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Electrical Tomography for seismic hazard monitoring: state-of-the-art and future challenges.

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The Self-Potential (passive) and DC resistivity (active) methods have been considered for a long period as ancillary and/or secondary tools in geophysical exploration, simplified procedures for data processing and purely qualitative techniques for data inversion were the main drawbacks. Recently, innovative algorithms for tomographic data inversion, new models for describing the electrokinetic phenomena associated to the subsurface fluid migration and modern technologies for the field surveying have rapidly transformed these geoelectrical methods in powerful tools for geo-hazard monitoring. These technological and methodological improvements disclose the way for a wide spectra of interesting and challenging applications: mapping of the water content in landslide bodies; identification of fluid and gas emissions in volcanic areas; search of earthquake precursors.
In this work we briefly resume the current start-of-the-art and analyse the new applications of the Electrical Tomography in the seismic hazard monitoring. An overview of the more interesting results obtained in different worldwide areas (i.e. Mediterranean Basin, California, Japan) is presented and discussed.
To-date, combining novel techniques for data inversion and new strategies for the field data acquisition is possible to obtain high-resolution electrical images of complex geological structures. One of the key challenges for the near-future will be the integration of active (DC resistivity) and passive (Self-Potential) measurements for obtaining 2D, 3D and 4D electrical tomographies able to follow the spatial and temporal dynamics of electrical parameters (i.e. resistivity, self-potential). This approach could reduce the ambiguities related to the interpretation of anomalous SP signals in seismic active areas and their applicability for short-term earthquake prediction. The resistivity imaging can be applied for illuminating the fault geometry, while the SP imaging is the key instrument for capturing the fingerprints of the electrokinetic phenomena potentially generated in focal regions.