Geophysical Research Abstracts
Vol. 21, EGU2019-13494, 2019
EGU General Assembly 2019


# Weakly vs strongly coupled data assimilation of satellite derived soil moisture into WRF using the EnOI

Jostein Blyverket, Paul Hamer, and William Lahoz
Norwegian Institute for Air Research, Oslo, Norway (jb@nilu.no)

Soil moisture (SM) plays a key role in the partitioning of incoming radiation into sensible and latent heat. It also controls evaporation and evapotranspiration of water from the land surface. Through its control on energy and mass fluxes SM regulates land-atmosphere interactions in climate and Numerical Weather Prediction (NWP) models. Thus improved initialization of SM could be of benefit for short and long-term predictions in the land-atmosphere system. Offline land data assimilation (DA), which uses prescribed atmospheric forcing, can improve the representation of SM; however, it can introduce biases when used to initialize a coupled land-atmosphere system.

Coupled DA avoids this initialization shock by updating the land-atmosphere system simultaneously (strongly coupled DA) or through model physics (weakly coupled DA). However, this comes with an added computational cost, since we now have to integrate a coupled system forward in time. Sequential DA methods such as the ensemble Kalman Filter (EnKF) are computationally expensive because they require an ensemble of these forward integrations. Here we propose to use the computationally cheaper ensemble Optimal Interpolation (EnOI) method, which solves the same equations as the EnKF; however, it relies on a climatological sampled ensemble.

In this study, we utilize satellite derived SM from the Soil Moisture Active Passive (SMAP) mission. For the coupled land-atmosphere modelling we use the Advanced Research version of the Weather Research and Forecasting model (WRF-ARW), coupled to the Noah land surface model. We remove biases between the model and satellite derived SM prior to the EnOI assimilation.

Here we consider different sampling strategies for creating the land-atmosphere ensemble, key to the DA method. We also consider a simple localization method for the coupled land-atmosphere system. The skill of weakly vs strongly coupled DA is evaluated using in-situ SM observations and 2 m temperature. Finally, we assess the relative impact of weakly/strongly coupled DA vs offline land surface DA using independent observations from in-situ SM stations.