



## **Fine structure of Wadati-Benioff zone beneath Hokkaido and NE Japan estimated from double-difference locations – anomalous intraslab seismicity and dehydration embrittlement**

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### **1. Introduction**

Generation process of intraslab earthquakes is one of important problems to be solved in seismology. In the Hokkaido and NE Japan subduction zone, intraslab earthquakes at 50-200km depths form a clear double seismic zone(e.g., Hasegawa et al., 1978).However, some large intraslab earthquakes that occurred recently ruptured the portion not only in the usual seismic planes but also outside them (e.g. the 1993 M7.9 Kushiro-Oki earthquake (Ide and Takeo, 1996); the 2003 M7.3 Miyagi-Oki earthquake (Sakoda et al., 2004) and the 2001 M6.7 Geijo earthquake (Suganomata et al., 2005b)). In the focal area of the 2003 Miyagi-Oki earthquake, anomalous seismicity between the upper and lower planes of the double seismic zone also had occurred before the earthquake (Okada and Hasegawa, 2003; Sakoda et al., 2004; Suganomata et al., 2005a). This anomalous seismicity may be also caused by reactivation of the pre-existing faults that are distributed within the subducting slab. Therefore characteristics of the seismicity in the regions off the upper and lower seismic planes may be one of important clues to understand the cause of intraslab earthquake.

In this study we relocated microearthquakes and detect anomalous seismicity within the Pacific slab beneath Hokkaido and NE Japan.

### **2. Data and method**

We relocated events ( $0 < M < 9$ ) in the JMA earthquake catalog at depths of 20-300km for the period from June 2002 to November 2005. Hypocenter parameters and arrival time data in the JMA catalog are used as the initial hypocenters and data for the relocation.

We adopted the double-difference hypocenter location method developed by Waldhauser and Ellsworth (2000).

### 3. Results

1) Anomalous seismicities between the upper and lower planes of the double seismic zone are found particularly beneath the eastern part of Hokkaido and the southeastern part of NE Japan. One typical type of anomalous hypocenters is horizontal hypocenter alignments and the other is hypocenters aligned parallel to the double seismic zone, forming a triple seismic zone. One of the horizontal hypocenter alignments is located beneath Kushiro area at a depth of about 100km, which corresponds to the aftershock distribution of the 1993 Kushiro-Oki earthquake. 2) Seismicities in the upper and lower planes in the region where anomalous seismicity is observed are also active. 3) The large post-seismic slip after the 2003 Tokachi-Oki earthquake Ajiyui et al., 2005Aj occurred along the deeper portion of the plate boundary just above the anomalous seismicity. 4) Areas with anomalous interplate coupling at depths beneath the land area estimated from GPS analysis (Suwa et al., 2003) correspond to the area where intraslab seismicities are extremely high.

### 4. Discussion

These anomalous seismicities seem to be located along the deeper extension of the seamount alignments on the Pacific plate. The subducted seamounts would exist on the plate interface in these areas, and the hydrated or carbonated minerals are distributed abundantly there, which may cause high activity of slab seismicity and the anomalous seismicity between the upper and lower planes. Note that Omori et al. (2002) predict the anomalous seismicity between the upper and lower planes based on the thermodynamic calculations on phase transition of hydrated and carbonated minerals. Abundant hydrated minerals may exist where the intraslab seismicity is active.