Observing and Characterizing Infragravity Waves Through Different Sampling Devices: A Case-Study Off the Belgian Coast

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Infragravity (IG) waves, surface ocean waves with long periods ranging from 30 to 300 seconds, are a significant factor in coastal dynamics, particularly in their contribution to processes such as beach and dune erosion, harbor seiches, and coastal inundation due to overtopping.

Implementing suitable sampling strategies for observing and characterizing IG waves might be challenging as these waves are hard to measure accurately due to their low amplitude. Additionally, their evolving characteristics in an environment marked by pronounced bathymetric features, such as the sand bank systems off the Belgian coast, add a degree of complexity that requires testing of different approaches, and at different sites.

To address methodological challenges regarding IG waves sampling, mooring deployments were conducted in winter 2023 at three different shallow water locations off the Belgian coast to measure IG waves impacting Living Lab Raversijde storm monitoring and overtopping. This study evaluated the performance of different instruments in detecting these waves, employing an innovative multi-sensor approach. The instruments include Acoustic Doppler Current Profilers (ADCPs), with pressure and Acoustic Surface Tracking (AST) sensors, and High-Accuracy Pressure Sensors, operating at a continuous frequency of 2 and 4 Hz, respectively. The inter-comparison of the sensors showed that the AST sensor integrated with ADCPs did not perform as expected during storms, showing discrepancies due to turbulence brought on by storm conditions and likely enhanced by the bathymetry features.
We then evaluated the behavior of IG waves in comparison with Sea-Swell (SS) waves in terms of significant wave height (H_{m0}) and concluded that H_{m0}-IG waves increased from 0.3 cm to 40 cm, contributing up to 15% to total H_{m0} during storm conditions, while H_{m0}-SS remained under 1.0 m in calm conditions and increased to 3.0 m during the most severe storm of the season.

This research is a step towards understanding the behavior and impacts of IG waves along the Belgian coast. It lays the groundwork for future investigations into the implementation of a comprehensive, long-term, near-real-time monitoring system that spans multiple locations.

Keywords
Infragravity Waves, In-Situ Observations, ADCP Measurements, High-Accuracy Pressure Sensors