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Sediment transfer in small agricultural catchments at high-resolution spatial and temporal scales

C. Deasy (1), R.E. Brazier (2), A.L. Heathwaite (3) and R. Hodgkinson (4)

Soil erosion modelling is currently inhibited by a lack of appropriate spatial and temporal monitoring data and limited process understanding beyond the narrow range of plot and catchment scales traditionally considered. Research carried out in the ADAS Rosemaund experimental catchment, Herefordshire, UK, has allowed some progress to be made in this area through field monitoring of observations of sediment transfers at high resolution spatial and temporal scales. A flexible sampling design, using on-site observation and point sampling during events, was developed for non-plot based hillslope patches of 60 m to 180 m lengths, and integrated with continuous monitoring and automated sampling of a 2 ha hillslope flume, drainage outfalls, and 30 ha first-order catchment outlet. Analysis at the event scale has allowed identification of hydrological and sediment transfer characteristics and consideration of relationships between characteristics, which have been compared between events and between scales of observation. The results show high variability both temporally between events and spatially between scales of observation. Maximum suspended sediment concentrations were recorded at the 2 ha hillslope scale, but event yields per hectare were highest at the catchment scale. Hillslope surface runoff contributed only slightly lower suspended sediment yields to the stream than the hillslope subsurface drain, but as surface runoff is only well connected to the stream from one field, drainflow is the most important pathway for transport of fine sediments to the catchment outlet. The dataset provided by this monitoring is unique in its spatial and temporal coverage of a first order catchment, and has great potential for modelling applications to small agricultural catchments, both through increasing the number of scales at which data are available for calibration and validation, and by the detailed process understanding and knowledge of scale linkages that it has provided.