

IUGG Grant Call 2024

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Note - over 20 other researchers expressed their interest in joining this initiative.

Project description

Infragravity (IG) waves are long ocean surface waves with periods of 25-300 seconds and lengths of few kilometres to few tens of kilometres (depending on their period and the water depth). These waves are characterised by longer periods than those of the wind sea, but lower than that of the shelf oscillations and tides, and are not significantly affected by Earth's rotations. The existence of IG waves was first confirmed in the works of Munk and Tucker in the late 1940s and early 1950s. In both works, waves in the coastal zone whose frequency was much lower than that of the wind sea were observed. Due to their larger scale their generation mechanism is not the same as for wind-waves, and is instead based on nonlinear interactions in the process of wave shoaling or wave breaking or in some cases due to large-scale atmospheric effects. IG waves are of smaller amplitudes than swells and wind waves, but still have significant impacts on a variety of physical processes and engineering applications.

Despite the importance of infragravity (IG) waves in ocean dynamics, significant gaps persist in our physical understanding, modeling capabilities and observation techniques. Currently, there is a notable lack of observations. Tools common to sea-state measurements, such as satellites, high-frequency radars (HFR), X-band radars, wave buoys or moorings do not have the capability or appropriate measurement methodologies fitting for IG spatial/temporal scales, slopes or accelerations. This leaves us with very few measurement datasets which commonly lack any directional information as well as long-term climatic trends. Furthermore, there are currently no large-scale numerical models for global or regional IG

forecasting and therefore no possibility to construct via modeling efforts their hindcast, forecast and climatic projections. Wind sea and swell climate do show long-term changes in trends. As IG waves are strongly tied to these waves, it is clear that they also have changes in their long-term trends. Still, these changes remain a gap in our knowledge. The proposed initiative aims to coordinate efforts in research, technology development, and interdisciplinary collaboration in order to push forward in filling these above various gaps.

To further establish best practices regarding IG wave measurements, we will submit a white paper to the Global Ocean Observing System (GOOS). This organization outlines standardised practices for monitoring of EOVs and ECVs, and we hope to establish such practices in the submitted paper. This is the primary goal of the initiative, and it involves incorporating IG waves into the “sea state” EOV.

Following that, we will also write an extensive review paper. While the focus of the paper will be on IG wave measurements, it will also cover other aspects. State-of-the-art practices, and gaps in knowledge will be identified. Beyond serving as a comprehensive overview of the topic, we aim for this paper to provide some guidelines for steering the research on the topic of IG waves for years to come.

Researchers (over 30 expressed their interest in joining the initiative) with expertise in various aspects of IG wave theory, measurements, and modeling will participate in this effort. To better organize such a large number of participants, a steering group has been established that streamlines the overall process and allows to divide the work into subgroups. These subgroups will be defined according to various impacts and technical aspects of IG waves. Currently, ten groups are planned: theory, modeling, in-situ measurements, remote sensing measurements, lab experiments, sediment transport, wave-ice interaction, altimetry, harbor resonance, flooding. Each subgroup will work on writing their respective part of the review and white papers. The organisation committee, which are the applicants for this grant, will synthesize all these different parts into cohesive paper.

The committee will organise the meetings of the subgroups and monthly progress reports. The IUGG Grants should help for the steering committee to meet in person, to structure the writing and ensure consistency between the different chapters. While no new research is planned as a main component of the initiative, joint work by the participants on their respective topics will be encouraged. As the work of subgroups nears its completion, the different contributions will be presented to all participants in a joint meeting. The details of the review paper and of application to GOOS will also be discussed. Besides these efforts, we aim to promote this initiative at various conferences, both individually and as a group. For the first time, as part of this promotional effort, we will conduct an IG wave pressure cell measurement in the East Mediterranean, with the data made publicly available.