

warmer than the mountain summit. Various circumstances are adduced to support the result, and the explanation is sought in the suggestion that the air flowing from the sea over the mountain would be mechanically raised and practically subject to the adiabatic gradient which is not reached in the free air. The consideration of the relative heights of clouds as observed on the hillsides and over the sea is adduced in corroboration.

A CURIOUS COINCIDENCE. IS IT ACCIDENTAL OR GOVERNED BY LAW?

By Mr. G. N. SALISBURY, Section Director, Seattle, Wash.

Two or three years ago the writer noticed in the annual precipitation totals of the Seattle station a certain apparent recurrence or periodicity in groups or series of three, and looked forward with much interest to see whether it would longer continue. It was found that the light rainfall of 1901 filled the conditions of the recurrence, and the writer concluded that, in accordance with the series, the year 1902, as a whole, should be one of maximum precipitation. Therefore, even during the long dry spell of last summer and autumn, he never lost confidence that the deficiency in precipitation would be made up. That the confidence was justified was seen in the heavy rainfall of November and December, while the total precipitation for 1902 was 45.78 inches, the greatest amount since the beginning of the rainfall record at Seattle.

To illustrate more clearly what is meant, the total annual rainfalls at Seattle are given in their order, beginning with 1892: 31.32, 45.16, 41.08, 29.69, 42.83, 41.53, 29.28, 37.13, 36.43, 30.18, 45.78. A striking peculiarity may at once be recognized in the above figures, viz: beginning with 1892, every third year appears to be one of minimum rainfall, thus: 1892, 31.32; 1895, 29.69; 1898, 29.28; 1901, 30.18. Also every third year beginning with 1893 appears to be a maximum, thus: 1893, 45.16; 1896, 42.83; 1899, 37.13; 1902, 45.78. Representing the minimum values by *c*, the maximum values by *a*, and the intermediate values by *b*, there results a recurring cycle or series like this: *c. a. b. . c. a. b. . c. a. b. . c. a. .* The records for 1890 and 1891 are incomplete, but judging from the record of Madrone, which is a near-by station, the year 1890 would be an *a* year and the year 1891 a *b* year, thus further extending the series.

Curiosity was naturally aroused to see if the same apparent 3-year cycle could be detected at other stations, and investigation revealed that at all stations throughout the State, so far as observations were complete, the same 3-year recurrence had obtained since 1890. As far as the investigation was pursued the same was found true in Oregon, Idaho, and extreme northern California.

This is certainly an interesting coincidence, if nothing more, and the question arises: "Is it an accidental one merely or is it one due to imperfectly understood cosmical causes, which may vary the track of precipitation-producing storms from year to year throughout a certain well-defined fluctuation, so that they return every third year to nearly the same position?"

Unless the records should show a similar recurrence extending back indefinitely we must conclude either (1) that the recurrence is wholly accidental or (2) that a new era has begun in the distribution of precipitation within recent years. In view of our well-established confidence in the constancy and permanence of natural phenomena, the latter conclusion is improbable. The former would be legitimate if there was sufficient past evidence, in the shape of records that could be relied upon. But unfortunately it is only within the past ten years that a considerable number of regular and reliable records of rainfall have been kept in this State. At only a few stations, viz: Spokane, Walla Walla, Vancouver, etc., does the record extend back as far as 1880. For the past twenty-five years at

Madrone the third year has always been one of minimum precipitation; but previous to 1890, the order of recurrence of the three years is reversed every cycle, so that we have such a series as: *a. b. . c. b. a. . c. a. b. . c. b. a. . c. a. b. . c.*, etc.

That the annual rainfall should be arranged in a 3-year period in the order *a. b. . c.* for twelve years over the whole State is a remarkable coincidence, even if accidental, but that the recurrence should continue for twenty-five years, or over eight complete 3-year cycles, even at a single station, suggests that there may be a pronounced physical cause. The writer does not insist that it is anything more than a single coincidence, being aware that meteorologists have long ago decided that such a thing as a regular cycle in precipitation need hardly be looked for. The coincidence, however, is so suggestive as to make one ardently wish that the rainfall records of Washington and other Northwestern States, prior to 1890, were not so few, irregular, or unreliable. It is also an incentive to the public spirited voluntary observer to continue his valuable records, showing, as it does, how important his records are as data in the solution of vital climatic problems.

A further interesting coincidence is the correlation of the annual mean barometer with the apparent rainfall cycles. During the past twelve years at the Weather Bureau stations of Washington, Oregon, and Idaho, viz: Seattle, Spokane, Walla Walla, Boise, Pocatello, Baker City, Portland, and Roseburg, the third year of minimum rainfall has invariably coincided with a year of maximum annual mean barometer. The years of maximum rainfall have also coincided with years of minimum mean barometric pressure. A coincidence of maximum rainfall with low barometer and of minimum rainfall with high barometer, is in accordance with meteorological principles and might be naturally expected. But that it should continue throughout the calendar year, and also be in cycles of three, strengthens the suspicion that there may be something more than accident in the coincidence.

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITRIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the drought continued up to the 8th, when the rain was general all over the country. The amount of rain for this month and also the duration of same have been without exception in excess over previous years. In San José temperature, pressure, and relative humidity have been about normal; rainfall, 371 millimeters against 230 millimeters, mean for 1889–1900; sunshine, 193 hours against 165 hours, with rather cloudy afternoons. On the Atlantic slope the rainfall was generally less than the normal.

Notes on earthquakes.—May 3, 3^h 36^m a. m., light shock E-W, intensity III, duration 10 seconds. May 14, 6^h 16^m a. m., very slight shock NW-SE, intensity II, duration 4 seconds. May 27, Tres Rios reports one strong shock followed by another, rather protracted, not felt in Jan José. May 28, 2^h 03^m a. m., rather strong shock E-W, intensity IV, duration 6 seconds, reported also from San Isidro Alajuela. May 29, 11^h 47^m p. m., light shock NW-SE, intensity II, duration 3 seconds.

ATMOSPHERIC ELECTRICITY CONSIDERED FROM THE STANDPOINT OF THE THEORY OF ELECTRONS.¹

By Prof. HERMANN EBERT of the University at Munich.

Recent investigations into the composition of the air, which we already thought we knew so well, have revealed to us a number of new constituents among which the monatomic noble gases discovered by W. Ramsay, and more especially the so-called atmospheric ions or electrons of Elster and Geitel, appeal

¹ A lecture delivered before the eighty-fifth session of the Swiss Society of Natural Sciences, Geneva, 1902, and translated from the *Meteorologische Zeitschrift*, Bd. 20, 1903, pp. 107–114, by Dr. C. Abbe, Jr.