ESC2016-272, 2016
35th General Assembly of the European Seismological Commission

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4–10 September 2016
Trieste

High-sensitivity seismic monitoring of the Collalto gas storage (Northern Italy) shows no induced seismicity

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Underground gas storage is one of the industrial activities capable of inducing earthquakes and its development in areas of high seismic risk may cause anxiety among people. The need of working as close as possible to safety conditions becomes the minimum requirement to carry out such operations, which are crucial for the energetic policy of an industrial country.
High-resolution seismic monitoring is a basic measure for recognizing the occurrence of possible induced microearthquakes from the very beginning, and consequently for taking prompt decisions about the management of the activity in the case of seismicity 'anomalies'.
The gas storage of Collalto is located in northeastern Italy, close to the Montello hill. It is managed by Edison Stoccaggio S.p.A. since 90ies. The seismic monitoring network has been developed in 2011 by the OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale) as a requirement of the local administration and the Ministry of the Environment to authorize the upgrading of the surface equipment to allow for the injection of up to 100% of original pressure. The Collalto Seismic Network (Rete Sismica di Collalto, or RSC) is being fully operating since January 1, 2012.
The RSC is a local seismic network featuring high sensitivity, high dynamic range and high resolution power. It is composed by 10 stations equipped with extended-band velocimetric sensors located in borehole. 5 stations are also equipped with accelerometers located at surface. The network is dense in the area above the reservoir, with station spacing of about 3-4 km, and gradually rarifies to merge harmoniously in the regional networks operated by the OGS.
In the first four years of monitoring, about one thousand of earthquakes have been located, with local magnitude -1.8<ML<4.6. A completeness magnitude of about 0.0 has been estimated in the area around the reservoir. In some cases, the RSC has also improved the location of microearthquakes that had erroneously been mislocated close to the reservoir by the regional network. The 3D pattern of seismicity, performed with different velocity models and location procedures, depicts very clearly the geometry of some main tectonic structures in the area both at depth and toward the surface. Concerning the gas reservoir, the nearest events are located at a minimum of 3 km of distance from its boundaries, and no time correlation is found between the gas injection/extraction operations and the detected seismicity. These evidences suggest that all the detected seismicity has natural origin.