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Three-dimensional simulations of double-diffusive salt-finger convection and layer formation STEPHAN STELLMACH, ADRIENNE TRAXLER, PASCALE GARAUD, University of California, Santa Cruz, TIMOUR RADKO, Naval Postgraduate School, Monterey — In double-diffusive convection, the buoyancy of the fluid is controlled by two components that diffuse at markedly different rates. In the so-called "fingering" case, the faster-diffusing component has a stabilizing gradient while the slower-diffusing component destabilizes the system through the formation of small-scale finger filaments. One important consequence of salt fingers is their ability to form persistent large-scale "staircases" of mixed layers separated by thin fingering interfaces. Although several theories have been put forward to explain the formation and subsequent merging of layers, there is considerable disagreement about the dominant physical processes involved. Until recently, three-dimensional direct numerical simulations of the process have been hampered by the vastly different length and time scales involved. Here, we present highly resolved two- and three-dimensional simulations of salt fingering and layer formation which allow to test existing theories on staircase formation. We observe markedly different structures in two and three dimensions, including large scale 3D wave-like instabilities that are absent in the two-dimensional case. These as well as other differences in physical behavior suggest that three-dimensional studies are essential for a complete picture of fingering systems.

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