AGU FALL MEETING
San Francisco | 12–16 December 2016

EP53E-1026: Sediment Transport Dynamics and Bedform Evolution During Unsteady Flows

Friday, 16 December 2016
13:40 - 18:00
Moscone South - Poster Hall

Dunes are ubiquitous features in sand bed rivers and estuaries, and their formation, growth and kinematics play a dominant role in boundary flow structure, flow resistance and sediment transport processes. However, bedform evolution and dynamics during the rising/falling limb of a flood wave remain poorly understood. Herein, we report on a series of flume experiments, undertaken at the University of Hull's Total Environment Simulator flume/wave tank facility, with imposed flow variations and different hydrographs: i) a sudden (shock) change, ii) a fast flood wave and iii) a slow flood wave. Our analysis shows that, because of changes of sediment transport mechanisms with discharge, the sediment flux rather than bedform migration rate is a more appropriate parameter to relate to transport stage. This is particularly the case during bedload transport dominated periods at lower flow discharge, where a strong power law relationship was detected. In terms of varying processes across the hydrograph limbs, bedform evolution during the rising limb is dominated not only by bedform amalgamation but also by the washing out of smaller-scale bedforms. Furthermore, bedform growth is independent of the rising rate of the hydrograph limb, while evolution of bedform decay is affected by the rate of discharge decrease. This results in an anticlockwise hysteresis between transport stage and total flux was found in fast wave experiment, indicating a significant role of the change in sediment transport mechanisms on bedform evolution. Moreover, analysis on the variation of deformation fraction (*F*, ratio of the deformation flux to the total bed material flux) suggests that net degradation of the bed enhances bedform deformation and leads to a higher *F* (~0.65). This work extends our knowledge on how dunes generate and develop under variable flows and has begun to explore how variations in transport stage can be coupled with the variation in sediment transport mechanisms, and/or sediment supply which can help improve the modelling of sediment transport processes.

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