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Low Magnitude Seismic Swarms in the Calabrian Arc (Italy)

Giuseppe Davide Chiappetta[1], Michela Ponte[1], Mario La Rocca[1]

1 Università della Calabria, Rende, Cosenza, Italy.

Email: giuseppe.chiappetta@unical.it

Abstract
During the last decades the Calabrian Arc has been affected by an overall low magnitude seismicity, with many earthquakes clustered in swarms which occurred both inland and offshore. Some earthquakes with magnitude up to M5.0 (Mt. Pollino, 2012) have occurred in many parts of the region. Some of them triggered a sequence of usually tens to hundreds of smaller earthquakes that occurred during the following weeks or months in a small source volume. In other cases swarms of low magnitude earthquakes occur without a mainshock-aftershock evolution, but rather with several earthquakes with similar magnitude. In this work we performed detailed analyses on some of these swarms, those well recorded by a high number of seismic stations. In particular, we computed the relative location and the focal mechanism of as many earthquakes as possible, also including very small earthquakes (M<1), in order to investigate the features of the seismogenetic volume. In many cases the relative location provided a useful constrain on the identification of the fault that produced most events of the swarm, especially when coupled with the solution found from the focal mechanism analysis. In other cases the relative location allowed for the identification of a small cloud of hypocenters without a planar shape geometry, thus indicating the occurrence of the swarm in a highly fractured seismogenetic volume. In all cases, we provide an estimation of the source volume through the relative location analysis, obtaining in many cases values smaller than 1 km^3 (e.g. Umbriatico 2022, valle del Mesima 2019, Molochio 2024), but still with an extension greater than the likely size of the mainshock rupture. In other cases the activated seismogenetic volume is much greater, more than 1000 km^3 (for example Pollino 2010-2014, Cirò 2024). In the case of Molochio swarm (2024), the relative location indicates that the earthquakes occurred on two different faults about 2 km apart from each other. Most of the analyzed swarms are characterized by normal kinematics, but strike slip and reverse kinematics are also found, in particular for swarms located offshore and near the coast. The timing analysis of relative located hypocenters does not show any evident migration of the sources, thus suggesting that the driving mechanism is not related with aseismic phenomena like fluid diffusion and stress waves.