Geophysical Research Abstracts
Vol. 20, EGU2018-15277, 2018
EGU General Assembly 2018

Ensemble simulations of the coupled atmosphere-land-surface-subsurface system for cross-compartmental data assimilation

Bernd Schalge (1), Gabriele Baroni (2,3), Harrie-Jan Hendricks Franssen (4,5), and Clemens Simmer (1)

(1) University of Bonn, Meteorological Institute, Bonn, Germany (bschalge@uni-bonn.de), (2) Helmholtz-Center for Environmental Research, Leipzig, Germany, (3) University of Potsdam, Institute of Earth and Envirenmental Science, Potsdam, Germany, (4) Forschungszentrum Juelich GmbH, Agrosphere (IBG-3), Juelich, Germany, (5) Centre for High-Performance Scientific Computing (HPSC-TerrSys), Geoverbund ABC/J, Juelich, Germany

As the usage of fully coupled models that incorporate the atmosphere, land-surface and subsurface in a physically consistent way increases, the need for strongly coupled data assimilation systems becomes apparent.
In order to set up a suitable ensemble for data assimilation it is necessary to investigate the sensitivity of fluxes and states of different compartments with respect to states and parameters of (other) compartments. This will also give additional insights in the potential of weakly or fully coupled data assimilation to further improve characterization of states in the atmosphere-land surface-subsurface system as compared to non-coupled data assimilation.
In this study we present preliminary results from a 32 member ensemble where 24 members either had different vegetation properties, soil properties or lateral atmospheric forcings compared to the reference simulation, while we added 8 further members where multiple properties differed compared to the reference.
The Terrestrial Systems Modeling Platform (TerrSysMP) is used to realize the simulation which is based on the region surrounding the Neckar river catchment located in SW-Germany. The spatial resolution of the atmospheric compartment of TerrSysMP is 2.8km while the land-surface and subsurface run at 800m resolution – the highest possible concerning needed computational resources.
We found that the impact of the atmosphere on the other compartments is dominant for the relatively small region considered. Nevertheless, feedbacks are still strong enough to warrant developing a coupled data assimilation system. It is found that the role of uncertain vegetation states is larger than the role of uncertain soil properties, while in summer the role of uncertain soil and vegetation properties is larger than in winter, for this particular case. Furthermore, feedbacks from the surface and subsurface may be more impactful if larger domains, such as continental scales are considered.