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An algorithm for the detection of tsunami signals on sea-level records

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One of the main tasks of tsunami early warning systems is the fast real-time detection of a tsunami from tide-gauge records. Among others, this is one of the topics addressed by the project TRANSFER (acronym for "Tsunami Risk ANd Strategies For the European Region"), funded by the European Community and coordinated by the University of Bologna (Italy), and involving 29 partners in the Euro-Mediterranean region. The main objectives of the project can be summarised as: 1) improving our understanding of tsunami processes in the Euro-Mediterranean region, 2) contributing to the tsunami hazard, vulnerability and risk assessment, 3) identifying the best strategies for reduction of tsunami risk, 4) focussing on the gaps and needs for the implementation of an efficient tsunami early warning system (TEWS) in the Euro-Mediterranean area, which is a high-priority task in consideration that no tsunami early warning system is today in place in the Euro-Mediterranean countries.

As regards the last point, a first step in this direction is the development of a real-time detection algorithm, capable to identify the occurrence of anomalous signals and to recognize the characteristic features of the tsunamis. Such an algorithm should have the maximum efficiency, i.e. false and missed detection have to be minimised, and has to guarantee quickness in detection and in computation: this implies that it has to use simple parameters and computing, in order to be used in the real time, continuous operational context.

The University of Bologna research team has developed a code that is based on the analysis of the characteristic of the background signal: a control parameter which is an

indicator of the average instantaneous noise is introduced and the prediction of the next sea level value is computed at any time step. If the measured sea-level value departs from the predicted one beyond a certain threshold, the alarm condition is reached. The procedure is iterated at each time step.

The control parameter is determined basing on the local sea level data set, while the threshold condition can be studied using tsunami scenarios. This procedure has been devised by using sea level data from Monastiraki, in Corinth Gulf (project 3HAZ-Corinth), and adding to the tide gauges synthetic signals, of different amplitudes, obtained by simulations tsunamis induced by landslides. The algorithm can be applied to both landslide- and earthquake-generated tsunamis, but parameters have to be adapted to the main characteristics of the targeted tsunamis.

The algorithm will be applied to the signals available from the stations of the network TSUNET, that is being deployed in the frame of a cooperation with INGV to monitor tsunami occurrences in southern Italy.