Calibration of 3D Upper Mantle Structure in Eurasia Using Regional and Teleseismic Full Waveform Seismic Data

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Main Value of Research
We propose a new approach to the construction of earth models at the regional scale that utilizes full waveform seismograms. This will increase theoretical knowledge for determining earth structure at regional scales for the purposes of path calibration.

Description of Research
Adequate path calibrations are crucial for improving the accuracy of seismic event location and origin time, size, and mechanism, as required for CTBT monitoring. There is considerable information on structure in broadband seismograms that is currently not fully utilized. The limitations have been largely theoretical. The development and application to solid earth problems of powerful numerical techniques, such as the Spectral Element Method (SEM), has opened a new era, and theoretically, it should be possible to compute the complete predicted wavefield accurately without any restrictions on the strength or spatial extent of heterogeneity. This approach requires considerable computational power, which is currently not fully reachable in practice.

We propose an approach which relies on a cascade of increasingly accurate theoretical approximations for the computation of the seismic wavefield to develop a model of regional structure for the area of Eurasia located between longitudes of 30 and 150 degrees E, and latitudes of -10 to 60 degrees North. The selected area is particularly suitable for the purpose of this experiment, as it is highly heterogeneous, presenting a challenge for calibration purposes, but it is well surrounded by earthquake sources and, even though they are sparsely distributed, a significant number of high quality broadband digital stations exist, for which data are readily accessible through IRIS (Incorporated Research Institutions for Seismology) and the FDSN (Federation of Digital Seismic Networks).

The starting model used will be a combination of a-priori 3D models recently developed for this region, combining various geophysical and seismological data, and a major goal of this study will be to refine these models so as to fit a variety of

Figure:
shows the area of study with the distribution of stations (triangles) and seismicity (circles: shallow (red), deep (black))
seismic waveforms and phases.