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Converted phases analysis of the Campi Flegrei caldera using active and passive seismic data

T. Blacic (1), D. Latorre (2), M. Vassallo (3), J. Virieux (1), A. Zollo (3)

(1) Geosciences Azur, University of Nice Sophia Antipolis, France, (2) INGV, Italy, (3) University of Naples, Italy (blacic@geoazur.unice.fr / Fax: +33 04 92 94 26 10)

The 2001 SERAPIS active marine seismic experiment and the 1984 Campi Flegrei bradiseismic crisis provide the data set for a converted phases study of the Campi Flegrei caldera. A subset of the SERAPIS data set is used consisting of 33 three-component OBS, 34 three-component land stations, and 1528 shots. The passive earthquake data set consists of 613 earthquakes recorded at 16 stations. A procedure for tracking converted phases developed by Diana Latorre, originally for use with earthquake data from the Gulf of Corinth, has been adapted to analyze both active marine seismic data and passive earthquake data from the Campi Flegrei area. The converted phases analysis requires three main steps. First, travel times for P- and S-waves are calculated between each grid point in a 3D volume and each source, and between each grid point and each receiver. New 3D P- and S-wave tomographic models of Campi Flegrei by Battaglia et al. (AGU, 2006) are used to calculate the travel times through a finite difference solution of the eikonal equation (Podvin and Lecomte, 1991) in a fine grid. Travel times are then recalculated by backward ray tracing to improve precision (Latorre et al., 2004). In the second step, weights are calculated for each source-receiver pair at each grid point by considering Snell's law at a local interface of arbitrary orientation. In the last step, converted phase energy (amplitude squared) is stacked at each grid point and the weights from step two are applied. Grid points showing focusing of converted phase energy can be interpreted as representing a subsurface interface or rapid change in material properties and/or composition. The method is similar to migration of multichannel seismic data. Results of the application of this method to a volume 16 X 16 X 7 km beneath Pozzuoli Bay will be presented.

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Podvin, P., and I. Lacomte (1991), Finite difference computation of travel-times in very contrasted velocity models: A massively parallel approach and it's associated tools, Geophys. J. Int., 105, 271-284.