most abused of any in this country. The scientist applies it to a storm perhaps 1,000 miles in diameter, with winds circulating about it from right to left, and of no great violence. Probably 64,000,000 people, at least, refer the term to a most violent outburst, not more than 50 to 200 feet across at the earth, which has energy enough to demolish every substantial building which it encounters. Dr. Hann objects to the word "storm," because, forsooth, seafaring men have adopted it to represent a very high wind. We are permitted the use of the words "rain-storm," "hail-storm," "thunder-storm," "snow-storm," "wind-storm," "sand-storm," etc., and it seems a great pity that we cannot apply the word "storm" in a general sense when we

wish to mention the accompaniment of any of these. We must be careful, however, not to confuse "storm" with "low."

Dr. Hann makes me contradict myself by assuming that I accept "the ordinary theories of storm-generation" in *Science* for June 6, and totally discard them in another *Science*. I am sure no one familiar with my views could charge that I accept ordinary theories in meteorology. If one quotes such views in a discussion for the purpose of advancing an argument, surely he does not accept them; and such quotation does not overthrow all his views given repeatedly.

Dr. Hann has failed to comprehend the argument I advanced regarding his earlier researches in this subject. He published as early as 1874 that in unsaturated air the theoretical diminution of temperature with height is not far from 1° F. in 183 feet, while in saturated air it was 1° F. in 300 to 400 feet. I assumed that in our highs the air was not saturated, while in our lows it was. I have changed the computation slightly, and have now determined the theoretical temperature at Sonnblick, and compared it with that observed.

Sonnblick Temperatures.(F.).

	Low, or Cyclone.		High, or Anticyclone.		Air Pressure
	1874 theory.	1887 observed.	1874 theory.	1887 observed.	
Air	Saturated	Moist	Unsaturated	Drying	
Pressure..	Diminished	19.96 inches	Increased	20.83 inches	Pressure
Temperature	28°	3°	-4°	18°	Temperature

There seems to be direct contradiction here between the earlier theory and the later apparently observed facts. It may also be

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- MASON, E. C. *The Veto Power*. (Harvard Historical Monographs, No. 1.) Ed. by Albert Bushnell Hart, Ph.D. Boston, Ginn. 232 p. 8°.
- NATURAL Speller and Word Book, The. New York, Cincinnati, and Chicago, Amer. Book Co. 166 p. 12°.
- NEWHALL, C. S. *The Trees of Northeastern America*. New York and London, Putnam. 250 p. 8°. \$2.50.
- RELIGIOUS Instruction, Manuals of. From the Writings of Emanuel Swedenborg. New York, The New-Church Board of Publication. 288 p. 24°. 50 cents.
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said that upon this earlier theoretical computation depends a great deal of the present theory of the generation of storms.

Dr. Hann tries to show by observations at Pic du Midi, Feb. 19-March 14, 1863, that the lowest pressure at that station did not accompany a high (anticyclone) at the base. It seems to me that this case establishes my position; and if Dr. Hann still insists that he is right, in the face of these observations, there is no possibility of our coming to an agreement, but others must settle the point between us. I have repeatedly insisted that we must discuss conditions at the centre of low and high only, and that we can never take a diminished or a low pressure either at the base or summit of a mountain to indicate that the centre of a low (cyclone) is passing over. It is also probable that there must be added to this, that the low or high must advance at some velocity from a westerly direction, or they must have simply their normal condition, as in the United States. In Europe I find tracks of both these conditions exceedingly erratic, frequently wandering toward the west, then again stopping, especially highs, for a week or more. We are almost totally unacquainted with such conditions in this country. It seems highly probable that the general acceptance of Espy's stationary low (cyclone) theory by the authorities in Europe is largely due to this cause. A velocity of forty miles an hour (eighteen metres per second), such as we encounter in this country, might stagger our Eastern meteorologists. In the case given by Dr. Hann there is a steady fall of pressure at Pic du Midi and Toulouse from about March 5 to March 10. On examining the weather-map, I find a wandering low moving erratically just before and up to March 9. It has very little intensity as we regard them in this country, and cannot be taken as a typical low (cyclone) in any sense. On the other hand, a high (anticyclone) appears in Spain on March 10, exactly the condition I have insisted on. In any event, it is plain that the low temperature is due to the strong northerly and north-westerly winds induced by the high and low combined, and has absolutely no connection with

the distribution of temperature in a vertical direction in the centre of a low (cyclone). The low does not approach Pic du Midi till March 9, when it is in North Italy. How any one can think that such a position of the low can have any bearing on this discussion seems impossible to understand. The low temperature at the summit undoubtedly was a factor in keeping down the pressure there.

Dr. Hann attempts to show that on the approach of a low on Mount Washington the temperature rises, owing to south and south-east winds in front. Loomis proved many years ago that the circulation in a low at sea-level does not take place at Mount Washington, so this speculation falls to the ground. It seems to me the discussion published in *Science*, Sept. 5, settles this question beyond a peradventure, although it would be a matter of gratification if some one else should be induced to repeat the investigation. I have just received a letter from Dr. Lüring of Germany, who has studied the matter thoroughly, and who agrees with my position that there is no reversal of temperature in a low, but is not quite willing yet to accept the same for a high. It seems to me the evidence is all one-way, and that, if we accept the results of this investigation in the case of a low, we must do so also in that of a high.

H. A. HAZEN.

Washington, Oct. 10.

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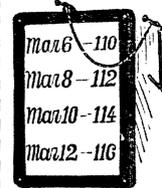
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