MSc internship (3-6 months)
“Seismic signatures of storm waves and boulder transport on Banneg Island”

Introduction

Ocean waves are known to generate low frequency noise in seismic records across the world. This “seismic hum” is generated by pairs of ocean wave trains of opposing propagation directions with half the seismic frequency (Ardhuin et al. 2011). The source of these wave-generated microseisms may be encountered either in the deep ocean for broad directional wave regimes or when independent wave systems interact, or in the coastal zone when coastal reflections is significant. Beucler et al. (2015) have shown that microseisms measured by coastal seismic stations were strongly modulated by the tide and this energy modulation could be used in numerical models of microseismic generation to constrain coastal reflection coefficients. Seismic stations are also used to investigate the wave-cliff interactions. Young et al. (2016) showed that microseims recorded on top of a cliff in southern California were sensitive to wave breaking and well correlated to the significant wave height and water levels at the base of the cliff. Finally, seismic records can be used to infer bedload sediment transport in rivers (Roth et al., 2016). The objective of this work is to investigate the seismic signature of waves and boulder transport measured by a seismic station deployed on Banneg Island during winter 2015-2016.

Study area

Banneg island is a small island located at the western tip of the Molène Archipelago (Brittany, France), subjected to macro-tidal regime (maximum tidal range ~ 8m) and regularly battered by extreme waves. These waves are sometimes combined with spring tides and atmospheric surge, which cause extreme wave runup and overtopping events, as evidenced by the displacement of massive cliff-top storm deposits across the island (Autret et al., 2018). These extreme water levels have been shown to be partly driven by large infragravity waves (Dodet et al., 2018).

Aerial view of Banneg island

Cliff top storm deposits on Banneg island

Objective

During winter 2015-2016, a seismometer was deployed on Banneg Island and sampled seismic signals at 250Hz over a one-week period, including an extreme storm event (Ulrika storm on February 13 2016) that caused potential boulder transport over the island (Autret et al., 2018).

Meanwhile, height pressure sensors were deployed in the intertidal zone along four cliff profiles and recorded water levels and wave parameters in the nearshore. Offshore parameters were synchronously measured in deep water by a bottom-mounted pressure sensor and a directional wave buoy. Finally, a few days of video records were measured by a camera overlooking the cliff. Unfortunately the video camera system was damaged during the storm event and stopped recording. The objective of this project is to process the seismometer data, the hydrodynamic data and the video camera records in order to investigate the seismic signatures of remotely-generated microseisms, wave breaking and the impact of displaced boulders

The candidate will be hosted at Ifremer, in the Laboratory of Physical and Spatial Oceanography (UMR LOPS), within the Satellite and Air-Sea Interaction team, and will interact with researchers from the European Institute for Marine Science (IUEM). He will benefit from a multidisciplinary supervision with specialists in oceanography, coastal dynamics, geophysics and geomorphology.

The candidate should have a scientific background in Physical Oceanography and/or Geophysics, computing skills (Fortran, Matlab and/or Pyhton), and oral and written communication skills.

CV and cover letter should be sent to guillaume.dodet@ifremer.fr.

Remuneration
~ 600 eur/months
Foreigner students are elligible for an ISblue mobility grant covering travel expenses (up to 800 eur + 100 eur/months). Deadline of application: November 25 2018.
https://www.labexmer.eu/fr/formation/bourses-mobilite/mobilite-entrante-etudiants-2018-2019

Supervisor / Co-supervisors
Guillaume Dodet (Ifremer, LOPS)
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