

At the end of August, 1932, severe flooding occurred in the Wairarapa Valley. About Lake Wairarapa it was in some parts the highest flood on record, and losses of stock and damage to property were severe. In Note No. 13 the weather-conditions which led up to this flood are described. Weather-charts, drawn in accordance with modern ideas, are used to explain the developments which occurred. The very heavy rains on this occasion were due to the effect of the mountains of the Dominion on the movements of a mass of cold air advancing from the south-west. A bay was formed in the forward boundary of this air (the "cold front" as it is called) while it flowed over the Wellington Province. As this bay closed up the warm air flowing above the cold in the higher levels was forced rapidly upwards. The resulting cooling of this warm air caused much of its moisture to condense out as heavy rain.

In connection with the Pan-Pacific Science Congress at Vancouver, I was asked to prepare papers on,—

- (1) "The Importance of Upper Air Observations in the Pacific especially with reference to Airships."
- (2) "The Circulation of the Atmosphere in the Australia - New Zealand Region."

Airships are very much at the mercy of the weather, first, because of their limited speed through the air and the consequent effect of winds, and, second, because they have to depend on being more buoyant than the air. The total weight which can be lifted depends on the absolute temperature. For example, at a temperature of 27° C. or 300° absolute, a rise of temperature of 1° C. means a reduction of $\frac{1}{3}$ per cent. in the load which can be lifted. Now the weight of the vessel itself constitutes a very large fraction of the total load, and this, of course, cannot be altered. Any loss of lift, therefore, has to come off the useful load carried. Thus loss of a small percentage in the total lift may mean a large reduction in the useful load. An airship will therefore lose a large part of its efficiency on passing from the temperate regions into the tropics. On the other hand, in cold regions there is danger of trouble due to the formation of ice on the vessel. It thus becomes most important to choose airship-routes on which the winds are favourable and air-temperatures as steady as possible and neither too high nor too low. But perhaps the most serious factor airships have to contend with is vertical air-currents. Recent experience with the largest vessels suggests, indeed, that the dangers and disabilities due to vertical currents and a turbulent atmosphere generally have not been sufficiently overcome to permit the satisfactory development of transport by airship on a commercial scale.

The paper on the circulation of the atmosphere mentioned above presents ideas which have been gradually developing in my mind in the course of studies extending over the past twelve years. Any one who is at all familiar with Australian and New Zealand weather-charts cannot fail to be impressed with the regularity with which, for most of the time at any rate, anticyclones and, what we call in New Zealand, "westerly depressions" follow each other from west to east across the charts. This feature is obscured in the Northern Hemisphere owing to the effect of the contrast between ocean and land masses. Conditions in the Southern Hemisphere are much simpler. For the latter reason one may expect that it would be easier to solve some of the elusive problems of the general circulation in the Southern than in the Northern Hemisphere. From this point of view the regular progression of anticyclones and depressions or, as I prefer to call them, atmospheric waves, appears to be of particular interest. On the average, the waves pass at the rate of one for every six days, about, and their length and speed is such that there would normally be eight waves at any one time in the circuit of the hemisphere, and a wave would make the journey round in about six weeks. It is due to the regularity of these waves that weather of a similar type is frequently experienced on a number of successive week-ends and so attracts considerable attention. Many other interesting characteristics of the waves are described in the paper, but their interest is mainly theoretical and space will not permit of further reference here. Their study is being continued.

The normal weather sequence described above is, however, sometimes wholly or largely interrupted. A remarkable instance of this occurred in February, 1932, when, after a prolonged dry period, continuous and heavy rains occurred in the eastern districts of the North Island, ending in a general rain over the whole Dominion. From the 5th to the 22nd February the flow of air over New Zealand was almost continuously from a southerly or south-easterly direction, and the movement of depressions and anticyclones from the westward practically ceased. For a considerable time prior to this there had been signs of activity in the tropics, and the cause of the development described was due, in my opinion, to a great outpouring of warm air from the tropics and past the east coast of New Zealand. By means of reports received, partly by post, a detailed examination according to the Norwegian methods was made of the weather-charts for the period mentioned, and a paper on them is to be published in a European periodical. The series contains numbers of features of great theoretical interest.

MISCELLANEOUS.

Observations of total solar radiation with an Angstrom pyrheliometer have been made at Kelburn by Mr. R. G. Simmers when weather-conditions were suitable. These will be published in the annual statistics. Mr. Simmers has also been making observations of soil-moisture and soil-temperatures at various depths. The problem of recording soil-moisture is a very difficult one, and much work remains to be done before it can be decided whether the method used, whereby the capillary attraction of the soil for moisture is measured, can be made of much practical value.

Hourly values of temperatures at Wellington and Alexandra for upwards of two years have been tabulated, mainly by Mr. A. G. C. Crust.

Mr. D. C. Meldrum has kept up-to-date tabulations of hourly values of sunshine, rainfall, and pressure at Wellington.

The temperature and rainfall tabulations have been made use of in connection with heating and other engineering problems.

Miss M. E. Ewart continued the tabulation of hourly observations of wind speed and direction at Auckland, Wellington, and Sockburn (near Christchurch).

In conclusion, I take pleasure in acknowledging once more the cordial co-operation of all members of my staff.