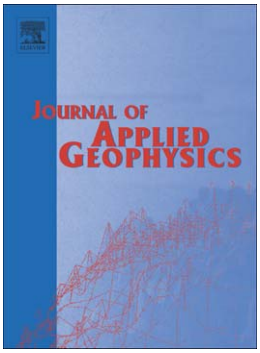

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Integrated tomographic methods for seismic imaging and monitoring of volcanic caldera structures and geothermal areas

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Abstract

In this paper we present innovative methodologies for seismic monitoring of volcanic structures in space and time (4D) which can possibly evolve toward an unrest stage. They are based on repeated phase and amplitude measurements done on active and/or passive seismic data including shots, vibrations, earthquakes and ambient noise in order to characterize the structure of the volcano and track its evolution through time. The characterization of the medium properties is performed through the reconstruction of an image of the elastic and anelastic properties of the propagation medium crossed by seismic waves. This study focuses on the application of specific tomographic inversion methods to obtain high quality tomographic images. The resolution of the tomographic models is influenced by the number and spatial distribution of data. The expected resolution thus guides the setup of, for example, active seismic surveys. To recognize and monitor changes in the properties of the propagation medium without performing an active survey we identify a fast proxy based on the time evolution of the *Vp/Vs* ratio. The advantages and limitations of the methods are discussed through synthetic tests, resolution analysis and case studies in volcanic areas such as the Campi Flegrei (southern Italy) and The Geysers geothermal area (California).