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The influence of dynamic vegetation models including harvest and fertilization management on the energy fluxes and the feedback effects between the weather and the land surface models

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Recent studies show that uncertainties in regional and global weather and climate simulations are partly caused by inadequate descriptions of the soil-plant-atmosphere system. Particularly relevant for the improvement of regional weather forecast are models which better describe the feedback fluxes between the land surface and the atmosphere, which influences surface temperature, surface air pressure and the amount and frequency of precipitation events.

Aim of this study was to examine the differences between weather simulation results by the "Regional Climate and Weather Forecast Model" (WRF) using either the frequently applied land surface model NOAH or Expert-N. Where the standard model NOAH distinguish between vegetation class specific monthly changing soil cover values (leaf area index) and defined soil characteristics, Expert-N is an ecosystem model that allows the application of more mechanistic soil and plant sub-models including the management of soil and vegetation and effects of water and nutrient availability on plant growth are considered.

The WRF-NOAH model was applied with a default land surface configuration typical for the simulation domain Bavaria, Germany. Expert-N was configured using the Hurley Pasture Model to simulate plant growth and calibrated using vegetation, management and soil data from one grassland site. Both models were applied to the simulation domain. The simulation results of energy fluxes in both models between the land surface and the atmosphere were compared with each other's and with weather data from about 100 weather stations in Bavaria using statistical methods. The influence of different harvest scenarios on the energy fluxes is discussed. The simulation shows the high impact of vegetation management on the energy fluxes which caused significant differences between weather characteristics such as the simulated surface temperatures and precipitation events on the regional scale. Therefore, we conclude that weather forecast on the regional scale could be significantly improved by modeling approaches that better describe the dynamic of vegetation growth.