THE FIRST COOL WAVE OF 1923 IN THE DAKOTAS AND LAKE REGION.

By ALFRED J. HENRY, Meteorologist.

[Weather Bureau, Washington, Sept. 22, 1923.]

Supervising Forecaster Bowie in his report on "Storms and Weather Warnings," this REVIEW, page 419, mentions the fact that an extensive area of high barometric pressure and cool weather spread over the Northwestern States on the 21st, this being the first occurrence of a pronounced anticyclone in the United States during the present transition season from summer to autumn.

There is, of course, no magic significance in the early or late occurrence of such events, nevertheless from the forecaster's viewpoint they almost always excite the liveliest interest and a desire to trace them back to their beginning. The occurrence of sea-level pressure of 30.40 inches in August in the northwest or elsewhere in the United States, is of itself sufficiently infrequent to merit a brief examination such as this purports to be.

I am advised by Mr. O. W. Roberts, meteorologist in charge of the Bismarck Weather Bureau Office that sea-level pressures of that amount have been recorded at his station on August 23–24, 1911; August 26, 1914; August 28–29, 1915; August 13, 1916, and August 21, 1923, or in 5 years out of 35. In practically all of these cases the increase in pressure was attended by a fall in temperature of approximately 20° F., more than the average cloudiness, and generally some precipitation. An antecedent condition in every case was the presence of an area of low pressure and high temperature over the Dakotas.

The evidence of the weather map does not support the view that in these cases polar air flows in to produce the surface cooling, as is so manifestly the case in the cold season; rather the inference is unavoidable that the cooling of the surface air and, inferentially, that for some distance above the ground is due, in great measure, to direct contact with the falling rain and indirectly to the increased evaporation that results from the wetting of the surface cover. Nocturnal radiation must be of secondary importance by reason of the very considerable cloudiness present.

I present in Figure 1 reduced copies of the Washington daily weather maps of August 21 and 22, 1923, respectively. The most pronounced features of the map of the 21st are the anticyclone with sea-level pressure of 30.40 inches, centered over the provinces of Saskatchewan and Assinaboia and the trough of low barometric pressure stretching from western Ontario to Texas. Rain has fallen over a broad band extending from Lake Superior westward to the Pacific.

So far as can be determined the anticyclone developed over the provinces above-named during the night of the 20th–21st. The barometric trough shown on the map of the 21st is the result of the eastward movement of a cyclonic system that was centered over Montana on the 20th.

The map of the 22d shows a very remarkable (for the season) deepening of the barometric trough of the preceding date and a very material change in the configuration of the isobars. An explanation of these changes is not afforded from surface conditions and none will be attempted other than to suggest that there may be and probably is a connection between the increase in pressure in the anticyclone on the 21st and the sharp fall during the night of the 21st–22d.

The records of kite flights and pilot-balloon observations on the 21st and 22d at the stations named hereinafter throw some light on the structure of the free-air column in the southeast quadrant of the anticyclone, but, as usually happens, kites could not be flown in the barometric minima that preceded it. The location of the kite stations is shown in Fig. 1.

The Ellendale and Drexel kite records of the 21st contain the material from which the following is extracted. The last-named station is about 345 miles (555 km.) more distant from the anticyclone center than the former, but nevertheless the records of both stations are in close accord. The wind direction from the surface up to about 1,500 meters (above sea level) was N.–NE., or anticyclonic, as might have been expected; it then backed to N. at about 2,000 m. and to NW. at 2,500 m., continuing from that direction up to 2,S94 m., the top of the flight at Ellendale. At Drexel the direction was practically the same and the NW. wind prevailed up to 3,500 m. Anticyclonic circulation therefore did not extend much, if any, above 1,500 m. At Broken Arrow, the most southerly station used, S.–SW. winds prevailed at the surface, shifting to SW. at 500 m., W.–SW. at 1,500 m., W. at 3,000 m., and continuing in that direction at 3,536 m.

Broken Arrow was in or perhaps a little south of the center of the barometric trough before mentioned. The wind direction conforms to what might have been expected in that position. The average lapse rate in the temperature of the free air on the 21st was, for Ellendale 0.30° C., Drexel 0.38° C., and Broken Arrow 0.64° C. per 100 meters. A rather pronounced temperature inversion was encountered just above the base of the cloud level, or at about 1,500 m. at both Ellendale and Drexel on the 21st and at Royal Center on the 22d at about 1,500 m., although in the last named no clouds were present. The relative humidity was quite low in the inversion stratum.

For the 22d pilot-balloon observations are available for each of the four kite stations, all of which were within the influence of the anticyclone which was then centered over Nebraska. On the northern margin of this anticyclone, as at Ellendale, westerly winds increasing in velocity above 3.5 km. prevailed up to 6 km., the top of the flight; Royal Center on the eastern margin showed a N. wind at the surface slowly backing to W. at 6.5 km. The velocity from 0.5 to 1 km. was about 12 m. p. s. It then fell to 7 m. p. s. at 2 km., increasing to 17 m. p. s. at about 3.7 km., and continued above 16 m. p. s. from that level up to the top of the flight at 6.5 km. At Broken Arrow, on the southern margin of the anticyclone, the wind was E. at the surface, backing to W. at 2 km. and to SW. at 3.5 km. The maximum velocity was from the N. between 1 and 1.5 km. Above that level it decreased very sharply. At Drexel, nearly in the central part of the anticyclone, the surface wind was E. It backed to N. and NW. at the 1.5 km. level, and the velocity increased from 2 m. p. s. at the surface to 15 m. p. s. in the higher levels. The increase in velocity of the westerly winds is easily understood.

On the 22d pressure in the central part of the anticyclone had decreased to 30.30 inches and it soon fell to about 30 inches.

From the foregoing and the data of the daily weather map, I conclude that the air in this particular anticyclone was not descending, neither was it a mass of polar air moving equatorward, but rather it must be considered as one of many local or regional reversals which must take place in the seasonal movement of air from low to high

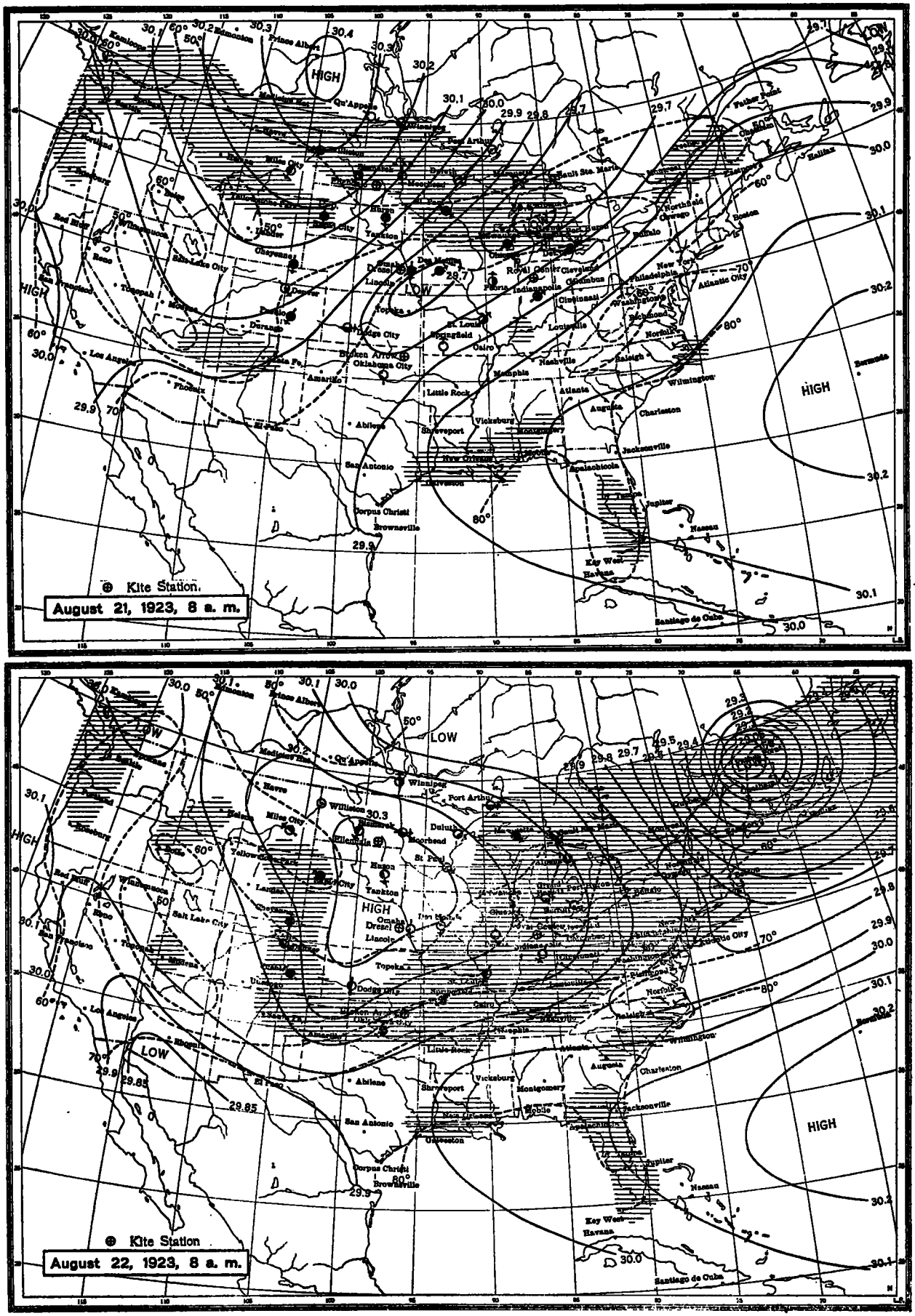

FIG. 1.—Weather maps for 8 a. m. seventy-fifth meridian time, Aug. 21 and 22, 1923.

latitudes and vice versa, especially during the transition from the warm to the cold season.

In early autumn the sequence, warm to cold, is of frequent occurrence in the northwest, but only in exceptional cases is the magnitude of the change so great as in the cases under consideration. The rise in pressure seems to be a reaction from the prevailing low pressure intensified and augmented by local conditions of rainfall and evaporation that promote cooling of the air. As a rule the high pressure does not persist much longer than 24 hours and many times a maximum pressure of 30.40 inches is reached on but a single morning.

FIRES CAUSED BY LIGHTNING IN IOWA, 1919-1922.

By ROY N. COVERT, Meteorologist.

[Weather Bureau, Washington, Aug. 31, 1923.]

An analysis of the table below shows that 74 per cent of the total fire loss caused by lightning in four years occurred amongst the farm barns and dwellings, of which 61 per cent was due to fires in barns which were unrodded while about 6 per cent occurred in barns supposed to be protected by rods. Eight of these latter barns, however, are known to have had defective rods, and in six cases lightning ran in on wires.

The value of rodding is effectively shown. The percentage of total money loss to include all rodded structures is 6.8, and it is estimated that in the rural districts, where most lightning fires take place (probably 80 to 90 per cent), that about half the structures are rodded, so that during these four years out of each hundred fires five to six occurred in rodded structures of which nearly 20 per cent had defective rods and 15 per cent started from lightning coming in on wires, both of which can be prevented.

It is interesting to note that a little over 17 per cent of the fires occurred in town barns and dwellings, but such fires gave only about 9 per cent of the money loss. The reason is not far to seek. Fires in rural districts usually result in the more or less complete destruction of the structure, while fires in town are generally stopped before they gain much headway. The average loss per building in 390 fires in farm barns and dwellings was $2,532, while in town the average was $1,146 for 110 fires among the same kinds of buildings. There would be more lightning fires in town were it not for the presence of overhead wires generally protected by lightning arresters and to other grounded masses of metal, such as stacks, roofs, structural framework of buidings, etc., which take the place of the usual lightining conductors.

Other unrodded structures which are rather frequently fired are grain elevators, churches, granaries, and hay, grain and straw stacks. The buildings should evidently be given protection against lightning by suitable rodding, and it is a relatively simple matter to protect a stack in the field by stringing a bundle of two or three wires across and well above the stack from two supporting poles on opposite sides where the ends of the wire are grounded to iron pipes.

The table was arranged from data compiled by Mr. J. A. Tracey, the fire marshal of Iowa, secured by him from chiefs, mayors and others, and presents the most complete and detailed information regarding lightning fires of which we have knowledge.

TABLE 1.—*Details as to rodding, kind of structure, location and estimated money loss.*

Number.	Kind.	Loss.	Per cent of total loss.	Number.	Kind.	Loss.	Per cent of total loss.
	UNRODDED STRUCTURES.				UNRODDED STRUCTURES—con.		
363	Farm barns	$894,546	61.1	2	Railroad depots	1,200	.....
37	Town barns	49,199	3.4	1	Restaurant	965	.....
27	Farm dwellings	92,894	6.3	7	School houses	7,595	.....
73	Town dwellings	76,928	5.3	1	Smoke house	300	.....
1	Auto sales room	200	.....	30	Stocks, hay, grain or straw	5,213	.....
1	Bank	400	.....	3	Storage houses	10,864	.....
3	Blacksmith shop	4,060	.....	2	Stores	8,144	.....
2	Cafes	200	.....	1	Street car	62	.....
1	Carpet cleaning	2,332	.....	1	Substation	511	.....
1	Cheese factory	7,000	.....	1	Tank-wagon station	2,000	.....
14	Churches	36,471	2.5	1	Telephone cable box	50	.....
1	Dry cleaning	75	.....	1	Transformer station	5	.....
1	Electric light plant	26,000	.....	3	Warehouses	1,468	.....
2	Factories	65	.....	1	Water tank	75	.....
1	Fair ground building	3,000	.....				
1	Feed mill	5,000	.....				
1	Foundry	350	.....				
7	Garages	12,716	.....				
8	Grain elevators	58,684	4.0	629		1,363,704	.....
11	Granaries	17,040	.....				
3	Hay sheds	3,800	.....		RODDED STRUCTURES.		
1	Hen house	100	.....				
3	Hog houses	3,725	.....				
1	Hotel	150	.....	28	Farm barns	81,281	5.6
1	Ice house	2,128	.....	6	Farm dwellings	17,330	1.2
2	Implement sheds or houses	2,000	.....	5	Town dwellings	1,865	.....
1	Machine shed	2,500	.....	39		100,476	.....
2	Office buildings	665	.....				
1	Printing office	349	.....		TOTAL.		
1	Produce house	21,525	.....				
1	Public library	100	.....	668	Rodded and unrodded	1,464,180	.....
1	Pump house	1,050	.....				

Average yearly loss, 167 structures, valued at $366,045.

NOTES, ABSTRACTS, AND REVIEWS.

DAILY WEATHER BULLETINS TRANSMITTED BY RADIO FROM THE UNITED STATES TO FRANCE.[1]

By E. B. CALVERT, Chief of Forecast Division.

[Weather Bureau, Washington, Sept. 27, 1923.]

The United States Weather Bureau sends each evening, Sundays and holidays included, to the French Meteorological Service at Paris, a bulletin containing observations taken at a number of stations in the United States, Alaska, and Canada, the position at the same hour of dominating high and low pressure areas, and weather reports from a limited number of ships in the North Atlantic Ocean. All land observations are of hour 0100 G. M. T., and Alaskan reports of hour 2100 G. M. T., current date. The bulletin is addressed to "Angot, Paris," and is forwarded through the United States naval radio station at Annapolis (NSS) to the radio station at Lyons (YN). The transmissions are made on a wave length of 17,145 meters, C. W., as the first message in the Annapolis schedule with France. This schedule begins at 0530 G. M. T., and transmission commences as soon thereafter as communication with Lyons (YN) can be established.

The messages are coded in a modified form of the International Meteorological Code, except that a date word is used to show the day of the month and the period of the day (a. m. or p. m.) that the land observations were taken, and key letters instead of numerals to desig-

[1] Reprinted from U. S. Hydrographic Bulletin No. 1776.