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Planning the improvement of seismic monitoring in a volcanic supersite: experience on Mt. Etna

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Etna is one of the most active volcanoes in the world and one of the most intriguing natural laboratories for the understanding of eruptive processes and lava uprising in basalt-type volcanic environments; indeed, it is considered, by the scientific international community, together with the Vesuvius and the Hawaiian Islands, as a volcanic supersite. Its activity is continuously monitored by the Osservatorio Etneo of the Istituto Nazionale di Geofisica e Vulcanologia (INGV), by means of an array of integrated multidisciplinary techniques. In particular, Etna seismicity is recorded by a dense local seismic network (ESN- Etna Seismic Network), which, nowadays, consists of about 40 real-time seismic stations, many of which equipped with broadband velocity and accelerometer sensors. The data are analyzed routinely in detail by the Osservatorio Etneo staff, producing daily and periodic reports and bulletins of the earthquakes located in the whole Sicily and southern Calabria region. In the last decades, seismological observations provided important information on both the dynamics and internal structure of the volcano, in addition to their interaction with the regional tectonic structures. In the last year, in the framework of the VULCAMED project, an INGV workgroup has taken on the task of developing the existing seismic network through the installation of new measurement stations. By considering the spatial distribution of earthquakes in the area, the presence of structures known as seismically active and through extensive geological-geophysical surveys, ten potential new sites were identified. In the following months, some of these sites will complement the existing network. The choice of optimal sites must clearly be made through a careful analysis of environmental noise, of the possible logistics, technical and broadcast problems, but must also take into account the geometry of the existing seismic network. For this purpose, we applied the Seismic Network Evaluation through Simulation (SNES) method (D'Alessandro et al., 2011) to ESN, to evaluate the location precision and accuracy, along with the magnitude detection threshold of the network, before and after the addition of some new stations in the candidate sites. The simulation permitted us to identify, among the ten candidate sites, the ones which can significantly increase the quality of the hypocentral location and reduce the magnitude detection threshold, especially in the south-eastern part of the Etna volcano.