



A study of spatial scaling in sediment yield and dynamics along a rural river system – the River Eden, Cumbria, UK

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Understanding and modelling the effects of spatial scale on catchment sediment dynamics is an enduring problem because the nature of the relationship between specific sediment yield and catchment area varies between basins. The research presented aims to overcome this problem by using a process-based approach to understand the spatial variation in specific sediment yield and its determining factors in the rural Eden catchment, Cumbria, UK. Measurement-based rating curves are used to quantify suspended sediment yield in a series of nested catchments ranging from 1 to 1373 km² in area. Bedload yield is estimated based on tracer pebble experiments and bedload transport formulae. At three sites turbidity measurements and suspended sediment sampling at a high temporal resolution during storms allows inference of dominant sediment input processes from analysis of hysteresis between discharge and suspended sediment concentration. A catchment sediment audit complements the sediment monitoring programme by identifying the spatial distribution of sediment sources, sinks and transfer processes.

Initial results suggest that most of the catchment does not contribute to the sediment yield because of low connectivity between hillslopes and channels. Sediment yields should therefore reflect variability in near-channel sediment inputs and rates of channel bank erosion. While bank erosion rates are related to channel scale, near-channel sediment inputs are strongly influenced by land-use intensity. Overall sediment yield can be seen as a product of the direct effects of scale (i.e. downstream channel and valley development and the associated variations in sediment input processes) operating

within variations in boundary conditions, land-use in particular. In the Eden this results in a marked difference in sediment supply processes, and hence sediment yields, between the upland and lowland parts of the catchment. Once determined, the sediment yield scale dependency in the Eden catchment will be tested using a catchment-scale model which incorporates the spatial variability identified in sediment sources and transfer processes. This will provide a basis for extending the results more generally.