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Three-dimensional velocity model of crustal structure in the southern Korean Peninsula and its full-waveform validations

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To obtain a high-resolution crustal three-dimensional (3-D) model, we incorporate multiple regional ambient noise datasets in different scales, which consist of 150 accelerometer stations (1-6 s group velocity), 37 regional broadband stations (5-30 s group and phase velocity), and longer period phase velocity maps from previous study (25-40 s phase velocity). A 3-D structure of shear wave velocity is constrained by integrating one-dimensional depth profiles from inversions of surface wave dispersions. The model estimation is carried out thoroughly in a trans-dimensional and hierarchical Bayesian inversion framework, such that the resulting model is less biased by arbitrary assumptions in the inversion process. To obtain P-wave velocity structure, then, a previous estimation of the variation of Vp/Vs ratio is applied. A 1-D velocity model will be replaced by this new 3-D model for determining accurate hypocenters and source processes of local earthquakes in the region. In addition, the new model will make more reliable seismic hazard analysis for scenario earthquakes possible. Before adopting the new model for various applications, it is necessary to validate it. To verify the validity of the model, full-waveform simulations for recent local earthquakes are performed. Four well observed moderate earthquakes in the southern Korean Peninsula are considered for waveform simulations. The comparison between synthetic and observed waveforms shows that the new model reasonably well represents the seismic wave propagation characteristics in the southern Korean Peninsula.