1. A decrease in the velocity of the wind which may, as observations show, die out completely or be replaced by a weak contrary wind blowing in the direction *EF* toward the "squall zone" at right angles to its front.
   The whirls of wind and dust which sometimes immediately precede thunderstorms are probably provoked by the meeting of these two opposing currents, *EF* and *CD*.
2. A fall in pressure all along the front of the squall throughout a more or less narrow region which Durand-Gréville calls the "squall trough" (*le couloir de grain*), and which is revealed in the local barograms by the minimum preceding the sudden rise in the curve (see fig. 7, pressure curve at 10^h.).

As for the rapid rise in pressure which is particularly marked a short distance within the front boundary of the "squall zone," its primary cause is evidently the vertical component of the descending wind probably aided by various secondary processes such as the partial local evaporation of rain,[2] or still more the mechanical transportation of air by the rain drops.[3] This characteristic irregularity or "hook" (*crochet*) in the barograph curve was first noticed in the case of thunderstorms, whence it received the name "thunderstorm hook" (*crochet d'orage*) [or "thunderstorm nose" (*Gewitternase*)]. As a matter of fact it always occurs upon the passage of a squall, even when there is no thunderstorm. The above names are therefore incorrect, they should be changed to "squall hook" (*crochet de grain*) [or "squall nose"].

The low temperature within a squall can scarcely be explained in any other way than by supposing that the original temperature of the masses of descending air was lower than that appropriate to their altitude, wherefor they show less heating in the course of their descent.

Similarly the cause of the rise in the relative humidity is very probably to be sought in the action of the descending cold air upon layers of air near the earth's surface which are always more or less heavily charged with moisture.

LOCAL PHENOMENA.

All the phenomena so far considered exist throughout the extent of the "squall zone"; they are not special or localized at the point of observation. We have now to consider, on the other hand, local phenomena distributed chiefly close to and a little behind the "squall front" and which may develop simultaneously at various points in the "squall zone," leaving great gaps between. These are called forth by the passage of the cold descending[4] air of the squall through an atmosphere properly prepared, which thus becomes the occasional cause of local phenomena.

It is indeed easy to understand that collections of clouds of all sizes will form wherever the cold descending "squall wind" meets the warm, moist lower air; that sudden downpours of rain, snow, or hail, will be produced in those less numerous regions already enclosing large completely formed cumulonimbus[5] clouds; and that the thunderstorm will burst particularly at the hottest time of the day in yet more circumscribed regions of great heat and high humidity and filled with lofty cumulo-nimbus surmounted by "mushroom" or other forms of false cirrus. For example, the regions visited by the thunderstorm of August 27–28, 1890, are shown by the stippled areas of fig. 5. They were three in number, the first in the south of France, the second in the district about Berlin, the third and much the largest area embraced central and eastern France, the grand duchy of Baden, Würtemberg, and the major portions of Switzerland and Bavaria. The "squall front" traversed these thunderstorm regions on August 27 between 13^h and 22^h local time.

Upon examining the successive positions of the "squall front" as shown in fig. 8, we see that during an interval of several hours, the isochrones of the passage of the squall did not notably change their shapes, and that the speed of translation of the "squall front" was almost constant. It is evident that it would be extremely easy, as was originally suggested by Durand-Gréville, to report to a central station the passage of a "squall zone" by means of one or several lines of signals or stations located in the west of Europe. One could thus determine the position of the "zone," its speed of translation; in a word watch it, follow it step by step and consequently, several hours in advance, warn regions lying in its path of the probability of the occurrence of a squall at about a given hour. One could then notice at each point whether the passage of the squall would call forth from the local atmospheric conditions, a simple shower, a gust of hail, or even a thunderstorm at those localities where in popular parlance it was "thunderstorm weather."

From this standpoint it seems to me that the use of some one of the electric-wave-detectors [the coherer of wireless telegraphy] recommended by A. Turpain[6] is the proper method to adopt for the local prediction of thunderstorms. The method of general prediction based on the observation (and charting) of the "squall zone" might thus be very happily supplemented in particular cases.

For the sake of completeness I would add that one and the same barometric low may be accompanied by several "squall zones" disposed radially about it and succeeding each other at intervals of some hours. Further there are complex "squall zones" or zones made up of several parallel neighboring "bands," each "band" (*bande*) when considered alone possessing the characters of a simple "zone."

Theoretically, there is nothing simpler than to predict the arrival of a "squall zone." But it is a long step from theory to practise. One has but to recall how much energy, perseverance, and even obstinacy, Le Verrier needed through long years in order to overcome the material difficulties and the individual antagonisms or collective oppositions *"which are in the nature of things."*

EXHIBIT OF METEOROLOGICAL DATA.

By D. T. MARING, Instrument Division. Dated August 14, 1909.

A subject frequently of great perplexity to Weather Bureau officials is that of presenting meteorological data to the public in the most attractive manner. From the earliest days of the service maps and charts have been found, and still are, indispensable for illustrating graphically various sorts of atmospheric conditions and results, and it is hardly practicable to improve on these in any way, except as to higher grade of workmanship, finish, and color printing. But the introduction of the street shelter, or kiosk, opens up new possibilities and requirements in this direction; the exhibit of certain data to the public in the most simple and efficient manner being most desirable. The reading of graduated and figured scales is universally understood, and it is only necessary to take advantage of this fact in preparing such meteorological data as normal precipitation, temperature, etc.,—elements of interest to almost everybody. A plan for showing *rainfall* data, complete, by vertical scales is illustrated in the accompanying figure.

For this suggested scale we use simply any arbitrary system of graduated lines, of units and tenths, and number these in a series that will take in the range desired from zero (0) to and beyond the normal. A suitable adjustable pointer legend, *L*, at the top gives the average annual precipitation at the station from the commencement of observations, e. g., 43.50 inches, as

[2] E. Mascart: Journal de physique, 1879, p. 329–336.

[3] W. Köppen: Beiträge zur Kenntniss der Boen und Gewitterstürme. Ann. Hydrog. marit. Met., 1879, p. 324–335.

[4] I am of the opinion that the wind is not an ascending one outside and in front of the squall "zone" in those regions where no particular phenomenon has, as yet, been observed.—*J. Loisel.*

[5] M. Loisel here uses the term nimbus as it is used generally in Europe, and will be used during 1910 by United States Weather Bureau observers (see Instructions for preparing meteorological forms, 1910, par. 101-2).—*C. A., jr.*

[6] A. Turpain in La Nature, 1 mai, 1909.

shown in cut. On the left-hand side is a movable pointer, *N*, set daily to show *the normal to that date*, in this case indicating 8.28 inches; while on the right is a similar, adjustable, index, *A*, for the *actual* rainfall to date, set to indicate 7.25 inches, for example. Where permanent exhibits are installed, as now the case at some of the more important stations of the service, at expositions, within boards of trade, street kiosks, etc.,—the same people may frequently pass or examine the data daily. If not already somewhat familiar with meteorological apparatus they very quickly learn to read the instruments, charts, and maps, and with graphic scales of this character, a glance only is necessary to see how the *actual* and the *normal* compare from day to day, as shown by the relative positions of the sliding pointers.

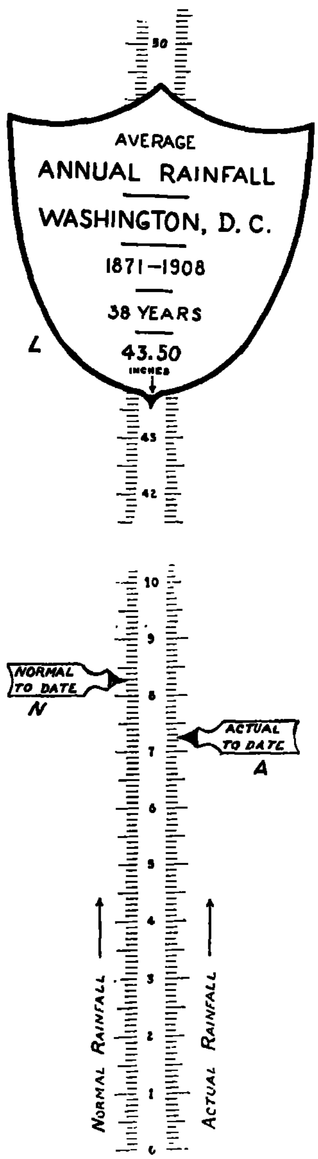

FIG. 1.—Meteorological display device (Maring).

Descriptive legends for conspicuous places such as the kiosks, should always be just as brief and concise as possible, so that even "he who runs" may read. To receive any attention from the average business man these legends should be in large type and in the fewest words; otherwise, he may not stop to read them at all. Increasing interest, however, is sure to develop from daily observations, and those who become especially interested in the subject can always obtain all the details required at the Weather Bureau offices.

In these days when advertising is an art, it is very desirable that the preparation and display of meteorological data be given every consideration, with a view to obtaining the best possible artistic effects, and, at the same time, educate the public to a better understanding of Weather Bureau work.

METEOROLOGICAL REGISTRATIONS IN SAMOA, 1902-1906. III. SUNSHINE.

By OTTO TETENS, Ph.D. Dated, Bensberg, Germany, May 13, 1909.

A Campbell-Stokes sunshine recorder was used, adapted to tropical conditions by mounting it on an adjustable board. During the first and last half-hours of the day the sheet-carrier shaded a part of the glass ball, thus shortening the registration by one hour on bright days. Furthermore the deepest part of the recording sheet was, by its concavity, able to collect some rain water which possibly prevented exact sunshine records once or twice about noon. Although the model used can not be recommended for a tropical station, still the records obtained can be reduced so that they are free from the defects of the instrument. Owing to the principal fault one hour was subtracted from the length of day in order to compute the true percentage of sunshine from the daily amount recorded. In the resulting percentage for days without clouds as known by eye observations 100 is given.

ANNUAL PERIOD.

Table 1 shows the monthly results for the years 1905 and 1906. During January, 1905, the recorder did not work satisfactorily, therefore the average percentage of the other five wet months of 1905 has been adopted for this month, the value has been placed in ( ).

TABLE 1.—*Insolation at Apia, Samoa*, 1905–1906.

Month.	Monthly.			Daily.	Average length of day.	Percentage of possible daily hours.		
	1905.	1906.	Average 1905–06.	Average 1905–06.		1905.	1906.	Average 1905–06.
	Hours.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	%	%	%
January	(162)	184	(173)	(5.6)	12.7	(45)	51	(48)
February	128	147	137	4.9	12.4	40	46	43
March	146	167	156	5.0	12.0	43	49	46
April	155	181	168	5.6	11.7	48	56	52
May	197	146	171	5.5	11.4	61	45	53
June	173	121	147	4.9	11.2	56	39	48
July	140	158	149	4.8	11.2	44	50	47
August	144	144	144	4.7	11.5	44	44	44
September	176	211	194	6.4	11.9	54	65	59
October	230	194	212	6.8	12.3	66	56	61
November	170	158	164	5.5	12.6	49	45	47
December	157	153	155	5.0	12.8	43	42	42
Annual total	1978	1963	1970	5.4	12.0	49	49	49
Average.								
Dry month	177	162	170	5.5	11.6	54	50	52
Wet month	153	165	159	5.2	12.4	45	48	46

From these figures it is seen that the last two months of the dry season, September and October, show the largest percentage of sunshine, whereas the distribution of the higher and lower values in the other months seems quite irregular. For example, considering the average values of the two years, August (a dry month) shows below 50 per cent of its possible, April (a wet month) above 50 per cent of possible sunshine. The months of May and June present the largest differences between the two years. This is in agreement with the character of these two months as determined by the rain observations.

Mean cloudiness.—For several places the mean cloudiness of the month, *d*, has been computed from the monthly number of clear, *s*, and cloudy, *c*, days, using the formula:

$$d=a+b\cdot\frac{c-s}{n},$$

c = the number of days per month with 25 per cent or less sunshine,

s = the number of days per month with 75 per cent or more sunshine,

n = the number of days per month.