Geophysical Research Abstracts
Vol. 16, EGU2014-9934, 2014
EGU General Assembly 2014

Effect of microphysics scheme in cloud resolving models in passive microwave remote sensing of precipitation over ocean

Ju-Hye Kim (1), Dong-Bin Shin (2), and Christian Kummerow (3)

(1) Korea Institute of Atmospheric Prediction Systems (KIAPS), Data Assimilation Team, Korea, Republic Of (j.kim@kiaps.org), (2) Department of Atmospheric Sciences, Yonsei University, Seoul, South Korea, (3) Department of Atmospheric Sciences, Colorado State University, Fort Collins, Colorado

Physically-based rainfall retrievals from passive microwave sensors often make use of cloud resolving models (CRMs) to build a-priori databases of potential rain structures. Each CRM, however, has its own assumptions on the cloud microphysics. Hence, approximated microphysics may cause uncertainties in the a-priori information resulting in inaccurate rainfall estimates. This study first builds a-priori databases by combining the Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) observations and simulations from the Weather Research and Forecasting (WRF) model with six different cloud microphysics schemes. The microphysics schemes include the Purdue Lin (LIN), WRF-Single-Moment 6 (WSM6), Goddard Cumulus Ensemble (GCE), Thompson (THOM), WRF-Double-Moment 6 (WDM6), and Morrison (MORR) schemes. As expected, the characteristics of the a-priori databases are inherited from the individual cloud microphysics schemes. There are several distinct differences in the databases. Particularly, excessive graupel and snow exist with the LIN and THOM schemes, while more rainwater is incorporated into the a-priori information with WDM6 than with any of the other schemes. Major results show that convective rainfall regions are not well captured by the LIN and THOM schemes-based retrievals with correlations of 0.56 and 0.73. Rainfall distributions and their quantities retrieved from the WSM6 and WDM6 schemes-based estimations, however, show relatively better agreement with the PR observations with correlations of 0.79 and 0.81, respectively. Based on the comparisons of the various microphysics schemes in the retrievals, it appears that differences in the a-priori databases considerably affect the properties of rainfall estimations.

This study also includes the discrepancy of estimated rain rate from passive radiometer and active radar for two rainfall systems of different cloud microphysics near the Yellow Sea. The first case have high cloud top (HCT) with large ice particles and the other case is precipitation with mid cloud top (MCT) having less ice particles. Two rainfall databases (DBs) are constructed that simulated component of the first is new WRF rainfall simulations and the second is CRM simulations used in GPROF algorithm. The cloud microphysics in CRM is important factor in rainfall estimations of deep convection in HCT case, because this system has ice phase particles in the upper atmosphere which brings scattering at high frequency TBs. On the other hand, high resolution channel of 85 GHz (7 km x 5 km) gives little information in MCT case and it brings underestimation of rain rate compare to radar measurement. In other words, dependency of CRM and its microphysics is not significant in estimation of rainfall by radiometer for warm type precipitation.