Supplemental material for

"What Rayleigh numbers are achievable under Oberbeck–Boussinesq conditions?"

by

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Here, we provide additional information that might be useful for the reader. In table I we list relevant fluid properties for the fluids considered in the paper. Figure 1 shows the temperature and pressure induced variation of physical properties for three important experimental data sets [1–3] as function of the Rayleigh number.

	water	air	ethane	helium		SF_6	
T (^{o}C)	40	40	40	40	-268.1	30	30
P (bar)	1	1	1	1	1	1	20
ρ (kg/m^3)	992.2	1.113	1.162	0.1537	11.73	5.857	157.6
α (1/K)	0.0003855	0.003201	0.003258	0.003192	0.3244	0.003415	0.009253
β (1/Pa)	4.424e-10	1e-05	1.007e-05	9.995e-06	1.262e-05	1.011e-05	7.473e-07
μ (Pa·s)	0.0006527	1.917e-05	9.791e-06	2.052e-05	1.388e-06	1.545e-05	1.675e-05
k (W/(K m))	0.6285	0.02735	0.02293	0.1607	0.01021	0.01337	0.01586
c_p (J/(K kg))	4179	1007	1816	5193	6726	676.7	882.5
$\varepsilon_{c_p,T}/\Delta$	2.209e-05	4.672e-05	0.002213	-1.835e-07	-0.1999	0.00228	-0.006495
$\varepsilon_{c_p,P}/(\rho g L)$	-5.896e-10	1.414e-08	5.749e-08	3.691e-11	4.166e-06	6.246e-08	3.254e-07
$\varepsilon_{\mu,T}/\Delta$	-0.0188	0.002469	0.002959	0.002189	0.1397	0.002941	0.001498
$\varepsilon_{\mu,P}/(\rho g L)$	1.921e-10	7.226e-09	2.258e-08	1.627e-09	1.232e-06	1.176e-08	1.028e-07
$\varepsilon_{\alpha,T}/\Delta$	0.01987	-0.003217	-0.003377	-0.003192	-0.527	-0.003654	-0.02539
$\varepsilon_{\alpha,P}/(\rho g L)$	7.321e-10	2.291e-08	2.022e-07	-5.04e-09	6.912e-06	3.513e-07	8.859e-07
$\varepsilon_{k,T}/\Delta$	0.00208	0.002677	0.005803	0.002209	0.1538	0.00562	0.001586
$\varepsilon_{k,P}/(\rho g L)$	8.454e-10	1.093e-08	3.613e-08	4.786e-09	1.051e-06	3.232e-08	2.113e-07

TABLE I. Fluid properties for water, air, ethane, helium and SF_6 for conditions analysed in the paper. We note that $\varepsilon_{\rho,T/\Delta\approx\alpha}$ and $\varepsilon_{\rho,P}/(\rho g L) \approx \beta$.

[1] Ahlers, Guenter, Bodenschatz, Eberhard, Funfschilling, Denis, Grossmann, Siegfried, He, Xiaozhou, Lohse, Detlef, Stevens, Richard J. A. M. & Verzicco, Roberto 2012 Logarithmic temperature profiles in turbulent Rayleigh-Bénard convection. *Phys. Rev. Lett.* **109**, 114501.

[2] He, Xiaozhou, Funfschilling, Denis, Nobach, Holger, Bodenschatz, Eberhard & Ahlers, Guenter 2012 Transition to the ultimate state of turbulent Rayleigh-Bénard convection. *Phys. Rev. Lett.* **108**, 024502.

[3] Urban, P., Hanzelka, P., Musilová, V., Králík, T., Mantia, M. La, Srnka, A. & Skrbek, L. 2014 Heat transfer in cryogenic helium gas by turbulent Rayleigh-Bénard convection in a cylindrical cell of aspect ratio 1. *New Journal of Physics* **16** (5), 053042.

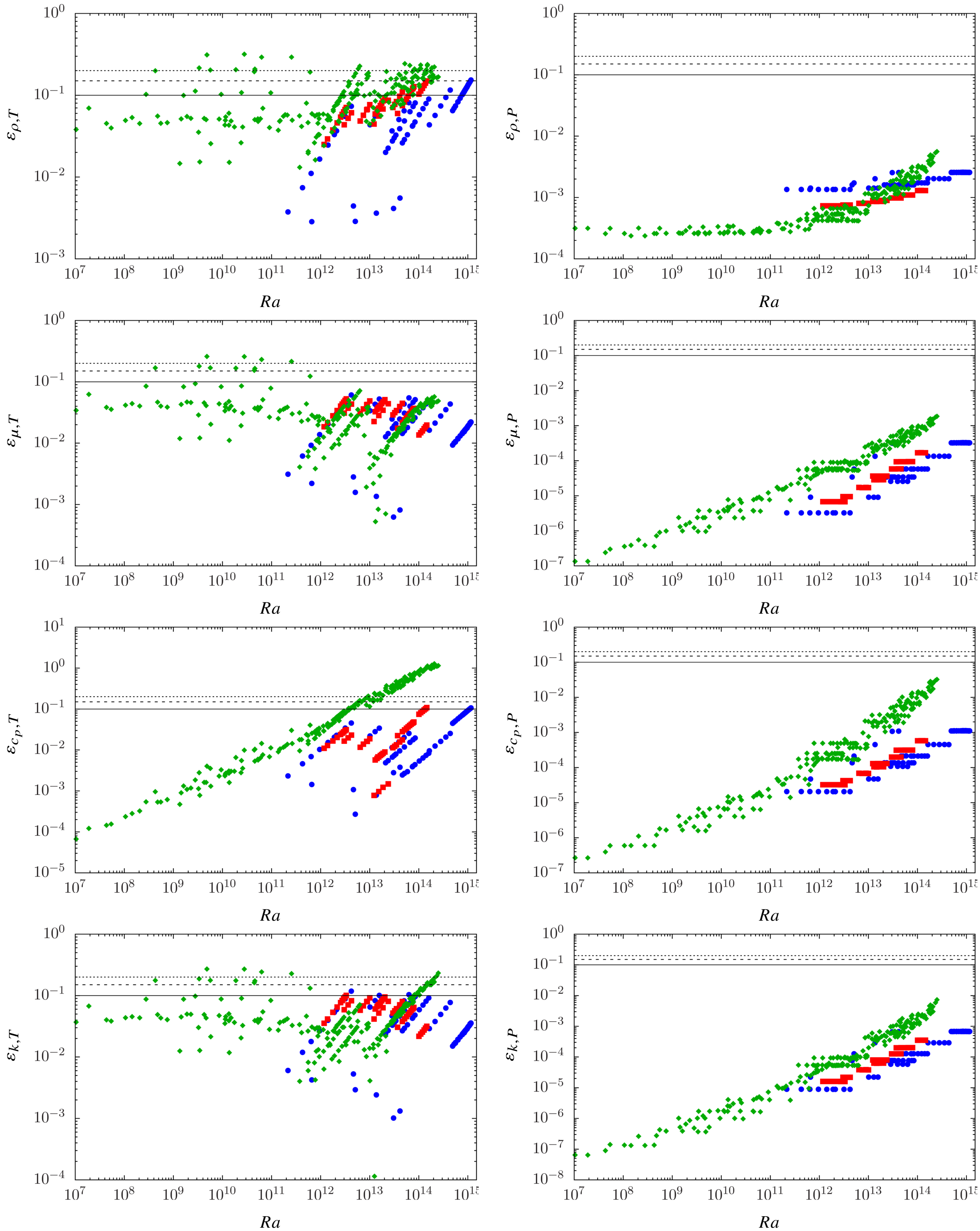

FIG. 1. Values of $\varepsilon_{\varphi,T}$ and $\varepsilon_{\varphi,P}$, as obtained from the Göttingen data for SF_6 and the container aspect ratio $\Gamma = 1$ [2] (red squares) and $\Gamma = 1/2$ Ahlers *et al.* [1] (blue circles), and from the Brno data for cryogenic helium Urban *et al.* [3] (green diamonds). The horizontal solid, dashed and dotted lines show the thresholds on the degree of NOBness $\hat{\sigma} = 5\%$, 10% and 20%, respectively.