E012-P001 Time: May 29 17:15-18:45

A numerical method for geodynamo simulations based on Fourier expansion in longitude and finite difference in meridional plane

Ataru Sakuraba[1], Yusuke Oishi[2], Yozo Hamano[3]

[1] Dept. of Earth and Planetary Science, Univ. of Tokyo, [2] Earth and Planetary Sci., univ. of Tokyo, [3] Dept. Earth & Planetary Physics, Univ. of Tokyo

Many attempts have been made to reproduce the Earth's dynamo process by computer simulations. In these attempts two numerical methods have been mainly used. One is a spectral transform method in which a variable is expanded by spherical harmonics, while the other is a local method such as finite difference and finite element methods. The spectral method has been chosen so that accuracy is relatively good and an electromagnetic boundary condition between a conductor and an insulator is naturally satisfied. Difficulty of this method is that the amount of computation is proportional to the biquadrate of N (degrees of freedom in one dimension). The amount of computation of the local method is, on the other hand, proportional to the cube of N. When N is around 1000, which is the case in our high resolution geodynamo simulations, the local method seems to be preferable in speed of computation. However, it is difficult to account for the electromagnetic boundary condition between a conductor and an insulator in the local method. Here we propose a new method based on one dimensional Fourier expansion in longitude. The spectral equations are solved in a meridional plane by finite difference techniques. In this method the amount of computation is proportional to log(N) times the cube of N and the electromagnetic boundary condition can be easily treated. We will dicuss the efficiency of the present method and the accuracy of the electromagnetic boundary condition.