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Complex dynamics near the threshold of convection for a water-ethanol mixture in a shallow cylinder ISABEL MERCADER, ORIOL BATISTE, ARANTXA ALONSO, Dept. Fisica Aplicada, Universitat Politecnica de Catalunya — Direct numerical simulations of binary convection in shallow 3D cells are presented. The full unsteady convection equations in cylindrical coordinates are solved with an accurate spectral solver. We use a mixture with separation ratio $S = -0.09$, Prandtl number $\sigma = 24$ and Lewis number $\tau = 0.008$ and we analyse pattern formation near the onset of convection in a cylinder of aspect ratio $\Gamma = 11$, motivated by the available experimental results in this geometry. The critical Rayleigh number (R), frequency and azimuthal mode ($n = 1$) obtained in current DNS computations perfectly matches former linear stability analyses. During the nearly linear transient growth, the pattern consists of radially travelling waves, nearly standing in the azimuthal direction. As convection evolves, simulations for slightly subcritical and supercritical values of R reveal differences in the dynamics. For slightly subcritical or supercritical values of R, repeated bursts of convection takes place. When the amplitude of convection is growing, the system suddenly collapses to a small-amplitude state that may grow aperiodically or eventually die. For supercritical values of R, the Nusselt number progressively increases and a blob of disordered convection forms around the cell centre slowly growing and reaching the cylinder walls, leading to a quasi steady state consisting of convection rolls coexisting with a small region of quiescent fluid.

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