The mornings of the wet season are, as a rule, cool and fresh. Preceding and during the afternoon and night rains, however, the atmosphere is sultry and oppressive, and in the low-lying Atlantic end of the Canal Zone the heat is particularly trying. In the dry season of the winter and early spring months temperatures are usually pleasant, except during the prevalence of "northers" when the weather is sometimes disagreeably cool.

At no point in the Canal route does the elevation above sea level exceed 300 feet. The entire strip may, therefore, be placed in the "hot zone", a term that is applied to portions of the Central American coast districts that are less than 300 or 400 feet above the level of the sea. The Atlantic, or Caribbean Sea, side of the Isthmus is, however, lower, hotter, more humid, and more malarial than the Pacific side. At Colon the April rainfall averages about 36.5 inches, which equals the annual rainfall in the Middle Atlantic States of the United States. The November rainfall at Colon is nearly 23 inches, and the so-called August dry interval yields about 15 inches. On the watershed the monthly rainfall amounts to about 13 inches in May, September, October, and November, with a maximum of 14 inches in August. At Panama the maximum, about 12 inches, occurs in November, and 7 to 9 inches falls monthly from May to October, the least amount during this period being about 7 inches, in August. Daily rainfalls of 5 to 7 inches and hourly amounts of 1 to 2 inches are not uncommon in the Canal Zone during the wet season.

In plans for the construction and operation of the Canal the importance of the study of the vicissitudes of Panama rainfall can not be overestimated. The rainfall element does not enter so largely into the problem of a sea-level canal; in a lock canal, however, whose feeders are subject to sudden and violent floods, a due consideration of the variability, intensity, and duration of rainfalls, and of possible periodicities in years of excessive rains, is of the utmost importance. Periodicities in maximum and minimum rainfall periods are most likely to be defined in the equatorial rain belt, for in this region the association with terrestrial and solar causes of meteorological effects is undoubtedly the most apparent, and it is here that variations in primary causes can be the more readily detected by means of observed facts. In an adjustment of available Central American rainfall observations made in 1895, Professor Harrington[1] noted a succession of maxima and minima of annual rainfalls, with intervals of recurring years of unusually heavy rains that ranged from five to eight years, and an average interval between the maxima of six years.

Aside from the value that may be attached by meteorologists to investigations of the periods of excess and deficiency in Panama rainfall, the results of investigations of this kind are calculated to be of practical value to engineers and of interest to the American public. In short, the construction of a lock canal in a part of the equatorial rain belt that is visited by seasonal downpours, which at intervals of several years are likely for periods of days and perhaps months to be abnormally heavy, presents a new and most important problem in canal construction.

[1] Phil. Soc. of Wash., Bul., Vol. XIII, pp. 1–30.

OBSERVATION OF CLOUD ALTITUDES AT NIGHTTIME.

In 1872 the Editor had occasion to make a report to the Chief Signal Officer on the importance of observing clouds, their altitudes, motions, and phenomena in greater detail than was common at that time. Among many methods recommended he enumerated the use of small balloons, filled with hydrogen gas, each carrying a long thread, by means of which its initial vertical velocity and its subsequent altitude could be determined at any time, whenever it entered or emerged from a cloud. The necessary balloons and instructions for using this method were furnished for the use of the arctic expedition of the schooner *Florence* in 1877.

Among other methods for permanent use at a fixt station, and as almost the only method appropriate for work at nighttime, he urged that within a few miles of an observer, a searchlight should be stationed, pointing vertically upward, and thus illuminating a circular patch of cloud or haze at the zenith.

The above methods are also described on pages 311 and 323 of the editor's "Meteorological apparatus and methods". He has often urged that this latter method of observation at nighttime is one of great value, likely to give us many new ideas as to the growth and structure of clouds. It is, therefore, with peculiar pleasure that we learn from the Geographical Journal, February, 1907, that Dr. J. Reden, assistant at the astronomical observatory at Vienna, has independently hit upon the same method, making use of the electric reflectors of the Leuchtbrunnen, or luminous fountain, erected at a point on the Ringstrasse, about a mile from the observatory. The observer has merely to measure the apparent angular altitude of the center of the luminous spot in the sky. The tangent of this angle, multiplied by the distance of the vertical beam of light, gives the linear height of the cloud. The first measurements were made June 14–24, 1906, and elevations between 5100 and 33,000 feet were soon measured. When the lower layer of clouds is thin it has become possible to detect three successive layers. The writer adds:

> The new method surpasses in exactitude the most trustworthy of the methods hitherto applied, viz, the photogrammetric, determining as it does the altitude in question with positive accuracy. It is hoped to start a systematic course of such observations in other parts of the earth as well. There is no doubt that not only for science, but also for practical weather forecasts, such observations will prove highly serviceable.

FOG ON THE NEWFOUNDLAND BANKS.[1]

By C. T. BRODRICK. Dated Harvard University, Cambridge, Mass., March 22, 1907.

During the greater part of the year the route for high-powered steamers between Nantucket Lightship and Fastnet or the Scilly Islands crosses the forty-seventh meridian to the south of latitude 43° north, making a considerably greater distance to be traversed by thus avoiding the Grand Banks. This circuitous route is taken because of the fog and the ice found in this district during the spring and summer months. Numerous collisions with other vessels and with icebergs occur every year, and some accidents in the past have been accompanied by large loss of life.

The occurrence of fog about the coasts of Newfoundland and farther north was noted by some of the earliest explorers of the regions—Cook, Ross, Parry, and others.[2] They remarked on its density, that it did not extend to any great height above the water, and that it was most prevalent with southerly winds. Some interesting speculations on the causes of these fogs are set forth at considerable length in Henry Ellis's "Voyage to Hudson's Bay," (1748).[3] His fantastic theories are in strange contrast with our present ideas, even with his own considerable accuracy of observation.

In 1822 Scoresby[4] published some data which he had accumulated during the previous summer. His general conclusions were that fogs are more prevalent during the summer months, that they have an average thickness of from 150 to 250 feet, and that they are accompanied by inversions of temperature.

[1] This article was prepared as a part of my college work in an advanced course in meteorology and climatology, under Prof. R. DeC. Ward. My original intention was to add some charts embodying the information kindly sent me by Mr. James Page, of the U. S. Weather Bureau, but the present work is principally bibliographic and historical. The article by Mr. Proctor, in the January, 1907, Review, was not available for me until after I had finished this work.

[2] Cf. Bibliography under Muncke.

[3] Cf. Bibliography: Ellis.

[4] Cf. Bibliography: Scoresby.