# Roughness-enhanced turbulent transition in a rough Rayleigh-Bénard cell filled with Fluorocarbon

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Rayleigh-Bénard convection in the high turbulence regime is a useful model system to understand the asymptotic convection regime, and the dynamics of convective flows that occurs in nature and geophysical flows. Our convection cell is a parallelepiped cell with dimensions $41.5\,\mathrm{cm} \times 41.5\,\mathrm{cm} \times 10\,\mathrm{cm}$, with glass walls, inserted in a temperature regulated plexiglas box[1]. The top plate is smooth, and the bottom plate is rough, which allows to define smooth Rayleigh and Nusselt numbers, $Ra_s$ and $Nu_s$ from the smooth half cell, and rough Rayleigh and Nusselt numbers, $Ra_r$ and $Nu_r$ from the rough half-cell[2]. The cell is filled with Fluorocarbon FC-770 with mean temperatures $40\,^\circ\mathrm{C}$ ($Pr = 11.9$), or $25\,^\circ\mathrm{C}$ ($Pr = 14.0$), and the Rayleigh number is in the range between $10^{11}$ and $3 \times 10^{12}$.

The velocity field is estimated using correlation image velocimetry (CIV) on shadowgraph patterns. The new set of measurements, in the rough cell, allows to estimate both the Rayleigh, Nusselt and the Reynolds numbers, and compare the behaviour of the smooth and rough half-cells, as well as the case of a standard fully smooth cell.

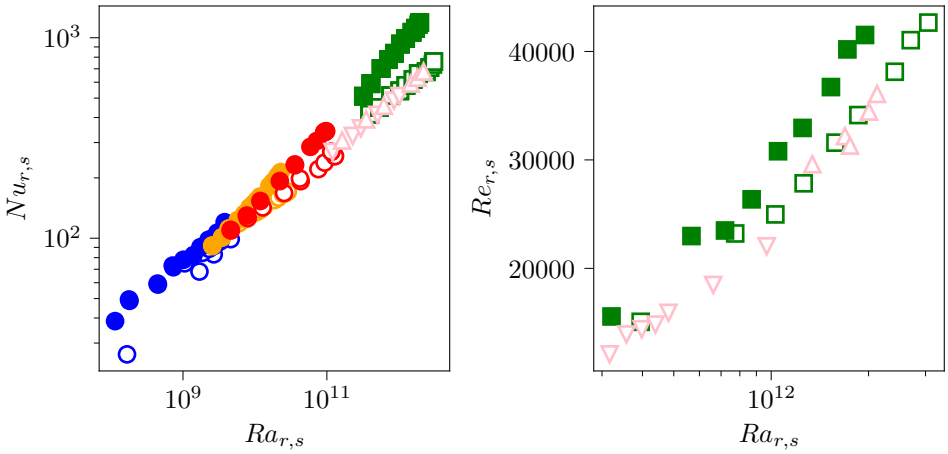


Figure 1: Heat-transfer (left) and mean velocity (right) measurements. Open symbols: smooth. Full symbols: rough. Previous measurements in water[2]: circles (blue $15\,^\circ\mathrm{C}$, orange $35\,^\circ\mathrm{C}$, red $45\,^\circ\mathrm{C}$). Previous measurements in standard fully smooth cell with fluorocarbon[1]: pink triangles (Downwards $Pr = 14$. Upwards $Pr = 11.9$). Present measurements: green squares.

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[1]Méthivier, et al, EPL, **136** (2021)
[2]Salort, et al, Phys. Fluids **26**, 015112 (2014)