SANDT-PRO: SEDIMENT TRANSPORT MEASUREMENTS UNDER IRREGULAR AND BREAKING WAVES

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MOTIVATION

The complex interactions between hydrodynamics and sediment transport processes in the near-shore region are not yet sufficiently well understood to enable accurate model predictions. This holds in particular for the effects of wave irregularity and wave breaking, and is primarily caused by a lack of detailed experimental data. Our research aim is to uncover further the physical processes that drive sand transport under different types of regular breaking (RB) and irregular non-breaking (INB) waves, by means of large-scale wave flume experiments.

EXPERIMENTS

The experiments were conducted at the CIEM flume of UPC, Barcelona. The initial bed set-up, built with medium sand (D_{50} = 0.25 mm), consists of an offshore linear slope, followed by a long horizontal test section and a fixed parabolic beach (Figure 1). Detailed measurements of sand transport processes were obtained using 2 CCM tanks (buried in the bed) and a range of instruments deployed from a (vertically + horizontally) mobile measuring frame, including a Vectrino Profiler, an Aquascat ABS, and a HR-ACVP. Total net transport rates were obtained by applying the mass conservation principle to the pre- and post-test bed profiles measured with acoustic bed profilers.

During the RB experiments sand transport process measurements were obtained at multiple cross-shore locations along an evolving breaker bar. For the INB experiments, a range of "irregular" wave groups were generated (e.g. bichromatic waves with varying wave sequences, modulated regular waves) and process measurements were obtained in the middle of the horizontal test section.

PRELIMINARY RESULTS AND OUTLOOK

Figure 2 shows a preliminary result for near-bed sediment concentrations, velocities and sediment fluxes, as measured by the HR-ACVP. This measurement was obtained in the shoaling zone just before breaking, during one of the RB runs with a period of 4 s.

The figure shows near-bed sand concentrations, velocities and horizontal fluxes in the sheet-flow regime. The HR-ACVP is able to penetrate quite far into the sheet-flow layer. Clearly, most of the transport occurs within the sheet-flow layer (up to 2 cm from the bed).

Future analyses on the RB and INB conditions will focus on identifying the dominant sand transport processes and their effects on the sediment transport components (wave, current, turbulent, total) at various cross-shore positions (RB) and for varying wave conditions (INB).

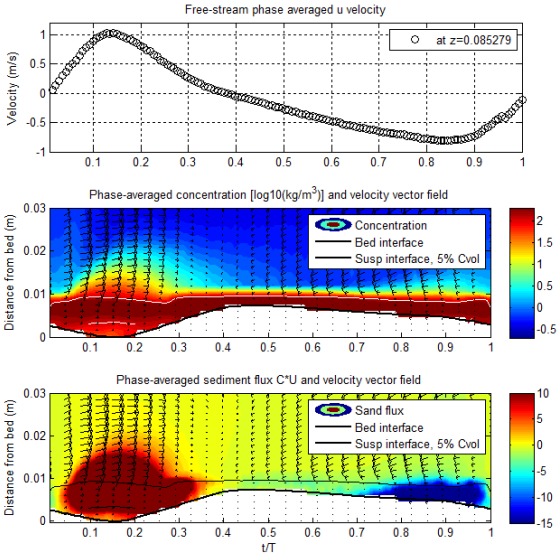

Figure 2 - Preliminary result of near-bed sand flux (HR-ACVP)

ACKNOWLEDGEMENTS

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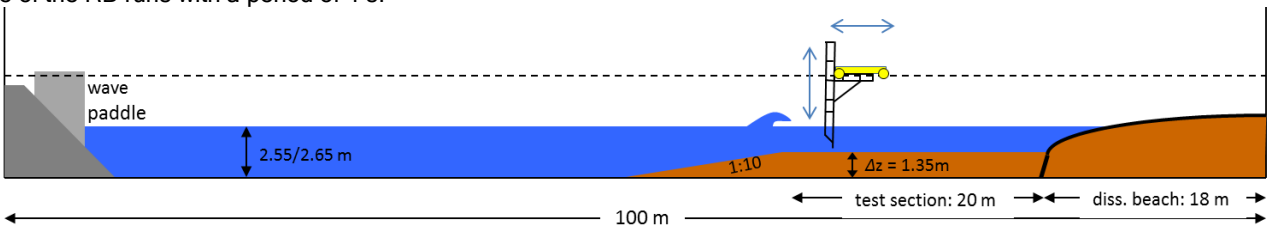

Figure 1 - Experimental set-up