



## **Making and breaking the sediment record - characterising effects of tsunamis, storms and average conditions on dune erosion and recovery: a forward modelling exploration.**

Dano Roelvink (1) and Susana Costas (2)

(1) UNESCO-IHE, Delft, the Netherlands, (2) Universidade do Algarve, Faro, Portugal

Geological records contain a wealth of information about accretionary episodes in the life of a coastal profile, such as age and type of the deposits and circumstances during which the accretion took place; of erosional events mainly the final limit of the erosion and circumstances under which the erosion took place can be estimated.

To obtain a more complete picture of the events shaping the sedimentary record and transport processes involved, process-based modelling can be a useful tool (e.g. Apotsos et al., 2011). However, application of such modelling to different types of events remains a challenge. In our presentation we intend to show examples of the effects of different events on the stratigraphic record and to discuss the challenges related to the modelling of each of these types of events.

The test site chosen is the Costa da Caparica, south of Lisbon, Portugal. The stratigraphic record and progradation rates of the coastal were obtained combining geophysical (Ground Penetrating Radar) and dating (Optically Stimulating Luminescence) techniques, which document very recent ages for the preserved coastal barrier. Within the record, we focus on a period around the big tsunami of 1755, during which the shoreline experienced a long-term prograding trend with evidence of severe erosion events. Rather than trying to exactly reproduce the stratigraphy observed here, we will carry out exploratory simulations to create 'building blocks' of stratigraphy related to the different types of events, which we can loosely compare with observations reported in Rebelo et al. (2013).

The model applied for all simulations is XBeach (Roelvink et al., 2009), which is used in three different modes (no short waves, time-varying wave action balance, stationary wave action balance, respectively) to accommodate the impact of tsunamis, storms, and average conditions; for the latter we include the dune and associated processes in a simplified aeolian transport and response model. In all cases we resolve wave-averaged flows, bed load and suspended load transport and morphology change including avalanching.

Results will be presented in terms of both profile change and resulting contribution to stratigraphy, allowing to evaluate the effects of these different building blocks on the stratigraphic record.

### References:

- Apotsos, A., G. Gelfenbaum, and B. Jaffe, 2011. Process-based modeling of tsunami inundation and sediment transport, *J. Geophys. Res.*, 116, F01006, doi:10.1029/2010JF001797.
- Rebêlo, L., Costas, S., Brito, P., Ferraz, M., Prudêncio, M. I. and Burbidge, C., 2013. Imprints of the 1755 tsunami in the Tróia Peninsula shoreline, Portugal In: Conley, D.C., Masselink, G., Russell, P.E. and O'Hare, T.J. (eds.), *Proceedings 12th International Coastal Symposium (Plymouth, England)*, *Journal of Coastal Research*, Special Issue No. 65, pp. 814-819, ISSN 0749-0208.
- Dano Roelvink, Ad Reniers, Ap van Dongeren, Jaap van Thiel de Vries, Robert McCall, Jamie Lescinski. Modelling storm impacts on beaches, dunes and barrier islands. *Coastal Engineering*, Volume 56, Issues 11-12, November-December 2009, Pages 1133-1152