Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SSS027-P23 Room: Convention Hall Time: May 24 17:15-18:45

Numerical simulations of temperature distributions associated with subduction of the

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Megathrust earthquakes have occurred along the Nankai Trough where the Philippine Sea (PHS) plate is subducting beneath southwest Japan in the NE direction. Deep low-frequency earthquakes have occurred beneath Shikoku and the Kii Peninsula. These earthquakes that have occurred in the convergent plate boundary are considered to be related to thermal state. Therefore, it is important to estimate thermal state beneath southwest Japan associated with subduction of the PHS plate.
A fossil ridge is located in its northern end, and the plate motion changed its direction at about 3 Ma (Takahashi, 2004), which should be considered in a modeling.
We constructed a 2-D thermal convection model associated with the PHS plate subduction beneath southwest Japan to estimate thermal state.
In this study, for the numerical model, we took account of spatio-temporal change of the age of the PHS plate, kinematics of the past and present plate motion of the PHS plate, and the up-to-date shape of the upper surface of the PHS plate, and viscosity change associated with yield stress. We calculated temperature distribution and heat flow along three profiles passing through northern Kyushu, Shikoku, and the Kii Peninsula, and compared these results with the observed heat flow data. We used Hi-net heat flow data (Matsumoto, 2007) as well as borehole and heat probe (Tanaka et al., 2004) and BSR (Ashi et al., 1999, 2002) data. Spatial resolutions of heat flow from the trough axis to land area were increased dramatically, improving constraint of estimation of thermal state.
The calculated heat flow fits well with the observation for all the three profiles within the range of horizontal distance of about 100km landward from the trough axis. In the case of calculation taking account of only plate subduction, the calculated values for all the three profiles were lower than those of the observed Hi-net heat flow data. According to current study of seismic tomography, the existence of mantle upwelling is inferred from a large low-velocity anomaly below the PHS slab in the Chugoku and Shikoku districts (Nakajima and Hasegawa, 2007). Based on their study result, we incorporated a hot plume in our model, by giving hot source in the lower portion of the model. We set also thin crust in the model. As a result, the calculated values in land area were higher than those of the numerical model only due to plate subduction, which is consistent with the observed values. This is because hot plume rising to shallower part was caused by reduced viscosity due to yield stress and thin crust, and surface thermal gradient was larger.
In this presentation, we will mention more realistic subduction model based on the calculated results and more detailed analysis of the observed heat flow data.

Keywords: philippine sea plate, thermal state, simulation, mantle