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On the effective use of S receiver functions for inverting the upper mantle shear-wave velocities

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The teleseismic P receiver functions and regional surface waves are two data sets that complement each other. They are commonly jointly employed for least-squares inverting the 1-D receiver structure underneath a three-component, broadband station. From many 1-D solutions, it is possible to construct a 3-D interpretation of the structure underneath the station array. It is recently shown that the teleseismic S receiver functions provide additional constraints that can be effectively used to complement the data set of P receiver functions and surface waves. The piercing points at depth for the S receiver functions are further away from the station providing a broader horizontal coverage. If the geological structure around the station is heterogeneous violating the 1-D assumption, then the surface reflected multiples particularly off the deep interfaces in the upper mantle sample different structures away from the station resulting erroneous 1-D inversions. We eliminate these deep multiples keeping only P-to-S and S-to-P conversions at the interfaces and also near surface multiples in the receiver function waveform inversion to obtain still reasonable 1-D velocities representative of the deep receiver structure. Four different model structures with a depth extension down to 500 km are selected to show the effectiveness of the proposed inversion strategy. If the restriction depth for the multiples is set to 0 km, then only P-to-S and S-to-P conversions (i.e. no multiples) are considered in the receiver function inversion. However, this is not effective for particularly the P receiver functions since the pulses of the unconsidered multiples are confused with the conversions. Instead, a restriction depth chosen between 50 and 100 km is more suitable where the energetic Moho multiples and the multiples above the Moho are effectively modeled to solve

the underground velocities. In this way, the teleseismic waves more strictly confined to the region around the station are preferred so that the 1-D approach is less affected by the likely heterogeneities horizontally away from the station.