# Internal wave generation in a non-hydrostatic model for modelling wave-WEC (array and farm) interactions and far field effects

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One of the challenges in the field of renewable wave energy is to determine the optimal geometrical layout for wave energy converter (WEC) arrays or farms, targeting the maximum energy production and the correct assessment of the impact of WEC arrays or farms on the surrounding wave field. For this purpose, accurate and detailed numerical modelling of WEC arrays and farms under realistic 3D wave conditions is considered crucial, which is a topic addressed by "Working Group 1" of the WECANet COST Action CA17105. This kind of application requires a homogeneous wave field in the entire numerical domain and thus a new internal wave generation technique (Figure 1) has been developed and implemented for the non-hydrostatic wave model, SWASH (Zijlema et al., 2011).

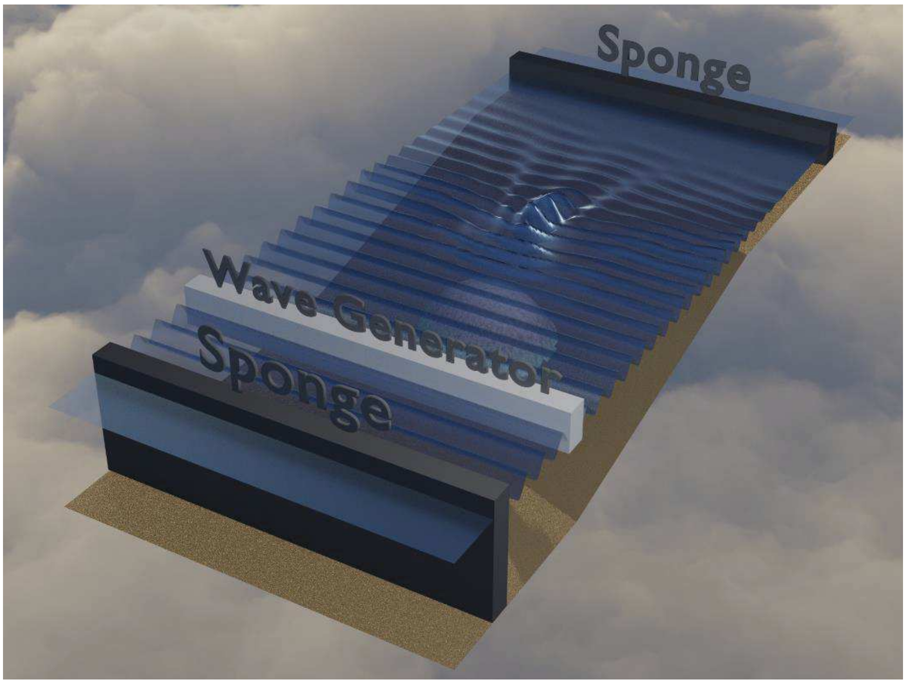


Figure 1 Wave propagation over the Berkhoff shoal, showing the 3D SWASH results of water surface elevations, using internal wave generation.

Traditionally, in time-domain models the waves are generated by using the weakly reflective wave generation method which is based on the assumption that the waves propagating towards the boundary

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of the computational domain are small amplitude shallow water waves with direction perpendicular to the boundary. As a result, this method is weakly reflective for directional and dispersive waves, leading to loss in absorption performance of the domain boundaries. The internal wave generation was proposed by Vasarmidis et al. (2019) as an alternative, for the open source non-hydrostatic wave model, SWASH, to avoid wave reflections. With this method, a spatially distributed source term in the form of mass is added to the continuity equation. This source term is a function of a velocity that is called the energy velocity and for the system of SWASH equations has been mathematically derived by Vasarmidis et al. (2019).

A comparison has been executed by Vasarmidis et al. (2020) between the performance of the new internal wave generation method and the weakly reflective wave generation, and it is shown that internal wave generation leads to much better results in case of waves reflected back to the numerical boundary. Thus the method provides a significantly more accurate prediction of the resulting wave field for cases with man-made structures (e.g., breakwaters, artificial reefs, artificial islands) and wave energy converter (WEC) farms, where the radiated and reflected waves cannot be estimated a priori.

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