Geophysical Research Abstracts
Vol. 19, EGU2017-12698, 2017
EGU General Assembly 2017

Coupling the land surface model NOAHMP with the generic crop growth model GECROS: Model calibration and validation

Joachim Ingwersen (1), Petra Högy (2), Hans-Dieter Wizemann (3), and Thilo Streck (1)

(1) Institute of Soil Science and Land Evaluation, University of Hohenheim, Stuttgart, Germany, (2) Institute of Landscape and Plant Ecology, University of Hohenheim, Stuttgart, Germany, (3) Institute of Physics and Meteorology, University of Hohenheim, Stuttgart, Germany

Weather and climate simulations depend on an accurate description of the exchange of water, energy and momentum between land surface and atmosphere. In state-of-the-art land surface models the vegetation dynamics is "frozen" that means prescribed in lookup tables. As a consequence growth and development of a crop is independent from the prevailing weather conditions, and an important feedback between atmosphere and land surface is not captured. In the present study we coupled the land surface model NOAHMP with the mechanistic generic crop growth model GECROS. On the basis of a comprehensive 5-year dataset on eddy covariance energy- and water fluxes and soil water and crop data from two different climate regions of Southwest Germany, we adapted the crop growth model GECROS, integrated it with NOAHMP, calibrated the coupled model for winter wheat and silage maize and tested its robustness in multiple-year validation runs against independent measurements. For winter wheat the model performed well both for the calibration and validation phase. Inter-annual and regional differences in crop development due to temperature anomalies were well reproduced by the model. Also the decline of evapotranspiration over the maturing phase was properly simulated. In case of maize the model performed not as good as for winter wheat. We attribute this somewhat lower model performance to the pronounced differences among maize cultivars, the high sensitivity of maize development to drill and emergence date, and its higher susceptibility to early summer droughts. Moreover, the model systematically overestimated evapotranspiration during long lasting droughts like in June 2014 indicating that in the current state NOAHMP-GECROS has some limitations in simulating water stress. We attribute this weakness to the uniform root distribution and the hydraulic functions (Clapp-Hornberger) that are implemented in NOAHMP which result in a uniform depletion of the soil water profile. The novel model system was recently integrated with WRF and will allow to consider two-way climate-crop interactions in future WRF-NOAHMP-GECROS climate simulations.