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Probabilistic Tsunami Forecasting (PTF) for Tsunami Early Warning operations

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Rapid tsunami forecasting is affected by large uncertainty, especially in the very first minutes after a potentially causative seismic event, when very limited seismic and tsunami data are still available. Given the potentially large cost of risk reduction measures, it is highly preferable to base potential Disaster Risk Reduction (DRR) measures on solid decision making that account for the intrinsic and unavoidable uncertainty of the short-term tsunami forecasts on which Tsunami Early Warning operations are based.

Here, we present the ongoing effort to introduce Probabilistic Tsunami Forecasting (PTF) in the Tsunami Early Warning operations of the Tsunami Warning Centre of the Istituto Nazionale di Geofisica e Vulcanologia (CAT-INGV), which is also a Tsunami Service Provider for the NEAMTWS. To be effective also in the near-field and in relatively small seas like the Mediterranean, CAT-INGV operations need to be activated within few minutes after the potentially causative seismic event. PTF quantifies the impact distribution of the potentially ongoing tsunami by estimating in each forecast point a probability density function that characterizes the uncertainty on the potential maximum run-up that the ongoing tsunami may locally cause. We make extensive use of the tsunami simulations and the probabilistic estimates produced within the recent project TSUMAPS-NEAM (http://www.tsumaps-neam.eu/) that produced the first region-wide long-term homogenous Probabilistic Tsunami Hazard Assessment model from earthquake sources for the coastlines of the North-East Atlantic, the Mediterranean, and connected Seas (NEAM) region.

To show that these probabilistic results may be correctly communicated and operationally used, we also discuss how PTF may be automatically connected to Disaster Risk Reduction (DRR) decisions (e.g. evacuation-yes/no) based on pre-defined rules that make explicit the distinction between the tasks of science (forecast and uncertainty quantification) and decision making (definition of acceptable risk and consequent actions). This process produces rational decision making under uncertainty leads to trackable and justifiable a posteriori decisions.

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