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# New Variational Data Assimilation System for Regional Model at JMA

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## Abstract

The four-dimensional variational method needs to keep up with the updates of the forecast models used as strong constraints. In JMA, with the development of non-hydrostatic model "ASUCA", we have developed the variational data assimilation system based on ASUCA (ASUCA-Var). In the ASUCA-Var, the control variables include the underground temperature and the soil moisture in addition to atmospheric variables, and the climatological background error covariances are classified by sea/land and local time. The cost function is designed to be in fully quadratic form, is minimized by three times the line search as inner loop with the basic field update twice in between the inner loops. For advanced observation processing within the variational system, variational quality control and variational bias correction have also been introduced. In addition, we developed an optimization method for the model's topography based on the variational method. Since the various validation indicators showed that the forecast accuracy of the NWP system using ASUCA-Var has been significantly improved compared to the former system, ASUCA-Var has been operated as the Meso-scale Analysis since March 2020. Currently, we have been developing the introduction of hybrid 4D-Var with ensemble of data assimilation and the extension of control variables to hydrometeors. In this presentation, the overview of ASUCA-Var, the impact of the observations using the degree of freedom signal and the verification results of the ASUCA-Var's performance will be shown.

**Keywords:** Data assimilation, Regional Model, 4DVar, Operational System

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