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Climate and Landuse Change Impacts on hydrological processes and soil erosion in a dry Mediterranean agro-forested catchment, southern Portugal

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Climate change is expected to increase aridity in the Mediterranean rim of Europe, due to decreasing rainfall and increasing temperatures. This could lead to impacts on soil erosion, since the lower rainfall could nevertheless become concentrated in higher intensity events during the wet season, while the more arid conditions could reduce vegetation cover, also due to climate-induced land-use changes. In consequence, there is an interest in understanding how climate change will affect the interaction between the timing of extreme rainfall events, hydrological processes, vegetation growth, soil cover and soil erosion.
To study this issue, the SWAT eco-hydrological model was applied to Guadalupe, an agro-forested catchment (446 ha) located close to the city of Évora, with a Mediterranean inland climate. The landcover is a mix of dispersed cork oak forests (“montado”), annual crops, and agroforesty regions where the cork oaks are associated with crops or pasture; this land cover is representative of the dry regions of southern Portugal and Spain.
The catchment has been instrumented since 2011 with a hydrometric station (water discharge and suspended sediment concentration data) and a soil moisture measurement station. There is also observed data of actual evapotranspiration, LAI and biomass production (in pasture; from 1999 and 2008) and runoff data and sediment yield measured in six 16m2 plots. Water balance, vegetation growth, soil erosion and sediment yield in SWAT was calibrated with this dataset.
This work will present the dataset, modeling process, results for impacts of climate and land-use change scenarios for vegetation growth, soil erosion and sediment export, considering the climate and socio-economic scenarios A1b and B1 (based on SRES storylines). Climate scenarios were created by statistical downscaling from Global Circulation Models (GCMs) for the period 2071-2100 (30 years). The reference period was 1971-2000 (30 years). The SWAT model was used to estimate long-term erosion rates for the reference period, as well as the role of extreme events, particularly those falling in the late autumn and early winter (when the soil cover is minimal); the model was then used to examine the impacts of changing temporal patterns of low vegetation cover and extreme events for erosion and sediment yield.