Waveform inversion for the 3D elastic and anelastic structure of the lowermost mantle beneath the western Pacific

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We invert seismic waveforms data for the 3D shear velocity (V_S) and attenuation (measured by the quality factor, Q) structure of the lowermost mantle beneath the western tip of the Pacific low shear velocity province (LLSVP). Our dataset consists of seismic waveforms from F-net for 31 deep earthquakes beneath Tonga and Fiji, and shows regional variations of S and ScS arrival times and amplitude ratios. Residuals between arrival times and amplitude ratios of peak-to-peak amplitude of S and ScS vary from west to east in the target region, as illustrated by inversion of our dataset for radial models of VS and Q in three subregions. The model explains lateral variations in those values. However, while the distribution of the travel time for the obtained 1D model (shown in the left) seems homogeneous, the other still shows lateral variation from west to east, that is we can see large values around 165 E. 10 N. In this study, in order to extract more information on the 3D structure from our dataset, in particular using waveform, we extend our 1D approach by dividing our region of interest in a larger number of subregions, which, when assembled together, provide a 3D elastic and anelastic model of the region. We show distribution of resolution for 3D structures and improvement of waveforms in several ways (not only peak-to-peak times and amplitudes but waveform variance, peak sharpness). We further discuss about the possibility to build models using stochastic inversion methods. Finally, we establish preliminary 3D joint models of V_S and Q for the western tip of the Pacific LLSVP.

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