Ensemble Data Assimilation of GSMaP precipitation into the nonhydrostatic global atmospheric model NICAM

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It is generally difficult to assimilate precipitation data into numerical models mainly because of non-Gaussianity of precipitation variables and nonlinear precipitation processes. Lien et al. (2013, 2015) proposed to use an ensemble Kalman filter approach to avoid explicit linearization of models, and a Gaussian transformation (GT) method to deal with the non-Gaussianity of precipitation variables. Lien et al. pioneering results show that using an EnKF and GT helps improve the forecasts by assimilating global precipitation data, in both a simulated study using the SPEEDY model, and in a real-world study using the NCEP GFS and TRMM Multi-satellite Precipitation Analysis (TMPA) data.
This study extends the work of Lien et al. by assimilating the JAXA's Global Satellite Mapping of Precipitation (GSMaP) data into the Nonhydrostatic Icosahedral Atmospheric Model (NICAM) at 112-km horizontal resolution. It develops a new method to construct the two GTs (forward and inverse GTs) for observed and forecasted precipitation using the previous 30-day precipitation data. Using this new forward GT, precipitation variables are transformed to Gaussian variables, and assimilating the GSMaP precipitation results in improved forecasts. We also found that using the inverse GT allows to create realistic observation-like precipitation fields from the model forecasts transformed by the observation-based inverse GT. Moreover, we also explore online estimation of model parameters related to precipitation processes using precipitation data. This presentation will include the most recent progress up to the time of the meeting.

Keywords: Data Assimilation, GSMaP, NICAM-LETKF, Gaussian Transformation

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