

## Cirrus cloud particles in the tropical tropopause layer observed by HYVIS

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Water vapor in lower stratosphere has influence on sea surface temperature and stratospheric ozone. Its sources are transportation from the troposphere to the stratosphere by Brewer Dobson circulation and oxidation of methane in stratosphere. In lower stratosphere, the transportation is dominant.

The air transported from the troposphere to the stratosphere pass through the Tropical Tropopause Layer; TTL. TTL is the cold area, where cirrus clouds are formed frequently, and the air passing through TTL is dehydrated. Therefore formations of cirrus clouds determine the water vapor concentration in lower stratosphere. In addition, cirrus clouds have an effect on earth radiation budget. Number concentration and shape of cloud particles are the basic information about microphysical characteristic and radiation budget of cirrus clouds.

In this study, we studied the microphysical characteristic of cirrus cloud by observations by HYdrometeor VideoSonde (HYVIS, manufactured by Meisei electric co., ltd.). Balloon born HYVIS collects cloud particles on transparent film, takes images of cloud particles from behind the film, transmits the images by radio waves to the ground. This device measures changes of shape and the number of cloud particles with through the balloon ascending. The HYVIS used in this study force to introduce air. We can calculate sampling air volume by actual area and aspiration rate, and it is possible to estimate the number concentration.

Some other observations had been performed as the part of SOWER campaign at Biak (1.17 degrees South, 136.06 degrees East), Indonesia in 5-14th January 2013.

We conducted a wide variety of simultaneous observations such as lidar, Cryogenic Frostpoint Hygrometer (CFH), Optical Particle Counter (OPC), and Electrochemical Concentration Cell (ECC) ozonezone. We launched HYVIS once in a day from 7th to 9th January 2013. The maximum duration of operation is 75 minutes. HYVIS can reach stratosphere within this duration.

The result of HYVIS observation launched at 18:46LT on 9th January shows that the size of particle and number density were much smaller than typical value. The diameter of the most of the particles was 6-20 micrometers and the estimated number density of cloud particle was  $10^4$ - $2 \times 10^5$ /m<sup>3</sup>. The shape of the cloud particles was almost sphere. The columnar, needle, plate-like shape particles were rarely observed. The large particles whose diameter is larger than 40 micrometers were not detected.

Ten hours before launching of the HYVIS, the clouds top heights observed by lidar was constantly 17.5 km. After launching HYVIS, due to the occurrence of thick clouds, lidar observation could not detect up to the cloud top. On the other hand, HYVIS observed cloud particles at the altitude higher than 19km. The simultaneous lidar observation detected the relatively high number density cirrus clouds from 8-17.5km altitudes. Therefore, it may be caused by the contamination of balloon or ropes when the HYVIS passed through the thick clouds.