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Preliminary analysis of fast Mw estimation for microseismicity recorded by the Collalto Seismic Network (2012-2018) in Northeastern Italy

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Fluid injections and extractions are able to change pore fluids pressure at depth and make faults unstable, due to friction force reduction, with increased possibility of triggering earthquakes. Little is known about how the regional geomechanical properties and stress field may influence the likelihood that oil/gas production or fluid disposal at depth will induce seismicity (Levandowski et al., 2018). Nevertheless, studying the stress field and the macro- and microseismicity of a specific area may lead to better understanding whether the recorded earthquakes are related to natural or anthropogenic causes, respectively. In both cases, the estimation of Local Magnitude (ML) and Moment Magnitude (Mw) is an essential step to characterize the recorded seismicity.
Estimation of Moment Magnitude is useful for investigating the energy released by an earthquake and the properties of the seismic source. However, a correct estimation of Mw for small events (M < 4) is not always a simple task: deviations from the simple point-source model, little knowledge on the properties of the local propagation medium, and the presence of background seismic noise influence strongly the quality of the final Mw estimation for small events.
The main object of this work is to develop a reliable estimation of Mw for the microseismicity (ML < 2.0) recorded by the Collalto Seismic Network (RSC) located in North-Eastern Italy. The study area is characterized by a medium-high seismic hazard (MPS work group, 2004), wherein the past earthquakes with ML > 6.0 were observed (Italian Earthquakes Parametric Catalogue). The RSC is a high-quality seismic network located in the Collalto-Montello area, managed by the National Institute of Oceanography and Applied Geophysics (OGS), which was deployed for monitoring an underground gas storage managed by Edison Stoccaggio S.p.A.
The RSC is able to recognize both microseismicity (down to M <.-1.0) and strong events, with location uncertainty of few hundreds m in the 20 x 20 km target area. The dataset of this study consists of 1700 events recorded from January 2012 to March 2018. Moment magnitude Mw is calculated through the algorithm proposed by Atkinson et al. (2014) and, later, calibrated by Moratto et al. (2017) for the Collalto area using a selected dataset of events. Here, we first apply the same technique of estimating Mw to the whole dataset of events recorded by the RSC, an then we estimate the empirical relationship between ML and Mw. Moreover, the Magnitude of completeness for Mw is eventually estimated.
The obtained results indicate that Mw can be reliably estimated in the Collalto-Montello area for small events ($M \geq 1.5$), although some difficulties, probably related to the high level of anthropogenic noise in the area, are found for events with a smaller recorded magnitude. Furthermore, a comparison between the proposed method and previous works for the Mw estimation (e.g. Zollo et al. 2014, Moratto et al. 2017) is discussed. In conclusion, the Magnitude of completeness (Mc) for Mw is eventually estimated.