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A preliminary census of engineering activities located in Sicily (Southern Italy) which may "potentially" induce seismicity

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The seismic events caused by human engineering activities are commonly termed as "triggered" and "induced". This class of earthquakes, though characterized by low-to-moderate magnitude, have significant social and economical implications since they occur close to the engineering activity responsible for triggering/inducing them and can be felt by the inhabitants living nearby, and may even produce damage. One of the first well-documented examples of induced seismicity was observed in 1932 in Algeria, when a shallow magnitude 3.0 earthquake occurred close to the Oued Fodda Dam. By the continuous global improvement of seismic monitoring networks, numerous other examples of human-induced earthquakes have been identified. Induced earthquakes occur at shallow depths and are related to a number of human activities, such as fluid injection under high pressure (e.g. waste-water disposal in deep wells, hydrofracturing activities in enhanced geothermal systems and oil recovery, shale-gas fracking, natural and CO_2 gas storage), hydrocarbon exploitation, groundwater extraction, deep underground mining, large water impoundments and underground nuclear tests. In Italy, induced/triggered seismicity is suspected to have contributed to the disaster of the Vajont dam in 1963. Despite this suspected case and the presence in the Italian territory of a large amount of engineering activities "capable" of inducing seismicity, no extensive researches on this topic have been conducted to date. Hence, in order to improve knowledge and correctly assess the potential hazard at a specific location in the future, here we started a preliminary study on the entire range of engineering activities currently located in Sicily (Southern Italy) which may "potentially" induce seismicity. To this end, we performed:

• a preliminary census of all engineering activities located in the study area by collecting all the useful information coming from available on-line catalogues;

• a detailed compilation of instrumental and historical seismicity, focal mechanisms solutions, multidisciplinary stress indicators, GPS-based ground deformation field, mapped faults, etc by merging data from on-line catalogues with those reported in literature.

Finally, for each individual site, we analysed: i) long-term statistic behaviour of instrumental seismicity (magnitude of completeness, seismic release above a threshold magnitude, depth distribution, focal plane solutions); ii) long-term statistic behaviour of historical seismicity (maximum magnitude estimation, recurrence time interval, etc); iii) properties and orientation of faults (length, estimated geological slip, kinematics, etc); iv) regional stress (from borehole, seismological and geological observations) and strain (from GPS-based observations) fields.