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

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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 at installation site. We present a new algorithm for tsunami detection that is based on real time pressure data analysis, consisting in tide removing, spike removing, low pass filtering and linear prediction: the output is then matched against a given pressure threshold allowing the detection of anomalous events. Different configurations of the algorithm, consisting for instance in a real time band pass filtering of the pressure signal in place of linear prediction, are also tested for comparison. The algorithm is designed to be used in an autonomous early warning system, with a finite set of input parameters that can be reconfigured in real time.

A realistic benchmark scheme is developed in order to characterize the algorithm features with particular regards to false alarm probability, sensitivity to the amplitude and wavelength of the tsunami and detection earliness. The algorithm behaviour in real operation is numerically estimated performing statistical simulations where a large number of synthetic tsunami waves with various amplitude, period, shape and phase is generated and superimposed to time series of real pressure data recorded in different environmental conditions and locations.