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Performance analysis of the Early-Est software within the tsunami early warning system installed at the INGV

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Fast, accurate and reliable earthquake source parameters (epicenter, depth and magnitude) are crucial for seismologically based tsunami early warning procedures. These parameters should be obtained within a few minutes after event origin time when coastlines in the near-field of the seismic source are potentially threatened.
Thus there is no time for a detailed analysis and accurate revision of the automatic solution, and only a quick validation/rejection of the results may be performed in most of the cases by a seismologist. Within this context it is important to have a reliable estimate of the uncertainties of the earthquake epicenter location, depth and magnitude.
Early-Est (EE) is a software currently installed at the recently established Centro Allerta Tsunami (CAT), the operational segment of the Italian National Tsunami Warning Centre (It-NTWC), in the seismic monitoring centre of the Istituto Nazionale di Geofisica e Vulcanologia (INGV) in Rome (Italy).
EE operates on continuous-realtime seismic waveform data to perform trace processing and picking, phase association, event detection, hypocenter location, and event characterization. This characterization includes mb and Mwp magnitudes, and the determination of duration, T0, large earthquake magnitude, Mwpd, and assessment of tsunamigenic potential using Td and T50Ex.
In order to test the performance of the fully automatic EE solutions for tsunami early warning, we first compare the hypocenters and magnitudes provided at global scale by different agencies (NEIC, GFZ, CSEM, GCMT) for events with magnitude Mw $\geq$ 5.5. We then compare the empirical uncertainties we obtain in this way with EE solution and with the differences between the EE system and the reference catalogues. Our analysis shows that EE is suitable for the purpose of the CAT since it generally provides fully automatic reliable locations and magnitudes within the uncertainties expected from statistical analysis of the manually revised reference catalogs.
We also analyze the performances of EE for several offshore earthquakes occurred in the last two years in the Mediterranean and analyze the warning messages that would have been issued for each of the events considered.