Modelling the impact of forest removal on shallow landslide sediment yield, Ljuez river catchment, Spanish Pyrenees

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The SHETRAN model for simulating the sediment yield arising from shallow land-slides at the scale of a river catchment was applied to the 45-km2 Ijuez catchment in the central Spanish Pyrenees, to investigate the effect of loss of forest cover on landslide and debris flow incidence and on catchment sediment yield. The application demonstrated how such a model, with large parameter evaluation requirements, can be used even when directly measured data are not available: rainfall and discharge time series were generated by reference to other local records and data providing the basis for a soil map were obtained by a short field campaign. Uncertainty bounds for the outputs were determined as a function of the uncertainty in the values of key model parameters. For a four-year period and for the existing forested state of the catchment, a good ability to simulate the observed long term spatial distribution of debris flows (represented by a 45-year inventory) and to determine catchment sediment yield within the range of regional observations was demonstrated. The lower uncertainty bound on simulated landslide occurrence approximated the observed annual rate of landsliding and suggests that landslides provide a relatively minor proportion of the total sediment yield, at least in drier years. A scenario simulation in which the forest cover was replaced by grassland indicated an increase in landsliding but a decrease in the number of landslides which evolve into debris flows and, at least for drier years, a reduction in sediment delivery to the channel network.