Simplified motion model and simulation of oblique plate-slab subduction (3): Application to Sagami trough and Kanto district

Hiroshi Shigeno[1]

[1] G.S.J., A.I.S.T.

http://staff.aist.go.jp/hiroshi-shigeno/index.html

1. Introduction

The Sagami trough area is located complicatedly between the triple junction of the Eurasia-North America, Pacific and Philippine Sea (PHS) plates, and the collision plate boundary of the Izu-Ogasawara arc and the Northeast Japan-Southwest Japan arcs. The Kanto plain, located north to the area, is characterized by the unique distributions of hypocenters, thermal gradients and others. The distribution of the PHS plate-slab under this region probably causing the above characteristics has been studied (Shigeno, 2008c).

2. Method and conditions

Simplified modeling and numerical simulation have been conducted for the distribution of the slab (ca top layer) of PHS plate subducting from the Sagami trough area using the method by Shigeno (2008a). The results have been repeatedly improved by comparing to the 3-D distribution of corresponding hypocenters under the Kanto district, and conducting the simulation with adjusted models and parameter values.

Assumed major conditions are as follows: (1) Present Sagami trough area is divided into three subareas, West Part (from the Ashigara plain and the Sagami bay to SE direction, turning around the off Boso peninsula to ENE direction, to the Kamogawa submarine canyon), Central Part (from the off Boso peninsula along the Awa submarine canyon (WNW-ESE direction) to the Katsuura basin), and East Part (the Katsuura basin and the Izu-Ogasawara trench which almost lack the forearc slope to SSE direction), and the slab is segmented into three corresponding to the subareas. (2) The PHS plate have been moving to NNW direction with a speed of ca 4 cm/year since ca 6 Ma for the area. (3) Early history of direction change of the Sagami trough distribution (from ENE to WNW) caused by the northward moving and collision of the Izu arc is negligible due to the short slab length at the time. (4) The apparent dip angle of the slab subduction is adjusted according to its stages (very low (ca 10 deg) at the early stage, and high (12 to 45 deg) at the later stage). Concordant results have been gradually obtained through these condition adjustments.

3. Results and discussion

Major results obtained by the above process are as follows: (1) Distribution of the slab from West Part (to ca 70 km depth) corresponds to the hypocenter distribution under the western part of the Kanto plain, and roughly to the active fault distributions (including the M8-class earthquakes in 1703 and 1923 occurred at the southern part). (2) Distribution of the slab from Central Part (to ca 100 km depth) corresponds to the hypocenter distribution under the wider plain area, and shows westward shift at the northwest areas, where slab dip angle is fairy large, due to the oblique PHS plate subduction. The above two slab segments overlap at the western part of the Kanto plain where hypocenters are thickly distributed. (3) Distribution of the slab from East Part (to ca 40 km depth) is limited, but probably corresponds to hypocenter distribution at the east margin of the Kanto plain and its eastward sea area.

The above results are fairy concordant to the previously studied results on 3-D distribution of hypocenters originated from the PHS plate-slab under the Kanto plain, and provide a concrete geometric and movement model of the slab from the present Sagami trough area. Also, the results provide a concrete model, namely subducting forearc area (relatively old and cool) of the Izu-Ogasawara arc, for the thermal conditions of the Kanto plain (non-volcanic and the most lowest geothermal gradient area in Japan)

References

Shigeno, H. (2008c) Subduction of the Philippine Sea plate-slab from the Sagami trough area to the Kanto plain, Japan: Simplified modeling and numerical simulation using open electronic earth-science information. Chishitsu Nyusu (Geology News, edited by GSJ) (in Japanese; submitted-in press).