Detection of the mixed phase top using the measured dual-frequency ratio of reflectivity with GPM/DPR

*Yuki Kaneko[1], Toshio Iguchi[2]

1. Japan Aerospace Exploration Agency, 2. National Institute of Information and Communications Technology

The core observatory of the Global Precipitation Measurement (GPM) mission was launched in 2014 and has been observing rain and snow between 65˚S and 65˚N by the Dual Frequency Precipitation Radar (DPR) and the GPM Microwave Imager (GMI). The DPR provides three-dimensional structure of storms derived from reflected energy from precipitation particles. Precipitation echoes at the two frequencies of the DPR, Ka-band (25GHz) and Ku-band (14GHz), make it possible to infer the mean size and physical property of precipitation particles. The swath width of Ka-band scanning was 125 kilometers centered at nadir and was nested within the Ku-band’ s wider scan width of 254 kilometers. On May 21 2018, the Ka-band scan pattern was changed to match with the Ku-band’ s. Dual frequency radar reflectivity factors are available for full swath of 254 kilometers now.

The classification (CSF) module in the standard DPR level2 algorithm detects a bright band (BB) and classifies precipitation into three types, stratiform, convective, and other. Rain types affect the retrievals of rain amount and latent heating in the DPR algorithm. Accurate classification is also important in the Global Satellite Mapping of Precipitation (GSMaP) algorithm because it affects the rain profile database used in the rain retrieval with microwave radiometers. The BB detectability by the standard CSF algorithm is lower at and near the swath edges than near nadir because only Ku-band data was available in the outer swath before and because slant incidence of radar beams smears the vertical profiles.

As the Ka-band scan pattern has changed to cover the full swath, we can apply a dual-frequency method to detect a BB now. We have developed a method that uses the dual frequency ratio (DFR) to detect the mixed phase top. It looks at the slope of DFR as a function of range to identify the transition height from ice to water. DFR itself is estimated from measured DFR (DFRm) with attenuation correction. Preliminary experiments show that the developed method can detect the BB in stratiform rain over the swath almost uniformly. This method also has a potential to identify the transition height even in some convective cases. In this research we evaluate the performance of the algorithm by comparing the altitude of BB and the transition height with those estimated by using X-band multi-parameter radar (XRAIN) data.

Keywords: GPM, Melting Layer, Precipitation Radar

