Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Modeling Low Reynolds Number Homogeneous Decaying Turbulence BLAIR PEROT, University of Massachusetts — Very low Reynolds number nearly homogeneous turbulence can occur in the free-stream outside of a turbulent boundary layer. It is also found in nocturnal atmospheric and oceanic boundary layers. Low Reynolds number turbulence represent the interesting situation where the nonlinear terms in the Navier-Stokes equations are weak, and therefore negligible or linearizable, and yet a turbulence model is still required because the initial conditions are unknown and a variety of length scales are still present. This work considers the behavior of two-equation turbulence models in the low Reynolds number limit. It is shown that some models are unstable in this limit and others result in inconsistent or incorrect decay rates. Perhaps most importantly, all current models involve an ad hoc blending function to include the low Re limit. In this work a low Reynolds number correction to classic two-equation models is proposed which requires no blending functions, which obtains the correct decay limits (for any low wavenumber spectra), and which is simple. The performance of the model is compared with a variety of experiments and simulations over a range of Reynolds numbers.

Blair Perot
University of Massachusetts

Date submitted: 12 Aug 2008 Electronic form version 1.4