Simulation of Microwave Radiative Transfer in Stratiform Rain over Land and Ocean

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Tropical Rainfall Measuring Mission (TRMM) observations of radiometer brightness temperature (Tb) and radar reflectivity (Z) have been analyzed together with simulation, in order to explain the connection between microwave radiative transfer and vertical profiles of hydrometeors over tropical land and ocean.

Vertical profiles of Precipitation Radar (PR) reflectivity were inputted for the stratiform rain model, developed in this study. Then simulated temperatures of corresponding three TMI channels (19, 37, 85 GHz) were compared with TMI Tb observations. In particular, radiative transfer simulations of microwave brightness temperature have been performed in order to show its sensitivity to particle size distribution (PSD; N^*, μ) and surface emissivity (ε). The brightness temperature at 85 GHz (i.e., T85) was enhanced as particle size of hydrometeors increased over land and ocean. However, T19 and T37 were decreased over the ocean under the condition of the particle size. Also, the simulaed Tb values in case of Gamma distribution were higher than those of Marshall-Palmer distribution except for low frequency channels (i.e., 19 GHz and 37 GHz) over the ocean. The Tb sensitivity to N^* and μ was strong at 85 GHz, but weak at 19 GHz and 37 GHz. On the other hand, there was a distinct difference in brightness temperature over between land and ocean at low frequency, but not at 85 GHz. The phenomenon is due to high intensity upwelling from the atmospheric lower layers and surface.