

VII.—CLIMATE AND METEOROLOGY.

1.—The Factors which Control Canadian Weather,¹

Several prime factors play important rôles in establishing climatic types, latitude, distance from the sea (especially on the western side of the continents), altitude, and prevailing winds, the last named being a variable, accounting for differences in the character of corresponding seasons in different years.

Canada, with her huge area, has a wide range of climatic types, varying between temperate and arctic, and between marine and semi-arid. No country, however, has a climate altogether independent of the rest of the world; the atmosphere knows no political boundaries, but moves in accordance with physical laws.

Prevailing Winds due to Inequality of Atmospheric Pressure.—Meteorological research has shown that the earth's atmosphere is not spread uniformly over its surface, and that certain regions exist where the atmospheric pressure is either higher or lower than the general average the year round, and other regions where it changes with the seasons. The winds are the outcome of the tendency to establish an equilibrium, which, however, is never attained. This general circulation of the atmosphere is withal a mechanism of marvellous beauty and intricacy, which, owing to causes yet imperfectly understood, is subject to many variations.

The most persistent and relatively unvarying feature of atmospheric distribution is a belt of high pressure between latitudes 30° and 40° in the southern hemisphere. Its partial counterpart exists in the northern hemisphere, but is there subject to greater changes, which without doubt, result from the larger land areas in the north. Between these two belts of high pressure is a belt of relatively low pressure over the equatorial regions. To this distribution, with certain other factors, is due the system of trade winds, the northeast and southeast trades. Towards higher latitudes beyond 40° in both hemispheres, there is a tendency towards a gradual diminution of pressure, and westerly winds prevail in the middle and even higher latitudes.

Unequal Heating of Land and Water.—The physical properties of land and water, as regards temperature, play an important rôle. The earth receives almost all its heat from the sun, and the character of the surface on which it falls plays a very important rôle in determining climatic differences. Water has a large capacity for heat and, being a fluid, is mixed by the winds and kept fairly uniform in temperature to considerable depths. Thus the sun's heat warms the oceans very slowly, and for the same reason the oceans cool very slowly. On the other hand, the same solar heat warms a mass of land more rapidly than the same mass of water in the ocean, and moreover the sun's heat is all absorbed in the surface layers of the land, which thus become very hot; similarly, when the sun is withdrawn, the land surface cools very rapidly. The result of these physical facts is that the northern portions of the continents of the northern hemisphere become very cold in winter, while the oceans in corresponding latitudes remain warm, and as cooling of the lower strata of the atmosphere, resting over the lands, leads to contraction, the pressure becomes higher over the continents than over the seas, and consequently, the tendency is for air to move from land to sea during the winter, while in summer, when all the continents become warmer than the oceans, the reverse holds. But the winter effect of contracting atmospheric lower strata is in operation

¹Contributed by Sir Frederick Stupart, Director of the Meteorological Service of Canada.