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Understand and control the large-scale circulation of thermal convection

by

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ABSTRACT

As the driving force of atmospheric and oceanic circulation, the large-scale circulation (LSC) of thermal convection appears in many natural phenomena on Earth and beyond. Understanding and controlling LSC is thus one of the most significant topics of modern fluid dynamics. In this talk, we first introduce a low-dimensional dynamical system to investigate the development and reversals of LSC in an annulus. This formulation offers a transparent mechanism for LSC reversals and it yields accurate predictions for the frequency of regular LSC reversals in the high Rayleigh-number limit. The second part of this talk focuses on controlling the LSC, where a simple means to control the flow and heat transfer in Rayleigh-Bénard convection is achieved by injecting heat through one lateral side of the fluid domain and extracting the same amount of heat from the opposite side. Our numerical and theoretical studies demonstrate how a classical Rayleigh-Bénard convection responds to such a perturbation, when the system is near or well above the onset of convection.

~ALL ARE WELCOME~