loons. This note is concerned chiefly with the mean thickness of cloud layers. The results for the different cloud types are as follows:

Stratus.—Thickness less than 400 meters in greatest number of cases; very seldom greater than 600 meters; mean thickness, 320 meters. There appears to be little seasonal difference.

Nimbus.—The difficulties of observation are very much greater, but the mean thickness of 800 meters is obtained. This is based on a smaller number of observations, due to the fact that under conditions when nimbus prevail, ascents are difficult.

Cumulus.—89 observations gave a mean thickness of 500 meters.

Strato-cumulus.—This layer presented easier determinations because of the attendant discontinuities in temperature and humidity; layers less than 500 meters in thickness were predominant; mean thickness, 310 meters.

Alto-cumulus and alto-stratus.—It is seldon that this level was attained by the registering instruments, and often the clouds were of such a flaky character as to render determinations of thickness difficult; mean thickness for A. Cu., 120 meters, for A. St., 300 meters.

On the whole these values are not in bad agreement with those of Süring at Potsdam. From these means, and from the mean heights of the lower surface of the various cloud types, it is possible to construct a schematic vertical section of the atmosphere above Lindenberg. This the author does, and it appears that there are three layers in which the clouds do not frequently occur—designated by Wenger and Köppen as *wolkenfrei Räume*. These are (1) from the surface to 500 meters; (2) between 1,300 and 1,400 meters—this level being somewhat in doubt; and (3) between 1,900 and 3,000 meters. Too much weight is not given this diagram by the author, and he remarks that "it has only the value of a schematic representation of a cloudy day, but, owing to the numerous observations, it probably approaches closely to the truth."—*C. L. M.*

ANALYSIS OF CLOUD DISTRIBUTION AT ABERDEEN, SCOTLAND,[1] 1916–1918.

By G. A. CLARKE.

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The cloud distribution is analysed from the point of view of aerial navigation. Cloud observations are taken at Aberdeen at 7h., 9 h., 13 h., 15 h., 18 h., 21 h., and to each day is assigned in addition a "cloud characteristic" indicating the kind of cloud which predominated, the lowest type taking precedence over higher ones if covering four-tenths of the sky or more. The day is "clear" if on the average the total amount of sky covered is less than four-tenths, while certain days of very mixed or rapidly changing cloud are classed as "various." Taking cumulus and cumulo-nimbus together, they are found to give the most frequent skies, 23 per cent of the total, while other low clouds are numerous. Alto-stratus skies are twice as frequent as alto-cumulus, but cirro-stratus and cirro-cumulus skies are of equal frequency. Using the average heights of the various types together with the cloud characteristic, 15 per cent of days are seen to be cloud-free below 15,000 feet, 26 per cent below 7,000 feet, 69 per cent below 3,000 feet, while the remaining 31 per cent of days have cloud predominating below 3,000 feet. Seasonal distribution is discussed. The frequency of cumulus and cumulo-nimbus taken together is found to be greatest in April, and there are secondary maxima in mid-summer and September. Air conditions should be most bumpy at these periods. Strato-cumulus skies are more common in winter than in summer, and there are indications that skies well covered with intermediate and higher clouds are also more frequent in winter, but the observations depend on the presence or absence of lower cloud.—*M. A. G.*

[1] Meteorological Office, London, *Professional Notes No. 9*, 1920, pp. 142–147. Cf. also, Brunt, D.: On the inter-relation of wind direction and cloud amount at Richmond (Kew Observatory), *ibid.*, No. 1, 1918, 11 pp.; Diagrams illustrating the amount of cloud during summer and winter with winds from different directions, at Kola and Archangel, *ibid.*, No. 7; The Climate of Northwest Russia, 1919, p. 94; Brunt, D.: Tables of frequencies of surface wind directions and cloud amounts at Metz, Mulhausen, Karlsruhe and Frankfurt, *ibid.*, No. 14, 1920.

THE ARGONNE BATTLE CLOUD.

By B. M. VARNEY.

[University of California, June 22, 1921.]

Descriptions of unusual clouds that were formed in the wakes of airplanes flying over the Argonne battle front in the autumn of 1918 has since been published by eye-witnesses. Mr. G. B. Vaughn wrote [1] as follows:

> We were passing through a little town * * * when we noticed three parallel lines of clouds or smoke stretching far across the sky. They looked as if they had been made by three planes passing, throwing out smoke and cutting stunts, for the lines were far from straight. Through these lines were waves which ran perpendicular to the earth, with a drift from left to right. They looked most like waves of heat one sees rising from the earth, but they traveled with a shifting motion somewhat like the flickering of the northern lights.

Capt. W. F. Wells, Sixtieth Infantry, American Expeditionary Forces, wrote: [2]

> There were two or three days of rain, when came a wonderfully clear and beautiful morning, with not a cloud in sight. * * * Our attention was first drawn to the sky by the sudden appearance of several strange and startling clouds—long, graceful, looping ribbons of white. These were tapering to a point at one end, and at the other, where they dissolved into nothingness, sixty degrees across the sky, were about as broad as the width of a finger held arm's distance from the eye. On close observation we noticed some distance ahead of each cloud point the tiny speck of a chase plane. Apparently the churning of the air was all that was needed to upset the delicately balanced meteorological conditions and precipitate this strange cloud formation. * * * Never before had I seen a plane writing in white upon the blue slate of the sky.

Capt. W. H. Nead, One hundred and sixty-eighth Infantry, described the phenomenon [3] thus:

> The Rainbow Division, on the morning of October 10, 1918, was lying in what had at one time been a wood just back of Montfaucon. The sky was clear except for a few fleecy clouds to the northwest. Three airmen came from the northwest and passed almost over our regiment, continuing on to the southeast.
>
> Behind each machine was a trail of white, which at first sight appeared to be smoke resulting from poor engine combustion, but which upon more careful observation proved too wide to have been caused by smoke. Perhaps the strangest thing of all was the fact that when the planes reached a certain point in the sky the rainbow (sundog) colors became distinctly visible.
>
> The explanation is not difficult. The air was almost saturated with moisture at the temperature which prevailed at that altitude. With the passing of the planes, the propeller movements caused a strong air current with a lowering of the temperature where the current was noticeable. With the lowering of the temperature the air became supersaturated with moisture, forming a small cloud, which at that altitude immediately became snow. This snow would give the white appearance * * * and would also account for the rainbow colors.

The attainment of the saturation point being necessary to condensation, the methods by which this may be

[1] *Am. Legion Weekly*, Sept. 24, 1920, p. 28.
[2] *Scientific American*, June 7, 1919.
[3] *Am. Legion Weekly*, Oct. 22, 1920, p. 12.