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What can we learn from the S receiver functions?

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Teleseismic mode conversions have provided an important means to explore the nature of seismic discontinuities in the crust and the mantle. Observations of P-to-S and S-to-P conversions have been made for more than three decades. The conventional receiver function method uses a procedure composed mainly of coordinate rotation and deconvolution to isolate the P-to-S converted waves from the incident P wave, and has become a routine data analysis tool. Recent developments attempting to use the same procedure to identify the S-to-P conversions (the S receiver function) have shown a big success. The S receiver functions have the advantage of being free of multiple reflections and are therefore more suitable for study of the mantle lithosphere. However, because of the different ray geometry, the use of the S receiver function has some limitations. We calculated synthetic seismograms to demonstrate the power and limitations of the S receiver functions in the study of deep structures.

Full wave-field seismograms were calculated using the reflectivity method and processed to generate synthetic S receiver functions for S and SKS waves. The model was modified from the IASP91 with a simplified single crustal layer. At a depth of 120 km a negative velocity jump was included representing the lower boundary of the lithosphere. The Earth flattening approximation was used to model the spherical Earth. A vertically dip-slip point source with strike perpendicular to the receiver was placed on the surface (at a depth of 10 meters). In the synthetic S receiver functions we can see the S-to-P converted waves at all discontinuities in the crust and upper mantle. The results demonstrate that the S receiver functions are useful to study the crust and mantle lithosphere, while the SKS receiver functions is more suitable for the deeper structures. We will show some data examples of the NORSAR array in Norway, along the Iceland-Greenland plume track and in other regions.