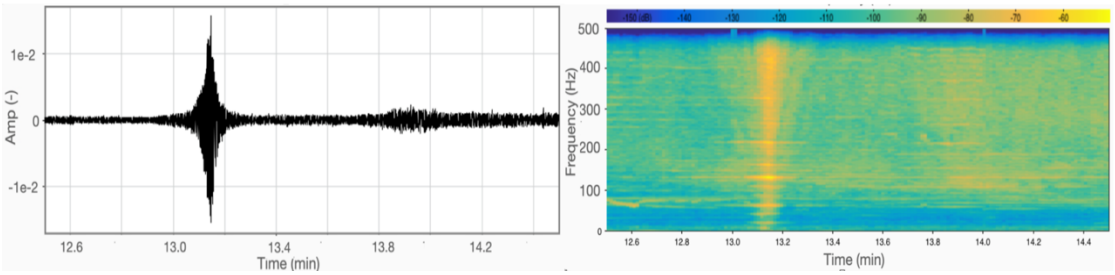
Low-cost acoustic and seismic sensors for environmental applications

(Proposer: Jacopo Boaga)

Low cost acoustic and seismic sensors can be adopted for environmental applications. In this project they will be applied for mountain river monitoring and underwater noise monitoring in the Venice lagoon. Bed load is the fraction of river sediment transport that moves downstream with constant or frequent contact with the riverbed. A reliable quantification of this process represents an issue that is key to addressing several scientific and management questions. The coarse sediment dynamic rules geomorphological evolution of landscape and may represent a significant threat for the environment in case of floods, with big impact for society and ecosystems. Traditional bed load sampling methods are sediment traps, samplers or mobile bag samplers and nets. In the last decade indirect way of measurements for bed load transport were developed (Rickenmann, 2017), based on sediments movement induced vibration (geophones and accelerometers) or acoustic emission (Mao et al., 2016). These indirect measurements, especially when coupled and calibrated with traditional direct sampling, proved to be efficient for the estimation of bed load transport in terms of occurrence and mass evaluation (e.g., Wyss et al., 2016).. Prototype of new sensors will be firstly tested in the laboratory, thanks to the experimental flumes recently built in the sedimentological lab of the Dept. of Geoscience and in the maritime lab of the ICEA Dept. (UNIPD), recording the movements of gravel and pebbles in controlled experiment. Later, real case studies will be instrumented, designing a calibration test for each installation (e.g., acoustic monitoring coupled with sediments trap). The same underwater acoustic logger will be also install in the lagoon of Venice, Italy, in order to monitor natural and anthropic noise. As this proposal is being written, a precise quantification and characterization of the impact of underwater noise and its source in the Venetian lagoon is still missing (see Boaga and Boschi 2022), despite the fragility of the area and its cultural and biological significance. Changes in daily, seasonal, and extreme meteorological events will be monitored and studied.



Example of the passage of a touristic motorboat as recorded by an underwater hydrophone station in Venice, from Boaga & Boschi (2022).

Available funds: FINA Project ‘Geofisica applicata all’ambiente e al territorio