沈み込み帯熱対流モデルを用いた2011年東北沖地震の2次元余効変動解析

Two-dimensional analysis of post-seismic deformation of the 2011 Tohoku-Oki earthquake by subduction zone thermal-flow model

*武藤 潤[1]、堀内 俊介[2]、岩森 光[2]、飯沼 卓史[2]、芝崎 文一郎[3]
*Jun Muto[1], Shun-suke Horiuchi[2], Hikaru Iwamori[2], Takeshi Iinuma[2], Bunichiro Shibazaki[3]

1.東北大学大学院理学研究科地学専攻、2.海洋研究開発機構、3.建築研究所国際地震工学センター
1.Department of Earth Science, Tohoku University, 2.Japan Agency for Marine-Earth Science and Technology, 3.International Institute of Seismology and Earthquake Engineering, Building Research Institute

Post-seismic deformation of the 2011 Tohoku-Oki earthquake observed in the world densest geodetic network may provide a robust constraint to the rheological properties over the NE Japan island arc-trench system. Various geophysical observations and petrological models also have given strong constraints for the thermal-flow structure of the NE Japan. Horiuchi and Iwamori (2016) have recently created a numerical model on thermal-flow structure of a subduction zone with plate coupling and chemical reaction. The consistent model takes account of the fluid distribution incorporating slab-dehydration, mantle hydration (such as serpentinization) and melting reactions in the mantle wedge. Using this model with a range in viscosity of serpentinites, the model successfully reproduces the various observations; surface heat flow distribution, alignment of Quaternary volcanoes, and seismic velocity structures of the NE Japan arc. The viscosity distribution calculated in the model includes the temperature- and water content-dependent law for olivine, and can be incorporated into FEM to test various parameters and assumptions of the model with respect to the post-seismic deformation. We used a two-dimensional FEM model incorporating the geometry of subducting slab and viscosity distribution estimated by the thermal-flow model (Horiuchi and Iwamori, 2016). Viscosity structure in the thermal-flow model is mapped to a two-dimensional FEM model as a steady-state value to calculate viscoelastic relaxation. The coseismic slip distribution was calculated according to Iinuma et al. (2012). Preliminary results show that the observed post-seismic vertical deformation of inland area can be reproduced by the thermal-flow model with a certain parameter range. In the presentation, we will show numerical results with various parameter spaces (such as viscosities of serpentinites, water contents and so on) and compare them with those based on our previous rheological model.

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