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How much does weather-driven vegetation dynamics matter in land surface modelling?

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Land surface models (LSM) are an essential part of weather and climate models as they provide the lower boundary condition for the atmospheric models. In state-of-the-art LSMs the seasonal vegetation dynamics is "frozen". The seasonal variation of vegetation state variables, such as leaf area index or green vegetation fraction, are prescribed in lookup tables. Hence, a year-by-year variation in the development of vegetation due to changing weather conditions cannot be considered. For climate simulations, this is obviously a severe drawback. The objective of the present study was to quantify the potential error in the simulation of land surface exchange processes resulting from "frozen" vegetation dynamics. For this purpose we simulated energy and water fluxes from a winter wheat stand and a maize stand in Southwest Germany. In a first set of simulations, six years (2010 to 2015) were simulated considering weather-driven vegetation dynamics. For this purpose, we coupled the generic crop growth model GECROS with the NOAH-MP model (NOAHMP-GECROS). In a second set of simulations all vegetation-related state variables of the 2010 simulation were written to an external file and were used to overwrite the vegetation-related state variables of the simulations of the years 2011-2015. The difference between both sets was taken as a measure for the potential error introduced to the LSM due to the assumption of a "frozen" vegetation dynamics. We will present first results and discuss the impact of "frozen" vegetation dynamics on climate change simulations.