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Experimental attempts to simulate continental drift

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Thermal convection in the mantle has been regarded as the determining mechanism that drives and sustains continental drift. A classical laboratory experiment on thermal convection – the well-studied Rayleigh-Bénard experiment – consists of a fluid confined within a rigid box that is heated at the bottom and cooled at the top. Our experimental study explores the intriguing phenomena when the rigid upper boundary of the system is replaced by a free fluid surface upon which floats a freely moving, thermally opaque "model-continent". We find that the behavior of this prototypical system is closely related to the continental drift process that takes place on the surface of the earth. The model-continent not only responds to the viscous drag from the convective fluid underneath, but also actively affects the overall flow pattern in the bulk. We identify within our table-top experiment several different dynamical states, ranging from regular oscillations to localization and to intermittency. A phenomenological, low-dimensional model seems to capture the essence of the experimental observations. Our on-going experiments further explore the rich dynamical behavior in an annular geometry, where both the model-continent and convective fluid experience periodic boundary conditions.