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Sensivity of tidal sand waves to environmental conditions, an integrated data analysis and modeling approach

H.E. de Swart (1), R.B. van Santen (1), T.A.G.P. van Dijk (2), P. Blondeaux (3), and G. Vittori (3)

(1) University of Utrecht, Inst. of Marine and Atmospheric Research, Utrecht, Netherlands (h.e.deswart@uu.nl, +31 30 2543163), (2) Deltares, Dept. of Applied Geology and Geophysics, Utrecht, Netherlands, (3) Department of Civil, Environmental and Architectural Engineering, Genoa University, Genoa, Italy

On the shelf of several coastal seas tidal sand waves are observed, which are rhythmic bed forms with typical wavelengths in the order of hundreds of meters and heights of several meters. Sand waves tend to be very mobile, with migration speeds up to tens of meters per year, and they might interfere with human activities in coastal areas. So far, sand waves have been studied either by focusing on field observations or on model simulations. In this presentation, the information of both observational data and model results is used to systematically investigate the relationship between sand wave characteristics and environmental conditions, such as local water depth, tidal current amplitude, tidal ellipticity and sediment grain size. For this, field data at a large number of selected locations in the North Sea have been analysed to yield characteristic lengths, heights and other shape parameters of sand waves. The observed sand wave lengths are compared with those computed by an extended version of a known model for sand waves, which uses observed local conditions as input. The model extensions concern the account of ellipticity of the tidal current, the presence of mega ripples and the grain size dependency of the critical Shields parameter. From the results of this study, it is concluded that observed and modelled sand wave lengths agree fairly well if the model parameters are adequately chosen.