
JAHRUL ALAM, Memorial University of Newfoundland

A multi-scale methodology for simulating the atmospheric boundary layer.

The study of turbulence in the atmospheric boundary layer (ABL) is an important topic to the field of weather forecasting or projecting climate change. In a large eddy simulation (LES) model of the turbulent ABL, one calculates “grid scale” large eddies, where “sub-grid scale” small eddies are parameterized. Evidences from physical and numerical models indicate that the LES model does not address fully the multi-scale and intermittent character of the turbulent ABL. In this talk, I will present a novel “multi-scale computational methodology” for modelling the full range of turbulent eddies, where a sub-range of large significant eddies are calculated on a multi-scale grid, and that of small non-significant eddies are parameterized. First, to model the full range of eddies, a multi-scale representation of the mean conservation laws are derived, taking into account the surface roughness. Second, two stages of multi-scale computational methods are developed. I will explain recent progresses for addressing some of the challenges that must be overcome, and will discuss possible ways for addressing other challenges, which is an ongoing research topic. I will present validation results for simulating a neutrally stable turbulent ABL using only about 41 131 grid points at a resolution 2048^3 .