

(b) The reflectivity of wet ice is approximately 0.2 times that of water, while the reflectivity of dry ice is 0.05 times that of water. Ice on the other hand has 10 to 20 times the diameter of water droplets. Therefore, when height is plotted against reflectivity it is seen that the reflectivity is greater at heights where hail or ice is present than at lower heights where only water droplets are present. Recently it has been found that a mushy coating around an ice nucleus has a greater reflectivity than ice or water.

(c) Measurements of reflectivity give an indication of the composition of rainclouds and therefore an insight into the rain-producing mechanism.

Dr. Atlas then proceeded to describe the principles and use of Doppler radar. The Doppler shift of the radar beam could be measured and by analysis of the Doppler spectra the drop size distribution for different rates of precipitation could be determined for both water and snow.

Also wind speed, wind shear and the fall speed of rain droplets could be measured by Doppler radar, and it would be possible to obtain the entire vertical wind profile in a short period of time.

Another important use of Doppler radar is in the analysis of the wind structure of tornadoes.

9 October 1963

JET STREAMS AND TURBULENCE

by E. R. Reiter

At a special colloquium, Dr. Reiter, Associate Professor, Department of Atmospheric Science, Colorado State University, Fort Collins, Colorado, U. S. A., a visitor to the Meteorology Department of the University of Melbourne, gave a talk on jet streams and clear air turbulence, with special reference to the high altitude turbulence measurements over southern Australia by a team, with an instrumented Canberra Aircraft, from the Royal Aircraft Establishment, Farnborough, England. An account of Dr. Reiter's talk will be published in the next issue of this Magazine.

19 November 1963

OPERATIONAL AND RESEARCH ASPECTS OF METEOROLOGICAL SATELLITE DATA

by L. F. Hubert

Mr. Hubert, Chief of the Synoptic Research Section, Meteorological Satellite Laboratory, U. S. Weather Bureau, commenced his talk with the introductory remarks that almost from the day of launch of TIROS I on April 1st, 1960, large scale cloud patterns were used in operations. The gross cloud patterns revealed the presence of cyclones and generally disturbed regions.

In addition infra red radiation data were obtained on later TIROS satellites and these are useful for determining the cloud heights. So far this has been done only in research studies but will soon be available quickly enough for operational use.

An important aspect in the interpretation of television cloud pictures for both operations and research is the exploitation of meso-scale and sub-synoptic scale patterns.

It is essential that we investigate this class of phenomena in order to understand the underlying thermo- and hydro-dynamics, but it is not necessary to await these results to use the information revealed in day to day analysis. Certain patterns have been seen so frequently that we have come to know some of the general atmospheric conditions, even though there are

few cases adequately documented. The reason the small scale patterns can contribute to large scale analysis is because the large scale synoptic situation produces the environment which in turn produces the meso-scale patterns. Thus without understanding all of the connection links, the small scale pattern, in some cases, can be associated uniquely with a larger scale situation.

Examples of such sub-synoptic scale patterns are:-

1. The narrow cloud lines of middle and high clouds associated with the jet stream (on its warm air side)
2. Gravity waves an order of magnitude larger than the billow waves treated in the literature, associated with strong winds in the troposphere. These are frequently produced when the strong wind is perpendicular to a range of hills or mountains. The wave crests will appear across the wind.
3. Stratocumulus patterns such as island - produced mechanical eddies, cellular and actinoform (spider-like radial) patterns, probably all associated with an inversion in the low troposphere.
4. Cirrus shearing from the tops of Cb's showing the shear, typically, between 700 mb and 300 mb, and frequently very close to the 300 mb wind direction.
5. Strong organization of tropical cloud patterns in deepening tropical storms.

The new Automatic Picture Taking experient soon to be flown on TIROS VIII and NIMBUS will enable picture data such as that discussed above, to be used in Australia for current analysis. This will be a large advance over the information that is currently available on the encoded nephanalyses.

DISCUSSION: In reply to Mr. I. C. McIlroy, Mr. Hubert gave some details of the NIMBUS Satellites. They would have two cameras with a scan of 800 lines, each covering a width of $\frac{3}{8}$ to $\frac{1}{2}$ mile of the earth's surface. The time the satellite could record information would be limited by the time required by the satellite to give the information to call stations. Answering Dr. Radok he said the time of exposure for picture-taking was 15 microseconds and in this time the movement over the ground was 15 to 30 feet.

To a query by Mr. R. H. Clark on the Easterly Wave, he replied this it had not been found yet.

Mr. G. T. Rutherford enquired on the effect of the brightness of the pictures in interpretation. Mr. Hubert replied that there was no brightness scale. The brightness of the pictures was relative and not absolute. The zenith distance of the sun should be known for estimating brightness. Reflection from the sea varies with state of sea and could in some cases be mistaken for cloud.

Dr. A. J. Dyer asked if the clouds of jet streams were always visible. Mr. Hubert in reply stated that they were only seen under favourable conditions. The difference between the high and low clouds of a jet stream was often noticeable.

Dr. C. H. B. Priestley inquired further concerning the spider web pattern shown in one illustration of the talk. The speaker said that little was known about their formation except that they were most evident near islands in the oceans in low latitudes.

Mr. Hubert in answer to a question by Mr. A. K. Hannay said that comparison of radiation in the window wave lengths and total radiation give an indication of the amount of moisture or water vapour in the atmosphere near the earth. The amount of radiation escaping from the top of the atmosphere in the water vapour window band 8-12 μ gave an estimate of the effective temperature of the radiating surface and thus provided a pattern of cloud distribution

and of cloud-top height.

Mr. W. J. Gibbs inquired about the automatic picture taking camera system of the satellite and how often pictures would be available over Australia, to which Mr. Hubert replied that TIROS would make one or two passes per day in favourable periods within reach of a read-out station and that two or three pictures could be received per pass.