

almost identical, except in the afternoon, when the maximum thermometer on the American Surety Building gave higher readings.

The second series of comparative readings, made later in the season, gave individual differences of as much as 10°, the thermometers on the American Surety Building reading in almost all cases the higher. The mean results are as follows:

*Average temperature in standard thermometer shelters on the roofs of the American Surety and Schemerhorn buildings, respectively.*

DRY THERMOMETER.

Date.	8 a. m.			8 p. m.		
	American Surety Building.	Schemerhorn Building.	Difference, A-S.	American Surety Building.	Schemerhorn Building.	Difference, A-S.
November 11-30.....	42.4	41.0	1.4	45.9	45.1	0.8
December 1-31.....	35.7	33.8	1.9	39.4	37.1	2.3

MAXIMUM THERMOMETER.<sup>1</sup>

November 11-30.....	48.1	46.0	2.1	52.8	49.7	3.1
December 1-31.....	48.1	39.1	4.0	45.7	42.0	3.7

MINIMUM THERMOMETER.<sup>1</sup>

November 11-30.....	38.3	39.0	-0.7	39.9	40.1	-0.2
December 1-31.....	31.8	32.1	-0.3	31.5	31.5	0.0

<sup>1</sup> Set at 8 a. m. and 8 p. m. daily.

Thus we see the greatest differences are generally found in the daytime, although the maximum temperatures on the American Surety Building during the night hours averaged almost 4° higher than those on the lower building; the minimum temperatures on the American Surety Building, on the other hand, were slightly lower than those on the Schemerhorn Building. It is also to be noticed that the minimum temperatures in the two locations approached equality as the weather became colder. During December the mean results of the minimum temperatures, registered between 8 a. m. and 8 p. m., were identical, and those of the night-time, from 8 p. m. to 8 a. m., differed by only a fraction of a degree.

The monthly mean temperatures of the winter of 1898-1899, for the New York station, are probably a degree and a half too high, as compared with those of 1899-1900 by reason of the influence of artificial heat on the thermometers.

LOSS OF LIFE IN 1899 BY LIGHTNING.

By ALFRED J. HENRY, Professor of Meteorology.

The loss of human life by lightning in the United States during 1899, was greater than for any preceding year for which statistics have been collected.

Five hundred and sixty-two persons were killed outright or suffered injuries which resulted in death, and 820 persons received injuries varying in severity from slight physical shock to painful burns and temporary paralysis of some part of the body.

In the great majority of fatal cases death came quickly; in a few instances only did the patient regain consciousness after being struck. On the other hand, many persons were struck and rendered unconscious for a time, but soon rallied from the shock and regained their usual health. The most common form of disability resulting from lightning stroke appears to be partial paralysis of the arms and legs.

Many apparently remarkable escapes from death were chronicled during the year. In several cases the clothing of

the person struck was set on fire, the body scarred and burned, yet, strange to say, complete recovery followed. This apparent immunity from death on the part of some persons is not easily explained. If we assume that the current is of an oscillatory character, that is to say, made up of a number of rapid discharges and recharges, we might argue, from the analogous case of a wire conductor the interior of which, in the case of very rapid alternations, may be almost free from current, that the injury to the human body would naturally be confined to the surface. Again we might explain the phenomenon by attributing it to the ability of certain individuals to withstand a much greater shock than others. It has been shown that among the lower animals the ability to resist injury varies widely in different members of the same family, and it is quite probable that the same characteristic holds in the case of man. The evidence afforded by cases of accidental contact with wires carrying a very high voltage is inconclusive, since the electrical contact in such cases is quite generally imperfect and rarely the same for any number of occurrences. There is as yet much uncertainty as to the maximum voltage that can be applied to the human body without fatal results.

Some anomalous results as regards the visible effect of lightning on the human body were observed during the year. In some cases of death the person struck showed scarcely any outward marks of the discharge, death apparently resulting from total collapse of the cellular tissues of the body. In other cases the apparent cause of death was manifest in the discoloration and burning of various portions of the body. One of the most singular cases in this respect was that of two brothers who were killed while driving together in a dog cart. They were found shortly after the flash lying side by side on the road, apparently as they had fallen out of the back of the vehicle. *The elder brother had no external sign of injury.* The younger brother presented the following appearance: The epidermis was burned over the chest and abdomen, not continuously, but in a number of circular holes from one-sixteenth to one-quarter of an inch in diameter. The metallic collar stud was fused and the skin beneath was deeply burned. The back from the neck to the buttocks was burned, but less severely than in front. The vest and shirt were charred, but the waistcoat and coat were uninjured. The ground was not disturbed where they fell.

The zone of danger from a stroke of lightning appears to be somewhat larger than is commonly supposed. In the ordinary conception of a lightning flash account is generally taken of a single discharge from cloud to earth or vice versa, with a diameter at the bounding surface between earth and air not exceeding a few inches at most. The circumstances attending fatalities by lightning are often inexplicable, if we confine ourselves to the supposed action or influence of a single bolt. Thus, we have an account of the killing of a span of horses attached to a wagon, and a man in the rear of the wagon, while the driver in front was not seriously injured. Other cases of a somewhat similar nature confirm the belief that not one but a number of discharges may pass from cloud to earth or vice versa within a comparatively small radius, within which, however, there may be small areas of safety. Photographs of the so-called ribbon flashes show that at times the discharge has a breadth of from 30 to 40 feet at the surface of the earth. Within these broad paths there appear to be narrow lanes, which are apparently free from violent electrical disturbances. A person who is fortunate enough to stand in one of these lanes might easily escape serious injury, while others near by would suffer death.

The greatest number of fatalities, 45 per cent, occurred in the open; the next greatest number, 34 per cent, occurred in houses; 11 per cent occurred under trees, and the least of all, 9 per cent, in barns.

The greatest number of fatalities at a single stroke was five. There was a single case of four deaths from a single stroke, two cases of three deaths and quite a number of cases of two deaths per stroke.

At least a dozen persons, mostly women, were killed either in the act of stripping clothes from a wire clothesline or by coming in close proximity thereto during a thunderstorm. The existence of a wire clothesline joining a neighboring tree and the corner of the house is a source of danger. If wire is used at all, it should not, under any circumstances, be stretched within 50 feet of a dwelling house.

Persons in a house during a thunderstorm should avoid chimneys and open windows. The middle of the room is probably the safest part. In the open, persons should never seek the shelter of trees. Wire fences and live stock should be avoided. If on horseback, it would be well to dismount and wait until the storm passes.

The number of deaths by lightning for each month of 1899, in each State and Territory, is shown by the figures of Table 1. The greatest number of fatalities in a single State, 56, occurred in Pennsylvania; the next greatest, 41, in Illinois. The greatest number of injuries in a single State, 124, also occurred in Pennsylvania; the next greatest, 103, in New York. In the last-named State the ratio of killed to injured was 1:4.5. In Illinois, on the other hand, more people were killed than injured, the ratio being 1:0.83. The ratio of killed to injured for the whole country was 1:1.46.

The greatest increase in the number of fatal cases in 1899, as compared with 1898, occurred in Illinois. There were also material increases in Pennsylvania, Ohio, North Carolina, Minnesota, and Michigan. The largest decreases were noted in Texas, New York, and Alabama.

TABLE 1.—Deaths in the United States by lightning in 1899.

States and Territories.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Alabama					1	1		4			1		7
Arizona						1	1		1				4
Arkansas					5	6	1	2					14
California					1	1							2
Colorado					1	5	2	1					9
Connecticut			1										1
Delaware						2							2
Florida					1	1			1				3
Georgia					3	3	4	2					12
Idaho													1
Illinois				1	18	6	4	9	3				41
Indiana					3	9	10	1	4	1			31
Indian Territory					1	2							3
Iowa						8	3	6	2		1		18
Kansas						2		3	2				7
Kentucky			2		2	3	1	5	1				15
Louisiana			1	1		1	1	4					8
Maine							5						5
Maryland			1			3	1	2	7				14
Massachusetts			1	1	1	6	2	1					11
Michigan				3		6	9	1	2				21
Minnesota					1	4	6	10	3				24
Mississippi						3							4
Missouri						5	4	2	3	2			16
Montana						2	4	2	1				9
Nebraska					5	4	7			1			17
New Hampshire													1
New Jersey							2	2	1				5
New Mexico							3	1					4
New York				1		5	8	1	2				23
North Carolina			3			6	5	1	4				19
North Dakota						2	2	2	1				7
Ohio					7	9	6	9	3				34
Oklahoma						3		2	2	1			10
Pennsylvania					17	13	9	13	4				56
South Carolina			1			3		7	1				12
South Dakota						1	3	9					13
Tennessee			1			2	4	4	5	1			17
Texas			3		1	3	1	4	3	2		2	19
Vermont						1	2	1					4
Virginia							3			1			11
West Virginia						2	5	2	2	1			14
Wisconsin				1	4	4	1	7	1				18
Wyoming													2
Cuba						1							1
Total	3	1	10	11	108	128	120	133	43	2	4		563

No definite conclusions can be reached as to the cause of the increase in one region as compared with another. The

number of thunderstorm days in Nebraska, Iowa, Minnesota, Wisconsin, and Michigan, in 1899 was considerably greater than in the preceding year, and there was also an increase in the number of deaths by lightning. In Pennsylvania, however, where the increase in deaths in 1899 over 1898 was about 140 per cent, there was a less number of thunderstorm days in 1899 than in 1898. In 1898 the number of fatalities in New York State was 36; thunderstorm days, 135. In 1899 the fatalities were 23; thunderstorm days, 121. The fatalities for Pennsylvania in 1898 were 23; thunderstorm days, 142. The fatalities in 1899 were 56; thunderstorm days, 129. It would seem, therefore, that the number of fatalities by lightning in any region is not a direct function of the number of thunderstorm days.

In both Pennsylvania and Illinois, where the increase in deaths in 1899, as compared with 1898, was most pronounced, there was an exceptionally large number of fatal cases in May, as may be seen by Table 1. In Illinois there was a large number of severe storms during that month; in Pennsylvania there were two severe storms in the western part of the State, but the month as a whole was not unusually productive of thunderstorms.

TABLE 2.—Number of persons in the United States injured by lightning in 1899.

States and Territories.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Alabama				1			2	2					5
Arkansas					2	4							6
California													1
Colorado							1			1			2
Connecticut				2			7						9
Dist. of Columbia													2
Florida						3	4						7
Georgia					2	1	4		1				7
Illinois					2	1	1	12					16
Indiana						17	15	12	2				46
Iowa						10	10	10	9				39
Kansas						1	3						4
Kentucky						1	3						4
Louisiana						1	1						2
Maine													0
Maryland						11	4	1					16
Massachusetts						14	17	4	4	2			28
Michigan						6	17	5	4	2			34
Minnesota						4	4	4	4	1			17
Mississippi													0
Missouri						3	9	3					15
Montana						2	2	2	2				8
Nebraska						2	3	3	3				11
New Hampshire						1	3	3	1				8
New Jersey						1	5	6	1				13
New York						23	24	15	1				44
North Carolina						4	4	4	3				15
North Dakota						1	1	1	4				7
Ohio						8	1	23	21	18			63
Oklahoma													0
Pennsylvania						1	9	20	30	23	8		124
Rhode Island													0
South Carolina													0
South Dakota													0
Tennessee						3	5	2					10
Texas								12	4	1			17
Utah													0
Vermont													0
Virginia							1	3		2			6
West Virginia							2	5	1	3			11
Wisconsin							2	3	4				9
Wyoming													0
Total	2	7	34	19	91	222	247	157	35	6			820

Injured.—In houses, 453; in the open, 161; in barns, 82; under trees, 45.

HURRICANES OF 1895 AND 1896 IN THE PHILIPPINE ARCHIPELAGO.

By F. O. STETSON.

The Manila Observatory has published a volume of 112 folio pages (Tifones del Archipiélago Filipino y Mares Circunvecinos, 1895 y 1896. Estudio de los Mismos por el P. Juan Doyle, S. J., Sub-Director Del Observatorio, Manila, 1899) containing a careful account of the cyclones of the Philippines and adjacent waters during 1895 and 1896. While there is no attempt