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An experimental study of the flow pattern and heat transport behavior in horizontal convection with large Rayleigh number and small aspect ratio[1] KE-QING XIA, SHI-DI HUANG, Department of Physics, The Chinese University of Hong Kong, Shatin, Hong Kong, China — Horizontal convection is a simple conceptual model to understand the role of buoyancy in the Meridional Overturning Circulation (MOC). Here we report an experimental study of the flow pattern and heat transport behavior in horizontal convection with Rayleigh number Ra up to 2×10^{12} and aspect ratio of 0.1 using a long apparatus. Flow visualization studies reveal that it is not necessary for the returning flow to penetrate the strong stratification in the thermal BLs, suggesting that much less energy may be required to maintain a global circulation than is generally believed. Moreover, both the heat transport efficiency and thermal BL thicknesses are found to follow a 0.3 power law, which indicates a stronger heat transport in horizontal convection with large Ra number than is suggested in the literature. These findings on horizontal convection may be relevant to the driving mechanism of the MOC.

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