The 505th Geodynamics Seminar

Towards numerical modeling of 3-D mantle convection with magmatism and plate tectonics

Dr. Masanori C. Kameyama
(Professor, GRC)

2018.11.2 (Fri.)

Meeting Room #486, Science Research Bldg. 1, Ehime Univ.

EHIME UNIVERSITY GRC GEODYNAMICS RESEARCH CENTER

We are developing 3-D numerical models of mantle convection including the effects of mantle magmatism and plate tectonics, in order to deepen the insights into the thermo-chemical evolution of the mantles of terrestrial bodies. The mantle magmatism is modeled by the generation of liquid phase (magma) owing to the pressure-release melting induced by ascending flows of solid-state convection and the motion of the generated magma as a permeable flow through the solid matrix driven by a buoyancy due to the density difference between the solid and the liquid phases. The coherent motion of tectonic plates is, on the other hand, helped by the narrow zones of low viscosity within the highly viscous "lithosphere" along the top cold surface generated by the stress-history-dependent rheology. However, despite their crucial roles in controlling the overall flow structures, these two mechanisms are incompatible with the solid-state convection of the mantle in essence from the numerical aspects: the localized irregularities caused by them severely deteriorate the large-scale numerical solution of solid-state convection particularly by the multigrid method. In this presentation, we will show the current status and outcrops of our attempts to overcome the numerical difficulty, together with some examples of 3-D experiments running on massive (super)computers.

Contact : Masayuki Nishi, Ph.D. (e-mail: nishi@sci.ehime-u.ac.jp)