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Soil erosion under climate change: simulatingthe response of temperature and rainfall changes in three UK catchments

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Soil erosion by water cost in environmental damages across the Great Britain is estimated in over £00m (2014 GBP) each year and could increase for the effect of climate change. Assessing the potential for increased climate-driven soil erosion, due to the several water processes involved (e.g., infiltration excess, return flow, direct precipitation onto saturated soil),is recognizedas a complex task.

Climate change can have a positive and direct effect on soil erosionsuch the case of increasing rainfall in amount and intensity, or an indirect effect through the variation of the atmospheric CO_2 level, which can improve plant productivityandwater infiltration capacity of soil reducing the likelihood of soil erosion. Changes in vegetation patterns and typologies with a different protection effect can lead also the soil system to dramatic changes in soil erosion rates, potentially amplifying or ameliorating the direct effects of climate change.Climate, vegetation and soil erosion are thus connected and several feedback effects could be accounted in the study of global change.

Understanding these interactions may be a primary goal for clarifying the impact of global change on soil erosion and its consequences on related soil functions such as water and organic carbon storage support to vegetation and agricultural production.

In this research, focused on three UK catchments (i.e. Conwy, 627 km2, Wales; Ehen, 225 km2, England; and Dee, 2100 km2, Scotland), we simulated soil erosionapplying SRES climatic scenarios(IPCC, 2000) for different CO_2 emission levels. We modelled using Pesera “The Pan European Soil Erosion Risk Assessment” (Kirkby et al., 2004), a model for vegetation growing and soil erosion evaluation at regional scale. For each catchment,we realised a sensitivity – analysis – like test investigating different increments in temperature and rainfall, then, we compared the results of the SRES scenarios with the issues of the parametric sensitivity analysis.

The results show that, because of the role of the vegetation, each land use has different reactions to temperature - rainfall variations; crop surfaces confirm to have a strong sensitivity while forests and grassland play a mitigation role on soil erosion.