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Two scales of tomographic inversions in Hokkaido (Japan) reveals the link between the volcanic areas and flows in the mantle wedge

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Seismic and volcanic activities in Hokkaido, Japan, the area of interest of this study, are related to the subduction of the Pacific plate. The region of Hokkaido corner is of great interest because it is located at a transition from the continental type subduction (Japan) to oceanic (Kuriles). This study is based on local earthquake tomography using data from Japan Meteorological Agency (JMA) for years 1998-2006. Simultaneous tomographic inversion for the Vp and Vs anomalies and the Vp/Vs ratio and source locations was done on two scales using the non-linear passive source tomographic code, LOTOS. We estimated both P and S wave velocity structures beneath the entire Hokkaido by using arrival times of P and S waves from more than 20 000 events registered by 122 stations. On a smaller scale, deep structures beneath three groups of volcanoes in Hokkaido were investigated in more details. For the separate areas the number of events varies from 2000 to 4000 and the number of stations varies from 30 to 70. To show the reliability of the results, we performed a series of different tests, including synthetic tests with checkerboard and realistic anomalies and tests with odd/even data. The resulting Vp, Vs and Vp/Vs ratio as well as the distribution of deep seismicity in the subducting slab reveal the paths of the ascending fluids and melts which are responsible for the volcanic activity in Hokkaido. In particular, in the general model of Hokkaido, we observe separate cone-shaped drops of hot materials ascending from the subducting slab which coincides with separate volcano groups. Based on smaller scale seismic tomographic results, we can single out fine structures inside each drop beneath each of the studied volcano groups. High-velocity features beneath the volcanoes are interpreted as frozen volcanic rocks in the crust, while low-velocity patterns probably reflect the locations of present magma channels and chambers.