Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SCG66-02 会場:414 時間:4 月 30 日 09:15-09:30

北海道下の３次元減衰構造：島弧－島弧衝突と M7 クラス内陸大地震（その３）
Detailed seismic attenuation structures beneath the Hokkaido corner, northern Japan (3)

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1. Introduction

In the Hokkaido corner, the Kuril fore-arc sliver collides with the northeastern Japan arc. Using travel-time data compiled from the nationwide Kiban seismic network and a dense temporary seismic network [Katsumata et al, 2002], Kita et al. [2012] determined high-resolution 3D seismic velocity structure beneath this area for deeper understanding of the collision process of the two fore-arcs. In this study, we merged waveform data from the Kiban-network and from the temporary network, and estimated the seismic attenuation structure to understand seismotectonics and collision process beneath Hokkaido.

2. Data and method

We estimated corner frequency for each earthquake by the spectral ratio method of coda waves [e.g. Mayeda et al., 2007]. Then, we simultaneously determined values of $t*$and the amplitude level at low frequencies from the observed spectra after correcting for the source spectrum. Seismic attenuation (Q-1 value) structure was obtained, inverting $t*$values and employing the 3-D ray-tracing technique of Zhao et al. [1992]. The study region covers an area of 41-45N, 140.5-146E, and a depth range of 0-300 km. We obtained 154,293 $t*$at 316 stations from 6,196 events (Mj>2.0) that occurred during the period from Aug. 1999 to Dec. 2012. Horizontal and vertical grid nodes were set with spacing of 0.1-0.3 degrees and 10-30 km, respectively.

3. Results

The calculated stress drops are distributed from 0.1 to 100 MPa. Stress drops of intraslab earthquakes increase with focal depth. The values of stress drops of events in the slab mantle tend to be larger than those in the slab crust at depths of 80 to 170 km, which might contribute to understanding of the physical nature of intraslab earthquakes.

Seismic attenuation structure is imaged for the region above the subducting Pacific slab at depths down to ˜80 km. For the forearc side of the eastern and western parts of Hokkaido, high-Qp zones are generally imaged at depths of 10 to 80 km in both the crust and mantle wedge above the Pacific slab. In contrast, low-Qp zones are clearly imaged in the mantle wedge of the backarcside.They are distributed in deeper parts and reach the Moho beneath the volcanic front. Locations of these low-Qp zones correspond to the low-Vp and low-Vs zones imaged by Zhao et al. [2012]. These suggest that the upper head of the mantle-wedge upwelling flow is detected beneath Hokkaido also by our seismic attenuation imaging.

In the Hokkaido corner, to the west of the Hidaka main thrust a broad low-Qp zone is imaged at depths of 0?60 km. Location of this broad low-Qp zone almost corresponds to that of the low-V zone in the collision zone found by Kita et al. [2012]. Fault planes of the 1970 M6.7 and 1982 M7.1 earthquakes are located at the edges of a broad low-Qp zone, being in contact with a high-Qp zone at 10 to 35 km. These results suggest that the occurrence of these anomalously deep and large inland earthquakes is related to the presence of hydrous minerals or fluids.

The subducting oceanic crust beneath the Hidaka region is imaged as a low-Q zone whose location corresponds to the low-Vp and low-Vs zone of Kita et al. [2012], suggesting the existence of hydrated materials at the top of the slab. Just above the slab surface, moderately low-Q zones are imaged at depths of 90 to 100 km beneath eastern and southern Hokkaido and at depths of 110 to 130 km beneath the corner, which are located at depths deeper than the upper plane seismic belt. These observations suggest the existence of the hydrated mantle wedge by the aqueous fluids supplied from the oceanic crust right below.

キーワード: 地震波減衰構造, 地震テクトニクス, 島弧衝突過程, スラブ内地震の応力降下量
Keywords: Seismic attenuation structure, Seismotectonics, arc-arc collision process, Stress drops of intraslab earthquakes