



Abstract Details

[AOGS 1st Annual Meeting](#) > [Ocean and Atmospheres](#) > **Vertical Structure of Winter Precipitation around Japan Using Satellites Data** >

Corresponding Author : Mr. Munehisa Yamamoto (s020144m@mbox.nagoya-u.ac.jp)

Organization: Nagoya University

Category: Ocean and Atmospheres

Paper ID: 57-OOA-A738

Title: Vertical Structure of Winter Precipitation around Japan Using Satellites Data

Abstract:

Ocean around Japan is well known as the precipitation zone of the winter monsoon. In this region, the change of the surface pressure pattern causes large changes of precipitation and cloud distributions. However, vertical structures for each type of precipitation systems have not yet been well studied, especially over the Pacific Ocean. In order to clarify the characteristics of the winter precipitation, the vertical structure of winter precipitation was investigated using the Tropical Rainfall Measuring Mission (TRMM) satellite data. The cloud distributions around Japan in winter were subjectively classified into the cold outbreak pattern and the extratropical cyclone and front pattern, and their vertical structures of precipitation and heat fluxes below the patterns are compared with each other. The top of precipitation echoes for the cold outbreak pattern is about 2 km, which is about 60 % of the cloud top height. Only a few echoes reach 4 km for the cold outbreak pattern. 0 degC height derived from the product of TRMM data, which is estimated using monthly mean SST and constant lapse rate, is about 1.5 km higher than that derived from NCEP data. This causes the incorrect detection of the phase of precipitation (solid or liquid) at the surface. On the other hand, the top height of precipitation echoes for the cyclone and front pattern is around 3 km, which is about a half of the cloud top height, and some echoes reach about 6 km. The distribution of TRMM Microwave Imager (TMI) brightness temperature for each frequency corresponds to differences in radiance property. However, about 85 % of precipitation for cold outbreak patterns is not detected on TMI estimated precipitation, while the 0 % for the low and front pattern. This is because the shallow and isolated precipitation is dominant for the cold outbreak pattern. When we estimate winter precipitation in mid-high latitude by the microwave radiometer data, it is necessary to handle these precipitation characteristics.

Presentation Mode: Poster

Keywords: winter precipitation, vertical structure, TRMM

Status: Pending.

Co-Authors

No.	Title	First Name	Family Name	Organization
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