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Response of the surface climate to different land surface models: WRF sensitivity to surface model options

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The Weather Research and Forecasting (WRF) model version 4.2 includes different land surface schemes, allowing a better representation of the land surface processes. Four simulations with the WRF model differing in land surface models and options were investigated as a sensitivity study over the European domain. These experiments span from 2004-2006 with a one-month spin-up and were performed at 0.11^{o} horizontal resolution with 50 vertical levels, following the CORDEX guidelines. The lateral boundary conditions were driven by ERA5 reanalysis from European Centre for Medium-Range Weather Forecasts. For the first experiment, the Noah land surface model was used. For the remaining simulations, the Noah-MP (multi-physics) land surface model was used with different runoff and groundwater options: (1) original surface and subsurface runoff (free drainage), (2) TOPMODEL with groundwater and (3) Miguez-Macho & Fan groundwater scheme. The physical parameterizations options are the same for all simulations. These experiments allow the analysis of the sensitivity of different land surface options and to understand how the representation of land surface processes impacts on the atmosphere properties. This study focusses on the investigation of land-atmosphere feedbacks trough the analysis of the soil moisture – temperature and soil moisture – precipitation interactions, latent and sensible heat fluxes, and moisture fluxes. The influence of different surface model options on atmospheric boundary layer is also explored.

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