The 506th Geodynamics Seminar

Development of 2-D numerical model of mantle dynamics incorporating self-consistent evolution of subduction zones

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We are studying the dynamics and evolution of plate subduction zones, by using numerical simulations of mantle dynamics in two-dimensional spherical annulus.

As a first attempt, we have studied what mechanisms control diverse morphologies of subducting slabs. By conducting a series of numerical simulations where the motions of surface plates are kinematically imposed, we have successfully reproduced various dynamic behaviors of subducting slabs, such as stagnation at around the mantle transition zone and penetration into the lower mantle, which can be well compared with those of observed by seismic tomography. In particular, we found that the slab behaviors are strongly affected by the rate of trench migration and its temporal change.

As the next step, we are currently developing new numerical models of plate subduction, in order to study the dynamics and evolution of entire subduction zones including both subducting and overriding plates. In our new models, the motions of subducting and overriding plates are determined in a self-consistent manner, which allows the deformations in the overriding plates including back-arc opening. In this presentation, we will report the research results of the kinematic model as well as the progress and current status of our new dynamic models.

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