Oceanography Seminar

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"Observations and Modeling of Coastal Infragravity Waves"

Many coastal regions are exposed to energetic short-period gravity waves. As they approach the shore, they lose much of their energy during the breaking process. Although frictional processes dissipate some of that energy, most of it is transferred to longer waves, commonly known as infragravity (IG) waves. IG waves often dominate the sea level and current variability in the surf zone, and they strongly influence coastal processes such as sediment transport, rip currents, sand bar formation, harbor and coastal resonances (seiches), and ultimately wave runup. This presentation will show observations of IG waves on O'ahu's North Shore, a coastline that is exposed to highly energetic sea/swell forcing throughout most of the year. The results reveal that the response of the coastline, including a small boat harbor, is dominated by a suite of modes ranging in periods from 1 minute to nearly 30 minutes.

These observational findings are combined with numerical modeling, in order to help us reconstruct the spatial distribution of the IG wave field for swell conditions where no data is available. As a first step, three high-resolution, dispersive nearshore numerical models (BOSZ - *Roeber & Cheung*, 2012; FUNWAVE - *Shi et al.*, 2012; XBeach - *Roelvink et al.*, 2009) are compared and contrasted with our harbor and reef observations, in an attempt to test their ability to reproduce the wave transformation processes in the complex Hawaiian reef-system environment. Results generated with outputs from all three models are in good agreement with the observations. Overall, the models replicate the spectral amplitudes and capture most of the observed auto- and cross-spectral details.

Further analysis using one of the models reveals complex spatial IG wave patterns. In particular, our simulations highlight standing IG waves modified by the coastal morphology, with alongshore symmetry that varies with frequency. The existence of such standing wave structures may result in strong currents across the sea level nodal lines. These wave forms are not unique to the North Shore of O'ahu as they can be found at other coastlines.

Thursday November 1st, 2018 3:00p.m. MSB 114

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