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ROYAL METEOROLOGICAL SOCIETY

VOL. XLVI.]

JULY 1920

[No. 195

CLOUDS AS SEEN FROM AN AEROPLANE.

By CAPTAIN C. K. M. DOUGLAS, B.A., F.R.Met.Soc.

[Synopsis of a Lecture delivered before the Royal Meteorological Society, March 17, 1920.]

A SERIES of photographs will be shown on the screen this afternoon which will illustrate, firstly, the appearance of the clouds from above; and, secondly, the relation of the forms of the clouds to the distribution of temperature and humidity in the upper air, and to the local weather and general meteorological conditions. The photographs were taken in conjunction with observations of temperature and humidity at different heights, from fully exposed dry and wet bulb thermometers on the wing strut of the aeroplane, and also from self-recording instruments.

It is not generally realised that when the sky is covered with a gloomy canopy of cloud, with the inevitable smoky haze over towns and for a considerable distance to leeward, one has only to ascend about a mile in order to enter a region with clear blue sky above, and a sea of white billowy cloud underneath, which stretches in all directions to a distant horizon which stands out sharply owing to the perfect visibility.

Until recently almost the only method of getting above the clouds was by the slow and laborious process of climbing a mountain, and from the mountains of this country a view of the upper surface of the clouds is comparatively rare. A fair number of instances were recorded at the Ben Nevis Observatory, but most of them were in winter or in the early morning. In many cases when the level of the cloud-sheet is just below the top of the mountain, the sheet rises to cross the mountain and covers up the top.

The aeroplane now provides a much simpler means of getting above the clouds. A modern high-powered machine will climb up through several thousand feet of cloud in a very few minutes. In the cloud one is surrounded by thick fog which covers the machine with water, or with ice if the temperature is below the freezing-point and the cloud consists of super-cooled water-drops. Very soon, however, it grows lighter up above, and shortly afterwards one breaks out into clear sunshine. On some occasions there are other layers of cloud up above, but in anticyclones at any rate there is usually only a single sheet.

I carried out observations of clouds from aeroplanes since 1915, but got very few opportunities of taking photographs. It was impossible to carry out cloud photography when flying on the line. But in the summer of 1918 I took over the flight which was obtaining upper air data for the meteorological section R.E. at G.H.Q. There was then a unique opportunity of obtaining cloud photographs. The necessary apparatus was already available, having been issued to the flight at the request of Lt.-Col. Gold. The camera used was one of the older patterns of R.A.F. hand cameras which proved suitable for the purpose. The plates available were the very fast panchromatic used for trench photographs and slow process plates used chiefly for copying. We found it difficult to avoid over-exposure with the fast panchromatics, and also found that they tended to get fogged as they had no paper on their backs, not being meant for taking bright objects. We found the process plates very suitable for bold cumulus clouds or rippled sheets of cloud. Some types, however, we never photographed successfully. We had no opportunity of carrying the photography to a fine art, as has been done by Capt. C. J. P. Cave and by Mr. G. A. Clarke of Aberdeen Observatory. It is possible to obtain quite good cloud photographs from an aeroplane by using Kodak films. The author obtained some photographs with Kodak films in England in the autumn of 1917, which were reproduced in the *Journal* of the Scottish Meteorological Society.¹ The best of these photographs illustrates the capabilities of a Kodak camera for cloud photography, when the lens is well stopped down and the right exposure given.

The flights were carried out twice daily in all types of weather in order to obtain upper air temperature for the artillery and forecasting. There were thus fairly frequent opportunities of taking photographs of clouds from above, but the photography was merely an extra. If ascents were made primarily to obtain cloud photographs, they would not be made at fixed hours, but when the clouds looked suitable for photography. In summer the clouds are usually most striking about the middle of the day, or early in the afternoon.

The photography was started in the middle of July 1918, and within ten weeks nearly a hundred good negatives had been obtained. Some further photographs were taken in the winter, but the clouds then have less variety than in summer. The majority of the photographs were taken by the author, but a number of good ones were also obtained by Lieut. R. V. Sessions, R.A.F., including Figs. 7 and 14 of those which are being reproduced. The photographs were taken from the pilot's seat, as we did not as a rule take up passengers. They were all obtained over or near Berck, on the French coast about twenty miles south of Boulogne. The locality is of interest from the meteorological point of view, and also because the area under observation included the Channel, which is important for commercial aviation. The coast-line runs from north to south from Cape Grisnez to the mouth of the Somme, a distance of fifty miles.

In winter the sky is very frequently overcast with a single sheet of low cloud varying in thickness from 500 to 2000 feet. This type of cloud is very characteristic of anticyclonic weather. There may be

¹ Vol. 17, ser. 3, 1917, pp. 133-147.

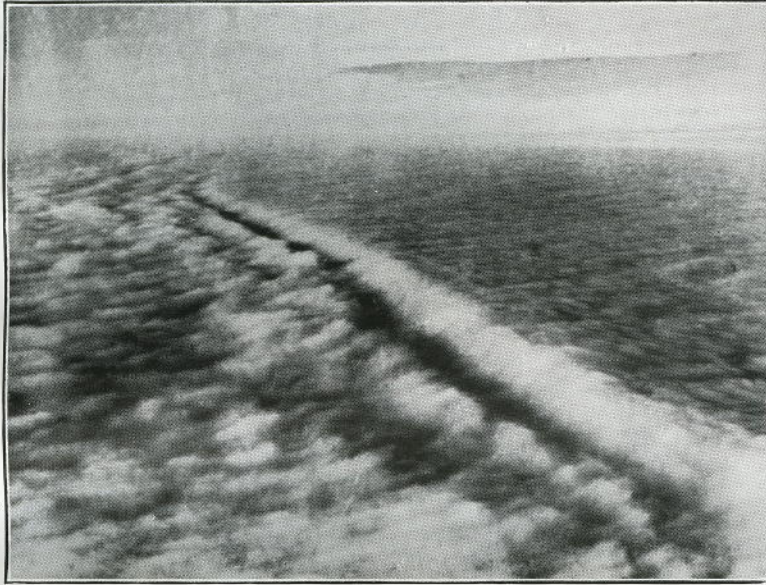


FIG. 1.—February 2, 1919, 15 h. A bank from SE to NW in a sheet of strato-cumulus cloud at about 4000 feet, moving from ENE.

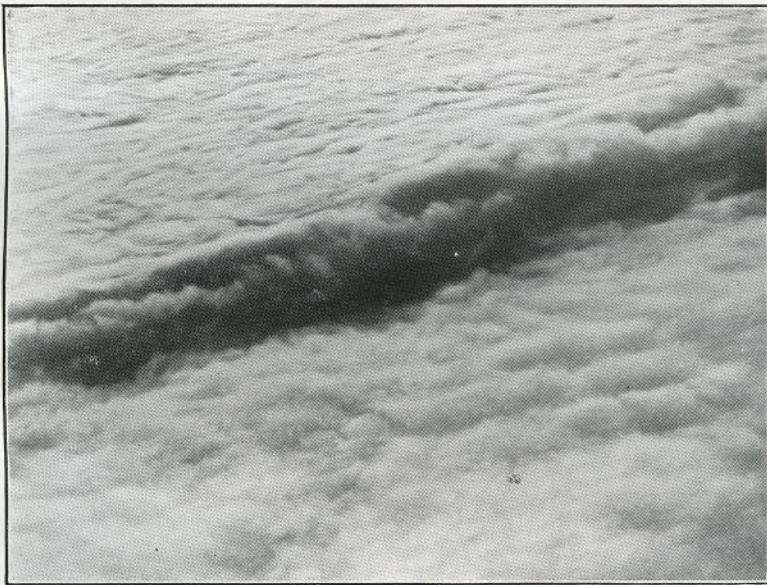


FIG. 2.—Another bank a few miles away at about the same time, in line ESE to WNW.

