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Variation of effective roll number on MHD Rayleigh-Benard convection confined in a small-aspect ratio box YUJI TASAKA, Hokkaido University, TAKATOSHI YANAGISAWA, JAMSTEC, TOBIAS VOGT, SVEN ECKERT, HZDR — MHD Rayleigh-Benard convection was studied experimentally using a box filled with liquid metal with five in aspect ratio and square horizontal cross section. Applying horizontal magnetic field organizes the convection motion into quasi-two dimensional rolls arranged parallel to the magnetic field. The number of rolls has tendency, decreases with increasing Rayleigh number Ra and increases with increasing Chandrasekhar number Q. To fit the box with relatively smaller aspect ratio, the convection rolls take regime transition accompanying variation of the roll number against variations of Ra and Q. We explored convection regimes in a ranges, $2\times10^3 < Q < 10^4$ and $5\times10^3 < Ra < 3\times10^5$ using ultrasonic velocity profiling that can capture time variations of instantaneous velocity profile. In a range $Ra/Q \sim 10$, we found periodic flow reversals in which five rolls periodically change the direction of their circulation with gradual skew of rolls. We performed POD analysis on the spatio-temporal velocity distribution obtained by UVP and indicated that that the periodic flow reversals consist of periodic emergence of 4-rolls mode in dominant 5-rolls mode. POD analysis also provided evaluation of effective number of rolls as a more objective approach.

Yuji Tasaka
Hokkaido University

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