Geophysical Research Abstracts
Vol. 15, EGU2013-6052, 2013
EGU General Assembly 2013

Comparing Noah-MP simulations of energy and water fluxes in the soil-vegetation-atmosphere continuum with plot scale measurements

Sebastian Gayler (1), Thomas Wöhling (1), Petra Högy (2), Joachim Ingwersen (3), Hans-Dieter Wizemann (4), Volker Wulfmeyer (1,4), Thilo Streck (1,3)

(1) WESS - Water & Earth System Science Competence Cluster, 72074 Tübingen, Germany, (2) Institute of Plant Ecology, University of Hohenheim, 70593 Stuttgart, Germany, (3) Institute of Soil Science and Land Evaluation, Biogeophysics, University of Hohenheim, 70593 Stuttgart, Germany, (4) Institute of Physics and Meteorology, University of Hohenheim, 70593 Stuttgart, Germany

During the last years, land-surface models have proven to perform well in several studies that compared simulated fluxes of water and energy from the land surface to the atmosphere against measured fluxes at the plot-scale. In contrast, considerable deficits of land-surface models have been identified to simulate soil water fluxes and vertical soil moisture distribution. For example, Gayler et al. (2013) showed that simplifications in the representation of root water uptake can result in insufficient simulations of the vertical distribution of soil moisture and its dynamics. However, in coupled simulations of the terrestrial water cycle, both sub-systems, the atmosphere and the subsurface hydrogeo-system, must fit together and models are needed, which are able to adequately simulate soil moisture, latent heat flux, and their interrelationship. Consequently, land-surface models must be further improved, e.g. by incorporation of advanced biogeophysics models. To improve the conceptual realism in biophysical and hydrological processes in the community land surface model Noah, this model was recently enhanced to Noah-MP by a multi-options framework to parameterize individual processes (Niu et al., 2011). Thus, in Noah-MP the user can choose from several alternative models for vegetation and hydrology processes that can be applied in different combinations.

In this study, we evaluate the performance of different Noah-MP model settings to simulate water and energy fluxes across the land surface at two contrasting field sites in South-West Germany. The evaluation is done in 1D offline-mode, i.e. without coupling to an atmospheric model. The atmospheric forcing is provided by measured time series of the relevant variables. Simulation results are compared with eddy covariance measurements of turbulent fluxes and measured time series of soil moisture at different depths. The aims of the study are i) to carve out the most appropriate combination of process parameterizations in Noah-MP to simultaneously match the different components of the water and energy cycle at the field sites under consideration, and ii) to estimate the uncertainty in model structure. We further investigate the potential to improve simulation results by incorporating concepts of more advanced root water uptake models from agricultural field scale models into the land-surface-scheme.

Gayler S, Ingwersen J, Priesack E, Wöhling T, Wulfmeyer V, Streck T (2013): Assessing the relevance of sub surface processes for the simulation of evapotranspiration and soil moisture dynamics with CLM3.5: Comparison with field data and crop model simulations. Environ. Earth Sci., 69(2), under revision.

Niu G-Y, Yang Z-L, Mitchell KE, Chen F, Ek MB, Barlage M, Kumar A, Manning K, Niyogi D, Rosero E, Tewari M and Xia Y (2011): The community Noah land surface model with multiparameterization options (Noah-MP): 1. Model description and evaluation with local-scale measurements. Journal of Geophysical Research 116(D12109).