High-Resolution Surface Wave Slowness Tomography in Central Asia

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We compute short-period, high-resolution surface-wave slowness maps for central Asia using Bayesian tomography. We focus on the region between 69° and 108°E and 29° and 54°N and used seismograms from more than 1100 events. Using multiple-filter and phase-matched filter techniques, we measured the dispersion characteristics of the signals between 6 and 30 seconds period. These Rayleigh-wave group velocity dispersion curves were used to compute high-resolution, half-degree cell size, slowness tomographic maps. Because short periods are primarily sensitive to upper crustal structures, the images display low velocities associated with the Tarim, Junggar, and Qaidam basins. Relatively high velocities are associated with mountainous tectonic features such as the Tian Shan. We validated our maps using dispersion curves from 640 events that were not used to construct the tomographic model. The model predictions show a significant variance reduction at short and intermediate periods (6 to 15 s) with respect to the prior model. Our model also shows 15% improvement in surface-wave detection capability with respect to previous 1D models. These high-resolution, short-period tomography maps can help improve regional magnitude estimations for construction of mb: Ms discriminants. Moreover, the short-period surface-wave tomographic results show unprecedented resolution that reveals greater geologic detail than has previously been achieved using surface waves, and which give us insight into the shear-velocity structure of the crust underlying this part of Asia.


Rayleigh wave slowness maps for different periods. The slowness values are expressed in s/km. Note that the color scale is different for each map.