Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MIS22-03 会場:106 時間:5 月 27 日 09:30-09:45

磁場の影響下での水平循環による流れ場の反転
Flow reversals under a magnetic field induced by horizontal circulation

柳澤 孝寿 [1*] ; 浜野 洋三 [1] ; 櫻庭 中 [2]
YANAGISAWA, Takatoshi[1*] ; HAMANO, Yozo[1] ; SAKURABA, Ataru[2]

[1] 海洋研究開発機構, [2] 東京大学大学院
[1]JAMSTEC, [2]University of Tokyo

Coherent flow structures in the outer core are controlled by the magnetic field and rotation of the Earth. It is important to know the basic behavior of flow in relation to the magnetic field, for understanding the flow patterns observed in the real Earth and core dynamo simulations. On the other hand, spontaneous flow reversals generally observed in high Rayleigh number thermal convections may provide clue to the mechanism of random geomagnetic field reversals. As the most basic setting to observe the nature of flow structures with their time variations, we performed numerical simulations of Rayleigh-Benard convection in a three-dimensional square vessel by an electrically conductive low Prandtl number fluid, under a uniform horizontal magnetic field. Computed behaviors are consistent with the result of laboratory experiment (Yanagisawa et al., 2013) that shows flow reversals, and detailed process of reversals is clarified. The key mechanism is the emergence of a global circulation in the horizontal plane and following reconnection between rolls. An increase of global circulation induces bend and reconnection of convection rolls. It establishes a reversed flow state through roll number transitions. The horizontal circulation is related to the skewed-varicose instability of two-dimensional roll structure aligned in the direction of the magnetic field. This is a newly identified mechanism of flow reversal that works in large-scale three-dimensional geometry.

キーワード: 流れ場反転, 水平循環, 低プラントル数, 磁場
Keywords: flow reversal, horizontal circulation, low Prandlt number, magnetic field