

## **Data requirements for the retrieval of regional-scale reflection responses by cross correlation**

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With the deployment of large arrays of receivers the crust and upper mantle under an array can be imaged without the occurrence of local earthquakes. Instead, transmitted waves can be used which are caused by earthquakes at teleseismic distances.

Either stacks of receiver functions (mode conversions in the transmission responses) or, more generally, the backpropagation of forward scattered energy can be used to image medium contrasts in the crust and upper mantle.

The last few years, an alternative technique is under development, Interferometric Seismic Imaging (ISI). With this technique, reflection data are extracted from the coda of transmissions. That is, the reflection response between receivers is retrieved by a summation of cross correlations of responses from several teleseismic earthquakes. Subsequently, the retrieved reflection responses are migrated to obtain an image.

With ISI, higher quality images might be obtained than with techniques that use forward scattered energy, since a higher resolution can be reached when imaging reflected amplitudes instead of forward scattered amplitudes. First though, one needs to establish that with ISI, under realistic conditions, a true reflectivity image can be obtained that is not obscured by artifacts.

The theory of ISI is well established, but the requirements for ISI are not always met in practice. We discuss what conditions need to be fulfilled to extract good quality reflection data from transmission responses. These conditions are for example related to the number of sources and their position with respect to the array. Even if not all requirements are met, we may still obtain useful information, but the retrieved reflection responses need to be interpreted with knowledge of the omissions.

We illustrate the requirements both with synthetic data examples and actual data examples from the Laramie broadband array (2000-2001) and show what artifacts may occur when not all requirements are met.