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Trans-dimensional ambient noise tomography of the northeast Asia

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A trans-dimensional and hierarchical Bayesian tomography is performed to estimate spatial variations of shear wave velocity and provide the uncertainty in the northeast Asia region from the ambient noise data. The method accounts for irregular data distribution and sensitivity using adaptive partition property of Voronoi cells. Importantly, the number of basis functions used to parameterise the Earth model in the inversion and the level of data noise are implicitly balanced by the information contained in the data (and treated as free parameters in the inversions). Thereby more reliable models and their rigorous uncertainties are estimated by avoiding over- or under-estimation and explicit regularisation. We measure Rayleigh wave phase and group velocity (8-70 s) for available inter-station paths between more than 300 broadband stations. The obtained group and phase velocity maps reveal characteristic features beneath the former (East Sea also known as Japan Sea) and the current back-arc (Okinawa trough) regions, where relatively high and low velocities are estimated at intermediate (20-40 s) and longer periods (50-60 s), respectively. We observe that the low velocity anomalies extend to beneath intraplate volcanoes in the northeast China and the Korean Peninsula. Based on the depth sensitivity of surface wave dispersions and previous geological evidences, we argue that the intraplate volcanism in this region might be influenced by sub-lithospheric processes related to the subduction of the Pacific and Philippine Sea plates.