

Short-term operational earthquake forecasts based on epidemic clustering models

Rodolfo Console (1,2), Maura Murru (), Giuseppe Falcone (), and Warner Marzocchi ()

(1) INGV, Rome, Italy (rodolfo.console@ingv.it), (2) CGIAM, Potenza, Italy (r.console@cgiam.org)

A rigorous definition of an earthquake forecasting hypothesis, usually based on retrospective data, should lead to the objective identification of particular sub-volumes (usually named alarm volumes) of the total time-space volume (usually named target volume) within which the probability of occurrence of strong earthquakes is higher than the usual. The test of a similar hypothesis needs the observation of a sufficient number of past cases upon which a statistical analysis is possible and it should be carried out on new and independent data, without any further adjustment of the model parameters. This concept can be extended to algorithms that include the computation of the occurrence rate density distribution of earthquakes in a continuous space of geographical coordinates, time and magnitude, as it is the case for models of short-term earthquake clustering considered in this study. In this study we show examples of application of the above mentioned concepts to the analysis of the Italian catalog of instrumental seismicity, making use of an epidemic algorithm developed to model short-term clustering features.

The epidemic-type aftershock sequences (ETAS) models have been experimentally used to forecast the space-time earthquake occurrence rate during the sequence that followed the 2009 L'Aquila earthquake and for the 2012 Emilia earthquake sequence. These forecasts represented the two first pioneering attempts to check the feasibility of providing operational earthquake forecasting (OEF) in Italy.

After the 2009 L'Aquila earthquake the Italian Department of Civil Protection nominated an International Commission on Earthquake Forecasting (ICEF) for the development of the first official OEF in Italy that was implemented for testing purposes by the newly established "Centro di Pericolosità Sismica" (CPS, the seismic Hazard Center) at the Istituto Nazionale di Geofisica e Vulcanologia (INGV). According to the ICEF guidelines, the system is open, transparent, reproducible and testable. The scientific information delivered by OEF-Italy is shaped in different formats according to the interested stakeholders, such as scientists, national and regional authorities, and the general public. The communication to people is certainly the most challenging issue, and careful pilot tests are necessary to check the effectiveness of the communication strategy, before opening the information to the public.