A study on Cloud Microphysics for Remote Sensing Data Assimilation

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A new km-scale hybrid-4DVar data assimilation system is being developed to improve short-range precipitation forecasts at the Japan Meteorological Agency. One of the purposes of developing this system is to enable the assimilation of observations related to hydrometeors. For the assimilation of such observation, a new simplified 6-class 3-ice 1-moment bulk cloud microphysics scheme suitable for the tangent linearization has been developed. This cloud microphysics scheme is tuned to reduce the forecast bias of hydrometeors profile by updating the assumption of ice and snow particles. In this revision, the shape assumption of ice and snow is changed from spherical particle to non-spherical particle, and the particle size-distribution of snow is changed from negative-exponential distribution to negative-exponential and+ modified gamma distribution. The unbiased attribution of hydrometeors is very important for the appropriate assimilation of the observation as well as the improvement of precipitation forecast.
A traditional 4DVar uses climatological background error covariance. However, the errors of hydrometeors are correlated each other, and the error correlation depends strongly on meteorological situations. To consider such flow-dependency, the background error covariance of hydrometeors is constructed using ensemble perturbations in the new hybrid-4DVar data assimilation system. Using this km-scale hybrid-4DVar data assimilation system, the impact of space-borne radar and radiance data was investigated. The results of this investigation will be presented.

