ULTIMATE REGIME OF RAPIDLY ROTATING CONVECTION

Experimental and numerical assessment of the « geostrophic turbulence » scaling predictions

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Rotating turbulent convection

Control parameters

Injected heat flux:	Ra_p
Rotation:	E
Diffusivities:	Pr

Emergent quantities

Heat transport efficiency:	Nu
Flow velocity:	Re
Temperature fluctuations:	Ra_θ

Hypotheses:

1. *High angular velocity*
2. *Turbulent flow*

Geostrophic turbulence regime

$$Nu \sim Ra_p^{\frac{3}{5}} E^{\frac{4}{5}} Pr^{-\frac{1}{5}}$$

$$Re \sim Ra_p^{\frac{2}{5}} E^{\frac{1}{5}} Pr^{-\frac{4}{5}}$$

$$Ra_\theta \sim Ra_p^{\frac{3}{5}} E^{-\frac{1}{5}} Pr^{-\frac{1}{5}}$$

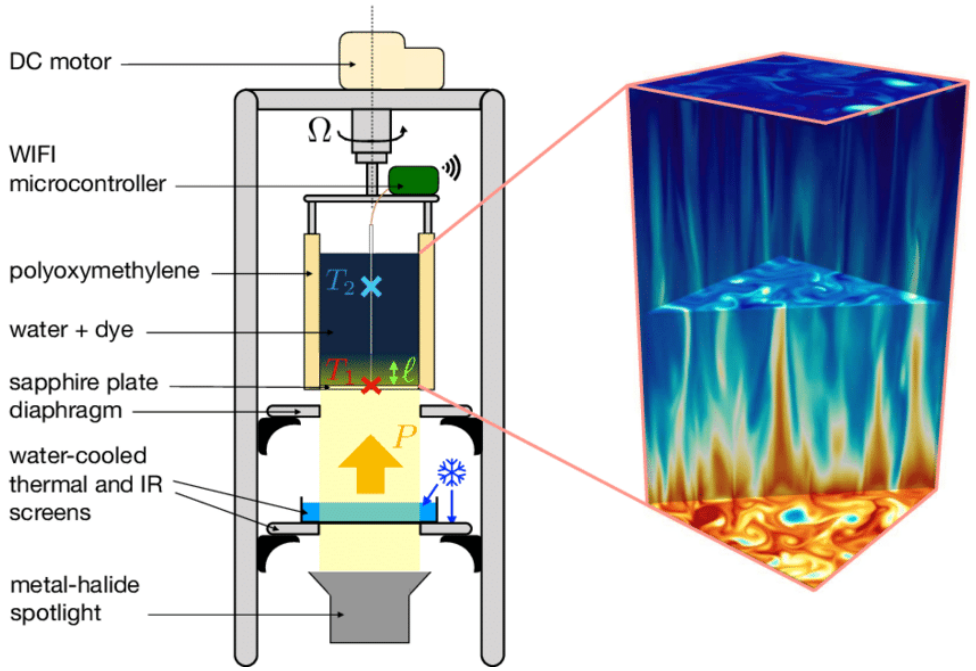

Figure: Radiatively driven rotating convection. A powerful spotlight shines from below at a mixture of water and dye.

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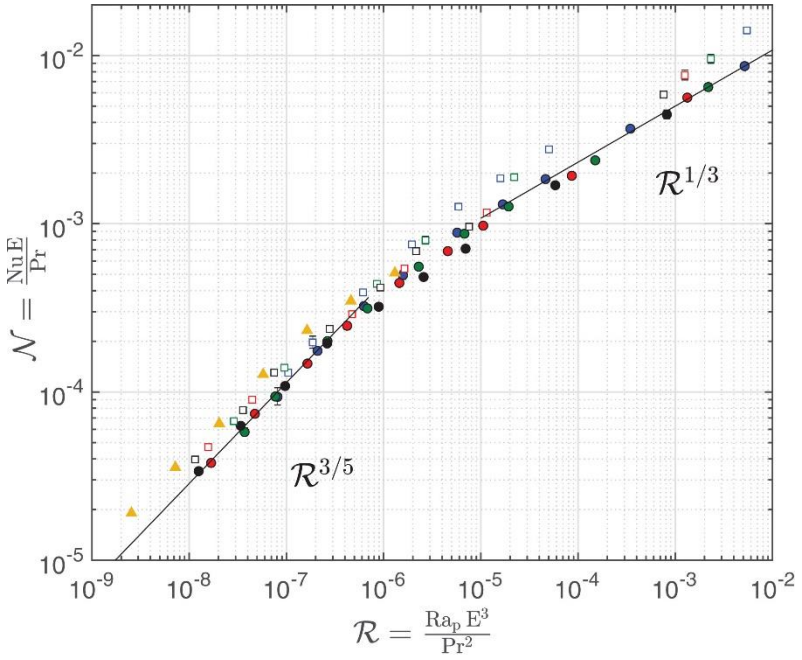

Figure: Observation of the geostrophic turbulence regime in terms of the diffusivity-free Nusselt number and Rayleigh number based on the flux. *Bouillaut et al (2021)*

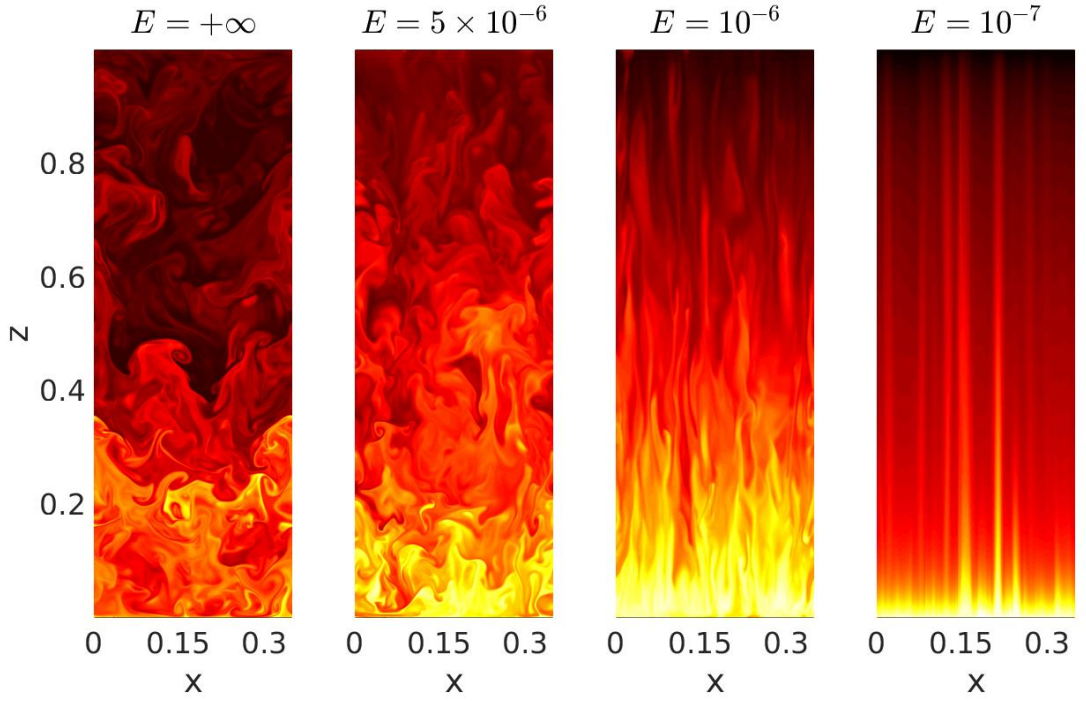

Figure: Vertical sections of the temperature field for increasing rotation rate (left to right) in DNS.

What about the other quantities ?