cember 29, 1889, with a 30-day departure of 21.1°; on the same day at Galveston and Indianapolis; on December 22 at Alpena, and on January 1, 1890, at Philadelphia.

As a rule, these courses of temperature pass off as deliberately as they come. The normal at Philadelphia was reached on March 17, 1890, and was crost at Alpena February 21; at Indianapolis and Memphis, February 20, and at Galveston, February 28.

These notes are suggestive of what might be found if a similar showing could be made for many stations. These large temperature movements do not fit to seasons as might be inferred from the cases cited. In the five years 1901–5 at Philadelphia there were sixteen courses of temperature having 30-day departures of 3° or more. The extremes were reached in eight different months.

It is evident that until the tides of the ocean had been observed by tide gages and the general movement measured no connection with the moon could have been traced. My belief is that we can not hope to discover the cause for our abnormal seasons until the departures from average seasons are measured.

SEASONAL DEPARTURES OF TEMPERATURE AT PHILADELPHIA, PA., DURING THE LAST TWENTY YEARS.

By HENRY GAWTHROP Dated Swarthmore, Pa., February 6, 1908.

On April 22 and October 22 the average of the day's mean temperature is the same as the average mean temperature for the year, and (at Philadelphia) these dates of equi-temperatures are midway between the coldest and warmest days of the year.

From the Philadelphia daily newspapers of January 1, April 23, and October 23, I have taken the accumulated departures of temperature; these data are all that is necessary to find the departures for the half-years shown in Table 1.

TABLE 1.—*Accumulated seasonal departures of temperature at Philadelphia, Pa.*

Years.	Summer half-year. (April 23–October 22.) Excess. (+)	Deficiency. (−)	Years.	Winter half-year. (October 23–April 22.) Excess. (+)	Deficiency. (−)
	°	°		°	°
1887	159		1887-1888		127
1888		353	1888-1889	396	
1889		26	1889-1890	951	
1890	93		1890-1891	234	
1891	27		1891-1892		17
1892	109		1892-1893		442
1893		11	1893-1894	292	
1894	177		1894-1895		338
1895	139		1895-1896	125	
1896	112		1896-1897	287	
1897	123		1897-1898	572	
1898	367		1898-1899		53
1899	131		1899-1900	258	
1900	632		1900-1901	220	
1901	286		1901-1902	63	
1902	50		1902-1903	648	
1903	10		1903-1904		578
1904	49		1904-1905		363
1905	213		1905-1906	404	
1906	314		1906-1907	3	
Sum	2,991	390	Sum	4,453	1,918

I note that there have been thirty periods of excess and ten of deficiency. The former foot up 7444° and the latter 2308°. The latest table of normals is, I believe, for about thirty-five years, so that these figures indicate that the first sixteen years must have had cold times to balance these warm years.

It is just possible that these dates of equi-temperatures might, by use, become as well established in the popular mind as the equinoctial was in the past generation. From October 23 to April 22, moreover, is approximately the period of furnace fires, and the accumulation of departures would appeal to the housekeeper.

It is also of interest to divide into three-month periods, for example:

October 23 to January 22.		January 23 to April 22.	
1904–5	−210°	1905	−153°
1905–6	+275°	1906	+129°
1906–7	+264°	1907	−261°
1907–8	+268°		

These periods of half and quarter temperature years are interesting for comparison, but are not the measure of the course of temperature desired. With the more exact measurement and the comparisons between many stations the evident great movements of temperature could be ascertained both as to area covered and their coming and going.

ELECTRIC DISTURBANCES AND PERILS ON MOUNTAIN TOPS.

By PROF. J. E. CHURCH, jr., Reno, Nev.
[Communicated January 11, 1908, by PROF. ALEXANDER G. MCADIE.]

In view of the scientific interest that has been aroused by the sudden death of mountaineers on the widely separated peaks of San Gorgonio and Whitney, during apparently the same electrical storm, in July, 1904,[1] the following recent experience of Capt. R. M. Brambila, U. S. Infantry, and the writer, will be welcomed as furnishing some hint of the power and magnitude of such electric disturbances. This experience was endured by the party during the regular visit to the automatic weather observatory maintained by the Nevada Agricultural Experiment Station on Mount Rose (altitude 10,800 feet), the dominating peak north of Lake Tahoe, on the California–Nevada State line, approximately 200 miles north of Mount Whitney.

The storm, which was mainly electric in nature, displayed itself first on the evening of Friday, October 19, 1907, in a heavy cloud mass lying close along the Carson Range, north of Mount Rose, but in no wise involving it. The flashes of lightning were frequent and heavy. Little thunder, however, if any, was heard. On the morning of the 20th, when the actual ascent of Mount Rose began, clouds gathered from the direction of Lake Tahoe about the summit, and enveloped it somewhat persistently during the day. The wind did not exceed 10 miles per hour, and the temperature remained above freezing.

From the summit itself the canyons below could be seen filled with masses of vapor. As night darkened a moderate storm of hail and snow with rain began to fall. The pack horse, which had been stabled on a terrace just below the observatory, was covered from tail to ears to protect him from the pelting missiles.

Then the electric display began, first as dull detonations to the south, and after an interval a flash at the observatory window, as if there were wires in the observatory and electricity had struck them. To this we paid little heed, for the occur-

[1] The distance between these peaks, which lie on opposite sides of the Mojave Desert, southern California, is approximately 180 miles, and the difference in elevation is 5,000 feet, the higher peak, Mount Whitney (altitude 14,499 feet [Gannett's Dictionary of Altitudes, fourth edition, gives 14,502]), being the highest mountain in the United States, excluding Alaska.

The death on San Gorgonio, said to be the first case of the kind in San Bernardino County, occurred July 24, 1904; that on Mount Whitney two days later, July 26. Referring to these fatalities Prof. Alexander G. McAdie, quoted in the Monthly Weather Review, September, 1904, page 420, says:

"The accidents have a scientific interest in that there are but few records of deaths by lightning in this State. But it should be noted that comparatively few people have been exposed to storms at high elevations. Mr. Byrd Surby was killed on the summit of Mount Whitney, within 50 feet of the monument. It was snowing at the time of the accident. It is probably not well known that the variations in the electrical potential of the air during a snowstorm are almost as rapid and as great as those prevailing during a thunderstorm. In this present case I am inclined to think that the electrical disturbance was not localized, but simply incidental to a disturbed field which extended well over the high Sierra, Inyo, Panamaint, and Telescope ranges; also the San Bernardino Range, and probably the mountains of Arizona. This condition lasted perhaps a fortnight."

rence was trivial. After a time, however, a crash a hundred feet below us and perhaps 590 feet away, and the immediate terror of the horse drew us to the door. As we emerged, every artificial projection on the summit was giving forth a brush discharge of electricity. The corners of the eaves of the observatory (made of Malthoid roofing), the arrow of the windvane, the cups of the anemometer—each sent forth its jet, while the high intake pipe of the precipitation tank on the apex of the summit was outlined with dull electric fire. Whenever our hands rose in the air every finger sent forth a vigorous flame, while an apple, partially eaten, in the hand of Captain Brambila sent forth two jets where the bite left crescent points. This latter phenomenon occurred, however, only when the apple was raised and ceased when it was lowered, so that the eating of the apple involved no visible eating of flame. To clap the climax, my felt hat above the brim flashed suddenly into flame. I could feel the draft, and it seemed to me I could hear it, too. The halo was dazzling, but before the senses could act it was gone. I had earlier rubbed Captain Brambila's hair, trying (but ineffectually) to elicit a discharge of electricity; because he was not so tall as I, nature selected me to serve as the point of electric discharge. So vivid were the flames that continued steadily to play from the corner of the observatory that I reached up to assure myself that the building was not actually on fire.

We felt no ill physical effects nor any special alarm, but for the sake of prudence we sought the interior of the observatory, where the pranks of the electricity were apparently completely avoided. About 7:30 p. m., an hour after the electric storm had burst, it had vanished. The clouds, however, continued to hover around the summit, and the following evening a heavy rainstorm swept from the mountain earthward toward Reno, gaining violence as it descended, until the valley was drenched. We followed the storm closely with but little inconvenience from rain.

Only once before have I met electricity actively present on Mount Rose. This was during the day of July 25, 1906, in a wet snowstorm accompanied by dense fog. At that time the thunder was pealing in the abyss below me, until I felt like some Jupiter hurling thunderbolts upon the earth beneath. Evidently the potential is higher during snowstorms, as Professor McAdie believes, than at other times; at least the fatality on Mount Whitney occurred during a snowstorm.

The puzzle is that the discharge took place not at the summit, but upon the rocks below. A possible reason may be found in the suggestion of Dr. R. S. Minor that the "scud which was sweeping between the heavier clouds above and the mountain mass may have become electrified by passing between the two poles, and then have discharged its electricity as it was swept down nearer the mountain, where the air currents swirl in its lee."

So far the discharges on Mount Rose have occurred at this lower point, and this habit may prove to be the security of the observatory. The large extent of the summit over which the brush discharge was active and the intensity of the discharge indicate imminent danger to the entire observatory. It was believed, when the observatory was planned, that such bolts would be induced to strike the high intake pipe on the crest; but such a conductor, it seems, would prove insignificant on account of the gigantic proportions of the electric activity. Besides it is impossible to create a satisfactory circuit from tank to mountain, for the summit is apparently one mass of shivered rock whose interstices are filled only with dry earth.

A nice cage in which to sit during thunderstorms has been suggested as affording possible immunity for the observers. It is possible that the observatory itself, which is sheathed with Malthoid roofing above and nestled in the rocks below, may serve the same purpose. The placing of wire netting around the louvered shelter where the meteorograph is installed might afford protection, but the anemometer mast may attract sufficient electricity to fuse the netting and reach the instruments by way of the mechanical connections. There has been no actual danger on Mount Rose, so far as known, during the past three years, except on October 20, 1907.

EARTHQUAKES ON THE PACIFIC COAST.

By Prof. ALEXANDER G. MCADIE. Dated San Francisco, Cal., January 21, 1908.

It has been brought to my attention by Prof. George Davidson that Belcher gives a short list of some earthquakes on the Pacific coast. Mention of these earthquakes is not found in Holden's Catalog of Earthquakes on the Pacific coast, and publication at this time may be of interest to seismologists thruout the world. Professor Davidson has also shown me in an old book in his possession a note concerning an earthquake felt by Francis Drake in March(?), 1579. Drake had sailed from Panama on March 13, and a few days later, while anchored off the southern coast of Costa Rica, felt a sharp shock.

In Belcher's "Voyage Round the World," London, 1843, Vol. I, p. 147, appears the following record for Acapulco, Mexico:

As far back as the year 1732 earthquakes of uncommon force have continued to afflict this city. On the 25th of February of that year a very heavy earthquake destroyed nearly the whole town. The sea rose to a great height, covering the Plaza (or about 10 feet perpendicular), the successive risings, after receding, recurring slowly at the periods of the several shocks.

On the 17th of August, 1754, another earthquake occurred, ruining the greater part of the town. On this occasion the rising of the sea was attended with more violence; the Plaza was again covered.

On the 21st of April, 1776, an earthquake occurred which destroyed many houses.

On the 14th of March, 1787, the whole town was ruined. The sea retired, leaving the rocks of the Punta Manzanilla (in the town bay) dry. The *Phillippine, Nao*, was anchored at the time in the port and was left in 4 fathoms before the tide returned—showing a fall of 36 feet.

No earthquake of consequence is recorded afterward until that of the 2d of May, 1820. This earthquake lasted several days, and entirely destroyed the place. The steeple of San Francisco fell on this occasion and the church was rent; the sea retired still farther than in 1787, and returned in two hours, rising up to the church door; the rise and fall taking place gently. At the ultimate recession the sand was found to have accumulated so as to nearly cover the pier (5 or 6 feet) by which upward of twenty varas of land was gained at the beach.

On the 10th of March, 1833, about 10 o'clock at night, a heavy earthquake was experienced. The sea retired 40 feet, and gently resumed its former level. This was felt at Mexico at precisely the same hour, lasting there about one minute and a half, the motion there being undulatory, but at Acapulco trepidatory.

On March 13, 1834, another shock is recorded; the sea receded fifty varas and several buildings were destroyed.

On the 6th of January, 1835, at 6 o'clock in the morning a very severe earthquake was felt, lasting upward of two minutes; motion trepidatory, the shocks recurring every thirty hours for upward of a month. This, like that of 1833, was felt in Mexico.

On the 9th of August, 1837, a heavy shock was felt, trepidatory, recurring at thirty hours for nearly three weeks. It was felt slightly at Mexico.

On the 18th of October, 1837, at 4 p. m., a heavy earthquake occurred, which lasted until the 22d. During this interval of four days the earth trembled continuously; one hundred separate shocks were counted between 4 p. m. 18th, and 10 p. m. 22d. During this interval five very severe shocks occurred, 4 p. m. 18th, 10 p. m. 19th, midnight 19th, 4 p. m. 20th, and 4 p. m. 21st. That at midnight on the 19th was terrific. Had it lasted a few seconds longer, rocks would undoubtedly have been rent asunder. Following this earthquake, for six weeks continuously, periodical heavy shocks were experienced, at 10 a. m., 10 and 12 p. m., and at dawn. At Mexico the shocks were severely felt at the same instants, on the 18th and 19th.

In conclusion *daily temblors* have occurred since the earthquake of 1820. But the season when the heaviest shocks occur is between March and June.

The above is extracted from notes made by a commissary resident for many years, and constantly holding office under the government of all parties.

FURTHER OBSERVATIONS OF HALOS AND CORONAS.

By M. E. T. GHEURY. Dated Eltham, England, August 3, 1907.

The accompanying table[1] gives my observations of halos, coronas, etc., during April, May, and June, 1907.

[1] This table closely follows in arrangement, abbreviations, etc., the table of the author's previous paper printed in the Monthly Weather Review, May, 1907, p. 213-215.—EDITOR.