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High-resolution data and products automatically retrieved from local dense seismological networks: The Altotiberina Near Fault Observatory (Northern Apennines) case study.

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A key feature to investigate earthquake mechanics is the detailed description and characterisation of fault zone structure and kinematics. In the last ten years, by improving the raw data quality, quantity and earthquake location techniques, we have upgraded the resolution of our observing system by more than one order of magnitude. We progressed from the reconstruction of the geometry of the main fault segments at the kilometre scale, to the identification and description of secondary structures tens of meters long. Currently fault anatomy recovered by seismicity distribution finally resembles the degree of complexity observed by field geologists on fault outcrops, showing multiple fault splays, bends and cross fault intersections.
A the same time the availability of high-resolution earthquake location catalogues covering long time intervals allows for the investigation of the earthquake preparation processes and seismicity pattern evolution profiting of robust statistical approaches.

A set of semi-automatic modular procedures generating high-resolution information have been created with the ambitious challenge of describing and modelling the multi-scale processes controlling the faulting phenomena and seismicity evolution at the scale of the single fault segment of the active normal fault system. The selected case study is located in the Northern Apennines where the existence of an active normal fault system dominated at depth by the presence of a large and misoriented (very low angle) normal fault (dip 15°), named Altotiberina fault, is documented.

The fault system (about 60 km long) is permanently monitored by a geophysical network composed by tens of seismic (co-located with geodetic and geochemical) stations forming a permanent research infrastructure managed by INGV, named The Altotiberina Near Fault Observatory (TABOO). The extraordinary minimum detection capability of the seismic network (around ML 0) in an area characterised by a very high seismic release (rate = 7.30e−04 eqks/day*km2), allows us to consider a low-magnitude event as a local mainshock.

We present a broad range of seismological parameters (e.g. earthquakes catalogues, time series, velocity models) characterizing the evolution of the fault segments, the earthquake preparatory phase and allowing a direct correlation between the earthquakes distribution and the main lithostratigraphic units.