Geophysical Research Abstracts
Vol. 21, EGU2019-16440, 2019
EGU General Assembly 2019

Impact of vegetation on channel migration rates under changing flood conditions in an experimental braided river

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Under present day climate change predictions, with both higher magnitude and altered frequencies of flood events, uncertainties exist in how the behaviour of river systems will change in the future. This uncertainty is greater when considering the impact of vegetation on the dynamics of fluvial systems, which itself may also vary because of climate change. Physical modelling can be a valuable tool to understand the processes on a smaller scale, in particular by simulating the effects of vegetation using surrogates that can grow rapidly, thereby mimicking the forcing induced by vegetation growth. Previous studies using surrogate vegetation in flume experiments on braided rivers (e.g. Tal and Paola, 2007; Bertoldi et al., 2015), have shown the potential for this modelling approach.
For this research, we allowed braided river systems to evolve under constant conditions in two 2.5 m wide by 10 m long flume channels, set-up in the Total Environments Simulator at the University of Hull. Once equilibrium conditions were reached under bare sediment conditions, Alfalfa was periodically seeded and allowed to germinate and then grow for different time periods. After each period of growth, we used a sequence of high and low magnitude flood events in order to capture change in morphology arising from the different sequences of events. Morphological changes were captured using a terrestrial laser scanner to collect over 50 DEMs.
These DEMs demonstrate the impact surrogate vegetation has on both stabilizing the river system and modifying the patterns of bank erosion and channel migration in a braided system. Furthermore, frequent spatial analysis of erosion and deposition based on the flow direction within the channel network allowed us to determine erosion and deposition width for individual segments of the river system. Collating these segments yields a large dataset that indicates both bank erosion rates and volumetric channel migration rates for different stages of vegetation growth/maturity under different sequences of flood events.