

Operational earthquake forecast: about two decades of CN and M8S algorithms practice in Italy

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The development of reliable forecasting tools requires their rigorous formalization and testing, first in retrospect, and then in an experimental real-time mode. It is unquestionable that only careful record of failures and successes can eventually lead to a solid evaluation of reliability and effectiveness of forecasting. Operational earthquake forecasting (OEF) is intended to provide decision-makers with reliable forecasting information for the implementation of a broad spectrum of possible actions. When prediction certainty is known, but not necessarily high, prudent cost-effective safety measures can be taken and lead to real risk reduction.

Long-term practice and results obtained for the Italian territory in about two decades of rigorous prospective testing, support the feasibility of earthquake forecasting based on the analysis of seismicity patterns at the intermediate-term middle-range scale. Specifically, two independent, globally tested, algorithms are simultaneously applied, namely CN and M8S, which are based on general concepts of pattern recognition and permit to deal with multiple sets of seismic precursors. These methods make use of detectable inverse cascade of seismic process to allow for a diagnosis of the intervals of time when a strong event is likely to occur inside a given region. The results from experimental testing, regularly updated every two months since 2003, permit a routine validation of the considered patterns at the intermediate space-time scale.

The reduction of uncertainties about location (where) and time (when) a strong earthquake has to be expected requires the use of additional information, which may be eventually provided by different observables (e.g. GPS, gravity, geochemical and other geophysical evidences), other methods (e.g. PI), as well as by relatively lower magnitude seismicity data from high quality local catalogs. The possibilities for an integrated analysis of different data are exemplified, focusing on the North-eastern part of Italy. In particular, a formal analysis of accurate local bulletins, compiled at National Institute of Oceanography and Experimental Geophysics (INOGS) since 1977, is carried out with the aim to detect possible local pre-earthquake features of seismicity in the area.

The issues related with operational prospective application of CN and M8S algorithms are discussed, including problems with space-time homogeneity of input data, and the results obtained for the recent strong earthquakes in Italy are illustrated.