Geophysical Research Abstracts
Vol. 15, EGU2013-10628-3, 2013
EGU General Assembly 2013

The effects of the sub-grid variability of soil and land cover data on agricultural droughts in Germany

Rohini Kumar, Luis Samaniego, and Matthias Zink
Helmholtz Centre for Environmental Research-UFZ, Computational Environmental Systems, Leipzig, Germany
(rohini.kumar@ufz.de, 0049 341 235-1939)

Simulated soil moisture from land surface or water balance models is increasingly used to characterize and/or monitor the development of agricultural droughts at regional and global scales (e.g. NLADS, EDO, GLDAS). The skill of these models to accurately replicate hydrologic fluxes and state variables is strongly dependent on the quality meteorological forcings, the conceptualization of dominant processes, and the parameterization scheme used to incorporate the variability of land surface properties (e.g. soil, topography, and vegetation) at a coarser spatial resolutions (e.g. at least 4 km).

The goal of this study is to analyze the effects of the sub-grid variability of soil texture and land cover properties on agricultural drought statistics such as duration, severity, and areal extent. For this purpose, a process based mesoscale hydrologic model (mHM) is used to create two sets of daily soil moisture fields over Germany at the spatial resolution of (4×4) km^2 from 1950 to 2011. These simulations differ from each other only on the manner in which the land surface properties are accounted within the model. In the first set, soil moisture fields are obtained with the multiscale parameter regionalization (MPR) scheme (Samaniego, et. al. 2010, Kumar et. al. 2012), which explicitly takes the sub-grid variability of soil texture and land cover properties into account. In the second set, on the contrary, a single dominant soil and land cover class is used for ever grid cell at 4 km. Within each set, the propagation of the parameter uncertainty into the soil moisture simulations is also evaluated using an ensemble of 100 best global parameter sets of mHM (Samaniego, et. al. 2012). To ensure comparability, both sets of this ensemble simulations are forced with the same fields of meteorological variables (e.g., precipitation, temperature, and potential evapotranspiration).

Results indicate that both sets of model simulations, with and without the sub-grid variability of soil texture and land cover properties, reconstruct the general features of the large scale extreme drought events (e.g. 1976, 2003, 2007) reported in the literature. Results also emphasize the importance of accounting for the parametric uncertainty for identifying benchmark drought events based on simulated soil moisture. Drought statistics such as duration, severity, and areal extent, estimated from both ensemble sets are currently under investigation.