LONG RANGE WEATHER FORECASTS*

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This is a subject that for years has created much discussion and criticism, and it is with diffidence I have accepted your invitation to speak on this subject.

However, it is hoped that the information presented may be instructive and may lead to a further study of what may prove of great practical value.

At the March meeting of the Western Forestry Association held at Seattle, I was invited to present a paper on "Will Science ever predict Fire Weather or Fire Seasons far in Advance?"

This paper was favourably received, and a general forecast then made that this last summer would probably be abnormally fine, hot and very dry on the Pacific Slope, has to a large extent been verified.

To obtain this information curves of the annual and summer precipitation records for Victoria, which go back 55 years, were closely studied, and also similar ones from the Vancouver, Kamloops and Stuart Lake records.

The Victoria record clearly indicates some interesting fluctuations in the annual amounts, and, from the curve for the summer months, dry and wet periods are shown, some of fairly regular intervals. It is interesting to note that the summers from 1874 to 1879 were abnormally dry, and from 1924 to 1928 the summers have been just as dry, while from 1890 to 1894, wet summers occurred, followed by a period of about normal summers to 1910.

Nineteen hundred and twelve was the wettest summer on record, followed by a general decrease in rainfall to the present time.

Turning to the Vancouver summer rainfall records which date back to 1901, we again find 1912 was abnormally wet, and from that date to the present the summers have steadily become drier.

In order to see what changes have occurred in the summer temperatures throughout this Province, the average temperature of the months of June, July and August were taken for Vancouver,

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Kamloops, and Stuart Lake, the latter representing the Northern Interior.

From these averages one finds that at Vancouver there are several regular fluctuations of about twelve years, but underlying these can be seen a steady rise, especially from 1909 to 1928 amounting to about three degrees.

In the case of Kamloops, where the records go back 32 years, we find several warm summers about 1897, followed by a cool one in 1900, then warmer to 1905 and 1906, then cooler summers continued to 1911 when there set in a marked and almost regular rise until the present time, amounting to over 2½° Fahr.

Taking the summer temperatures as recorded at Fort St. James, Stuart Lake, where observations have been taken for our Service for 36 years, we find that hot summers are shown in cycles of about nine years' period, but running through the whole record is to be noted an almost steady increase in temperature amounting to nearly six degrees.

The annual temperatures are not used in this discussion, as cold winters sometimes occur with warm summers and reduce the annual average to or below normal.

As these interesting temperature changes and marked decrease in rainfall in this Province and other portions of the world are part of the great and complicated meteorological changes which have and are taking place throughout this sphere, it is necessary, in order to endeavour to account for these, to refer to previous work on this subject by reliable authorities such as Dr. Humphreys of the U.S. Weather Bureau at Washington and Dr. Abbot, also of Washington.

In the former's great work entitled "The Physics of the Air," he points out that certain changes noted on the sun's surface have some effect upon our climate, and that the great solar storms, or more commonly termed "sun spots", when most numerous have a tendency to reduce slightly the temperature of our air, and when these storms are either entirely absent, or few in number, our earth receives more solar heat.

These storms, or spots, appear in fairly regular cycles of about 11 years, though other much longer periods have been noted, and

also that some periods of maximum sun spots are not nearly so pronounced as at others.

Dr. Humphreys has published an interesting diagram giving the annual number of sun spots dating back to 1750, and below this curve the departure from normal of the temperature as taken from numerous parts of the world is also shown for the same period.

A close study of these curves is most interesting, and it clearly shows the 11-year sunspot cycle, and also that when the sun spots are at a minimum the world's temperature is usually above the normal, and that periods of maximum solar disturbances appear to reduce our temperature.

There are, however, to be seen some marked exceptions to this rule, and to account for these the author has placed below the temperature curve the dates of some of the world's greatest volcanic eruptions, and he points out that, at the time of these, vast quantities of fine dust were blown to great heights where they were carried by the upper air currents around the earth, causing a screen which prevented a portion of the sun's rays reaching the earth's surface. Such conditions may last for a year or more after these great eruptions.

Dr. Humphreys cites the great cold of 1784 and 1785 which was preceded by the great Asama eruption.

The great cold of 1816, which was termed the year without a summer in the United States, was preceded by numerous serious eruptions, including Tombora, which killed 56,000 and caused darkness for 300 miles for three days.

Coming to more recent times the great Krakatoa eruption of 1883, which blew up half the island and caused such wonderful red sunsets for several years, evidently affected the temperature of 1885.

In 1912 the great Katmai eruption in Alaska caused a world-wide drop in temperature, and locally not only did the fine dust extend to Victoria, but the sulphur fumes affected metal parts exposed here also.

Dr. Abbot, now Secretary of the Smithsonian Institution, Washington, has for a number of years been recording the solar temperature as taken at mountain stations in South America and in Africa,

and these also point to certain cycles in connection with the sunspot curves.

From what has been said it would appear that we are justified in stating that our weather does come in cycles, and that it is quite in order to strive to fathom the periodicities of these and to determine their causes.

We have a splendid example of this in the grand work which for years has been carried on by Sir Gilbert Walker in India on the long range forecasting of the monsoons which means so much to that densely populated country, and how wonderfully accurate these forecasts are becoming.

From a study of over thirty years of these great weather changes on this North Pacific coast, one is convinced that they are part of the rhythmic changes ever active throughout our vast ocean of air, which when better known will make it possible even on this continent to forecast the weather months or even a year in advance, and this information would be of great practical value to many, such as the farmers of our vast interior, our efficient forest fire protection services both provincial and dominion, and the great water power companies.

In conclusion, in looking over the abnormal world weather during the past year one is struck by the number of records broken for many years as to intense cold in Europe, depth of snow extending to southern France, zero weather in London, followed by intense heat and droughts in the British Isles and Europe. On this continent intense heat and severe drought in many parts, including Ontario and the prairie provinces, also on this Pacific slope, the months of July, August and September were the driest and warmest on record and they were also very bad forest fire periods extending even to California.

From the above abnormal conditions may we ask what is in store for the world as to weather during the coming year, and are we entering into the 100-year weather cycles referred to in Europe upon several occasions?

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