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Assimilation of GPM DPR Spectral Latent Heating using Situation Dependent Observation Error Covariance with Spatial Correlation in Kalman Gain (No 279)

Pre-recorded oral presentations
4. IMPACT OF SATELLITE DATA IN GLOBAL NWP (JOINT WITH ECMWF)

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The observation error covariance matrix is often approximated with a diagonal matrix when assimilating observation data. However, observations about the vertical distribution of precipitation such as space-borne radars have an observation error correlation which cannot be ignored in the vertical. In addition, the structure of the correlation matrix depends on the environment of precipitation such as deep convection and stable stratification.

To incorporate this correlation and dependency, we directly calculated the Kalman gain including the correlated observation error using the Moor-Penrose inverse matrix for each precipitation type, and investigated the impact of full or diagonal observation error covariance matrix in a data assimilation system. It was also found that the amount of correction other than latent heat such as water vapor can be constrained based on the model error with inter-elements correlation in the Kalman gain. In this study, we investigated the impact of assimilating GPM DPR Spectral Latent Heating (GPM-SLH) by a nudging method with Kalman gain including the correlated observation error. The NWP model used in the experiment was Local Forecast Model (LFM) operated by JMA for short range precipitation forecasts and aviation weather forecasts. As a result of the assimilation experiments, we found that the observation error covariance matrix of SLH has a characteristic structure depending on the precipitation type and plays an important role in the assimilation of dense observation data without vertical thinning. In addition, by introducing inter-element correlation into the Kalman gain, water vapor and temperature can be assimilated under the constraints of the model error.

Assimilation of SLH significantly improves the forecast of deep convective precipitation in the summer season. In this presentation, we will show the characteristics of the situation dependent observation error covariance matrix and demonstrate the impacts of spatial correlated observation error on assimilation and prediction results.