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Impacts of Freezing-Level Altitudes on Rainfall Estimations from Passive Microwave Sensors

Ji-Hye Kim (1,3), Dong-Bin Shin (1), and Kyoung-Wook Jin (2)

(1) Yonsei University, Atmospheric Sciences, Seoul, Korea (dbshin@yonsei.ac.kr), (2) COMS System Engineering Team, Korea Aerospace Research Institute, Daejeon, Korea, (3) Global Environmental System Research Laboratory, National Institute of Meteorological Research, Seoul, Korea

A major uncertainty in many algorithms to estimate rainfall from microwave brightness temperatures results from lack of information on a physical parameter, the thickness of the rain column, because the algorithms consider the radiative properties of frozen and liquid precipitation hydrometeors differently. The rain-column thickness is, however, not well determined directly from simultaneous measurements. Most estimation models use the freezing level derived by indirect methods for the unknown parameter. This study investigates the differences between three types of parameters that may be used to provide information about the rain-column thickness. The three parameters are based on different physical backgrounds and include the freezing level estimated from the linear combination of 19 GHz and 21 GHz brightness temperatures from the Tropical Rainfall Measuring Mission (TRMM) microwave imager (TMI), the bright-band height observed from TRMM precipitation radar (PR), and the freezing level derived from the NCEP reanalysis data. Rainfall estimations using the parameters related to the rain-column thickness are then evaluated.