Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

A Multilevel Kinematic Simulation for the Stratified Surface Layer[1] ADITYA GHATE, SANJIVA LELE, Stanford University — For problems involving a wide range of spatially disparate scales, Kinematic Simulations (KS) offer a low-cost alternative to LES. This is especially true when the phenomena of interest (Ex. Wind turbine fatigue, pollution dispersion, etc.) are those that are primarily affected by the statistical properties of turbulence. In the proposed KS, Isotropic turbulence is first "rapidly distorted" using an effective mean shear and density gradient (RDT). The temporal advancement of the stochastic fields can then be done using two different models. The first model idealizes the inter-scale interactions as exclusively those due to "sweeping" of smaller eddies by the larger eddies. In the second formulation, the inter-scale "straining" is accounted for using an RDT - like formulation wherein the Gabor transform is used to explicitly enforce separation of scales between successive resolution levels. Both models produce non-Gaussian turbulent fields for the velocity and temperature fluctuations. The KS will be appraised by comparison of cross spectra, space-time correlations, higher order statistics and other attributes of near wall turbulence using higher fidelity results obtained from LES.

[1]This research is supported as an Exploratory Research Project by the TomKat Center for Sustainable Energy at Stanford University

Aditya Ghate
Stanford University

Date submitted: 31 Jul 2015 Electronic form version 1.4