IUGG 2025 grant call report for:
The infra-gravity wave initiative

Overview: The primary effort over the last year was on establishing the InfraGravity Wave (IGW) group, writing a review paper (focusing on IGW measurements) and a recommendation to include IGWs into the "sea state" Essential Ocean Variable (EOV). To this end, a meeting in Belgrade was funded through the IUGG grant call. All participants (with the exception of Gal Akrish who contributed remotely) met, and discussed organization of the initiative, wrote a rough draft of the review paper, and established parameters of measurement devices that can be used to measure IGWs. Illustrations of important IGW processes and measurement techniques were also funded through the IUGG grant.

As of now, there are over 30 researchers who have participated in the work of the initiative. They are divided into different groups (with some overlap). The groups include in-situ measurements, remote sensing measurements, theory/modelling, coastal impacts, wave-ice interactions, data, and lab experiments.

Besides the organizational and writing efforts, a new design of pressure cell was developed (optimized to measure IGWs), and several of them have already been built and deployed. It was originally planned to buy an existing model of pressure cell for this purpose, however due to sharp increase in price, this was a much more cost effective solution (with improved capabilities as well).

Deliverables:

1. The work on the draft of the IGW review paper, and on petition to include IGWs into the sea state EOV to GOOS is ongoing. The first draft of the review paper was completed, and in the current form contains outlines of each section, as well as illustrations of IGW related processes and measurement techniques. We hope to finish (or nearly finish) both of them by the end of the next year. A proposal to Reviews of Geophysics journal (attached to the email) was completed and submitted. It covers all of the topics we plan to cover, and explains the importance of the topic.
2. The work developed an integrated underwater pressure data logger system for long-term autonomous operation in marine environments. Following a comprehensive review of existing professional and low-cost logging solutions, a modular concept was established emphasizing high accuracy, low power consumption, and synchronized multi-point measurements. The system architecture enables deployment as a pressure-sensor array designed for separating infragravity wave (IGW) components through spatially distributed synchronized measurements, achieved without the need for cabling connections between units. A dedicated real-time clock subsystem was designed around the SiT7910 precision oscillator (±0.1 ppm, −40 °C to +85 °C), complemented by GPS-based timing for initial synchronization accuracy within microseconds. The MS5803 pressure sensors were selected for their reliability and serviceability under extended immersion, while the Arduino MKR ZERO serves as the control and data management platform, providing deep-sleep energy-saving capabilities and onboard data storage. A fully functional prototype has been fabricated and successfully tested under laboratory conditions, and preparations are underway for field validation, endurance testing, and refinement of synchronization algorithms for coordinated multi-unit array measurements.

Suggestions:

While the current work focuses on summarizing the state of knowledge of IGWs and providing a framework for policymakers to take them into consideration, the long term goal of this initiative is to raise the awareness of the importance of IGWs within the research community, and to open up new venues of research. To do so, we plan to attend various conferences around the world to promote the work of the initiative. Care will be taken to present work to all different communities for which the IGWs are relevant, including wave researchers, coastal scientists and engineers, oceanographers, and cryospheric scientists. It is planned to present the work at the next IAPSO scientific assembly, where we will summarize the work of the initiative.

A two week course covering theory, impacts, modelling, and measurements of IGWs is also in the planning phase. It will be open to students, professionals in relevant fields, and researchers. Beyond equipping the attendees with the knowledge needed to work with various aspects of IGWs, the developed curricula will be openly shared. It is hoped that parts of the curricula will be adopted at various universities across the globe.