Sand transport process measurements around an evolving breaker bar

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Sand transport formulations form a main component of morphodynamic models, and are therefore essential tools for coastal engineers. Although various sand transport models are available, they all encounter difficulties when it comes to sand transport in the near-shore region and in particular the breaking zone. The cause of this is that the sand transport processes induced by wave breaking are not yet understood in sufficient detail. With a recently finished new series of measurements in a large-scale wave-flume, using innovative instruments to obtain accurate data, we hope to improve our understanding of the wave-breaking effects on sand transport. The obtained dataset includes both process measurements and net transport rates (profile evolution) and can hence also be used for validation of morphodynamic models.

The experiments were conducted in the large CIEM wave flume at UPC, Barcelona, from October 2013 to January 2014. Main instruments were deployed from a measuring frame that was horizontally and vertically mobile, and included a Vectrino Profiler and an Acoustic Concentration and Velocity Profiler (ACVP) for near-bed sediment fluxes, and an Acoustic Backscatter Sensor for concentration profiles higher in the vertical (Figure 1, left). Moreover, two CCM tanks for sheet-flow measurements were buried below the bed and an additional two ACVP's were deployed from the wall. We used regular waves (H=0.85 m, T=4 s) that were breaking on a horizontal test section, consisting of medium-grained sand, and we measured at various locations around the evolving breaker bar (Figure 1, right).

First results show the formation of a large breaker bar and breaker trough at the beginning of the test section. Further examination revealed that this evolution could be explained by sand coming from both the offshore and onshore direction. Likely explanations are that prior to breaking, velocities are strongly acceleration-skewed which drives an onshore sand transport. After breaking, the transport in the surf-zone is offshore-directed due to a strong undertow.

During next weeks, we will continue analyzing the new dataset and focus more on the other instruments. In particular, we will study the near-bed sediment transport processes with a particular interest in the expected wave-related suspension fluxes resulting from wave breaking.

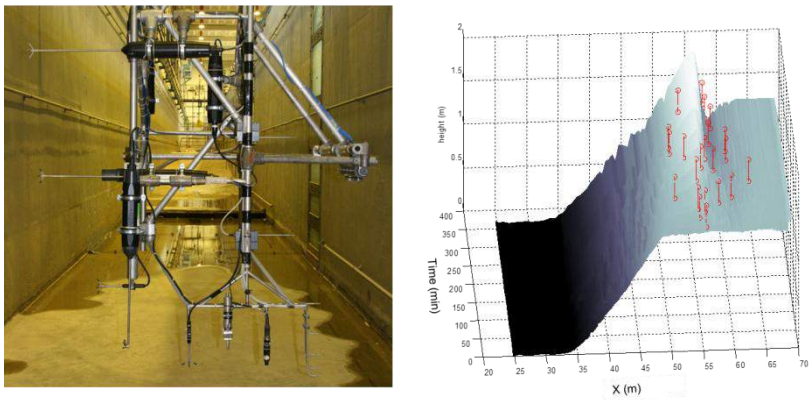

Figure 1. Left: instrumental set-up on mobile measuring frame;
Right: profile evolution and measuring positions (red bars).