The 454th Geodynamics Seminar

Numerical simulations on the formation and behaviors of slabs in 2-D spherical annulus

Mana Tsuchida (Msc. student, Ehime University)

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EHIME UNIVERSITY GRC GEODYNAMICS RESEARCH CENTER

Abstract

We developed a numerical model of thermal convection of highly viscous fluid in a two-dimensional spherical annulus, in order to study what mechanisms control the dynamic behaviors of subducting slabs such as the formation of "stagnant slabs" in the mantle transition zone (MTZ). We found that our model successfully reproduces the diverse morphology of subducting slabs which can be well compared with those of natural slabs, by carrying out calculations with systematically varying the velocities of subducting slabs and trench migration, the Clapeyron slope at around 660 km depth, and the viscosity jump between the upper and lower mantle. In particular, the dynamic behaviors of slabs around the MTZ can be classified into five types depending on the combinations of varying parameters: (1) Penetrating, (2) Accumulating, (3) Floating, (4) Long-term Stagnation, and (5) Short-term Stagnation. A careful comparison of the slab morphologies in our numerical experiments with those of natural slabs in selected subduction zones also enabled us to successfully estimate the rate of trench migration with respect to the deep mantle, given that both the duration of subduction and rate of two-plate convergence are properly known. This implies that the morphology of slabs can be used to settle a reference frame of motions of surface plates, which is of crucial importance in determining their absolute velocities from the relative ones.

詳細は当センターホームページ: http://www.grc.ehime-u.ac.jp/をご覧ください
問い合わせ先：西 真之 (TEL: 089 927 8153, e-mail: nishi@sci.ehime-u.ac.jp)