Geophysical Research Abstracts
Vol. 18, EGU2016-7372-1, 2016
EGU General Assembly 2016

Crustal structure beneath the Japanese Islands inferred from receiver function analysis using similar earthquakes

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The stress concentration and strain accumulation process due to inter-plate coupling of the subducting plate should have a large effect on inland shallow earthquakes that occur in the overriding plate. Information on the crustal structure and the crustal thickness is important to understanding their process. In this study, I applied receiver function analysis using similar earthquakes to estimate the crustal velocity structures beneath the Japanese Islands. Because similar earthquakes are caused repeatedly at almost the same place, they are useful for extracting information on spatial distribution and temporal changes of seismic velocity structures beneath the seismic stations. I used telemetric seismographic network data covered the Japanese Islands and moderate-sized similar earthquakes which occurred in the southern Hemisphere with epicentral distances between 30 and 90 degrees for about 26 years from October 1989. Data analysis was performed separately before and after the 2011 Tohoku-Oki earthquake. To identify the spatial distribution of crustal structure, I searched for the best-correlated model between an observed receiver function at each station and synthetic ones by using a grid search method.
As results, I clarified the spatial distribution of the crustal velocity structures. The spatial patterns of velocities from the ground surface to 5 km deep are corresponding with basement depth models although the velocities are slower than those of tomography models. They indicate thick sediment layers in several plain and basin areas. The crustal velocity perturbations are consistent with existing tomography models. The active volcanoes correspond low-velocity zones from the upper crust to the crust-mantle transition. A comparison of the crustal structure before and after the 2011 Tohoku-Oki earthquake suggests that the northeastern Japan arc changed to lower velocities in some areas. This kind of velocity changes might be due to other effects such as changes of velocity polarizations and/or the effect of noise. I will clarify the cause of changes in the estimated velocity structure in the further studies.