Abstract Submitted
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Three-dimensional doubly diffusive convectons: instability and transition to complex dynamics[1] EDGAR KNOBLOCH, University of California at Berkeley, USA, CEDRIC BEAUME, University of Leeds, UK, ALAIN BERGEON, Université de Toulouse, INPT, UPS, IMFT, France — Doubly diffusive convection in a closed vertically extended 3D container driven by competing horizontal temperature and concentration gradients is studied. No-slip boundary conditions are imposed. The buoyancy number $N = -1$ to ensure the presence of a conduction state. The primary instability is subcritical and generates two families of spatially localised steady states known as convectons. The convectons bifurcate directly from the conduction state and are organized in a pair of primary branches that snake within a well-defined range of Rayleigh numbers as the convectons grow in length. Secondary instabilities generating twist result in secondary snaking branches of twisted convectons. These destabilize the primary convectons and are responsible for the absence of stable steady states, localized or otherwise, in the subcritical regime. As a result, once the Rayleigh number for the primary instability of the conduction state is exceeded, the system exhibits an abrupt transition to large amplitude spatio-temporal chaos that arises whenever the twist instability leading to collapse is faster than the nucleation time for new rolls. These numerical results are confirmed by determining the stability properties of all convecton states as well as spatially extended convection.

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