300 meters above the valley floor at different times of the night and in different localities.

It would be an uncertain procedure to apply the observations made in one valley to the conditions in another, except in a general way. The general remarks above are based (1) on three or four years' observations of mountain and valley temperatures in the vicinity of Mount Weather, Va., and (2) on a number of observations by means of captive balloons at Lone Pine and Mount Whitney, Cal. The observations in the vicinity of Mount Weather were summarized with reference to late and early frosts in the Bulletin of the Mount Weather Observatory, volume 5, page 118. This number of the Bulletin was issued in February, 1914. The captive balloon observations at Lone Pine and Mount Whitney, Cal., were published in the MONTHLY WEATHER REVIEW, July, 1914. Another helpful article on this subject, based on the above data, was published in the MONTHLY WEATHER REVIEW for October, 1914, under the title "Air drainage explained." Other observations in the mountain regions of North Carolina have been made by the Weather Bureau in the further study of this subject, but these observations have not yet been published.

LOW PRESSURE AT PARIS, NOVEMBER 18, 1916.[1]

By [CHARLES] ALFRED ANGOT, Director.

[Dated: Bureau Central Météorologique de France.]

On November 18, 1916, there occurred a meterological phenomenon really exceptional in this region. After a period of low pressure which lasted nearly 48 hours, the barometer at Paris fell to a point almost unprecedented. The pressure reduced to sealevel was 722.5 mm. (28.44 inches) at $22^h\ 25^m$ (10:25 p. m.), which corresponds to less than 720 mm. (28.35 inches) in the lowest parts of the city. The extreme minimum observed at Paris, 719.4 mm. (28.32 inches) at sealevel, occurred on December 24, 1821.

Ordinarily barometric depressions pass over the British Isles or farther north, moving almost directly from west to east. The position of the center is usually such that Paris is in the region of violent ocean winds from the south, southwest, and west. This time the center followed an entirely different track. It came from the Gulf of Gascony and at 7^h on the 18th was between Belle Isle and the mouth of the Loire. From there it moved inland across the south of Brittany, turning toward le Mans (Department of Sarthe), where it arrived about 18^h (6 p. m.), then toward le Havre and Dieppe, and finally toward London, where it arrived at 7^h on the 19th. All the coast of the Gulf of Gascony, of Brittany, and the western side of the English Channel experienced violent ocean winds blowing from the west. On the other hand, at Paris, on the right of the track, the wind came from the land; it blew from between the south and southeast and remained relatively moderate. At the top of the Eiffel Tower the wind hardly reached a velocity of 20 meters per second (45 miles per hour) even in squalls at the middle of the night when the barometer first began to rise rapidly, although velocities of 30 to 35 meters per second (67 to 78 miles per hour) are often observed with ocean winds from the west and southwest in the winter storms whose centers pass much farther to the north.

During the time the depression was following an abnormal track its velocity was very slight. From the south of Brittany to London the storm scarcely moved 600 kilometers (373 miles) in 24 hours, or with a mean velocity of 25 kilometers (16 miles per hour). Finally, the period of low pressure was of very long duration, but at the time when the barometer was falling most rapidly the rate of change did not exceed 1.5 mm. (0.06 inch) per hour. All these considerations, and others upon which it is not possible to comment now, explain why at least in the Paris region stronger winds were not observed in spite of a pressure entirely comparable to those often observed in tropical cyclones.

[1] La baisse barométrique du 18 novembre 1916. Comptes rendus, Acad. d'agric. de France, 2:1042-1043. Paris 22 nov. 1916. *Translation* by W. G. Reed.

THUNDER AND HAIL IN THE PARIS REGION.[2]

By [CHARLES] ALFRED ANGOT, Director.

[Dated: Bureau Central Météorologique de France.]

It has been shown that thunderstorms are always a result of atmospheric movements which lead to the formation of cumulo-nimbus clouds. There are often accompanying phenomena such as rain, hail, and electric manifestations, which may be produced simultaneously, but there is no relation of cause and effect between them. The cause of the production of hail can not be seen in the electric manifestations.

In the course of recent investigations there was occasion to tabulate the number of days with thunder and the number of days with hail observed at the Parc Saint-Maur Observatory during the 40 years 1874–1913. Table 1 gives the results.

TABLE 1.—*Number of days with thunder and the number of days with hail, at Parc Saint-Maur, Paris, during (40 years) 1874–1913.*

Months.	Total number of days with—	
	Thunder.	Hail.
January	3	24
February	11	36
March	34	80
April	85	66
May	170	65
June	226	21
July	221	18
August	185	10
September	108	9
October	38	20
November	8	10
December	5	24
Total	1,094	383

In this table only days with true hail have been included, grésil ("soft hail") has been omitted. Part of the decrease in frequency of hail in the summer months appears to be due to the fact that when the hailstones are small they are melted before reaching the ground and are recorded as rain. It is in part for this reason that hail is rare within the Tropics.

In the Paris region hail is more frequent than electric manifestations in Winter; but very much less frequent in Summer. The maximum frequency is in Spring from March to May, specially in March ("April showers"); thunder, on the other hand, is most frequent in June and July.

These data furnish an additional proof of the complete independence of hail and electric phenomena.

[2] *Angot, Charles Alfred.* Le tonnerre et la grêle dans le région de Paris. Comptes rendus, Acad. agric. de France, Paris, Oct. 11, 1916, 2: 912-913. *Translation* by W. G. Reed.