

Relation of Precipitation to Altitude.—Generally speaking, precipitation decreases with the increase in altitude. It has been found in travelling westward away from the Atlantic that as the country rises, the rainfall decreases. This general rule, however, does not seem to apply to the precipitation in the valley of the Bow River; in fact, the direct opposite is apparently the case in practically all the territory forming the eastern slope of the Rockies. An examination of the records will show that as the altitude increases on the eastern slope, the precipitation increases. Special local influences are at work here, however, the mountain ranges in which are situated the sources of the rivers, causing this reversal of the general rule.

The warm, moisture-laden winds from the Pacific are first intercepted by the mountains of the Coast range and deflected upwards to mingle with cold air currents or to come in contact with land at a lower temperature; becoming chilled below the temperature of saturation, they deposit some of the moisture as snow or rain as they pass over the mountains, giving rise to the heavy precipitation near the coast, the greatest recorded on the continent.

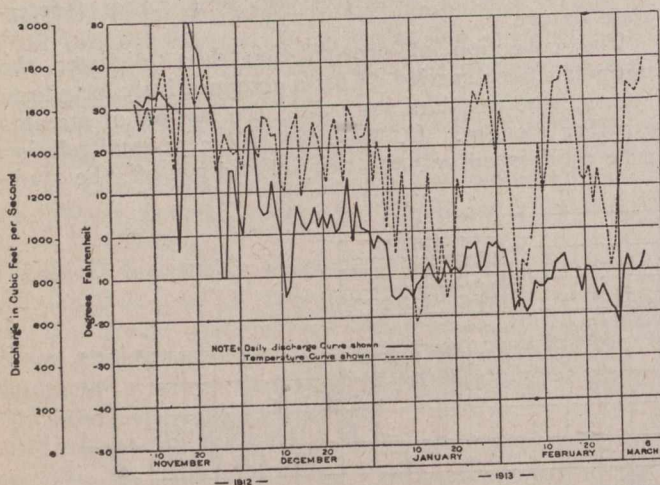


Fig. 2.—Daily Discharge (at Horseshoe Falls) and Mean Temperature (at Banff, Alta.), Bow River.

They then pass over a stretch of low-lying land, depositing but little moisture until the Selkirk range is reached, where the process is repeated. When the Rocky mountains are reached the humidity of the air has become much reduced, but the low temperatures reached at the higher altitudes is sufficient to cause more precipitation; therefore, in the Bow River basin, with which we are dealing and which is on the eastern slope of the Rockies, it is at the higher altitudes that the greatest precipitation occurs. The alteration of mountain ranges with stretches of country of low altitude is accepted as the cause of the arid and semi-arid regions to be found to the east of the continental divide.

Value of Records.—In making a study of rainfall in any district, it should be borne in mind that the average precipitation gives only a relative view of the question, as great variation from the average annual precipitation may occur at different points in the district. In this regard no general law can be made to apply. The number of conditions contributing are so great and variable that, for special purposes, a detailed study of the rainfall in the locality is necessary.

When studying precipitation records extending over a given period, it is necessary to know what value may be attached to them. Sir Alexander Binnie has given this

question careful consideration in a paper published in the proceedings of the Institution of Civil Engineers (Vol. 109, pages 89 to 172). He reached the conclusion that for records extending over a period of 25 years, the mean obtained would be within 2 per cent. of the true mean. The conclusions reached by Mr. Rafter in a discussion of this paper were: that, for a period of 5 to 10 years, the probable extreme difference from the mean would be 15 per cent., and of 10 to 15 years, 4.75 per cent. Other authorities have expressed the opinion that it is necessary to have records for a period as great as 40 years in order that the mean may represent the true mean precipitation within 5 per cent.

Accuracy of Records.—In Canada, the recording stations are all under the direction of the Meteorological Service, and a standard method of obtaining the records is adopted. It is to be noted, however, that the placing of the recording instruments can have a very great influence upon the accuracy of the records. To arrive at the average precipitation upon a district, it is necessary that as many records as possible in the area to be considered should be available, as conclusions based upon records from a limited number of stations are liable to be considerably in error. An ideal condition under which to study rainfall data would be attained if the stations were uniformly distributed over the territory, or placed along each branch of the stream of which the relation between run-off and precipitation was to be established.

Distribution of Precipitation.—A study of the periodical distribution of the rainfall is interesting. Generally this distribution throughout the year, from year to year, is fairly constant in any district, but is different in different districts. For instance, there is a similarity in the distribution in the different localities along the Pacific coast; the same may be said of the territory to the east of the Rockies, while that portion around the Great Lakes has its typical distribution.

Tables showing the fluctuation in the annual precipitation recorded at Banff and Calgary have been prepared. At Banff, the records are available at intervals from 1890 to 1896, from which year they are continuous to date; during that period, the maximum precipitation occurred in 1902, 30.59 inches being recorded, and the minimum was 10.33 inches in 1903. The mean yearly precipitation for twenty years is 19.13 inches. At Calgary, the records are available from 1885 to date, during which interval the lowest recorded annual precipitation occurred in 1892, 7.91 inches being the amount; and in 1902, the maximum precipitation occurred, 34.57 inches being recorded. The mean yearly precipitation over the period of 27 years is 16.10 inches.

Owing to the scattered location of the recording stations in the district—at Banff, Calgary, and Jumping Pound (from the latter, only partial records are available)—they do not truly represent the conditions obtaining in the basin.

As has been mentioned before, the precipitation increases in this locality with the altitude. The altitude of the station at Calgary is approximately 3,400, that at Jumping Pound about 4,200, and at Banff 4,525 feet, and an examination of the records will show a greater precipitation at Banff and Jumping Pound than at Calgary, that recorded at Banff being the heaviest of the three. The sources of the Bow River and its tributaries are at much greater altitude than is the gauging station at Banff; in fact the greater part of the drainage area above Kananaskis Falls lies above this altitude, so that the stations are by no means representative of the greater part of the drainage basin.