

Centrifugal

Fredy Ramirez

Last Modified: January 2020

1 Mathematical Model

2 Centrifugal Force Only

2.1 Aspect Ratio = 0.1

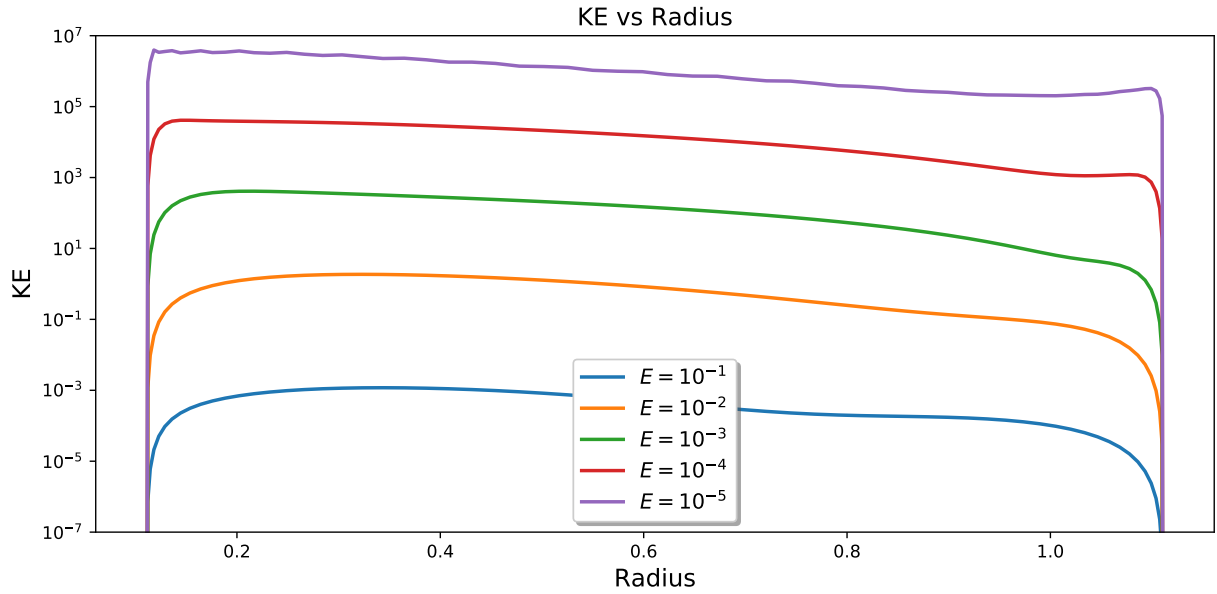


Figure 1: Kinetic energy shell average as a function of radius during equilibrated phase for a range of Ekman numbers.

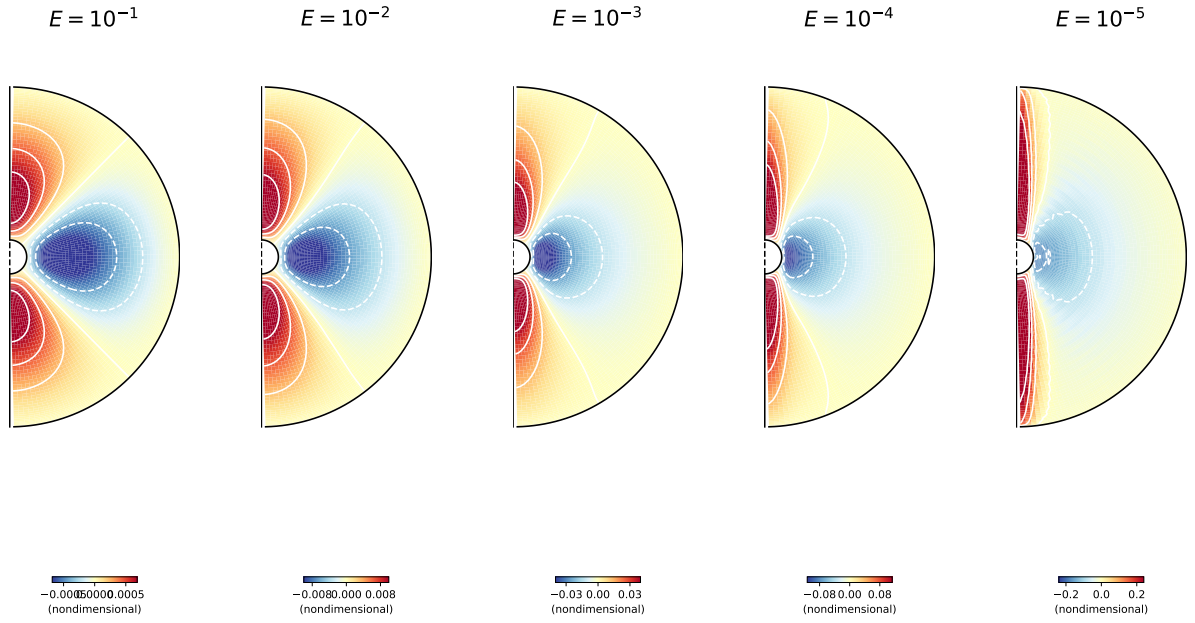


Figure 2: Temperature azimuthal average during equilibrated phase for a range of Ekman numbers.

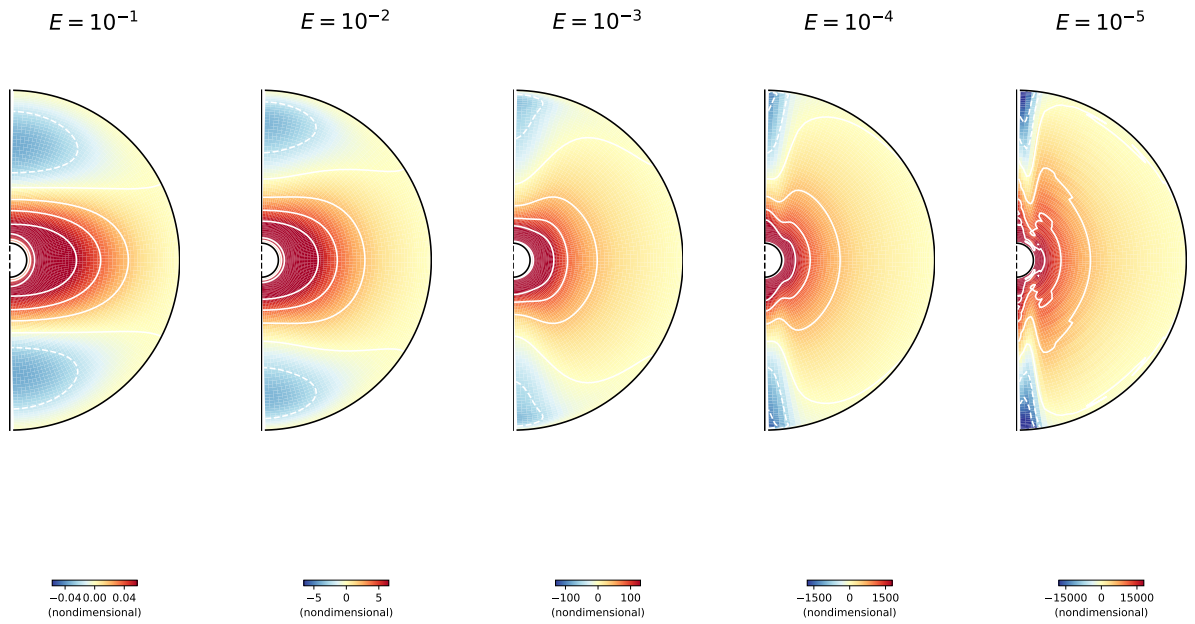


Figure 3: Angular velocity azimuthal average during equilibrated phase for a range of Ekman numbers.

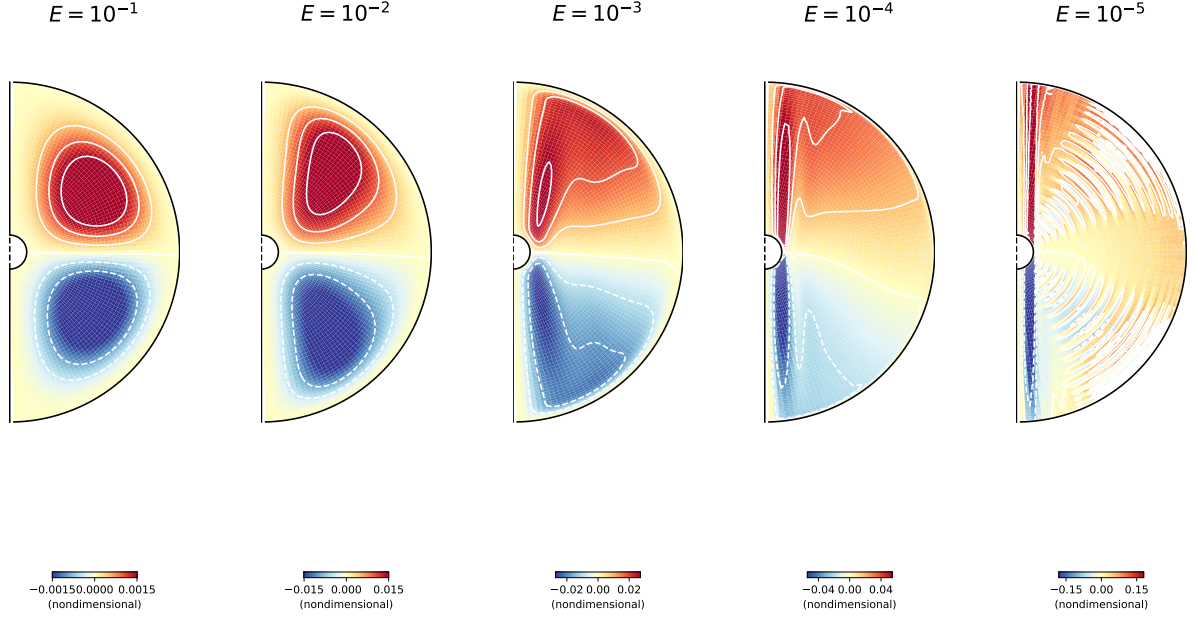


Figure 4: Mass flux azimuthal average during equilibrated phase for a range of Ekman numbers.

Aspect Ratio	E	Δt	$N_r \times N_\theta \times N_\phi$	KE	KE_r	KE_θ	KE_ϕ	ℓ degree	Wavenumber m	P_ℓ
0.1	10^{-1}	10^{-4}	64x96x192	2.72×10^{-4}	1.33×10^{-4}	9.82×10^{-5}	4.00×10^{-5}	6	4	376
0.1	10^{-2}	10^{-4}	64x96x192	3.71×10^{-1}	1.98×10^{-2}	1.08×10^{-2}	3.4×10^{-1}	6	4	376
0.1	10^{-3}	5×10^{-5}	64x96x192	67.23	2.12×10^{-1}	1.01×10^{-1}	66.92	6	4	376
0.1	10^{-4}	10^{-5}	64x96x192	9.77×10^3	3.511	2.016	9.76×10^3	6	4	376
0.1	10^{-5}	10^{-6}	64x96x192	9.59×10^5	85.2	251.36	9.76×10^3	6	4	376

Table 1: Details of numerical simulations performed for the incompressible model in this section. The following are specified, aspect ratio of the sphere, the Ekman number (E), the luminosity, the Rayleigh number (Ra), the Prandtl number (Pr), the time-step size (Δt), the spatial resolution ($N_r \times N_\theta \times N_\phi$), and the spherical harmonic degree ℓ with corresponding wavenumber m . The power and growth rate are also recorded alongside each respective ℓ degree.

2.2 Aspect Ratio = 0.5