TABLE 1.—*Monthly rainfall, in inches, at Tacoma, Wash.*

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Ann'l.
1897...	......	......	......	.....	1.46	1.54	0.87	0.58	1.41	1.63	12.31	14.48	......
1898...	3.01	8.68	0.97	2.26	1.12	2.41	0.26	0.38	4.24	1.60	5.92	4.73	35.58
1899...	9.17	4.50	3.82	4.58	2.75	1.27	0.21	2.26	1.93	3.23	10.11	7.05	50.88
1900...	4.97	4.66	5.51	1.77	4.62	3.22	0.33	0.84	1.57	6.13	5.23	7.97	46.82
1901...	6.48	6.56	2.97	5.93	2.26	1.46	0.50	0.32	2.42	2.60	9.62	4.63	45.75
1902...	6.21	7.78	5.00	2.96	1.83	1.87	1.91	0.20	2.75	2.88	10.84	10.44	54.67
1903...	8.23	1.35	5.83	3.05	1.69	2.59	0.80	0.75	3.59	2.72	10.00	4.51	45.11
1904...	6.39	7.57	6.08	3.84	1.04	1.36	0.94	0.07	0.40	1.27	11.88	5.07	45.91
1905...	4.93	2.51	3.78	0.71	4.15	3.23	0.34	0.39	2.79	5.50	3.08	5.19	36.60
1906...	5.83	3.95	1.26	1.09	2.90	2.75	0.21	0.08	4.11	5.46	7.74	6.72	42.10
1907...	3.92	......	......	......	......	......	......	......	......	......	......	......	......
Av'ge.	5.91	**5.28**	**3.91**	**2.91**	2.38	2.17	0.64	0.59	2.52	3.30	8.67	7.08	*45.36

Averages in black figures are from 9 years record. *Sum of monthly averages.

TABLE 2. – *Mean temperature, in degrees F., at Tacoma, Wash.*

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Ann'l.
1897...	......	......	......	......	57.2	59.0	61.4	66.2	56.0	50.0	42.9	41.7	......
1898...	38.4	44.8	42.0	49.2	55.4	60.3	63.8	65.6	59.6	50.6	43.4	38.5	51.0
1899...	40.4	38.0	42.5	47.2	50.6	56.9	64.0	59.6	60.0	50.7	50.9	42.7	50.3
1900...	42.2	41.7	49.0	50.4	55.2	61.4	64.0	61.2	57.2	50.0	42.6	44.2	51.6
1901...	39.3	41.6	44.6	46.4	53.4	56.1	60.8	64.2	56.0	56.0	47.6	40.8	50.6
1902...	38.4	45.2	43.8	48.2	55.5	59.1	62.3	62.9	57.0	53.0	44.4	40.6	50.9
1903...	41.5	38.7	41.6	46.4	53.3	60.8	60.8	62.3	56.7	52.2	45.3	41.0	50.0
1904...	41.0	38.1	41.6	51.3	53.6	58.0	63.2	62.9	60.2	53.6	48.7	42.7	51.2
1905...	39.3	42.2	48.6	51.3	54.1	59.0	64.8	62.6	59.4	47.4	43.8	40.7	51.1
1906...	41.4	42.7	44.2	52.0	54.2	57.8	68.0	64.1	58.6	53.0	44.2	41.8	51.8
1907...	33.6	......	......	......	......	......	......	......	......	......	......	......	......
Av'ge.	39.6	**41.4**	**44.2**	**49.2**	54.2	58.8	63.3	63.2	58.1	51.6	45.4	41.5	**50.9**

Averages in black figures are from 9 years record.

TABLE 3.—*Average cloudiness, percentage, at Tacoma, Wash.*

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Ann'l.
1897...	......	.....	......	......	54	74	41	27	58	65	90	87	......
1898...	80	80	56	58	45	50	31	43	50	60	80	74	59
1899...	90	81	67	71	76	57	36	69	43	74	87	90	70
1900...	79	80	71	65	70	63	36	58	60	75	75	88	69
1901...	78	60	71	64	63	70	43	37	52	69	83	86	65
1902...	78	83	77	72	73	56	55	37	53	79	94	98	71
1903...	95	68	73	74	75	74	56	67	71	62	91	83	74
1904...	85	88	66	60	52	46	51	50	49	72	86	82	66
1905...	70	56	69	52	70	66	44	54	73	69	72	89	65
1906...	94	76	71	65	74	66	30	42	59	68	83	81	67
1907...	67	......	......	......	......	......	......	......	......	......	......	......	......
Av'ge.	82	**76**	**69**	**65**	65	62	42	48	57	69	84	86	**67**

Averages in black figures are from 9 years record.

TABLE 4.—*Prevailing wind directions and average hourly velocities at Tacoma, Wash.*

Date.	Jan.		Feb.		Mar.		April.		May.		June.		July.	
1897....	......	.....	......	.....	......	.....	......	.....	*	*	sw.	6.0	sw.	6.4
1898....	sw.	5.8	sw.	7.6	sw.	7.2	n.	5.8	sw.	6.5	n.	5.6	n.	5.7
1899....	sw.	7.1	sw.	8.9	sw.	8.3	sw.	8.4	sw.	5.6	sw.	6.6	n.	5.4
1900....	sw.	5.4	sw.	6.7	sw.	5.5	n.	5.6	sw.	6.0	n.	5.9	n.	5.3
1901....	s.	6.2	s.	7.8	sw.	6.9	n.	6.6	sw.	5.4	sw.	6.7	n.	5.4
1902....	s.	5.2	sw.	6.0	sw.	7.7	sw.	6.2	sw.	6.2	n.	5.8	n.	6.1
1903....	sw.	6.7	s.	4.5	n.	7.4	sw.	6.6	sw.	6.3	n.	5.2	n.	5.4
1904....	sw.	7.1	sw.	8.1	sw.	8.3	sw.	5.8	n.	5.8	n.	6.3	n.	6.1
1905....	sw.	4.9	n.	5.9	n.	6.5	n.	6.1	sw.	6.7	sw.	5.2	n.	4.8
1906....	sw.	6.2	sw.	4.6	n.	6.9	n.	5.2	sw.	5.7	sw.	6.4	n.	5.1
1907....	sw.	7.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	sw.	6.2	sw.	**6.7**	sw.	**7.2**	n.	**6.3**	sw.	**6.0**	n-sw.	6.0	n.	5.6

Date.	Aug.		Sept.		Oct.		Nov.		Dec.		Annual.	
1897............	n.	4.8	n.	4.2	n.	4.1	sw.	7.1	sw.	6.4	......	.....
1898............	n.	4.3	n.	5.3	sw.	5.4	sw.	7.2	sw.	5.2	sw.	6.0
1899............	sw.	5.4	n.	4.0	sw.	5.5	s.	5.0	sw.	6.5	sw.	6.4
1900............	sw.	5.2	n.	4.6	sw.	6.3	sw.	6.1	s.	6.2	sw.	5.7
1901............	n.	4.4	n.	5.1	sw.	4.4	sw.	5.8	sw.	6.8	sw.	5.9
1902............	n.	4.9	n.	5.4	sw.	3.5	sw.	7.2	sw.	6.7	sw.	5.9
1903............	n.	4.5	n.	5.8	n.	5.1	sw.	6.2	sw.	4.2	n.	5.7
1904............	n.	4.1	n.	4.0	n.	4.5	sw.	5.9	sw.	6.6	sw.	6.0
1905............	n.	5.4	sw.	5.9	n.	5.8	sw.	4.5	sw.	5.7	sw.	5.6
1906............	n.	4.4	n.	5.2	sw.	6.3	sw.	6.1	sw.	5.7	n.	5.6
1907............	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	n.	4.7	n.	5.0	sw.	5.1	sw.	6.1	sw.	6.0	sw.	**5.9**

Averages in black figures are from 9 years record. *No record for May, 1897.

infrequent, however. By far the greater number of high winds come from the southerly directions. The number of gales (winds of 40 miles or over per hour that continue for periods of at least five minutes) is usually about two in three years. The highest wind velocity ever recorded at this station was 46 miles per hour from the southwest.

TABLES.

For the benefit of those who desire more detailed information than that given above, the preceding tables, showing the monthly rainfall, temperature, cloudiness, and the average hourly velocity and prevailing direction of the wind for the same period have been compiled.

SNOW ROLLERS AT CANTON, N. Y.

By M. L. FULLER, Observer. Dated Canton, N. Y., March 30, 1907.

I send a few notes relative to the formation of snow rollers in the village of Canton on February 19, 1907.

The conditions attending the formation of the rollers were as follows: Upon a dry and evenly distributed snow covering of 4 inches depth there fell late in the forenoon of the 19th a half inch or more of fine, dry snow. After 1 p. m. the falling snowflakes were of greater size, becoming large, moist, and feathery after 3:25 p. m. and continuing to 4:25, by which time a total of about one inch had fallen. Light snow, with about one-tenth inch of dry sleet, occurred from 4:25 to 6:55 p. m.

The temperature, from 10° F. at the 8 a. m. observation, increased to 17° by 3:15 p. m., then rose suddenly to 31° at 3:30, and slowly to 34° by shortly after 6 p. m., from which maximum it fell to 17° by 7:15 p. m.

This abrupt rise of temperature and brief thaw accompanied a southwest wind with a velocity of 30 to 40 miles per hour that burst suddenly upon this locality at 3:25 p. m., displacing the northeasterly winds of 4 to 12 miles of the morning and midday, which had continued practically up to that hour.

Tho the formation of the rollers was not witnessed, so far as ascertained, it is known to have occurred in the late afternoon or early evening, probably between 5 and 6 p. m. Small rollers were found next morning in a variety of locations. The largest had been developed on a sloping lawn where the strong wind, striking the exposed side of a large cottage, had swept downward and away, rolling the snow downhill. Here the largest attained diameters and lengths of 10 to 12 inches. In structure they closely resembled rolls of cotton batting, but the centers were almost invariably shorter than the outer layers. The layers were plainly marked and varied somewhat in thickness, averaging probably three-fourths of an inch or more and being usually thinner near the axis. In occasional instances the centers were very short or almost wanting; and the rolls, altho firm enough next morning to be handled, were much lighter than snowballs of the same size when rolled by hand, thus indicating but slight packing of the snow in the wind rollers.

From the conditions observed in this instance it would appear that the flakes of a light, fluffy layer of surface snow are made adhesive by a sudden rise in air temperature while the under snow still remains cold and dry, and the particles of damp surface snow are enabled to adhere to each other but not to the dry under snow. A strong wind may then push over little prominences or projections of the surface snow and start them rolling, when of course they will continue to travel and grow until the resistances overcome the propelling power of the wind.

The accompanying photographs [see figs. 1 and 2] of the Canton rollers were taken by Mr. Ford Moran, of the class in climatology at St. Lawrence University.

Another member of the class in climatology, Miss Ione A. Jillson, subsequently reported having once witnessed the formation of snow rollers, and at the suggestion of the writer contributes the following account. As its author appears to be habitually careful and painstaking in both observation and statement, the description is thought to be of value:

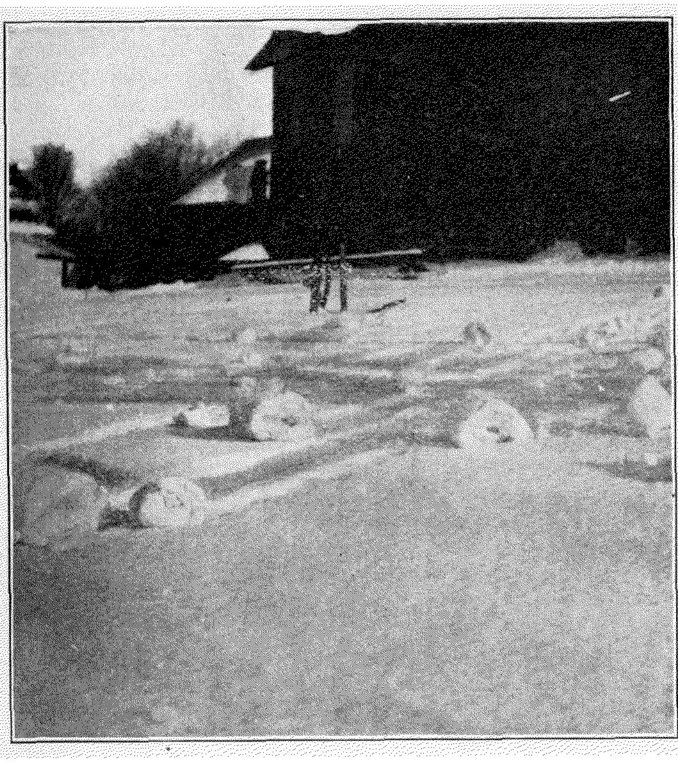

FIG. 1.—Snow rollers at Canton, N. Y., February 20, 1907.

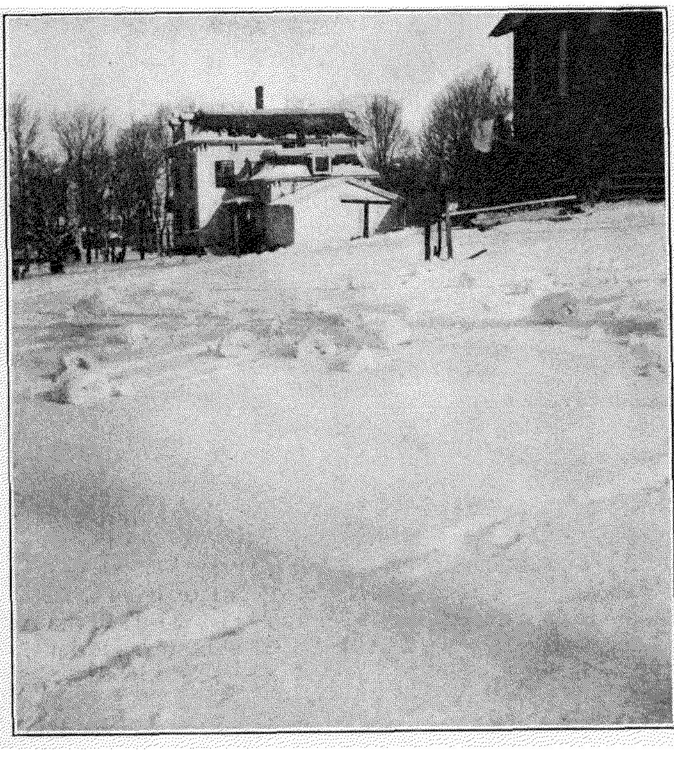

FIG. 2.—Snow rollers at Canton, N Y., February 20, 1907.

During the winter of 1895 I watched the formation and progress of so-called snow rollers. The temperature was probably a trifle above the freezing point, following a snowstorm characterized by very large, light flakes. For the most part the wind seemed to sweep downward and get under a slightly projecting mass of snow and set it in motion. As the roll grew in size the speed, at first very rapid, slackened until the mass became too compact and heavy to be moved farther. Sometimes a triangular shaped "card" of snow, often three or four inches across the base, would rise and fall several times before the wind gained sufficient purchase to turn the point over and start the roller. This card lookt very much like the corner of a piece of paper as it rises and falls with the wind just before it is blown away. The snow seemed to be of an unusual consistency, rendering it tough and flexible.

These rollers were observed at Edenton, St. Lawrence County, N. Y.

E. SCHARF ON THE EFFECTS OF HAIL ON CROPS [1]

Insurance against damage to growing crops by hail is practised quite extensively in Europe, chiefly by small local associations on the mutual plan. It is to aid in the adjustment of claims under this form of insurance that the present work appears to have been written.

The author begins by defining the three varieties of hail commonly recognized in his section of Germany, viz, "Graupel", the small, opaque, snowy hail of cold weather; "Schlossen", an intermediate form; and "Hagel", or true hail, the frequent accompaniment of summer thunderstorms. Well known facts regarding the distribution of hailstorms in space and time are also summarized.

The bulk of the work, however, is an original study, in great detail, of the effects of hail upon each of the ordinary field crops; these vary with the severity of the storm, with the stage of the crop's growth. and even with the character of the soil and the amount of fertilization, as influencing the vigor of the plants and their ability to withstand the blows of the hailstones. Numerous drawings and photographs make clear the characteristic effects of a hailstorm, and aid one to distinguish these effects from the ravages of wind, insects, and disease.

We believe this is the first treatise of its kind. It should be within the reach of anyone who is interested in hail insurance, whether as an underwriter or a policy holder.—*C. F. T.*

LONG-RANGE INDIAN MONSOON FORECASTS.

The annual publication by the director of the Meteorological Service of India of a statement of general atmospheric conditions, with an attempt to forecast the general character of the southwest monsoon rainfall, has now proceeded for about twenty years with a variable degree of success, but sufficient to show that the effort at long-range forecasting is really worth while. The work was begun by Blanford, was carried on by Sir John Eliot, and is now in the hands of his successor, Gilbert T. Walker. Pending a more extensive investigation into the philosophy of these seasonal forecasts we quote the following remarks from a review of the subject by Professor Hann, of Vienna, as published in the Meteorologische Zeitschrift for February, 1907.

Blanford thought that he had shown that generally snowfall in the regions to the north and west of India produced an abnormal distribution of pressure over northern India that was unfavorable to the advance of the southwest monsoons over this region; and he adopted the general principle that lower atmospheric pressure over any area increased the amount of its rainfall.

Sir John Eliot showed that the conditions over India alone would not suffice to justify reliable forecasts, and after the year 1894 information as to the conditions over the Indian Ocean was made use of, extending annually farther south, until, in 1897, even Africa and Australia were considered. It seemed most probable that heavier rainfall at Zanzibar and off the Seychelles in May would justify predicting heavier rainfall in India later in the season, when the monsoon has crost over the equator. But later experience showed that the opposite was the case. Then it was assumed that perhaps an abnor-

[1] Scharf, Edmund. Der Hagel. Erkennung, Beschreibung, Beurteilung und Schätzung von Hagelschäden. Halle a. S.: Im Selbstverlage des Verfassers. 1906. vi, 195 p. 12°.