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Effect of simulated rill erosion on overland flow connectivity in synthetically generated fields

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Preferential flow paths developed during rill erosion processes connect different parts of the soil surface that may increase the degree of connectivity and hence the hydrological response of the soil surface. However, few studies have tried to quantify the effect of rill networks on overland flow connectivity. For this purpose, simulated rill networks were generated by the RillGrow erosion model (Favis-Mortlock, 1998; Favis-Mortlock et al. 2000) on synthetically generated fields. To characterize the hydrological connectivity a functional connectivity indicator called the relative surface connection function (RSCf) (Antoine et al. 2009) was used. This indicator, which relates the area connected to the outflow boundary to the degree of filling of maximum depression storage (MDS), is fast to compute and was previously shown to be able to efficiently discriminate between contrasted connectivity scenarios. The RSCf function was calculated for different DEM obtained at different times during the development of the simulated rill networks. The evolution of overland flow connectivity was then quantified and compared at these different time steps. The results of this study showed that the changes in microtopography resulting from the simulated rill erosion have a strong impact on the hydrological connectivity as reflected in the RSCf. Furthermore, the results show that the evolution of the RSCf may allow identifying different types of erosion since the shape of the RSCf only starts to change when rill networks are visualized on the surface.