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Landscape Development and spatio-temporal Variation in Soil Erosion Rates: Impact of Man, Climate or Neo-tectonics?

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In the region of SE Spain soil erosion processes affecting soils and changing landscapes are widespread. The question arises whether soil erosion processes driven by the impact of man only, as a direct result of land use change, or that climate change and tectonics are also important. Especially the high variability in precipitation makes the interpretation of erosion data from plots extremely difficult. It is well known that upscaling also involves thresholds in runoff generation and that sediment yield declines with increasing catchment size.

A case study will be presented, comparing erosion rates in a small semi-natural 12 km^2 catchment in the Guadalentin basin (Murcia, Spain) at different spatio-temporal scales. Soil erosion rates were estimated in four different ways: A 10 year erosion dataset was obtained using classical open erosion plots, for 3 different cover types; a time series comparison of landscape metrics derived from detailed aerial photography; by determination of deposition rates in a small 70 year old retention basin and by incision rates determined over the last 650 years. For each of the different methods different erosion rates were estimated. The rates found, showed a large variation in erosion rates, ranging from very low erosion rates ($<$0.1 ton ha^{-1}) up to an extremely high incisionrate of approximately 6mm yr^{-1}over thelast 650 years, although deposition also occurred in the same channel.

The area under study does currently not have any agricultural activity, nor grazing,

and only a few agricultural hectares have been abandoned over 50 years ago. Hence direct impact of grazing and agriculture can be excluded to have affected the upstream catchment itself. There might be an impact of changed precipitation regimes, but from the local precipitation data available this is not clear. However from historical data it can be derived that there have been periods with much higher flood levels in the most important regional rivers, and that commonly are related to land use changes and climate transitions (little ice age). A final discussion will be related to the possible impact of stream rejuvenation, as the basin is part of a neo-tectonically active area. However the impact of this last factor is strongly influenced by human agricultural and engineering activity such as terracing and reservoir building. The data discussed show that soil erosion has important impacts on landscape evolution and that different measurement methods contain spatio-temporal scale effects that affect processes and their respective rates.