Upper mantle tomography of the Pacific using surface waveform data

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Abstract

We invert long period waveform of Rayleigh waves in the time domain in the framework of normal-mode-based nonlinear asymptotic coupling theory (NACT) [Li and Romanowicz, 1995] for the velocity structure underneath the Pacific region. We propose a two-step lateral model parameterization approach, by which both the accuracy in the forward computation and the flexibility in the inversion stage are reserved. In the first step, the initial model is parameterized in terms of spherical harmonics up to degree 60. Spherical harmonics can be simplified to cosine and sine functions in the great circle path, allowing an efficient and accurate analytical solution for the path integral. In the second step, partial derivative matrices w.r.t. spherical harmonics are converted onto nodes of the spherical triangle meshes within the selected region. With the new matrices, we may utilize either the fixed-scale or the multi-scale inversion technique for the regional tomography. We have selected data suitable for the study region from a massive global data set. We present the validation of the converted kernels and the preliminary results of the inversion.

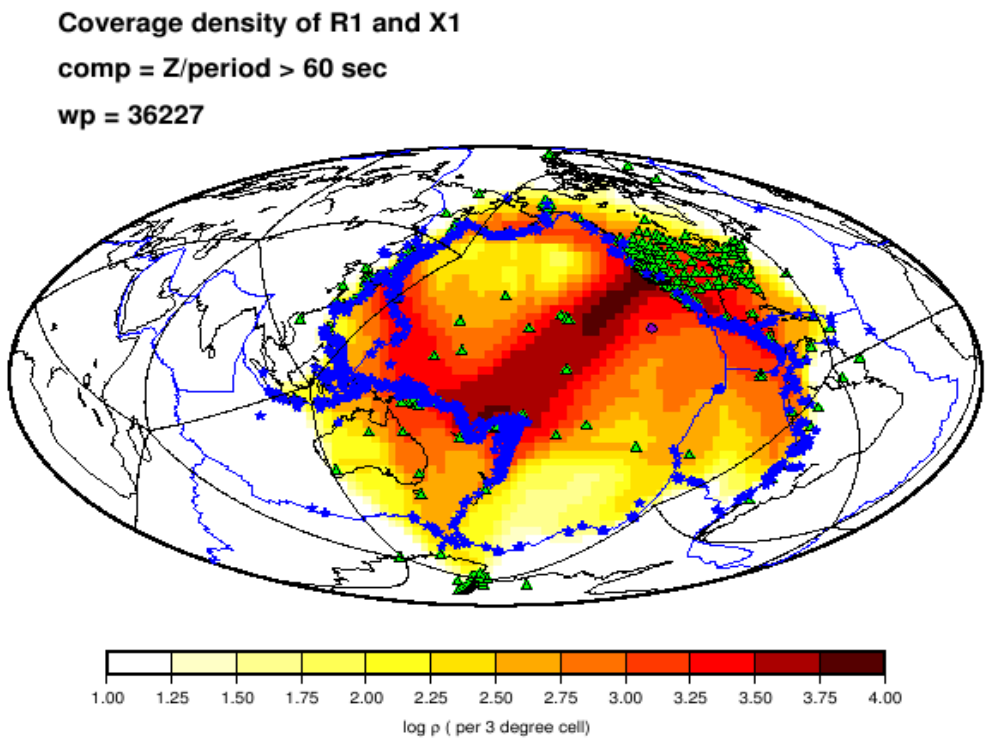

Figure. The coverage density of the first data set, expressed as the logarithm of the ray length in each 3x3 degree cell, corrected for latitude. Earthquake epicenters and stations are shown in blue stars and green triangles respectively.