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Integrated geophysical approaches for geo-hazards evaluation in urban areas: first activities in urban pilot sites of Basilicata region (southern Italy)

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An innovative integrated geophysical approach for geohazard evaluation in urban areas has been proposed with the aim of providing scientific and open digital data of multi-scale and multi-resolution near-surface geophysical observations to the scientific community, practitioners, and decision-makers according to the Digital Earth concept. This will be achieved by: a) acquiring cutting-edge geophysical equipment suites to enhance the existing ones; b) establishing a service aimed at integrating the data from a variety of geophysical sensors; c) investing in the next-generation technologies and enabling FAIR data access.

One of the three pilot sites of this project is the Basilicata region (southern Italy), that is a predominantly mountainous zone affected by high seismic and hydrogeological risks. Therefore, it is well-suited to test and integrate the different geophysical methodologies, with particular attention to the seismic and electromagnetic methods. Geophysical data collected by each experiment will be integrated into the ICT project platform and made available to the scientific community.

In detail, a part of Activity 7.4 focuses on the innovative use of the ERT method as an advanced observing system, able to describe the spatio-temporal changes of the resistivity patterns within the depth range 0-1 km. Preliminary tests have been conducted in some urban areas affected by landslide phenomena. The planned activity will also leverage machine learning technologies for geophysical data processing and analysis.

Another action aims at enhancing the suitability of geophysical infrastructures for the characterization of urban areas, specifically for seismic risk mitigation purposes. Great attention is placed on the characterization of the urban subsoil, the overlying-built environment, and their mutual interaction to identify areas of cities where the possible resonance effect between the soil

and the built environment during earthquakes may cause increased damage; this aspect is being studied and evaluated for the city of Potenza (southern Italy).

The last part of the activity is devoted to designing an experiment aimed at integrating DAS measurements (to be carried out using a 4 km long fiber-optic cable already installed in the industrial area of Tito, located close to the urban area of Potenza), ERT surveys, and seismic array data for a multi-parametric characterization of the near surface and monitoring its changes over time. This will offer unique opportunities for the scientific community to test and improve different methods in a controlled environment, while also assessing the effectiveness of monitoring the near-surface through DAS-recorded ambient noise.