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Campi Flegrei (Southern Italy) calderic model from the joint inversion of reflected (PP, PS) and first arrivals seismic traveltimes

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The Campi Flegrei located west of the city of Naples, is one of the most active calderas in the world. With several hundred thousand people living within its borders, this area is considered at high risk for eruptive scenarios. With the aim of investigating and reconstructing the volcanic structure of the Campi Flegrei caldera, the extensive marine investigation SERAPIS was carried out in the area in September 2001. The large amount of data provided by the experiment is still able to provide new insights into the velocity structure underneath the Campi Flegrei area.

This study discusses a 3D velocity model with seismic interfaces for the Campi Flegrei caldera from the joint inversion of first and secondary seismic phases based on the SERAPIS dataset. The traveltimes used during the inversion are obtained by a refined manual picking of first arrivals and of main reflected/converted (PP and PS) phases. The dataset of first arrivals is the same as used during the previous tomographic studies of the area, but the travetimes have been manually re-picked. Concerning the reflected dataset, we performed a refined picking of the main PP and PS reflections on vertical and radial seismic sections composed with traces arranged in 3D Common Mid Point gathers. Three main reflection events have been inferred through graphic display of the seismic sections and analysis of the lateral coherency of reflection events by visual comparisons of different gathers along EW and NS profiles. Preliminary information on the morphology of reflectors has been obtained using the residual traveltimes between observed reflected picks and reflected traveltimes computed for 1D interfaces and using an average 1D velocity model with the aim of indicating large wavelength anomalies of the reflector depths. A final joint inversion has then been applied for the determination of the morphology of the reflector using CAT3D software which models both the velocity in the bulk and the shapes of the layers. Moreover, the joint use of first arrivals and reflected/converted data investigates the extension of a new 3D velocity model at greater depths as compared to tomographic models based on the inversion of only first arrival traveltimes.