Geophysical Research Abstracts
Vol. 17, EGU2015-446, 2015
EGU General Assembly 2015

High resolution modelling of soil moisture patterns with ParFlow-CLM: Comparison with sensor network data

Sebastian Gebler, Harrie-Jan Hendricks-Franssen, Stefan Kollet, Wei Qu, and Harry Vereecken
Forschungszentrum Jülich, Agrosphere Institute (IBG-3), Jülich, Germany (s.gebler@fz-juelich.de)

Soil hydrological processes play an important role for heat, water and matter exchanges in the soil-vegetation-atmosphere continuum. The prediction of the spatial and temporal variability of soil moisture and discharge and evaporative fluxes with land surface models on small scales and at high resolutions is still a challenge. This work focuses on the comparison of soil moisture measured by a sensor network (179 sensors installed in an area of size 31 ha) and modelled with a variably saturated groundwater model (ParFlow) coupled to a land surface model (Common Land Model (CLM, version 2.0)) using different levels of model complexity and spatial resolution. ParFlow simulates variably saturated flow fully coupled with overland flow on large scales and at high spatial resolutions. The Common Land Model (CLM) is embedded as a module in ParFlow, the soil column of CLM is replaced by ParFlow to improve the representation of lateral subsurface flow, groundwater and overland flow.

In this study, we investigated the impact of different parameterization schemes of a ParFlow-CLM model set-up for a managed 31 ha grassland TERENO head-water catchment in the Eifel (Germany). Therefore, model runs with 1 x 1 m and 10 x 10 m lateral resolution, 0.05 m vertical resolution, and different complexity levels regarding subsurface soil hydraulic parameters are conducted. For each model complexity level (completely homogeneous; homogeneous parameters for different soil horizons; different parameters for each soil unit and soil horizon; heterogeneous stochastic realisations), we vary saturated hydraulic conductivity and porosity on the basis of measurements. The model performance is then evaluated using data of the SoilNet wireless sensor network, discharge measurements, and evapotranspiration data recorded by lysimeters and eddy covariance stations.

The majority of simulations capture the temporal variable soil moisture at an acceptable level. However, spatial variability of soil water content is too low for model setups with low complexity. One of the main conclusions is that spatial variability of soil moisture content at the subcatchment scale is dominated by variability in soil hydraulic parameters, and not by topography or other sources of variability.