stations being directly on the coast. The record includes pressure, temperature (dry bulb and difference between dry and wet-bulb readings), relative humidity, vapor tension, cloudiness (kind and amount), general state of the weather, wind (direction and velocity on Beaufort scale), and remarks. The monthly means are also given. At the rainfall stations the daily observations are limited to wind direction and velocity, amount of cloud, general state of the weather, and precipitation. The Boletim also includes the results of magnetic observations made at the central station in Rio de Janeiro, and a map showing the magnetic variation for 1904 in different parts of Brazil, as determined by the first Brazilian magnetic survey.

The Boletim Semestral, of which sixteen numbers have been issued, was first published in 1898, and has grown from a small pamphlet to an octavo volume of somewhat over 1,000 pages. The last issue is No. 16, October, 1904, to March, 1905, dated Rio de Janeiro, 1907. This contains in full, the results of the observations at the several stations above referred to. The service is apparently growing in a healthy way. An inspection of the various stations, of which the details are given in the last Boletim Semestral, showed on the whole a satisfactory condition. It is hoped soon to be able to equip the coast steamers of the Brazilian Lloyd with meteorological instruments. One great difficulty now encountered is the delay of all publications which are printed at the Government Printing Office, and it is the intention of the Navy Department to establish, at the earliest possible moment, a printing plant of its own. The observations at the central station (Morro do Santo Antonio) in Rio de Janeiro are given hourly, the values for the night hours being taken from self-recording instruments, and include pressure, temperature, relative humidity, vapor tension, kind and amount of cloud (6 a. m.–11 p. m.), general weather conditions, character of precipitation (if any), optical and other phenomena, direction and velocity of the wind (Beaufort scale), frequency of different wind directions and velocities by hours, and a summary for each day, giving maximum and minimum temperatures, evaporation, and amount of rainfall. Monthly, six-months, and annual means are also given. For the second-order stations the observations are given in full for 9 a. m., noon, and 9 p. m., and are summarized for each month, for six months, and for the year. In the last number of the Boletim Semestral the number of stations given,[3] excluding Rio de Janeiro, is 8 second-order (three observations a day), 3 third-order stations (noon observation only), and 7 rainfall stations. The magnetic observations made at the central station are also included.

[*To be continued.*]

FURTHER OBSERVATIONS OF HALOS AND CORONAS.[1]

By M. E. T. GHEURY. Dated Eltham, England, July 10, 1908.

On examining the results of the complete year of observations of halos, etc., I was struck by the fact that it shows that, while the failures are evenly distributed for all the phenomena except the solar halos, the latter exhibit very few failures and and seem a very good guide. Other particularities develop on examination. I therefore submit the observations for the last part of the year 1907 to complete the work already published in the MONTHLY WEATHER REVIEW.[1] I do not think the further publication of other years' observations would be of much avail altho one year's complete record of halos, coronas, and rainfalls in England may prove interesting.

[3] At the end of 1904.

[1] Previous papers in this series appeared in the Monthly Weather Review, May, 1907, XXXV, p. 213; and December, 1907, XXXV, p. 579. The table accompanying closely follows in arrangement, abbreviations, etc., the tables of the previous papers.

TABLE 1.—*Observations of halos, coronas, etc., at Eltham, England, July–December, 1907.*

No.	Date and time of day, 1907.	Nature of phenomenon.	Previous minimum.	Previous maximum.	Mean barometer for preceding 24 hours.	Following minimum.	Following maximum.	Mean barometer for following 24 hours.	Weather at time of observation.	Weather during following 24 hours.	Description of phenomenon and general remarks.
1	2	3	4	5	6	7	8	9	10	11	12
			° C	° C	Inches.	° C	° C	Inches.			
53	July 1, 7:30 p. m.	Annulus, S.	9.2	15.7	29.69, rising from 29.64 to 29.74.	12.1	17.2	29.74, steady	Fine, cloudy, light wind.	Cloudy, rain	With undefined edge, extending to 1 d.
54	July 2, 8 p. m.	Annulus, S.	12.1	17.2	29.74, steady	8.2	17.5	29.60, falling from 29.73 to 29.45.	Fine, cloudy, windy.	Wet all day.	With undefined edge, extending to 1 d.
55	July 13, 10:30 a. m.	Corona, S.	10.3	20.2	30.08, falling from 30.15 to 30.04.	15.9	23.5	30.04, steady	Fine, cirro-cumuli veil.	Overcast, rain	Seen with biconvex lens; reddish, from 3 to 4 d.
56	July 13, 10:45 a. m.	Halo, S.	10.3	20.2	30.08, falling from 30.15 to 30.04.	15.9	23.5	30.04, steady	Fine, overcast	Overcast, rain	Halo of 22°, reddish.
57	July 20, 7 p. m.	Annulus, S.	13.5	20.2	29.94, variable	13.6	21.9	29.91, falling from 29.94 to 29.83.	Fine, cloudy, still	Overcast, hazy, very gloomy, distant thunder.	With undefined edge, extending to ¾ d.
58	July 21, 6 p. m.	Annulus, S.	13.6	21.9	29.91, falling from 29.94 to 29.83.	15.2	21.0	29.78, falling from 29.83 to 29.72.	Overcast, very gloomy.	Pouring rain	With undefined edge, extending to 1 d.
59	July 25, 2 p. m.	Corona, S.	9.9						Fine, cloudy, still	Rapidly overcast, pouring rain.	Seen with biconvex lens; reddish, from 4 to 5 d.
60	July 26, 10 a. m.	Corona, S.							Fine, cloudy, light wind.	Overcast, rising wind, showery.	Seen with biconvex lens; reddish, from 2½ to 3½ d.
61	July 27, 3:30 p. m.	Corona, S.							Fine, cloudy, light wind.	Cloudy, windy, overcast, rain.	Seen with biconvex lens; orange and red, from 2 to 3 d.
62	July 29, 3 p. m.	Halo, S.							Fine, windy, cirri veil.	Overcast, strong wind.	Halo of 22°, inner edge orange, outer edge bluish; lasted 2 hours.
63	July 31, 7 p. m.	Annulus, S.							Fine, cloudy, light wind.	Fine, very pure; cloudy, overcast, strong wind.	With undefined edge, intermittent, variable, extending to a distance from the limb varying from ½ to 1½ d.
64	Aug. 1, 10:30 a. m.	Halo, S.							Fine, cloudy, light wind.	Cloudy, overcast, strong wind.	Halo of 22°, inner edge reddish, outer edge bluish.
65	Aug. 2, 3 p. m.	Corona, S.							Fine, sun behind a very bright veil of pink cumuli, light wind.	Overcast, rain, and strong wind.	Seen with biconvex lens; reddish, from 1½ to 2½ d.
66	Aug. 4, 12:30 p. m.	Halo, S							Veiled sky, strong wind.	Overcast, strong wind, some rain.	Halo of 22°, pale orange.
67	Aug. 4, 5 p. m.	Rainbow, S.									Single, faint.
68	Aug. 16, 10 a. m.	Halo, S.							Fine, cirri veil	Overcast, rain, gale.	Halo of 22°, inner edge orange, outer edge bluish.
69	Aug. 18, 8 p. m.	Corona, M.							Fine, cloudy, light wind.	Strong wind, heavy squall of rain.	Reddish, from 2 to 3 d.
70	Aug. 18, 10 p. m.	Annulus, M.							Fine, light wind, sky apparently very pure.	Strong wind, heavy squall of rain.	With well-defined edge, from limb to 5′ distance round the gibbous moon, following exactly the shape of the illuminated portion; greenish, with a very narrow reddish edge 1′ in width; outside, a pale orange annulus with undefined edge, extending to ¾ d.

TABLE 1.—*Observations of halos, coronas, etc., at Eltham, England, July-December, 1907*—Continued.

No.	Date and time of day, 1907.	Nature of phenomenon.	Previous minimum.	Previous maximum.	Mean barometer for preceding 24 hours.	Following minimum.	Following maximum.	Mean barometer for following 24 hours.	Weather at time of observation.	Weather during following 24 hours.	Description of phenomenon and general remarks.
1	2	3	4 °C	5 °C	6 Inches.	7 °C	8 °C	9 Inches.	10	11	12
71	Aug. 25, 10:30 p. m.	Annulus, M.	.....	.....	.....	.....	.....	.....	Very fine, sky with a very light veil.	Overcast; fine and cloudy, light wind.	With undefined edge; very wide, extending to 2¼ d. Outer part (width ½ d.) reddish. Seems a small corona the inside of which would be bright up to the moon's limb. Outside, a very pale and indistinct ring, touching it and extending to 5 d.
72	Aug. 26, 4 p. m.	Corona, S...	.....	.....	.....	.....	.....	.....	Fine and cloudy, light wind.	Overcast; fine and still.	From 2 to 3 d., reddish edge, inside very bright.
73	Aug. 27, 6:30 p. m.	Annulus, S..	.....	.....	.....	.....	.....	.....	Cloudy, fine, still...	Cloudy, fine, still...	With undefined edge, extending to 1 d.
74	Aug. 30, 5 p. m.	Halo, S.....	.....	.....	.....	.....	.....	.....	Cloudy, fine, still...	Overcast, fine, light wind.	Halo of 22°, inner edge reddish, outer edge bluish; lasted 1 hour.
75	Aug. 30, 6:15 p. m.	Corona, S..	.....	.....	.....	.....	.....	.....	Cloudy, fine, still...	Overcast, fine, light wind.	With undefined edge, extending to 1 d.
76	Aug. 31, 4 p. m.	Halo, S.. ...	.....	.....	.....	.....	.....	.....	Cloudy, fine, light wind.	Strong wind, cloudy, fine (storm, pouring rain).	Halo of 22°, inner part yellow, outer edge bluish.
77	Sept. 1, 12:30 p. m.	Halo, S.. ...	.....	.....	.....	.....	.....	.....	Strong wind, fine, cloudy.	Overcast, strong wind, rain (storm, pouring rain).	Halo of 22°, inner part yellow, outer edge bluish; lasted 2 hours.
78	Sept. 8, 5:45 p. m.	Annulus, S..	13.6	21.9	30.17, rising from 30.07 to 30.23.	12.1	19.8	30.23, variable....	Fine and warm, cloudy, light wind.	Overcast, fine and warm.	With undefined edge, extending to 1 d., orange.
79	Sept. 15, 6 p. m.	Annulus, S..	8.4	17.4	30.10, rising from 29.98 to 30.18.	8.6	20.9	30.18, variable....	Fine, cloudy, still...	Overcast, light wind.	With undefined edge, extending to 1 d., red. (Sun very low.)
80	Sept. 25, 10 a. m.	Halo, S.....	10.7	19.9	29.70, falling from 29.82 to 29.58.	16.0	24.9	29.55, falling from 29.58 to 29.53.	Fine, very hot, still.	Cloudy, rising wind, overcast, rain.	Halo of 22°, faint, milky (after three weeks of settled, splendid weather without any halos, coronas, or annuli).
81	Sept. 25, 10 p. m.	Annulus, M.	10.7	24.9	29.60, falling from 29.70 to 29.56.	16.0	22.0	29.53, falling from 29.57 to 29.51.	Cloudy, light wind..	Overcast, rain.....	With undefined edge, extending to ⅛ d.
82	Sept. 27, 1 p. m.	Halo, S.....	14.6	22.0	29.51, steady.....	14.3	22.1	29.60, rising from 29.52 to 29.64.	Cloudy, rising wind.	Cloudy, strong wind.	Halo of 22°, milky.
83	Oct. 11, 6 p. m.	Annulus, M.	11.3	16.7	29.67, variable....	10.0	16.9	29.82, variable....	Cloudy, a little wind.	Overcast, strong wind, pouring rain.	Oval shaped around the crescent; with undefined edge, over all dimensions 1½ and 1 d.
84	Oct. 15, 10 p. m.	Corona, M...	9.6	13.2	29.11, rising from 29.04 to 29.25.	6.0	11.5	29.10, falling from 29.25 to 28.94.	Cloudy, a little wind.	Overcast, pouring rain.	From 3 to 4½ d., reddish.
85	Oct. 16, 10 a. m.	Annulus, S..	6.0	13.2	29.17, variable....	10.1	11.5	28.99, variable....	Overcast, sun showing faintly.	Overcast, pouring rain.	With undefined edge, extending to ¼ d.
86	Oct. 17, 10 p. m.	Corona, M...	10.1	12.0	28.97, rising from 28.94 to 29.00.	7.7	13.3	29.10, variable....	Cloudy, still.....	Overcast, strong wind, rain.	From 3½ to 5 d., reddish.
87	Oct. 18, 10 p. m.	Corona, M...	7.7	13.3	29.10, variable....	11.3	16.3	29.39, rising from 29.18 to 29.55.	Cloudy, gale.....	Overcast, gale, pouring rain.	Reddish, of variable diameter.
88	Oct. 20, 8:30 p. m.	Double corona, M.	11.1	15.8	29.50, variable....	10.7	16.9	29.69, rising from 29.63 to 29.74.	Cloudy, warm, fine, fresh wind.	Fine, cloudy, still...	Double; (outer only partial) inner very wide, from 1¼ to 4 d., yellow and reddish then a yellowish green band 1 d. wide, then outer, on arc of about 120°, reddish, 1 d. wide.
89	Oct. 21, 10 p. m.	Corona and annulus, M.	10.7	16.9	29.70, rising from 29.65 to 29.74.	9.9	14.8	29.77, steady.....	Fine, still, cloudy...	Fine, cloudy, strong wind.	(1) Annulus with undefined edge to 1 d., then, on a background of fine, cirro-cumuli, a faint, rosy corona. (2) Annulus reduced to ¼ d. (3) Thicker cirro-cumuli, annulus gone, reddish corona 3 to 4 d. (4) No cirro-cumuli, corona gone, annulus ¼ d. (5) Annulus 1 d. again.
90	Oct. 22, 10 p. m.	Corona, M...	9.9	14.8	29.77, steady.....	8.3	12.1	29.73, falling from 29.78 to 29.70.	Fine, cloudy, light wind.	Overcast, rain.....	Reddish, from 2 to 3 d.
91	Nov. 12, 3 p. m.	Annulus, S..	2.3	9.7	29.65, variable....	5.9	11.1	29.59, variable....	Fine, hazy, cloudy..	Hazy, cloudy, strong wind.	With undefined edge, orange with outer rosy edge, extending to 1 d.
92	Nov. 12, 10 p. m.	Annulus, M.	2.3	9.7	29.63, variable....	5.9	11.1	29.64, variable....	Hazy, cloudy, strong wind.	Fine, sunny, gale...	With undefined edge, extending to 1 d.
93	Nov. 13, 10 p. m.	Annulus, M.	5.9	11.1	29.64, variable....	4.7	12.1	29.91, variable....	Cloudy, strong wind.	Overcast, gloomy, a little rainy.	With red, undefined edge, extending to 1 d.
94	Nov. 16, 3 p. m.	Annulus, S..	1.8	6.7	30.06, steady	4.1	11.8	29.99, falling from 30.03 to 29.94.	Fine, cloudy, light wind.	Cloudy, hazy, light wind, overcast, rain.	With undefined edge, orange, extending to 1 d.
95	Nov. 16, 5 p. m.	Annulus, M.	1.8	6.7	30.06, steady.....	4.1	11.8	29.98, falling from 30.02 to 29.93.	Fine, cloudy, hazy, still.	Cloudy, hazy, light wind, overcast, rain.	With defined edge, extending to ¼ d. from the limb, which it followed closely in outline (gibbous moon), greenish orange; lasted 1 hour.
96	Nov. 18, 10 p. m.	Annulus, corona, and halo, M.	*	11.7	30.03, rising from 29.94 to 30.11.	7.3	10.4	30.06, falling from 30.11 to 30.00.	Fine, cloudy, still...	Fine, very hazy, light wind.	(1) Corona, 3 to 4½ d., reddish, with annulus, undefined edge, ¼ d. (2) Annulus alone ½ d. (3) Halo of 22°, milky, and annulus, ½ d. (4) Besides these, a corona 4 to 5 d. (Annulus of two parts, inner with well defined edge, greenish, outer edge (½ d.) pink.)
97	Nov. 19, 6 p. m.	Annulus, M.	7.4	10.4	30.07, variable....	4.1	9.3	30.01, variable....	Fine, very hazy, light wind.	Fine, very hazy, light wind.	With undefined edge, extending to 1 d.
98	Nov. 19, 10 p. m.	Corona, M...	7.3	10.4	30.06, falling from 30.11 to 30.00.	4.1	9.3	30.02, variable....	Fine, very hazy, light wind.	Fine, very hazy, light wind.	Reddish, from 4 to 5 d.
99	Nov. 21, 10 p. m.	Annulus, M.	5.0	7.5	30.09, variable.	0.9	7.1	29.92, falling from 30.10 to 29.72.	Thick fog.....	Overcast, gloomy, little wind.	Very bright, greenish yellow until ¾ d. from limb, then a strongly red ring, width 1 d., undefined edge.
100	Dec. 13, 10 p. m.	Corona, M...	2.9	9.7	29.08, variable....	4.1	6.6	28.78, variable...	Gale; just left off raining.	Gale, pouring rain..	Reddish, from 3 to 4 d.
101	Dec. 15, 6 p. m.	Annulus, M.	1.6	4.2	29.43, rising from 28.90 to 29.32.	−0.5	6.9	29.95, rising from 29.82 to 30.03.	Misty, still, frosty..	Thick fog, heavy frost, fine.	With undefined edge, extending to ½ d., following the contour of the gibbous moon.
102	Dec. 16, 6 p. m.	Annulus, M.	−0.5	6.9	29.96, rising from 29.84 to 30.04.	2.9	6.4	30.07, variable....	Cloudy, still.....	Overcast, still.....	With undefined edge, extending to ½ d., in middle of large nebulous patch.
103	Dec. 17, 8 p. m.	Annulus, M.	2.9	6.4	30.07, variable....	2.2	†	29.93, falling from 30.04 to 29.83.	Fine, still.....	Overcast, rain.....	With sharp edge, extending to ½ d., then a ring extending to 3 d. from limb, with undefined edge; lasted several hours.
104	Dec. 20, 10 p m.	Double corona, M.	11.5	12.8	29.69, falling from 29.76 to 29.60.	10.0	11.3	29.60, variable....	Cloudy, strong wind.	Overcast, strong wind, some rain.	Inner very red, 2 d. to 3½ d., outer faint, 5 to 5½ d.

* Gradual increase since November 17. † Gradual increase since December 17.

DEDUCTIONS.

The following deductions are made from the record for the second half of 1907:

Annuli.—Twenty-five observed.

Sun, 11. Five followed by rain, two by wind, one by thunder-storm, three by fine weather.

Moon, 14. Four followed by rain, two by wind, two by wind and rain, one by fog, five by fine weather.

Coronas.—Eighteen observed.

Sun, 7. Four followed by rain, one by wind and rain, two by fine weather.

Moon, 11. Two followed by rain, one by wind, five by wind and rain, three by fine weather.

Halos.—Eleven observed.

Sun, 10. Two followed by rain, four by wind, three by wind and rain, one by fine weather.

Moon, 1. Followed by fine weather.

GENERAL REMARKS.

Altogether, out of fifty-one distinct individual displays, there were—

Followed by rain, 17.
Followed by wind alone, 8.
Followed by wind and rain, 11.
Followed by fog, 1.
Followed by thunder-storm, 1.
Followed by relatively fine weather, 13.

The failures are in greater number than in the previous half year. They are: 3 annuli of the sun, 4 annuli of the moon, 1 combined annulus, corona, and halo of the moon, 2 coronas of the sun, 2 coronas of the moon, 1 halo of the sun.

REMARKS ON THE YEAR.

Observations for the whole of the year 1907 are now available.

TABLE 2.—*Summary of displays and unverified predictions in 1907.*

Quarter.	No. of distinct displays.	No. of failures.	Failures.
			Per cent.
First	19	2	10.5
Second	31	2	6.5
Third	29	7	24.0
Fourth	22	6	27.0
Total	101	17	17.0

If all the phenomena that took place had been observed it would be of some interest to compare the warmer half (2d and 3d quarters) with the colder half (1st and 4th quarters) of the year. However, as it is probable that a large number of displays have escaped attention and such a comparison would be of doubtful utility, we may remark that 60 per cent of the displays occurred in summer (2d and 3d quarters) against 40 per cent in winter (1st and 4th quarters). One fact is evident

TABLE 3.—*Summary of displays and the subsequent weather, Eltham, England, 1907.*

Nature of phenomenon.	Total number of distinct displays.	Number of displays followed in 24 hours by—					Failures.
		Rain, hail, or snow.	Wind or storm without rain, hail, or snow.	Wind and rain, hail, or snow.	Fog.	Fine weather.	
							Per cent.
Annuli, S.	18	7	3	4	.....	4	22
Annuli, M.	21	6	4	6	1	4	19
Coronas, S.	9	5	.....	2	.....	2	22
Coronas, M.	19	3	1	10	1	4	21
Halos, S.	29	7	7	10	3	2	7
Halos, M.	4	2	.....	.....	1	1	25
Total	100	30	15	32	6	17	17

from the series of observations obtained in the year, and this is that these displays afford a valuable help in the shaping of local short-range forecasts. In Table 3 the observations of the whole year are classified in a more convenient manner in order to ascertain the respective utility of each kind of phenomenon. (The pillar No. 3 is not included.)

In the case of a combined display, such as displays Nos. 8[2], 13[2], 37[3], 52[3], 89[4], and 96[4], the most conspicuous phenomenon is chosen as the name of the display, a halo if there is one, or a corona if the halo is absent, the annulus being the least conspicuous of the three.

This Table 3 is exceedingly interesting. It shows first that the failures are equally distributed amongst the various kinds of optical displays, with only one exception, the solar halos, which seem to be an excellent guide for the forecast of approaching meteorological disturbances.

The nature of the disturbance to be expected is next to be considered It is apparent that 68 per cent are of the nature of condensation, or precipitation of water vapor in its various shapes, vesicles, drops, or crystals; 15 per cent are violent movements of the atmosphere, those cases recorded as followed by wind include only the times where the wind attained a velocity greater than those of the first third of Beaufort's scale. The remaining 17 per cent are failures, altho, in several cases, characterized by a very gloomy appearance of the weather, with probable local precipitations elsewhere, or excessive condensation as white mist. This latter phenomenon is a by no means uncommon beginning to a fine, warm, sunny day.

The observations concerning temperature and atmospheric pressure do not show any systematic connection with the observed phenomena.

Minima.—Out of 65 double temperature minima observed, the following minimum is higher in 33 cases (51 per cent).

Maxima.—Out of 58 double temperature maxima observed, the following maximum is higher in 37 cases (54 per cent).

Barometer.—Out of 73 double values of mean atmospheric pressure, the following mean pressure is lower in 40 cases (55 per cent).

At most there is an indication of a rise in the temperature and of a lowering of pressure in a majority of cases. These observations should be discontinued, and, where possible, continuous psychrometric observations made instead, for such observations have a much closer connection with the condensation of the atmospheric vapor, which seems the principal feature of the prevailing meteorological conditions immediately succeeding an optical display of either phenomenon.

REMARKS AS TO THE NATURE AND FORMATION OF THE PHENOMENA.

Some observations made in the second half of the year have led me to modify my opinion as to the annuli being closely allied to halos and due to the same cause. While they sometimes appear simultaneously with halos, when possibly both kind of strata, that producing halos and that producing coronas, are present, they more often occur together with coronas, in a way and under circumstances that could hardly obtain if they were but modified forms of coronas themselves. (See above, observations 71, 89, and 96).

The appearance of coloration in several of the best-marked and more interesting annuli supports this conclusion, as the colors noted (observations 5, 27, 30, 38, 70, 71, 93, 95, 96, and 104) are in agreement to show that the less refrangible end of the spectrum appears on the outside edge, as in the coronas, while this is the reverse for the halos, pointing to diffraction fringes as being the cause of the annuli.

In such diffraction effects, the diameter of the luminous ring produced is inversely proportional to the diameter of the vapor vesicles; it follows that the coarsest globules of vapor must produce the annuli. As the finest displays have,

[2] See Monthly Weather Review, May, 1907, XXXV, table on p. 215.
[3] See Monthly Weather Review, December, 1907, XXXV, table on p. 580.
[4] See Table 1 above.

however, occurred with a sky apparently pure, or with a very light veil, these globules can not be densely packed, as otherwise they would form a visible mist. This thin distribution explains how, in some cases, the light suffers so little absorption that brilliant rings could be seen around the moon *before sunset* (observation 38). On the other hand, the best displays have been observed to be characterized by a fairly sharp edge to the main ring at least (observations 5, 30, 38, 70, 95), with the exception of the annulus of 99, and diffraction patterns are known to be sharpest when the screening particles are of very uniform size. This condition seems to be difficult of realization in agglomerations of large vesicles of water vapor, while quite possible with very small vesicles. Such homogeneity of size would, moreover, produce several colored rings, while only one could be seen generally. In some cases, two or three rings were observed, but they usually did not extend farther than $1\frac{1}{2}$ to $1\frac{3}{4}$ diameters from the limb of the moon (observations 5, 31, 38, 70, 99, 103). The majority of the annuli observed extended only to about $\frac{1}{2}°$ from the limb, while the coronas are situated at a minimum distance from the limb of $1\frac{1}{2}°$ to 2°. A very few intermediate sizes were observed (observations 71, 103).

THE DUTY OF THE GOVERNMENT TO PROTECT THE PEOPLE FROM SWINDLERS.

Under existing laws of the United States it is not allowable to use the United States mails to promote lotteries or any form of swindling. The public authorities do not wait for the victim to bring suit but do so themselves promptly in the name of the people.

It is the duty of the Editor to call attention to the fact that the folly of any human attempt to make rain or to alter the weather in any way, has been so abundantly demonstrated in this country, in Europe, in Australia, in New Zealand, and elsewhere, that it is high time our law givers made it a penal offense to promise to do this or to secure money under such false pretenses as these promises are.

It is not enough to say that the "operator" makes no promise, that he only experiments and performs and leaves it to the public to draw its own conclusion. The good natured public is willing to give the fakir a dollar and stand by looking on with idle curiosity. The local authorities want a crowd at the county fair and the rain-maker draws, just as did Barnum's wooly horse seventy years ago. Well, put him in a cage and let him draw, but stop this praying and sacrificing, dynamiting, and steaming. Let the deluded ones go elsewhere to spend their money.—*C. A.*

THE OBSERVATORY ON MOUNT ETNA.

Under the above title in the MONTHLY WEATHER REVIEW for April, 1908, p. 102, we erroneously referred to Prof. G. B. Rizzo, as director of the observatory near the summit of Mount Etna, whereas it is really Prof. Annible Riccò who is director of the summit observatory and is also director of the astronomical observatory at Catania, the official name of which is Regio observatorio astronomico ed Etneo.

On the other hand Professor Rizzo, who is director of the observatory of Messina and of the Institute for Terrestrial Physics and Meteorology of the Royal University, at Messina, writes that in studying solar radiation he includes observations with the Ångström electric compensating pyrheliometer both at the Rocciamellone and at the summit also, by the kind cooperation of the director Professor Riccò.—*C. A.*

THE HEAVIEST RAINFALL IN ONE HOUR.

By Prof. A. G. MCADIE. Dated San Francisco, Cal., July 8, 1908.

In connection with the note on a cloudburst near Shasta, Cal., in the MONTHLY WEATHER REVIEW for April, 1908, p. 97, and the article on cloudbursts, by Mr. Edward L. Wells, Section Director, Boise, Idaho, in the Year Book for 1906, p. 325, it seems proper to call attention to a well authenticated case of a cloudburst which appears to have been overlookt. At Campo, Cal., August 12, 1891, a rainfall of 292 millimeters in one hour occurred, or at the rate of 4.87 millimeters per minute. This is probably the heaviest rainfall [in one hour] on record. At least it heads the column of heaviest rainfall given by Hann in his Lehrbuch der Meteorologie, 2d edition, p. 272.

The details of this cloudburst, and the rainfall measurements, by Mr. Archibald Campbell, of Campo, were sent to the Central Office in a communication previous to the 18th of April, 1906. Unfortunately all of our records have been destroyed. The rate of precipitation is more than twice that given by Mr. Wells, in the Year Book for 1906, in the article on cloudbursts, as occurring at St. Louis, on August 15, 1848. At Campo 11.50 inches (292.1 millimeters) fell in twenty-four hours. This is both the greatest rainfall in twenty-four hours and in one hour.

From the MONTHLY WEATHER REVIEW for August, 1891, we find that this was the heaviest monthly, daily, and hourly rainfall reported during the month of August up to 1891.

Original notes made by S. E. Gaskill, cooperative observer at Campo, Cal., regarding the cloudburst of August 12, 1891.

On the 12th of August had a cloudburst. One heavy thunder-cloud came up and it rained about thirty minutes very hard, raising the water in the streams flood high by the gage. I could not tell [how much water had fallen because] it was running over, emptied it and then another cloud came up and the one that had past over drew back and the two came together and it poured down whole water nearly. I went to the gage again in thirty minutes and it was running over and the reservoir was nearly half full, I emptied it out of the gage and did not stop to measure the reservoir; after the shower was over I went out to measure the water and the gage was gone, carried off by the flood. It was exciting times with us about that time.

The Weather Bureau is not aware of any rainfall in the United States, which has exceeded the above record for one hour at Campo, Cal.—*C. A., jr.*

STUDIES IN THE FORMATION OF FROST.

By DEWEY A. SEELEY, Observer. Dated Peoria, Ill., May 8, 1908.

For some years past the writer has taken an active interest in temperature variations near the surface of the soil, and in the moisture and temperature conditions which accompany the formation of frost. Over two years ago, January 22, 1906, I enumerated a number of problems which I intended to work upon. They were as follows:

(1) What becomes of the heat of condensation during the formation of dew and frost?

(2) Are fluctuations in temperature at night due to ascending and descending currents of air?

(3) How does the color of the soil affect the amount of frost formed?

(4) What effect does a covering of vegetation over the ground have upon its temperature and the amount of frost deposited?

(5) What are the sources of that moisture which forms as dew and frost, and how much does each contribute?

(6) What is the effect of smudging, flooding, cultivating, etc., upon the formation of frost?

(7) How far does the temperature fall on clear, still nights below the dew-point as determined in the late afternoon or early evening?

I have been at work upon suitable experiments and observations during the past two years, but failed to secure many definite results on account of the complexity of the problems and the impossibility of eliminating nonrelated causes and effects. However, I desire to report what little I have accomplished.