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Influence of the map complexity of saturated hydraulic conductivity on runoff and soil erosion modeling. A case study in Ribeira Seca, Santiago Island, Cape Verde.

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In this paper, the potential equifinality on the spatial variation of runoff and erosion patterns resulting from different types of input parameter maps is studied using the LImburg Soils Erosion Model LISEM, a physical event-based model. The study area is Ribeira Seca, a $90km^2$ catchment located in Santiago Island, Cape Verde (West Africa), a semiarid country subject to scarce but extreme rainfall during the short tropical summer monsoon. Four types of input maps with different degrees of complexity were created, given particular attention to the soil saturated hydraulic conductivity K_{sat}. The first input map was produced allocating K_{sat} averages to the broad units of the soils map available for the study area. The second map was made by allocating average K_{sat} values to the units of a soil texture map, derived from a land capability map with detailed units and soil textures obtained from laboratory analysis of field samples. The third map was obtained interpolating field measured K_{sat} values by ordinary kriging. The fourth map was made by interpolation of K_{sat} using the soils texture map as external drift. For compatibility purposes, additional parameter inputs of the model (soil porosity, moisture content, cohesion, soil depth and random roughness) followed the same mapping scheme. For the generation of the maps by kriging with external drift, the soils texture map was used as drift for soil porosity, soil moisture content and cohesion. For random roughness the land use map (obtained from an ALOS AVNIR image classification) was used as external drift, and for soil depth, the slope information was employed. To further evaluate the influence of rainfall on runoff and erosion, two storm events of approximately the same duration but with different intensity pattern were considered. Calibration and validation of the model was done using gauge data from sub-basins located in the upper and middle of the catchment. Preliminary results show that the input maps produced by averaging parameters resulted in higher runoff and erosion amounts varying with the mapping unit size, with total discharge volumes above $10000m^3$. Ordinary kriging and kriging with external drift produced similar total discharge volumes but below to $1000m^3$. The spatial distribution of runoff and erosion was also affected by the complexity of the input parameter maps. The results prove the importance of the map units size and the mapping method on the resulting output of erosion and runoff modeling.