Investigating the ice water path in convective cloud life cycles to improve passive microwave rainfall retrievals

RAMON BRAGA
National Institute for Space Research, Brasil
Vila, Daniel (NATIONAL INSTITUTE FOR SPACE RESEARCH, Brazil)

E-mail: ramonbraga87@gmail.com

This study focuses on the possible relationship between ice water path (IWP) retrievals using high-frequency channels (89 and 150 GHZ) from: Advanced Microwave Sensor Unit – B and Moisture Humidity Sounder sensors (NOAA 16-19) and the life cycle stage of convective clouds. In the first part of this study, the relationship between IWP and the cloud area expansion rate is analyzed using the 235 K isotherm from GOES-12 thermal infrared images (10.7 μm). Then, the relationships between cloud convective fraction, rain rates (from ground radar) and cloud life cycle are analyzed. The selected area and time period coincides with the research activities of the CHUVA-GLM project at São José dos Campos, Brazil. The results show that 84% of precipitating clouds contain ice, according to the microwave surface and precipitation products system (MSPPS) algorithm. Convective systems in the intensifying stage (when the area is expanding and the minimum temperature is decreasing) tend to have larger IWPs than systems in the dissipating stage. Larger rain rates and convective fractions are also observed from radar retrievals in the early stage of convection compared with mature systems. Hydrometeor retrieval data from polarimetric X-band radar suggest that particle effective diameter (De) and IWP patterns inferred with the MSPPS algorithm could be used to determine the life cycle stage of a given convective system. Using this information, a new set of equations is evaluated for rainfall retrievals using De and IWP from the current retrieval algorithm. This new approach outperforms the current algorithm in the studied region.