Detection and characterization of microseismicity and its relation with fluids at the Irpinia Near Fault Observatory

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The Irpinia Near Fault Observatory (NFO) is an EPOS infrastructure located in the Campania-Lucania Region (Southern Italy). Its goal is to characterize the microseismicity and to understand the underlying chemical and physical processes occurring along the fault systems that can potentially generate large earthquakes in the area. The Irpinia NFO is currently composed of ISNet – Irpinia Seismic Network, with associated products and services. ISNet is a local network of 32 accelerometric, short-period and broad band stations, that cover the seismogenic areas related to the main earthquakes that occurred in the region in the last centuries, including the 23 November 1980, Ms = 6.9 event. Also, ISNet provides real-time analysis and it represents the prototype network for the testing of early warning systems in Italy.

Here we present tools and techniques to accurately locate and characterize the seismicity within the Observatory. Accurate event detection of weak signals from small magnitude events is based on the coherence of arrival times and migration techniques. This method is then coupled with advanced picking and double differences techniques to accurately locate events with a sub-kilometric scale resolution. Source parameters are thus computed inverting the displacement amplitude spectrum, with a probabilistic approach based on the conjunction of states of information in the data and model spaces. This technique is able to automatically rule out unconstrained solutions, while accounting for correlation among parameters. Source location and characterization is here used to investigate the role of the fluids in the region embedding the fault systems; space and time changes in the medium properties or in the source parameters can be used to detect a deviation from the present mechanical state of the faults owing to changes in fluid pore pressure and migration.

Finally, local dense arrays are used here to improve our capability to detect events within the noise level and to move from a point-source to an extended source description of small events in the area.