ERT AND GPR SURVEYS FOR THE DETECTION OF INCIPIENT COLLAPSE AREAS IN URBAN ENVIRONMENT

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MOTIVATION

- Urban Resilience Improvement
- Underground city and urban planning support for making decision and development of the urban digital twin
- Absence or lack of geotechnical and geological information
- Environmental vulnerability
- Fast and high-resolution methodologies

EXPECTATION VS REALITY



SOURCE: URA, STRAITS TIMES GRAPHICS



Ospedale del Mare car park (Naples, Italy)



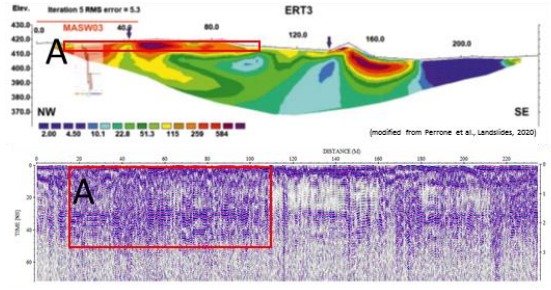
Pomarico Landslide (Basilicata region)

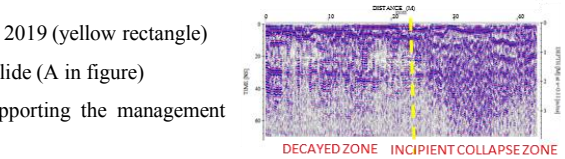
APPROACH

- Developing of integrated systems for the observation and monitoring of the subsoil;
- Non-invasive and high resolution geophysical methods;
- Combined use of GPR and ERT for identification of collapse hazard areas in urban or industrialized contexts;
- Use of non-conventional ERT arrays and different GPR frequency antennas (200-270-400 MHz).

RESULTS 1/2 Study case: Pomarico



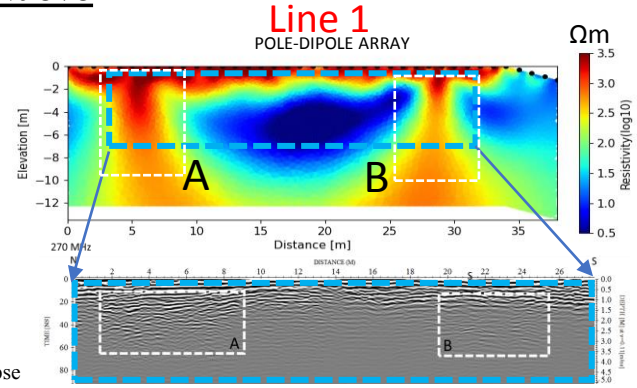




- Area affected by a landslide that has caused a subsoil collapse on January 29th 2019 (yellow rectangle)
- GPR and ERT have clearly detected the most damaged areas close to the landslide (A in figure)
- GPR data allows to highlight the "signature" of the incipient collapse supporting the management strategy of the local authorities

RESULTS 2/2 Study case: Marsico Nuovo





- Sudden opening of small sinkholes in man-made soil (red circle)
- GPR and ERT have detected the most dangerous areas closer to collapse

CONCLUSIONS

- Geophysical integrated methodologies could effectively support the identification of hazard areas in urban contexts:
- Cooperative use of GPR and ERT is necessary in order to reduce the limits of each technique in terms of resolution and depth of investigation;
- GPR allows to predict the areas will suffer significant hydrogeological problems while ERTs permit to enhance the knowledge about the cause of potential disasters;
- The use of geophysical characterization of areas susceptible to urbanization and industrialization, should be mandatory in order to reduce hydrogeological risks, in particular during exceptional events.

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