Department of Ocean and Resources Engineering
Seminar

Wave-sediment interactions on a muddy shelf

By

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ORE

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MSB 114

3:00-3:30 pm Coffee Hour
3:30-4:30 pm Seminar

Please join us for the coffee hour near the seminar venue a half hour before the seminar, 3:00 – 3:30 pm

Abstract

In an effort to better understand the interaction between wave propagation and sediment transport processes in a muddy environment, this talk discusses the data collection and analysis of high resolution coherent observations of waves, currents and sediment dynamics in the Atchafalaya shelf, Louisiana, USA.

The data shows that strong swells associated with cold front passages induce bottom liquefaction, the formation of fluid mud layers that move seaward, and subsequently settle as the wave energy decreases. These rheological changes in the state of the bed occur in the time span of a storm questioning the practical applicability of sediment and wave evolution models based on single-phase mud rheology. This scenario also contradicts previous hypotheses that point to post-frontal upwelling to explain the accretion patterns in muddy coasts.

It is found that bottom-induced wave energy dissipation increases gradually after the arrival of pre-frontal swells reaching a maximum of about 60% over 4 km. Contrary to what is suggested in previous studies, the results of this work show that fluid muds do not seem to particularly influence dissipation, instead, most of the dissipation takes place after the fluid mud is deposited and the seabed is, presumably, in an underconsolidated soft-mud state. This dissipation is not constrained to the swell band, as it is observed in the infra-gravity wave, and sea bands during high swell events. Further analysis indicates that nonlinear three wave interactions during these periods are significant and may contribute to the dissipation of energy in frequency bands that would otherwise not be affected by bottom effects.

Similar nonlinear processes have been explored in previous numerical and theoretical studies, but have not yet been observed with the temporal and spatial resolution achieved in this experiment. The present observations will help to verify the relevance of such models. Future improvements to the measurement techniques applied in this work, should include vertical profiles of rheological properties of mud.