Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Reynolds number measurements in Rayleigh-Benard convection[1]

DENIS FUNFSCHILLING, ERIC BROWN, ALEXEI NIKOLAENKO, GUENTER AHLERS, Dept. of Physics and iQUEST, UC Santa Barbara — We determined the Reynolds number R_e in cylindrical cells of aspect ratio $\Gamma \equiv D/L = 1$ (D = diameter, L = height) filled with water at a mean temperature of 40°C and heated from below for Rayleigh numbers R from 10^9 to 10^{11}. It is well known that the main flow structure in this system is a collection of hot and cold plumes and an associated large-scale circulation (LSC). We measured the temperature of the cell side-wall as a function of time at eight azimuthal locations on the horizontal mid-plane. The cross-correlation functions of temperatures on opposite sides of the cell indicate that localized hot or cold volumes associated with the LSC survive for a time comparable to the turnover time τ as they follow the LSC. ¿From maxima of the cross-correlation functions we find τ, and from it the Reynolds number $R_e \equiv (4L/\tau)(L/\nu)$ (ν is the kinematic viscosity), of the LSC. The results are consistent with measurements by others [2] for $R \lesssim 10^{10}$ and with the prediction of Grossmann and Lohse footnoteS. Grossmann and D. Lohse, Phys. Rev. E **66**, 016305 (2002)..

[1]Supported by DOE Grant DE-FG02-03ER46080
[2]X.-L. Qiu and P. Tong, Phys. Rev. E **66**, 026308 (2002).

Denis Funfschilling
University of California, Santa Barbara

Date submitted: 01 Dec 2004 Electronic form version 1.4