Prediction of wave field generation performance for the new Coastal and Ocean Basin (COB) in Belgium

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In recent years there has been much discussion on the role of experimental facilities in coastal and offshore engineering. It is commonly recognized that despite the progress in computing and consequently in numerical modelling performance, physical scale modelling remains an essential tool for numerical modelling validation. Scientific research in the fields of coastal and offshore engineering, like many other engineering domains, has evolved into a so-called integrated research methodology, combining both numerical and physical scale modelling. In this context, limitations of existing testing infrastructure and the need for modern facilities for maritime research and development calls for further investment in this sector.

The new Coastal and Ocean Basin (COB) located at the Greenbridge Science Park in Ostend, Belgium, is under construction since February 2017. The laboratory will provide a versatile facility to facilitate a wide range of physical modelling studies, including the ability to generate waves in combination with currents and wind under arbitrary relative directions. The new wave basin is designed to have state-of-the-art generating and absorbing wave generators, a recirculation current system, and a wind generator. The COB will allow users to conduct tests for coastal and offshore engineering research and commercial projects, i.e. scale models of coastal and offshore structures, coastal defense constructions, floating wind turbines, wave and tidal energy converters, floating platforms and device mooring applications. Applications directly related to Blue Energy and Blue Growth. The COB will be 30 m long, 30 m wide and will have a variable water depth of up to 1.4 m allowing for coastal to near offshore test conditions with a maximum regular wave height of 0.55 m while at the same time a central pit with a water depth of 4.0 m will serve for mooring applications. The wave generator will ideally cover spatially two sides of the basin, forming an 'L'-shaped corner. The other two sides will be equipped with wave-absorbing units. This layout will allow generation of waves with 1.0 s wave period or higher in any oblique direction with respect to the wave generators.

However, the optimization of the wave field generation performance of a wave basin is a challenge. Wave reflection from physical wave-absorbing units and variations in the homogeneity of the wave field due to the interaction between the wave generators and the other two basin sides are to be expected. The purpose of this research is to deal with these issues and increase significantly the performance of the generated wave fields. To achieve this aim, numerical modelling is undertaken using two phase resolving wave propagation models, MILDwave (Troch, 1998; Troch & Stratigaki, 2016), a mild-slope wave model developed at Ghent University and SWASH (Zijlema et al., 2011), a non-hydrostatic model, in order to provide a first assessment of the homogeneity of the generated wave field in the COB, and how this is affected by a range of different configurations of the L-shaped wave generators.

References

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