

Spatial variation of plate interface reflectivity at the source area of 1952 Tokachi-oki earthquake

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At the Tokachi-oki region, one of big question for recurrent large thrust events is why the source area of the 2003 Tokachi-oki (M 8.0) was smaller than the 1952 event (M 8.2). Although these hypocenters are almost similar position, these slip amounts significantly differ, especially at the eastern patch of the Tokachi-oki segment [Yamanaka and Kikuchi, 2003]. Hereafter we call this patch as the segmentation area. At the segmentation area the largest amount of coseismic slip of 7 m took place among the previous event [Hirata et al., 2003] However, the corresponding area didn't slip among the latest one. We focused on the difference in slip amount of them at the segmentation area even though they are recurrent events each other, and expected that it comes from an especial physical condition on the plate interface at the corresponding area. One of approaches to confirm it is to research the spatial variation of the plate interface reflectiveness which reflects a physical property on the interface such as the interplate coupling strength.

We continued analyzing an airgun-OBS experiment data obtained along the trench parallel profile, including the segmentation area in August 2010 [Azuma et al., 2011]. We applied a travel time inversion for first arrivals [Fujie et al., 2006] and, subsequently, a travel time mapping method was used for travel time of reflected waves [Fujie et al., 2006].

The result reveals that the plate interface is more reflective at both the Tokachi-oki and the segmentation areas than at the Nemuro-oki area. This clear reflectiveness implies the presence of a low seismic velocity layer at the corresponding areas, which is possibly the water contained sediment layer on the plate interface. On the other hand, we found that the weaker reflective section at the Nemuro-oki is included in the predictive Nemuro-oki source area. These features agree with the previous seismic research at the Tokachi-oki [Azuma et al., 2007] and the Nemuro-oki [Nakanishi et al., 2004]. The segmentation area is probably an area not similar to a place ruptured by the thrust events with 50 years recurrence interval, such as the 2003 Tokachi-oki and the 1973 Nemuro-oki thrust events, so-called "regular" earthquake. We interpret that the segmentation area probably slips quasi-statically or ruptures as a more long-term asperity that can excite great tsunami, such as the 2011 Tohoku giant thrust. We infer that the 1952 Tokachi-oki thrust was an especial event which has the characteristic slip of "tsunami" earthquake in addition to that of regular earthquake.

Keywords: Kuril Trench subduction zone, plate interface reflectivity, tsunami earthquake