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# Numerical simulations of temperature distributions associated with subduction of the plate beneath Tohoku and Kanto

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1. Introduction

The Pacific plate is subducting beneath the Tohoku district, whereas the Philippine Sea plate is subducting beneath the Kanto district, overlapping on the top of the Pacific plate. In this study, firstly, we performed numerical simulations of temperature distribution associated with subduction of the Pacific plate beneath the Tohoku distinct. Secondly, based on the obtained temperature distribution beneath the Tohoku district, we performed numerical simulations of temperature distribution beneath the Kanto distinct, by incorporating subduction of the Philippine Sea plate.

2. Models and Methods

We calculated temperature distribution, using a 2-D box-type thermal convection model developed by Yoshioka and Sanshadokoro (2002). We gave subduction velocity of the Pacific plate, referring to Sella et al. (2002). We changed the age of the subducting plate according to Sdrolias et al. (2006). Based on Nakajima et al. (2007, 2009) and Hirose et al. (2008), we gave the shape of the upper surface of the Pacific and the Philippine Sea plates. We used heat flow data of bore holes & heat probe (Tanaka et al., 2004; Yamano, 2004) and Hi-net in the wells (Matsumoto, 2007).

In the model of Takagi et al. (2011), mantle flow with high temperature took place near the tip of the mantle wedge associated with subduction of the Pacific plate beneath the Kanto district. This resulted in much higher calculated heat flow than observed one just above the tip of the mantle wedge with high temperature. Therefore, we constructed a domain where mantle flow does not flow into near the tip of the mantle wedge, which is referred to as the cold nose. Comparing observed heat flow data with those calculated from the temperature distribution obtained by numerical simulation beneath the Tohoku district, we constructed a temperature model which reproduces the observed heat flow values. We attempted to explain the observed low heat flow field spreading in the Kanto district, by subduction of the Philippine Sea plate in the model used for the Tohoku district.

3. Result

Incorporating the cold nose, we obtained a result which fits the observed heat flow values in the area of the oceanic side of the Tohoku district. In the Kanto distinct, the subduction of the Philippine Sea plate produced low heat flow region in the area of the landward side of the cold nose. To explain the observed heat flow values better in the Kanto district, we are also considering introducing frictional heating on the upper surface of the subducting Pacific plate.

Keywords: subduction, temperature distribution, flow field, heat flow, Kanto district, cold nose