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LandSoil, a model for evaluating soil erosion on mid-term agricultural landscape evolution: Sensitivity analysis

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Soil-landscape evolution modelling is a widespread research topic; many models have been developed to analyse space-time dynamics in soil redistribution processes. Such modelling presumes both to use precision input data and affordable models able to model different land use scenarios and climatic variations. Based on this context, we tested the LandSoil model (Landscape design for Soil conservation under soil use and climate change) for sensitivity analysis. This model is designed for the analysis of agricultural landscape evolution at a fine spatial resolution scale [1–10 meters] and a mid-term temporal scale [10–100 years]. It is spatially distributed, event-based, and considers water and tillage erosion processes. Specificity of the model is to have dynamic representation of the agricultural landscape with a monthly representation of soil surface properties and to account for the climate component directly in rainfall events. Sensitivity analysis (SA) is a classical tool for the evaluation of the model's reaction to the different input variables. We investigated local SA of the model to rainfall inputs, related hydrological fluxes and specific erosion parameters responsible for diffusion and concentrated soil erosion. Tests analysed multiple combinations of rain amounts and intensities, as well as different runoff conditions within the soil parameter space using the one-at-a-time and Latin-Hypercube resampling methods. Sensitivity to spatial distributions of erosion parameters was calculated as an index of numerical spread of soil loss results obtained at the outlet of virtual catchment endowed with a fixed flow network. The study furnished a ranking of the parameters' sensitivity and provides evidence that some discontinuities in response are due to the non-linearity in parameterisations.