Morphology, bedload and sedimentology of active gravel bed rivers

Peter Ashmore
University of Western Ontario, Geography, London, Canada (pashmore@uwo.ca)

Morphology, bedload and sedimentology of morphologically active gravel bed rivers interact in fundamental ways. In braided and wandering rivers these interactions have distinct characteristics. In these cases much of the bedload transfer is tied up in morphological change so that the bar and channel scale morpho-dynamics are, in effect, the bedload transport process. Physical models and field data reveal several inter-related aspects of this interaction. We can define the morphological active layer as that in which erosion, deposition and bed particle exchange occur during channel-forming flows. The dimensions, complexity, and lateral and longitudinal connectivity of this layer increase with discharge in a given river and with channel-forming stream power between rivers. Bedload flux correlates strongly with the dimensions of the active layer and temporal variability of bedload at a given discharge is a consequence of bar-scale variation in morphological change in complex morphology. Rates of planimetric change in braided channels also follow this morphological-bedload relationship. Higher rates of morphological change also correlate with greater bed material mobility, approaching equal mobility at the highest rate of change and the highest morphological active layer dimensions. Bed particle transfer distances and burial depths are also strongly controlled with the length scale and depth of the bar-scale morphology and active layer. The sedimentology reflects the channel morphological scale and processes in defining sedimentary unit thicknesses and geometry. The deposits of the active channel belt are almost homogenous with respect to particle size because of the ‘turnover’ of the bed material. Morphology, bedload and sedimentology of morphologically active gravel bed rivers interact in fundamental ways that help to define the characteristics of these channel types. To what extent are these observations applicable in other channel types?