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Modelling the effects of recent agricultural land use change on catchment flow and sediment generation

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Intensive agricultural practices can exacerbate runoff and soil erosion leading to detrimental impacts downstream. Physically-based models have previously been used to assess the impacts on flow and sediment transport in response to land use change, but there has been little investigation of the effect shorter-term changes linked to variations in the extent of cultivated land. The aim of this project is to quantify the impacts on flow generation and sediment transport of different catchment conditions related to both actual recent changes in agricultural land use as well as future change scenarios. To this end, a physically-based distributed hydrological model, SHETRAN was applied in the Blackwater catchment (12 km2) located in south-west England. Land cover was simulated on the basis of satellite-derived land cover maps (1990, 2000 and 2007) as well as a catchment-scale field survey (2011). Soils were represented in the model using five layers for five different soil types in which parameter values were varied in accordance with land use and literature values. Rainfall data (15 min) combined with monthly calculations of evapotranspiration using a simple temperature-based PE model were used to represent contemporary climatic conditions spanning 2010-2014. Calibration was undertaken for selected events during 2011 when land use information was concurrent with available flow and suspended sediment yield data. All land use simulations were then completed for the period 2010-2014 to enable the comparison of model outputs. This contribution will present preliminary results from these land use simulations alongside the effect of several future changes scenarios on catchment flow and sediment generation.