

Monitoring of sea dikes with ambient seismic noise

This PhD grant is part of the VIBRIS project, dedicated to the use and study of ambient seismic noise at various scales, from laboratory experiments to applied geophysics and regional tomography.

The VIBRIS project is carried out by OSUNA, the Observatory which coordinates and sustains observations in Environment, Planetary and Earth Sciences in the french region Pays de la Loire.

The PhD student will be hosted by the Laboratory of Assessment and Imaging at IFSTTAR, the French Institute for Transport, Development and Networks, located close to the city of Nantes.

Subject of the thesis:

Sea dike breaching induced by internal erosion is one of the main causes of coastal flood disasters. Since the Xynthia storm in 2010 and its catastrophic effects in the western part of France, sea dike characterization has become a major concern for the Pays de la Loire region. Our objective is to develop a reliable and innovative method for monitoring the physical properties of the dike.

In the past few years, the use of seismic ambient vibrations has become a very active research field, and has proven to be very efficient in many applications, such as crustal tomography, monitoring of volcanoes or subsurface characterization.

Preliminary measurements have shown that passive recording of seismic vibrations induced by sea waves allows to retrieve the velocity of surface waves inside the dike within a suitable frequency range, providing valuable information about its mechanical properties, and offering the opportunity to design a remote device that continuously monitors the health of the structure.

The PhD student will carry out the development of the method, based on field measurements on sea dikes in Loire-Atlantique, signal processing, and surface wave inversion. The resolution and sensibility of the method will also be investigated both numerically and analogically, the latter by the use of ultrasonic sources and laser interferometry on small-scale models.

The PhD student will join the geophysical team of the Laboratory of Assessment and Imaging. This study will benefit from the collaboration of members of the VIBRIS project – located in Nantes (LPGNantes), Grenoble (IsTerre) and Barcelona (ICTJA-CSIC) – and from the contribution of a currently running project on the electrical resistivity tomography of dikes and dunes.

Candidates profile:

Experience in seismic prospecting methods, signal processing and numerical programming is sought. Profiles of applicants familiar with other fields of geophysics, physics or acoustics will also be taken into consideration.

The PhD will start in early fall 2013.

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