Modernising the Land Data Assimilation and Land Model Uncertainty Estimation in NOAA's Global NWP Systems

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Abstract

In contrast to other national NWP centers, the soil moisture and temperature in NOAA's global NWP models is not directly constrained with observations, and our operational snow analysis is also outdated. This presentation then provides an overview of research efforts to modernise the land data assimilation used in our global atmospheric systems, together with relevant experimental and scientific results. For snow, we have developed an Optimal Interpolation (OI) snow depth analysis to assimilate station snow depth and remotely sensed snow cover observations, based on the schemes used elsewhere. The OI corrects our current analysis' bias against adding snow, while improving the snow depth and low-level atmospheric temperatures over land. It is now being implemented in NOAA's global prediction systems within the JEDI software framework. For the soil states, a coupled land/atmosphere Ensemble Kalman Filter (EnKF) has been developed to constrain the soil temperature and soil moisture with observations of 2m temperature and humidity. The EnKF is in early testing, and results from initial experiments will be presented. Additionally, since NWP ensembles are consistently under-dispersed at and near the land surface, prior to developing the EnKF we introduced a scheme to account for land model uncertainty in the generation of our NWP ensembles. This scheme perturbs key parameters controlling the land/atmosphere fluxes,thus generating ensemble-based land/atmosphere error covariance estimates that represent uncertainty in these fluxes, while also showing agreement with independent estimates of the model uncertainty. This scheme is intended to be introduced operationally together with the land/atmosphere EnKF described above.

Keywords: coupled data assimilation, land/atmosphere, ensembles

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