Field observations of Infragravity waves along the Belgian coast

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Infragravity waves are surface waves that have longer periods compared to the incident gravity waves that dominate the peak frequency in the offshore wave spectrum. They are characterized by periods between 30 and 300 seconds, amplitudes that range from a few millimeters to tens of centimeters, and wavelengths of kilometers (Munk, 1950). Different mechanisms have been proposed for their generation, including height variation of incoming waves, varying wave heights causing the breaking point of the waves to vary with height, and nonlinear interaction between shorter waves (Bertin et al, 2018).They play an important role in coastal dynamics (Svendsen, 2005) and they are known to cause various nearshore processes such as beach and dune erosion (Roelvink *et al.*, 2009), seiches in harbors (Melito *et al.*, 2006), and wave-driven coastal inundation (Stockdon *et al.*, 2006) if not accounted for in design calculations. Field observations and measurements are crucial for understanding their behavior and impacts, which have been reported to cause extreme water levels and damage in various locations around the world (Yamanaka *et al.*, 2019). Nevertheless, their measurement is challenging due to their low amplitude and long period.

This poster presents preliminary results from a mooring deployment conducted in collaboration between VLIZ, UGent and KULeuven in the framework of the FWO project "*Influence of infragravity sea waves during storms on the hydro- and morphodynamic processes along hybrid soft-hard coastal defence structures with a shallow foreshore*". One of the main goals of this project is to assess the incidence of infragravity waves along the Belgian coast for the first time. The *in-situ* measurements were performed through ADCP-based acoustic surface tracking and high-accuracy quartz pressure sensor deployed on a multipurpose mooring frame. The mooring was deployed off the Belgian coast, in front of Nieuwpoort harbor entrance (51°09.61 N – 002°41.44 E). Both ADCP and pressure sensor were set to measure continuously at 4 Hz being, therefore, able to capture both infra- and gravity waves. Data analysis focused on sensitivity, measurement range, and ability of the sensors to detect infragravity waves of low amplitude. The measurement setup, data processing techniques, and initial results regarding the relevance and occurrence of infragravity waves in the study area are presented. The characteristics of the infragravity waves, such as their frequency, wavelength, and amplitude were determined. The relationship between infragravity waves and other oceanic processes, such as tides and wind-generated waves was also examined. In short, this first assessment provides valuable insights into the dynamics of infragravity waves and their potential impact on the coastal zone. The findings are key for coastal hazard assessment and management initiatives. Finally, this assessment also suggests future directions for researching infragravity waves along the Belgian coast, such as through a long-term near-real-time monitoring system based on several measurement sites.

References

- Bertin, X., de Bakker, A., van Dongeren, A., Coco, G., Andro, G., Ardhuin, F., *et al.* (2018). Infragravity waves: From driving mechanisms to impacts. Earth-Science Reviews, 177, 774–799.
- Lashley, C. H., X. Bertin, D. Roelvink, and G. Arnaud. 2019. Contribution of infragravity waves to run-up and overwash in the pertuis Breton embayment (France). J. Mar. Sci. Eng. 7 (7): 205.
- Melito, I., Cuomo, G., Bellotti, G., Franco, L., 2006. Field Measurements of Harbour Resonance at Marina di Carrara. Paper Presented at the 30th International Conference on Coastal Engineering held in San Diego, U.S.A.
- Munk, W. H. (1950). Origin and generation of waves. Coastal Engineering Proceedings, 1.
- Roelvink, D., A. Reniers, A. van Dongeren, J. van Thiel de Vries, R. McCall, and J. Lescinski. 2009. Modeling storm impacts on beaches, dunes and barrier islands. Coastal Eng. 56 (11–12): 1133–1152.
- Stockdon, H. F., R. A. Holman, P. A. Howd, and A. H. Sallenger. 2006. Empirical parameterization of setup, swash, and runup. Coastal Eng. 53 (7): 573–588.
- Svendsen, Ib A. (2005) Introduction to Nearshore Hydrodynamics. WORLD SCIENTIFIC.
- Yamanaka, Y., Matsuba, Y., Tajima, Y., Shibata, R., Hattori, N., Wu, L., & Okami, N. (2019). Nearshore dynamics of storm surges and waves induced by the 2018 Typhoons Jebi and Trami based on the analysis of video footage recorded on the coasts of Wakayama, Japan. Journal of Marine Science and Engineering, 7(11), 413.

Keywords
Infragravity Waves; North Sea; ADCP; Pressure Sensors