The other item is the finding of the balloon identifying tag, attached to the balloon released here at 3 p. m., January 21, 1920. It was found late in April, 185 kilometers from Lansing, along azimuth 80° (East 10° north), at a point 5 miles northeast of Port Lambton, Ontario. This balloon was observed up to an altitude of 6 kilometers, during which altitude a westerly gale without southerly component was found. From the time it was lost to view at 31 kilometers distance until it landed at Port Lambton it pursued a course averaging 78 degrees, part of which contains the north component which existed over this part of the country in the lowest 2-kilometer layers of the atmosphere. Therefore, the wind, during a large part of the voyage to Port Lambton, must have been from a nearly southwest direction at a high rate of speed, indicating a large southerly component of velocity.

While there is nothing definite at hand concerning the altitude where the southerly component prevailed, it is of interest to know that it existed somewhere above the 6-kilometer level of the air.

Both of these items are in accord with the conclusions which were arrived at in the discussions of sleet and glaze.

THE STRUCTURE OF THE ATMOSPHERE WHEN RAIN IS FALLING.

By V. BJERKNES.

[Abstracted from Quart. Jour. Roy. Meteorological Soc., April, 1920. No. 194, 46: 119-138, disc. 138-140, 17 figs.]

In this lecture before the Royal Meteorological Society Prof. Bjerknes presented later developments of study by H. Solberg and J. B. Bjerknes under his direction, arising from the Scandinavian weather begun in the interests of daily detailed local forecasting in Norway, in the summer of 1918. Earlier Bjerknes papers (this REVIEW, Feb., 1919, 47:90–99) made clear the nature of wind circulation in cyclones and the cause of the distribution of rainfall as it was. Cold air already in the region, when attacked on the flank by relatively warm air is overridden by the latter and a moving rain-stripe 150–300 km. wide is formed by the consequent precipitation. Associated with this rain-stripe and at another angle to it is a narrow stripe of intense rainfall marking the line where cold air underthrusts the western flank of the warm current. (See fig. 1.) The former is called the steering-line and the latter is the well-known squall-line. In this new paper the conditions in some specific cases are carefully described and the magnitude of the operation estimated. The rainfall ordinarily occurring in the belt immediately east or north of the steering-line is said to represent 1,000 million H. P., or the equivalent of a waterfall equal to fifteen Niagaras.

The concluding paragraph of his discussion of the moving cyclone is worth quoting:

> The appearance of the sky in the different parts of a cyclone, at different distances from its center and in different situations relative to the steering and squall-lines, is so characteristic, and develops in so typical a way during the passage of the whole system, that it will always be recognized when one has once become acquainted with it. Of course the formation of clouds and rain of local topographical origin may change the picture, but not in general beyond recognition, and these local changes of the picture should be studied carefully at every place. When this is done, observation of the phenomena of the sky will be seen to have an importance equal to the study of the weather chart, especially for short-range forecasts. The time should be past when weather forecasts are made as bureau work in an office from which only a narrow strip of the sky is seen.

A distinctly new contribution to local forecasting is brought out in his description and explanation of the distribution of local thunderstorms in Norway in a selected 6-day period in summer. The showers developed by day only where solar winds (i. e. sea breezes and valley winds) converged, but not all such points of convergence had showers on the first, second, or even third day. It was found that not till moist air arrived from the sea was it possible for showers to develop over inland convergence points. The divergence points were, of course, over glaciers, fiords, and large lakes, and hence these and their surroundings remained dry on account of descending air.

FIG. 1.—Distribution of cloudiness and precipitation in a moving cyclone.

After the third day, however, nocturnal rains began to occur over such valley areas, for the cold mountain breezes at night smoothly underran and lifted the relatively warm, moist air over thse bodies of water and their shores.

Rains in cyclones and such local showers are due to new air and to overrunning, up-thrust, or local heat convection.

For greatest success the forecaster should find the region of convection, using stream-line charts, and by observation of humidity and other factors follow the advancing front of new air. With such information, detailed forecasts are now being made as to when and where precipitation will occur, and the method seems to hold the possibility of foretelling how much will fall as well.—*C. F. B.*