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The impact of upland land management on flooding at multiple spatial scales

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In response to a growing awareness of flood risk and questions as to the impact of land use management on this, an extensive dataset is currently being collected within the Pontbren catchment in Wales. This 12 km^2 catchment has a long history of drainage and intensifying, but otherwise unchanging, land use. A preliminary study within the catchment indicated that strategically placed, small scale planting of trees could improve the infiltration capacity of grazed pasture. Following this, an intensive experimental programme was initiated to further examine how changes in land use might impact at different spatial scales. Stream flow, soil water potentials, overland flow and drain flow, precipitation, and other climatic variables are continuously monitored, and data on groundwater levels, interception and soil moisture is also collected. Soil hydraulic properties and runoff processes are being investigated under different land use treatments including woodland buffer strips and no grazing management. An associated modelling programme uses these data to inform models examining the effects of land use change over differing spatial scales and levels of process representation. A multi-dimensional soil water model with macropore and overland flow representations is used to examine dominant processes at the plot to field scale. Results at this scale are then used to examine appropriate representations and parameterisation at the field to catchment scale. Upscaling techniques assimilating the small-scale information and ensemble uncertainty into the catchment scale model are being developed. Results from both the physically based modelling and the catchment scale modelling are presented, conditioned on data and with a focus on the potential of localised strategic changes to land-use for reduction of flood risk as scale increases.