A numerical method for geodynamo simulations based on Fourier expansion in longitude and finite difference in meridional plane (2)

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In attempts to reproduce the Earth's dynamo process by computer simulations a spectral transform method (STM) in which a variable is expanded by spherical harmonics have been mainly used. 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. This method is better than STM in the amount of computations. The verification of accuracy was performed by comparing with the result of a dynamo benchmark advocated by Christensen et al.(2001. PEPI. 128, 25) in the code development.In the case0 (rotating non-magnetic convection), the mean kinetic energy density and some values at a defined local point were in agreement to these of the benchmark within 1.5 % errors in the highest resolution model. In the case1 (self-exciting dynamo with an insulating inner core), the error level increased to about 3 %. It is found that a self-exciting Earth-type dynamo can be simulated by the present model with an acceptable accuracy. Some parallelization techniques will be also presented to perform a very high resolution simulation on a massively parallel computer.