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Transitional boundary layer in low-Prandtl-number convection at high Rayleigh number[1] JOERG SCHUMACHER, VINODH BANDARU, TU Ilmenau (Germany), AMBRISH PANDEY, IIT Kanpur (India), JANET SCHEEL, Occidental College Los Angeles (USA) — The boundary layer structure of the velocity and temperature fields in turbulent Rayleigh-Bénard flows in closed cylindrical cells of unit aspect ratio is revisited from a transitional and turbulent viscous boundary layer perspective. When the Rayleigh number is large enough the boundary layer dynamics at the bottom and top plates can be separated into an impact region of downwelling plumes, an ejection region of upwelling plumes and an interior region (away from side walls) that is dominated by a shear flow of varying orientation. This interior plate region is compared here to classical wall-bounded shear flows. The working fluid is liquid mercury or liquid gallium at a Prandtl number of $Pr = 0.021$ for a range of Rayleigh numbers of $3 \times 10^5 \leq Ra \leq 4 \times 10^8$. The momentum transfer response to these system parameters generates a fluid flow in the closed cell with a macroscopic flow Reynolds number that takes values in the range of $1.8 \times 10^3 \leq Re \leq 4.6 \times 10^4$. It is shown that particularly the viscous boundary layers for the largest Ra are highly transitional and obey some properties that are directly comparable to transitional channel flows at friction Reynolds numbers below 100.

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