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AAS02-03 Room:201B Time:May 26 12:30-12:45

Comparison of 4DVAR, Hybrid-4DVAR and Hybrid-4DEnVAR at cloud resolving scales

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In the Strategic Programs for Innovative Research (SPIRE) Field 3 state-of-the-art data assimilation methods were implemented in the K Computer, among them 4DVAR, Hybrid-4DVAR, and Hybrid-4DEnVAR. These methods are expected to represent the atmospheric state more accurately, thus improving the forecast quality, especially for severe weather phenomena like local heavy rainfall. All the above methods belong to the variational data assimilation technique which estimates the mode of the posterior distribution through minimization of a cost function. While 4DVAR and Hybrid-4DVAR use the tangent linear and adjoint models to propagate the uncertainty in time, Hybrid-4DEnVAR retrieves this information from the nonlinear forecasts of ensemble members. Both Hybrid-4DVAR and Hybrid-4DEnVAR take ”errors of the day” in consideration when using the background covariance from an ensemble forecast. To provide this ensemble background covariance for the two hybrid systems, a 4D-LETKF system was run in parallel to the 4DVAR module. However, this is not a one-way interaction between 4DVAR and 4D-LETKF. The 4D-LETKF analysis is replaced by the one of 4DVAR, combining this with the ensemble analyses estimated by 4D-LETKF to propagate the system state and its uncertainty in time. Performance of three methods is shown in experiments with real observations. Other aspects like computational cost, complexity, and balance of the analyzed field will be discussed.

Keywords: Variational data assimilation, 4DVAR, Hybrid-4DVAR, Hybrid-4DEnVAR