**Connecting Braided River Substrate, Hydrology and Sediment Load with Large River Models**

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# ABSTRACT

Excess fine sediment can alter fluvial form, ecosystem health and groundwater recharge. Measuring sediment in large braided rivers is a challenging field task due to their scale and dynamic nature. The advent of large-scale mapping technologies has enabled reconstruction of fluvial substrate facies over broad scales but even detailed surveys represent only a moment in time. Physical or numerical models can extrapolate in time, but the required combination of fine spatial resolution and long timescales still represents a computational challenge at large river scales. This study links new remotely-sensed observations of deposited fine sediment over the 55-km lower Rangitata River with hydraulic-inferred transport capacity under various flow regimes. We have developed a hybrid methodology that links spatially-distributed models of bed substrate with synthetically reconstructed models of river hydraulics to better infer the controls on sediment transfer and deposition in braided rivers.

We propose a workflow involving the following steps:

1. Sediment facies patterns are classified and positioned longitudinally and hypsometrically in a hydraulically complete map of the river;

2. Water depths are estimated from colour and ground truth data;

3. Numerical simulations involving a fixed-bed, varying-roughness 2D hydraulic model are used to estimate the longitudinal, section-averaged hydraulic geometry over a representative range of flows;

4. The resulting library of flow models is then used to reconstruct a synthetic hydraulic history for every cell in the DEM, which is then used to evaluate the potential for sediment accumulation or transport relative to an inflowing sediment load.

In this talk, we focus on the fourth step in this workflow. The flow histories of specific depositional environments such as backwaters and dry braided channels are examined. Finally, the flow histories are used to interpret the capacity of each km-scale reach to transport fine sediment, illustrating longitudinal trends and changes from dry to wet years.