Geophysical Research Abstracts
Vol. 21, EGU2019-10836, 2019
EGU General Assembly 2019

Observations of nearbed turbulence intermittency over mobile bedforms in combined wave-current flows

Hachem Kassem (1), Charlie Thompson (1), Carl Amos (1), Ian Townend (1), and David Todd (2)

(1) University of Southampton, Ocean and Earth Science, Southampton, United Kingdom (hachem.kassem@soton.ac.uk), (2) HR Wallingford, Wallingford, Oxfordshire United Kingdom

Nearshore flows are often characterized by non-linear wave-current interactions. These are often assumed to be the same for currents following or opposing the direction of wave propagation; and corresponding momentum and mass exchanges to be restricted to the oscillating boundary layer (zero-flux condition) with enhanced but equal time-averaged bed shear stresses. To examine these assumptions, a prototype-scale experiment investigated the nature of turbulent exchanges in the near bed (just outside of the combined boundary layer) in flows with currents aligned to, and opposing, wave propagation over a mobile sandy bed. Measurements show that the nearbed flow is not uniformly dominated by the current, and experiences upward turbulent fluxes in aligned flows, coupled with sediment entrainment by vortex shedding at flow reversal, whilst downward fluxes of eddies generated by the core flow, and strong adverse currents can quickly advect and break suspension clouds, or enhance sheet flow conditions, in opposing currents. The current plays a significant role in dictating the prevalence of coherent turbulent motions underneath the waves. Current-aligned turbulence structures contribute significantly to the stress. These preliminary findings suggest a notable difference in wave-following and wave-opposing wave-current interactions, leading us to conclude that a stochastic description is needed to account for the intermittent momentum-exchanges.