

EAS 572: Assignment 1, January 2004 **Value: 5%**

Consider the vertical motion of a spherical particle (diameter d and density ρ_p) in an unbounded domain of homogeneous, stationary turbulence (viz., turbulence whose statistical properties are independent of position and time). The particle is subject to the gravitational force (gravitational acceleration g), and to random drag forces due to its motion relative to the fluid. Let the fluid have density ρ and kinematic viscosity ν and suppose the fluid turbulence is characterized by a velocity scale σ (the standard deviation of the velocity fluctuations) and a length scale L .

Perform a dimensional analysis leading to formulae for the mean vertical velocity (W^*) of the particle, and the standard deviation σ_w^* of the fluctuations of its velocity about that mean value.