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Validation and Improvement of 3DVar in GRAPES (Global and Regional Assimilation Prediction System)

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GRAPES (Global and Regional Assimilation Prediction System) is the Chinese new generation NWP system for which the pre-operational tests are being conducted currently in operational NWP centers. 3DVar is one of the main components of GRAPES and plays an important role in the whole system. After a brief introduction to the GRAPES-3DVar, results of a series of validations of GRAPES analyses against the observation data and analyses derived from other operational NWP center to assess its performance are presented in this paper. The GRAPES-3DVar is shown to be capable of upgrading the quality of initial fields of the prediction model by directly assimilate the unconventional observational data such as satellite radiances. However, the fact that the analyses are sensitive to some prescribed parameters reflecting the statistics of background errors, which are not well defined up to now, causes some problems in the operational implementation of the system. In order to improve the analyses, results of background error statistics by new algorithms are introduced. The validations are then implemented repeatedly to assess the impacts of new statistics. In addition to the improvement of the background error statistics, different options of control variables in the 3DVar are evaluated. It is shown that proper choice of moisture variable is crucial for the prediction of precipitation, but more studies are still needed.