Geophysical Research Abstracts
Vol. 13, EGU2011-3934-3, 2011
EGU General Assembly 2011

Radiative impacts of precipitating hydrometeors on atmosphere circulation features in weather and climate models

Juilin Li (1), Richard Forbes (2), Duane Waliser (1), and Tristan L'Ecuyer (3)
(1) JPL/NASA/CalTech, United States (jli@jpl.nasa.gov), (2) ECMWF, Reading, UK, (3) CSU, CO, USA

Climate models such as those used in the Intergovernmental Panel on Climate Change (IPCC) assessments, often ignore radiative impacts of precipitating hydrometeors (e.g., rain, snow) due in part to the perception that the combination of their limited spatial and temporal extent and large particle radii are insufficient to have a tangible radiative impact on the atmosphere and because there has been limited observations on the amount of precipitating hydrometeor mass in the atmosphere. Because of this, the models ignore the radiative processes associated with falling hydrometeors and only consider the "suspended" water in the radiation calculations. The implications of this are that such models are likely achieving top of atmosphere (TOA) radiation balance through compensating errors and introducing atmospheric circulation, hydrometeors, precipitation and land/sea surface temperatures biases.
We perform a series of sensitivity tests in order to examine the impacts of exclusion/inclusion of the precipitating hydrometeors for radiation calculations on atmospheric radiative fluxes and heating rates, as well as surface precipitation and dynamics using ECMWF IFS. Preliminary sensitivity tests onto identifying the radiation impacts from inclusion of precipitating components in the ECMWF forecast system all indicate the reduction of convective intensity, surface wind stress and convective precipitation etc. These imply that the radiation impacts from exclusion of precipitating components in the conventional GCMs tend to enhance the convective intensity/precipitation over land as well as vertical updraft with warmer skin land temperature associated with excessive surface SW & TOA LW fluxes.
These results demonstrate the usefulness in helping to evaluate and constrain model representations of cloud-radiative processes and feedbacks.