Visiting Lecture in MSc Coastal Engineering and Management

Dr. Eva Kwoll

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Title:

The effect of dune geometry and relative flow direction on the turbulent flow field

Date, Time and Location:

Tuesday 17 March 2015, 17:45 – 19:30, ENG Lecture Theatre 3, UWI

About the Talk:

Small scale morphodynamic processes at the fluid-bed interface in coastal environments are still not fully understood. Often, the sandy seabed is organized into bedforms of a variety of shapes and scales. Owing to their interaction with the flow field and turbulence production, large bedforms such as dunes significantly influence sediment transport and flow resistance.

In the first part of this talk, data collected in a laboratory study examining the effect of the dune lee-slope on the turbulent flow field and flow resistance will be presented. It will be shown that the flow separation zone, occurring in the lee-side of high-angle dunes due to strong adverse pressure gradients, decreases in size and frequency of occurrence for lower lee-slopes. Further, turbulence production above bedforms is predominately associated with large-scale coherent flow structures (macroturbulence).

As macroturbulence is the principal mechanism behind the entrainment and transport of sediment in suspension, the second part of the talk will present some investigations into the turbulent flow field above natural dunes when mobile sediment is present. The focus will be on shipborne data collected in the Danish Knudedyb tidal inlet with very large compound bedforms (water depth <20 m). The primary bedforms remain ebb-oriented during a tidal cycle while smaller superimposed bedforms reverse direction with each tidal phase. Macroturbulent structures are shown to be responsible for the rapid upward transport and mixing of suspended sediment and may form distinct clouds on the water surface.

The complexity of the processes occurring at these small scales currently lacks adequate description. Sedimentary budgets may be under- or overestimated if the variability in macroturbulence caused by the dune lee-slope and flow direction is not taken into account. Therefore, there is a need for current generations of morphodynamic models to take into account the variability of flow resistance induced by flow unsteadiness, the relative orientation of flow to bedforms, and lee-slope characteristics, to which the current research is aimed.

About the Presenter:

Dr. Eva Kwoll is a postdoctoral researcher within the coastal dynamics research group at the MARUM Center for Marine Environmental Sciences in Bremen, Germany. She completed her PhD at the same institution and her research focuses on the interaction of flow, the erodible bed and morphological adaptations at various scales in the coastal environment. She uses data derived from hydroacoustic ship-based measurements as well as high resolution laboratory investigations. Her motivation and research approach builds on her geological educational background, having obtained her BSc in the broad field of Geoscience and a double degree MSc in Marine Geosciences from the University of Waikato in New Zealand and the University of Bremen. She has conducted internships and teaching projects in the Netherlands, China, USA and Ireland. Most recently, she has developed close collaboration with the Simon Fraser University in Canada. Apart from living for research and travel, she loves cinematography and running.

Light refreshments will be served following the lecture.