A high-resolution seismic catalog for the Southern Apennines (Italy) built through template-matching

Giovanni Diaferia[1], Luisa Valoroso[1], Luigi Improta[1], and Davide Piccinini[1]

[1]Istituto Nazionale di Geofisica e Vulcanologia

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Abstract

The incompleteness of earthquake catalogs is a well-known issue caused by our technical limitation in detecting the small- to very small-magnitude seismicity falling near or below the level of background seismic noise. According to Gutenberg-Richter distribution, small earthquakes represent the majority of the events occurring in a certain area and their detection is key for improving our knowledge of: i) the geometry and kinematics of seismogenic sources; ii) the spatio-temporal characteristics of seismicity, thus leading to better models for seismic hazard. Template-matching (TM) is a well-known and powerful technique based on similarity measure that allows to find earthquakes hidden in the continuous recording, similar to to known events (templates). Nowadays, the larger availability of computational resources, allows the application of such technique to regional areas. This work represents the first application of template-matching to Southern Apennines (Italy), using about 4.000 high-quality events as templates and scanning 6-years long continuous recording (2009-2014) at more than 180 stations of the INGV network. About 20.000 new events are found, showing a comparable quality to the template catalog in terms of hypocentral solution, and reaching a decrease of the magnitude of completeness of about one unit. In order to highlight the improved quality of the TM catalog, we report on two main examples regarding the Sannio-Matese area, where TM allowed us to unravel relevant details on the spatio-temporal distribution of the local seismicity, providing useful insights for the understanding of the seismic hazard.