

## **Identification and characterization of earthquake clusters: a comparative analysis for selected sequences in Italy**

Antonella Peresan and Stefania Gentili

Istituto Nazionale di Oceanografia e Geofisica Sperimentale, CRS-OGS, Udine, Italy (aperesan@inogs.it)

Identification and statistical characterization of seismic clusters may provide useful insights about the features of seismic energy release and their relation to physical properties of the crust within a given region. Moreover, a number of studies based on spatio-temporal analysis of main-shocks occurrence require preliminary declustering of the earthquake catalogs. Since various methods, relying on different physical/statistical assumptions, may lead to diverse classifications of earthquakes into main events and related events, we aim to investigate the classification differences among different declustering techniques.

Accordingly, a formal selection and comparative analysis of earthquake clusters is carried out for the most relevant earthquakes in North-Eastern Italy, as reported in the local OGS-CRS bulletins, compiled at the National Institute of Oceanography and Experimental Geophysics since 1977. The comparison is then extended to selected earthquake sequences associated with a different seismotectonic setting, namely to events that occurred in the region struck by the recent Central Italy destructive earthquakes, making use of INGV data.

Various techniques, ranging from classical space-time windows methods to ad hoc manual identification of aftershocks, are applied for detection of earthquake clusters. In particular, a statistical method based on nearest-neighbor distances of events in space-time-energy domain, is considered. Results from clusters identification by the nearest-neighbor method turn out quite robust with respect to the time span of the input catalogue, as well as to minimum magnitude cutoff. The identified clusters for the largest events reported in North-Eastern Italy since 1977 are well consistent with those reported in earlier studies, which were aimed at detailed manual aftershocks identification.

The study shows that the data-driven approach, based on the nearest-neighbor distances, can be satisfactorily applied to decompose the seismic catalog into background seismicity and individual sequences of earthquake clusters, also in areas characterized by moderate seismic activity, where the standard declustering techniques may turn out rather gross approximations.

With these results acquired, the main statistical features of seismic clusters are explored, including complex interdependence of related events, with the aim to characterize the space-time patterns of earthquakes occurrence in North-Eastern Italy and capture their basic differences with Central Italy sequences.