Scattered wavefield imaging of the Japan subduction structure using Hi-net array data

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The Japan arcs exhibit significant along-arc transition in slab geometry, subduction-driven magmatic activity, and plate coupling state. We exploit teleseismic data from dense Hi-net array to define the present-day subduction-zone geometry and to constrain the plate boundary dynamics in response to variable slab geometries and physical properties of the subducting material. We retrieve backscattered (or reverberated) body-wave phases in addition to direct Ps (incident P wave forward-scattered as an S wave) and apply the teleseismic migration method based on the Generalized Radon Transform (Bostock et al., 2001) to accurately define both Pacific and Philippine Sea plate subduction structures. This method inverts the scattered waves for sharp variations in the Earth’ s elastic properties beneath the high-density array using analytical expressions for their travel-times and amplitudes (Bostock et al., 2001). The four scattering modes (Ps, PpPs, PpSs|v, and PpSs|h) are sensitive to S-wave velocity perturbations (d*Vs*/*Vs*) and are combined to form a single composite image. As more migrated phases are stacked in, the artifacts due to cross-mode contamination (i.e., parallel echoes of the real structure) become attenuated while energy mapped to its correct depth is sharply imaged. Preliminary images show complex slab structures down to a depth of 200 km with significant along-arc velocity variations at the top of the plate. Such differences in the velocity structures may indicate different hydration state due to slab age and/or presence of low-strength materials.

Keywords: Teleseismic migration, Subduction-zone geometry, Hi-net data

