SOME INTERESTING TYPES OF MANILA CLOUDS

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NOTE.—This monograph is substantially the same as that presented orally for the author by Rev. Leo Welch, S. J., on September 9, 1939, at the Washington meeting of the International Geophysical Union.

I. INTRODUCTION

Although the altocumulus is one of the most beautiful of cloud types, its varied and intricate forms have long puzzled meteorologists. Within the last ten years, however, experimental laboratory work by Mal, Brunt, Walker and others has succeeded in imitating to a great extent many of these curious shapes, so that we are now in a position to give a tentative, although not wholly satisfactory, explanation of their origin. It is the purpose of this paper to present illustrations of these forms, selected from the many thousands of cloud photographs taken by the author at Manila with a Contax miniature camera.

II. ALTOCUMULUS DUPLICATUS

(*a*) Quevain,(3) late in the last century, was perhaps the first to call attention to the common intimate connection between altostratus and altocumulus. He noticed that when altocumulus was turning into altostratus, it was not, as he had thought, accompanied by the huddling together of the altocumulus balls, but by the formation of a stratus layer underneath the balls and distinct from them. Viceversa, when altostratus changed to altocumulus, it was not done by the mere fracture of the stratus, like "the breaking up of an ice sheet into fragments," but by the tearing away or dissipating of an underlying veil of stratus. Fig. 1 is a good illustration of the transition type. To the left we have plain altocumulus fragments, in the lower middle we have undulations in which the stratus has already formed underneath; to the right of the picture the altostratus is practically complete. Figs. 2 and 9 are other examples.

(*b*) Peppler(1) (2) examined these clouds more carefully, designating them altocumulus duplicatus because of the duplex nature of the cloud. He found, with Quevain, that at least in his locality the two layers are usually very distinct, with several hundreds of meters between them, the stratus below, the altocumulus proper above. He considers, from meteorographic evidence, that a double inversion is responsible, but with the upper inversion more pronounced. He recognizes, however, another type, which he calls altocumulus duplicatus loosely called, in which the true stratus veil is *immediately* below the altocumulus proper. In these cases he says there is only one inversion, with the altocumulus duplicatus just below it. The stratus veil may be due to shear or turbulence just below the altocumulus and spreading out there, or from "fallstreifen." As might have been expected, this same formation appears in cirrocumulus. (Cf. Fig. 3)

(*c*) As to the altocumulus duplicatus properly so called, with the stratus layer quite distinctly below the altocumulus, it is doubtful whether in our region the separation is as pronounced as Peppler saw it. Nevertheless, we may infer, if we see individual ripples in the veil of stratus, that the stratus must be truly distinct from the altocumulus above it. These ripples are at times very striking; they remind one forcibly of the direction lines of a flowing stream with ribbed sand beneath, since the altocumulus above