From measured 2D short wave spectrum to infragravity wave surface modulation in deep water

Zhang Qinghui[1], Monballiu Jaak[1] and Toorman Erik[1]

[1] Department of Civil Engineering, KU Leuven Kasteelpark Arenberg 40 - box 2448, 3001 Leuven
E-mail: qinghui.zhang@kuleuven.be

Infragravity waves (IGs), often referred to as gravity waves with periods from 0.4 to 4 min (Herbers 1995), are generated by the interaction of primary wind waves offshore. When the whole wave set travels across the ocean as far as the near coastal region, short waves steepen and eventually break. Due to the long wavelength of IGs, they never reach the steepness required for breaking and are able to travel all the way to the coast. Under stormy conditions, IG contain much more energy when travelling close to the coast due to shoaling process. They are also believed to play an important role in harbor oscillations and nearshore sediment transport (Herbers 1995).

Within the framework of the CREST project, from the short wave spectrum which has been measured during a storm in January 2016 at location Westhinder, the corresponding water surface variations caused by IGs have been computed. The calculation procedure has been verified by comparing to the analytical solution (assuming a constant water depth). Sensitivity tests show that the total long wave energy varies quadratically with the short wave energy, and that the long wave energy increases dramatically at lower water depths.

The following step is to incorporate the computed long wave water level variation in the water level variation in the coastal region. The objective is to take into account the complex processes that occur nearshore: the release of the bound IG into free IG during the short wave breaking, and the generation of additional IG energy due to the time varying breaking point. We have identified two main limitations to this methodology, with heavy computational time being the main difficulty.

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Keywords: infragravity wave; offshore; water surface modulation

Reference

- Herbers, T. H. C., S. Elgar, and R. T. Guza (1995), Generation and propagation of infragravity waves, J. Geophys. Res., 100(C12), 24863–24872.