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Can simulations of flux exchanges between the land surface and the atmosphere be improved by a more complex description of soil and plant processes?

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Can simulations of flux exchanges between the land surface and the atmosphere be improved by a more complex description of soil and plant processes?

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Recent studies show, that uncertainties in regional and global climate simulations are partly caused by inadequate descriptions of soil-plant-atmosphere. Therefore, we coupled the soil-plant model system Expert-N to the regional climate and weather forecast model WRF. Key features of the Expert-N model system are the simulation of water flow, heat transfer and solute transport in soils and the transpiration of grassland and forest stands. Particularly relevant for the improvement of regional weather forecast are simulations of the feedback between the land surface and atmosphere, which influences surface temperature, surface pressure and precipitation. The WRF model was modified to optionally select either the land surface model Expert-N or NOAH to simulate the exchange of water and energy fluxes between the land surface and the atmosphere for every single grid cell within the simulation domain. Where the standard land surface model NOAH interpolates monthly LAI input values to simulate interactions between plant and atmosphere Expert-N simulates a dynamic plant growth with respect to water and nutrient availability in the soil. In this way Expert-N can be applied to study the effect of dynamic vegetation growth simulation on regional climate simulation results.
For model testing Expert-N was used with two different soil parameterizations. The first parametrization used the USGS soil texture classification and simplifies the soil profile to one horizon (similar to the NOAH model). The second parameterization is based on the German soil texture classification “Bodenkundliche Kartieranleitung” (KA4) and soil horizons were described in more detail.
The simulation results of the surface fluxes obtained by applying the two land surface models NOAH and Expert-N were compared to observed flux measurements at different site stations. Latent heat flux, sensible heat flux, net radiation and soil heat flux were analyzed by statistical methods.
Preliminary results show that latent and sensible heat fluxes may be more accurately simulated, if the dynamics of crop growth are considered.