Internal wave generation in numerical models

Vasarmidis Panagiotis[1], Stratigaki Vasiliki[1], Suzuki Tomohiro[2] and Troch Peter[1]

[1] Department of Civil Engineering, Ghent University, Technologiepark 60, 9052 Zwijnaarde, Belgium
E-mail: Panagiotis.Vasarmidis@UGent.be
[2] Flanders Hydraulics Research, Berchemlei 115, 2140 Antwerp, Belgium

One of the most important ecological and economic issues related to coastal engineering is the protection of the coastal areas and the unique ecosystems and economic activities they host. Moreover, coastal areas around the world should be able to cope with new challenges caused by sea level rise and by more frequent and intense storms due to climate change, phenomena that require human's high attention.

Nowadays, numerical models are commonly used as engineering tools for the study of wave propagation and impact on coastal areas. Depending on the problem under investigation and the corresponding time and space scales, different numerical models are used. In the field of wave transformation in coastal areas, SWASH (Zijlema et al., 2011), which is a phase-resolving wave propagation model based on the nonlinear shallow water equations with added non-hydrostatic effects, has already reached a fairly mature stage (Suzuki et al., 2017).

In order to simulate waves in the nearshore zone correctly, the generation and absorption of waves at the boundary of models need to be modelled accurately. In the SWASH model, waves are generated by prescribing the horizontal velocity component normal to the boundary of the computational domain over the vertical direction. However, this method is weakly reflective for directional, dispersive waves. The purpose of this research is to deal with these issues and improve the performance of the generated wave fields. To achieve this aim, an internal wave generation technique has been implemented in SWASH, where a source term in the form of mass is added to the governing equations. The first obtained results show that the method is working very well.

References

- Suzuki, T., Altomare, C., Veale, W., Verwaest, T., Trouw, K., Troch, P., Zijlema, M., 2017. Efficient and robust wave overtopping estimation for impermeable coastal structures in shallow foreshores using SWASH. Coast. Eng. 122, 108–123. https://doi.org/10.1016/j.coastaleng.2017.01.009
- Zijlema, M., Stelling, G., Smit, P., 2011. SWASH: An operational public domain code for simulating wave fields and rapidly varied flows in coastal waters. Coast. Eng. 58, 992–1012. https://doi.org/10.1016/j.coastaleng.2011.05.015

Acknowledgement

The first author is Ph.D. fellow of the Research Foundation – Flanders (FWO), Belgium (Ph.D. fellowship 11D9618N).

Keywords: Numerical modelling; Coastal and offshore engineering; Wave generation; SWASH