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Modelling soil erosion under land use and climate change in a vineyard catchment of southern France

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Vineyards of southern France are important environments for the quality of agricultural production and for the peculiarity of their landscapes. In a changing world, where these environments are experiencing new challenges, land use (LU) and climate change play a central role in hydrological and soil erosion processes.
The study area is a 91ha hilly catchment (Roujan), located in the Occitanie region around 25 kilometres from the southern coast, with an average elevation of 102 meters a.s.l.; in the present land coverage configuration, it contains 62% vineyard land cover.
Effect of land use and climate changes were modelled by comparing 2050 to present conditions using LandSoil, a model simulating water and tillage sediment redistribution on fine spatial (1-10 metres) and temporal (rainfall event) scales.
We tested the climatic impact, simulating on medium terms with: 1) a 20 years climatic historical series (1992-2012) and, 2) a future climatic scenario (2040-2060), as the result of RCM (ALADIN53) on a RCP4.5 CO_2 emission configuration.
Land use change is accounted for in considering land cover and soil-water conservations techniques evolutions through four different scenarios developed from socio-economic surveys such as: 1) Business-as-usual, following the last decade's LU trend changes (i.e. decreasing of vineyards surface abandoning and or grouping small fields); 2) Productivist (i.e. introducing grape varieties with high productivity, adopting vineyard irrigation, as well as accepting the use of fungicides and pesticides and reducing the grass strips percentage); 3) Environmental protection (i.e. prohibiting pesticides to protect ground waters, creating additional vegetative strips to decrease the erosion and to increase the local biodiversity); 4) Sustainable (i.e. adapting the productivity to local demand and valorising small quality productions with a balanced land-use pattern and architecture).
Results show that even in a monitored catchment, where the landscape architecture is preserved from soil loss, interesting differences are observed when land use changes dramatically, as in the proposed LU scenarios, pushing the soil loss balance to very different equilibrium conditions.