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The D'' layer beneath the Northern Pacific

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Several seismic studies investigate the lowermost mantle using reflected seismic energy and encounter multiple features: areas beneath geologically recent subduction zones often show one or even two D'' reflectors exhibiting a flat, step-like or rough topography, whereas the lowermost mantle close to the large low shear wave velocity provinces (LLSVP) shows phenomena from non-detectable reflectors to multiple reflectors, as well as sharp and wide vertical gradients in elastic property contrasts across the discontinuity. In our previous study presented at last year's EGU meeting, we investigated the effects of topography of the D'' reflector on seismic wave fields and our seismic processing methods. An axisymmetric spectral element method was used to model the 3D seismic wave propagation in Earth models with 2.5D lateral heterogeneities of different length scales, elastic properties, shapes, or inclinations. We showed that e.g. low inclinations of reflectors result in a travel time perturbation that can be mistaken for lower depth of the reflector, and that strong inclinations can result in the seismic undetectability of the reflector. Following this study we present our data processing of compressional waves and shear waves reflected off the D'' and core-mantle-boundary discontinuities. Therefore we use array seismological methods to enhance signals of low energy. For our data analysis we choose an area beneath the Bering Sea, densely covered by earthquakes from Japan and the Kuriles, which were detected by several seismic networks and arrays in Canada and the US. For this well sampled area beneath the Northern Pacific, we find a sharp and high reflector beneath the Bering Sea, a westward dipping reflector further west and increasing topography of a sharp reflector beneath the Gulf of Alaska. Comparing these results to our seismic resolution study, we will present several models of the lowermost mantle structure beneath the Northern Pacific fitting the data. Therewith we provide uncertainty estimates on topography, volume and contrast of elastic properties between the ambient mantle and the lowermost mantle structure of the lowermost mantle beneath the Northern Pacific.