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Modelling the impacts of climate and land-use change on the sediment transport of the River Thames (UK)

Gianbattista Bussi, Simon Dadson, and Paul Whitehead
University of Oxford, School of Geography and the Environment, Oxford, United Kingdom

In this study we assessed the impact of a range of climatic variations and land-cover scenarios on the sediment transport of the River Thames (UK). We evaluated the response of the system to changes in some climatic stressors (average precipitation, average temperature and increase in extreme precipitation) and to changes in land-cover stressors (change in the extent of arable land and a soil erosion mitigation strategy, consisting in the implementation of better agricultural practices, riparian buffer strips and afforestation of some grassland areas), using a scenario-neutral framework. To do this we used the INCA hydrological and sediment model. The resulting response surfaces allowed assessing the system sensitivity to the considered driving stressors, and the effect of the interactions between them (e.g. the joint effect of climate and land-use changes). Climate projections originating from the UKCP09 assessment (UK Climate Projections 2009) were used to evaluate the likelihood of the range of projected outcomes. The results showed that climate and land cover each exerts an individual control on sediment transport. Their effects are comparable in magnitude but vary depending on the fraction of arable land in the catchment and the magnitude of climate change. The suspended sediment yield of the River Thames just upstream the city of London is expected to decrease by 9% (-24% - +7% confidence interval, p=0.95) under the A1FI emission scenario for the 2030s, although these figures could be substantially altered by an increase in extreme precipitation, which could raise the suspended sediment yield up to an additional 8%. An increase in the fraction of agricultural land is projected to increase sediment yield by around 25% in the lowland reaches. A soil erosion mitigation scenario consisting in afforestation and the implementation of optimal agricultural practices and riparian buffer strips could be a robust adaptation strategy to climate change, as it was found to reduce sediment transport across all the considered climate scenarios.