Studies on horizontal scale, vertical scale, and microphysical properties of convective cloud in tropical Pacific by using Cloud Object analysis method

*Naoya Takahashi[1], Tadahiro Hayasaka[1]

1. Tohoku University

Deep convective cloud is important for modulating climate, radiation budget, and hydrological cycle. In the tropics, the mean radiation budget is significantly affected by the amount of upper-level ice clouds associated with deep convective cloud. The objective of this study is to understand the vertical structure and microphysical characteristics of deep convective clouds. In this study, we used the cloud object analysis method which is introduced in Bacmeister and Stephens (2011). This method evaluates horizontal and vertical scale of cloud by using dataset with active sensors on board satellite. Compared with previous studies, we improved the method by using not only CloudSat satellite but also CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) satellite. The improved method showed that optically thin cirrus has a significant impact on horizontal and vertical scale of deep convective clouds. Moreover, we took advantages of ice cloud properties retrieval from the CloudSat 2C-ICE product to provide microphysical properties of convective core or anvil part in deep convective cloud. We analyzed only deep convective clouds in tropical Pacific oceans (30°S-30°N) and used dataset from 2007 to 2011.
From the comparison horizontal and vertical scale of cloud in western tropical Pacific (WP) and that in eastern tropical Pacific (EP), we found that both horizontal and vertical scale in WP are larger than that in EP. However, ratio of width of convective core to entire horizontal scale of deep convective cloud in WP and EP are almost same. Convective activity in WP and EP are different because of difference in sea surface temperature. It suggested that convective activity has an impact on entire horizontal scale of deep convective clouds.
For evaluation of cloud microphysical properties in the convective core and anvil parts, we investigated vertical distribution of cloud particle effective radius and ice water content in each part. Below 15 km, ice cloud particle effective radius and ice water content of convective core part are larger than that of anvil part. This result seems to reflect the process of formulation of deep convective clouds.

Keywords: Deep convective cloud, Cloud microphysics, CloudSat, CALIPSO

