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Enhancing data assimilation of GPM observations

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In precipitation science, satellite data have been providing precious, fundamental information, while numerical models have been playing an equally important role. Data assimilation integrates the numerical models and real-world data and brings synergy. We have been working on assimilating the GPM data into the Nonhydrostatic ICosahedral Atmospheric Model (NICAM) using the Local Ensemble Transform Kalman Filter (LETKF). We developed a method to effectively assimilate JAXA's GSMaP (Global Satellite Mapping of Precipitation) data together with the AMSU-A radiances and conventional observations, and successfully improved the medium-range weather forecasts. We extended the method to directly assimilate reflectivity from GPM/DPR. In addition, we applied data assimilation to estimate NICAM model parameters related to precipitation processes and obtained promising results. Moreover, we explored running the LETKF with 10240 ensemble members and found that about several hundred ensemble members may be sufficient to remove vertical localization completely for satellite radiance data assimilation. We also explored how to treat observation error correlations in data assimilation; this is an important problem for effective assimilation of satellite observations which are likely to have inter-channel and horizontal error correlations. Further, we explore including land-surface variables such as snow and moisture to be analyzed together with the atmospheric variables in NICAM. In this presentation, we will present the most up-to-date results of our research on enhancing data assimilation of GPM observations.