Flow structures over fixed 2D bedforms in transient states

Unsworth, C.A., Parsons, D.R., Reesink, A.J.H., Best, J.L., Ashworth, P.J. and Hardy, R.H.

Flow processes measured in the laboratory over fixed, 2D or 3D bedforms have mostly been conducted at one flow depth and with bedform dimensions set by scaling laws based upon “equilibrium” flow conditions. These results thus have limited applicability to many natural situations where bedforms and flow fields are co-evolving at different rates in response to transient conditions, such as changes in flow depth and flow discharge associated with a flood. The research presented herein investigates flow processes over 2D fixed bedforms under a range of non-equilibrium, transient, states in order to quantify the spatio-temporal changes in turbulence associated with steady conditions that are set at non-equilibrium depths and velocities. Flow field information was obtained at steady states for a range of flow depths and mean flow velocities, mimicking conditions during the transient evolution of flow and bedforms during a flood wave. This allowed quantification of flow fields over bedforms under transient boundary conditions, including shear stress profiles and the spatial variation in the dynamics of the separation zone. These findings provide data for a preliminary assessment of the link between sediment transport lag and transient flow dynamics, and facilitate an analysis of the implications of variable dune height: flow depth for flood wave propagation and bedform response.

Presented at: Marine and River Dune Dynamics - MARIDIV, 15 – 17 April 2013, Bruges, Belgium

bedforms in unsteady flows