

Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Rise Heights of Lazy Fountains GARY HUNT, NIGEL KAYE, Imperial College London — The initial rise height z_m of turbulent Boussinesq fountains is determined analytically for small and large source Froude numbers Fr_0 . Solutions were obtained after recasting the plume conservation equations of Morton, Taylor & Turner (1956) in terms of the inverse square of a local Froude number and a local dimensionless fountain width. For large Fr_0 , the fountain is ‘forced’ and the well-established linear increase of the rise height with Fr_0 is obtained, i.e. $z_m/r_0 \sim Fr_0$; r_0 denoting the source radius. However, for small Fr_0 the fountain is ‘lazy’ and the dependence $z_m/r_0 \sim Fr_0^2$ more sensitive. Additionally, the rise height for lazy fountains is predicted to be independent of the entrainment coefficient α . Comparison of our solutions with existing experimental and numerical results of fountain rise height, as well as with our own experimental results, show good agreement and support the derived scalings. Experimental results suggest that the entrainment coefficient for highly-forced fountains is $\alpha_f \approx 0.058$, i.e. closer to that of a jet than of a plume.

Morton, B. R., Taylor, G. I. & Turner, J. S. (1956), Turbulent gravitational convection from maintained and instantaneous sources, *Proc. Roy. Soc. A* **234**, 123.

Gary Hunt
Imperial College London

Date submitted: 12 Aug 2005

Electronic form version 1.4