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MIS004-02 Room: Exibition hall 7 subroom 3 Time: May 27 15:40-15:50

Development of Stokes flow solver against a large contrast in viscosity: toward plate-mantle simulation

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We are interested in solving a high resolution coupled plate-mantle system to study the complex deformation of a subducting plate. In our earlier study (Furuichi, et al 2008), we developed a numerical method for performing plate-mantle simulations which was specifically designed for massively parallel vector supercomputer systems (e.g. Earth Simulator). The numerical method was validated by simulating a fluid rope coiling event (Furuichi, et al 2009). The results showed that our method enables us to reproduce large non-linear deformation problems of a rigid plate, surrounded by soft material, without serious quantitative errors. As a next step, we are trying to develop a Stokes flow solver which is scalable with respect to both problem size and large, discontinuous viscosity variations. This step is important for extending the Stokes flow approach to more realistic plate-mantle problems (for example free surface treatment with a sticky air). In this presentation, I propose to use BFBt preconditioner (May, et al 2008) and double-double precision techniques to solve steep viscosity contrast problems. We demonstrate the efficiency and robustness of our new approach with results from some test calculations.

[1] M. Furuichi, M. Kameyama, A. Kageyama, Journal of Computational Physics, Vol 227, 4977-4997, 2008
[2] M. Furuichi, M. Kameyama, A. Kageyama Physics of the Earth and Planetary Interiors, Vol 176, 44-53, 2009
[3] D. A. May, L, Moresi Physics of the Earth and Planetary Interiors, Vol 171, 33-47, 2008

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