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Effects of Grain Size Distributions on Fluid-Sediment Feedback

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Accounting for the feedback effects between sediment suspension and the generation of turbulence (Conley et al., 2008) has recently been shown to improve predictions of morphological evolution (Falchetti et al. 2010). Accounting for these interactions, which in general lead to an increase in the wave coherent component of transport relative to the mean component of transport, have been shown to even result in a change of transport direction. However most research to date has focused on simulations representing the unrealistic case of sediment beds composed of a single grain size.

The recently initiated project TSSAR Waves (Turbulence, Sediment Stratification and Altered Resuspension under Waves) has initially focused on examining how the size distribution of bed sediments affects this fluid-sediment feedback. It has already been demonstrated (Conley et al. 2008) that the magnitude of the effects of sediment stratification scale with the ratio of maximum orbital velocity to grain settling velocity suggesting that the effects will be highly dependent on the grain size distribution. The nature of these effects has been investigated utilizing a modified version of the Generalized Ocean Turbulence Model (GOTM).

Implementation of the ability to handle size distributions involved investigating questions such as how the mobility of individual scaseize fractions are related to total bed mobility, how excess shear stress is partitioned among size classes and grain size dependency of the Schmidt number. Observations from these investigations will be presented as well as predictions of sediment mobilization and suspension which are compared to appropriate laboratory experiments.

Reference:

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