



How important is mode-coupling in global surface wave tomography?

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To investigate the influence of mode coupling for fundamental mode Rayleigh waves with periods between 64 and 174s, we analysed 3,505,902 phase measurements obtained along minor arc trajectories as well as 2,163,474 phases along major arcs. This is a selection of five frequency bands from the data set of Van Heijst and Woodhouse, extended with more recent earthquakes, that served to define upper mantle S velocity in model S40RTS. Since accurate estimation of the misfits (as represented by χ^2) is essential, we used the method of Voronin et al. (GJI 199:276, 2014) to obtain objective estimates of the standard errors in this data set. We adapted Voronin's method slightly to avoid that systematic errors along clusters of raypaths can be accommodated by source corrections. This was done by simultaneously analysing multiple clusters of raypaths originating from the same group of earthquakes but traveling in different directions. For the minor arc data, phase errors at the one sigma level range from 0.26 rad at a period of 174s to 0.89 rad at 64s. For the major arcs, these errors are roughly twice as high (0.40 and 2.09 rad, respectively). In the subsequent inversion we removed any outliers that could not be fitted at the 3 sigma level in an almost undamped inversion. Using these error estimates and the theory of finite-frequency tomography to include the effects of scattering, we solved for models with $\chi^2 = N$ (the number of data) both including and excluding the effect of mode coupling between Love and Rayleigh waves. We shall present some dramatic differences between the two models, notably near ocean-continent boundaries (e.g. California) where mode conversions are likely to be largest. But a sharpening of other features, such as cratons and high-velocity blobs in the oceanic domain, is also observed when mode coupling is taken into account. An investigation of the influence of coupling on azimuthal anisotropy is still under way at the time of writing of this abstract, but the results of this will be included in the presentation.