# PARAMETERIZATION OF WAVE ORBITAL MOTION AND ITS EFFECT ON LONG TERM MORPHOLOGICAL DEVELOPMENT IN THE NEARSHORE

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For reasons of computational efficiency, the orbital velocities are often parameterized in morphodynamic simulations, e.g. through Isobe and Horikawa (1982). Other methods are summarized in Abreu *et.al.* (2010). The parameterization simplifies the wave shape and velocities by applying higher harmonics, for example. The risk is that this simplifies the nearshore hydrodynamics to such a degree that even a small error in wave-shape prediction leads to large net sediment transport and, in the long term (i.e. months to decades), to unrealistic modelled morphology. To improve the parameterization, Ruessink *et.al.* (2012) compute the intra-wave velocity based on extensive field data.

Our objective is to assess effects on long-term morphodynamics of the differences between the methods described in Ruessink *et.al.* (2012) and Isobe and Horikawa (1982) in a hydrodynamic and morphological model – Delft3D. This comparison is part of a larger project with long-term modelling and large-scale equilibrium-oriented simulations focusing on sediment transport trends and general behaviour from deep water to the beach.

The Isobe-Horikawa parameterization overestimates onshore transport and the depth of closure, causing rapid beach and shoreline accretion. The general steepening of the cross-shore profile is inconsistent with the simulated wave condition. The Ruessink *et al.* parameterization shows more natural development. Morphological changes were limited to water shallower than the depth of closure; a subtidal bar formed and the shoreline and upper beach weakly eroded (Figure 1).

Until now, modellers using IH usually have tuned down the transport factor in order to reduce excessive erosion and coastline accretion, but this affects sediment transport in the entire domain, which inhibits long-term morphological modelling of the coastal system. We believe that a new intra-wave parametrization implemented into Delft3D may improve long-term 2DH and 3D morphological models. We are expanding this analysis to larger model domains and looking into comparisons with field data.

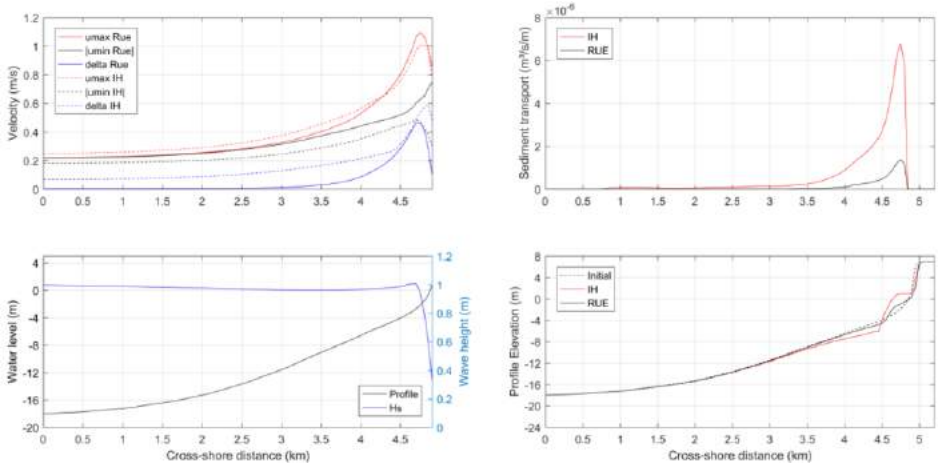


*Figure 1: Comparison between IH and Ruessink parameterization along the beach profile for a perpendicular wave condition of 1m, 8s. Top Left: peak intra-orbital velocity; Bottom Left: Bed level and wave height; Top Right: sediment transport along the profile; Bottom Right: resulting topography after 10 morphological years.*

Abreu, T., Silva, P.A., Sancho, F., Temperville, A. (2010). Analytical approximate wave form for asymmetric waves. *Coastal Engineering*, 57(7), 656-667.

Isobe, M., Horikawa, K. (1982). Study on water particle velocities of shoaling and breaking waves. *Coastal Engineering in Japan*, 25(1), 109-123.

Ruessink, B.G., Ramaekers, G., van Rijn, L.C. (2012). On the parameterization of the free-stream non-linear wave orbital motion in nearshore morphodynamic models. *Coastal Engineering*, 65, 56-63.