



A new real time tsunami detection algorithm for bottom pressure measurements in open ocean: characterization and benchmarks

Luca Pignagnoli (1), Francesco Chierici (2), and Davide Embriaco (3)

(1) Istituto di Scienze Marine, Consiglio Nazionale delle Ricerca, sezione Bologna, via Gobetti, 101 - 40129 Bologna, Italy,

(2) Istituto di Radioastronomia, Istituto Nazionale di Astrofisica, sezione Bologna, via Gobetti, 101 - 40129 Bologna, Italy, (3) Istituto Nazionale di Geofisica e Vulcanologia, sezione Roma 2, via Pezzino Basso, 2 - 19025 Portovenere (SP), Italy

In the last decades the use of the Bottom Pressure Recorder (BPR) in a deep ocean environment for tsunami detection has had a relevant development. A key role for an early warning system based on BPRs is played by the tsunami detection algorithms running in real time on the BPR itself or on land. We present a new algorithm for tsunami detection based on real time pressure data analysis by a filtering cascade. This procedure consists of a tide removing, spike removing, low pass filtering and linear prediction or band pass filtering; the output filtered data is then matched against a given pressure threshold. Once exceeded a parent tsunami signal is detected.

The main characteristics of the algorithm is its site specific adaptability and its flexibility that greatly enhance the detection reliability. In particular it was shown that removing the predicted tide strongly reduces the dynamical range of the pressure time series, allowing the detection of small tsunami signal. The algorithm can also be applied to the data acquired by a tide gauge. The algorithm is particularly designed and optimized to be used in an autonomous early warning system.

A statistical method for algorithms evaluation has been developed in order to characterize the algorithms features with particular regards to false alarm probability, detection probability and detection earliness. Different configurations of the algorithm are tested for comparison using both synthetic and real pressure data set recorded in different environmental conditions and locations. The algorithm was installed onboard of the GEOSTAR abyssal station, deployed at 3264 m depth in the Gulf of Cadiz and successfully operated for 1 year, from August 2007 to August 2008.