

Weekly Seminar: Fall 2010

Date: Friday September 17th

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Charles Meneveau (Johns Hopkins University)

Title: *"Fluid mechanics and turbulence in the wind-turbine array boundary layer"*

Abstract

When wind turbines are deployed in large arrays, their ability to extract kinetic energy from the flow decreases due to complex interactions among them and the atmospheric boundary layer. In order to improve our understanding of the vertical transport of momentum and kinetic energy across a boundary layer flow with wind turbines, Large Eddy Simulations and wind-tunnel experimental studies are undertaken. A suite of LES, in which wind turbines are modeled using the classical 'drag disk' concept, are performed for various wind turbine arrangements, turbine loading factors, and surface roughness values. In the wind tunnel studies, the boundary layer flow includes a 3 by 3 array of lightly loaded model wind turbines. The results of both the simulations and experiments are used to shed light on the vertical turbulent transport of momentum and kinetic energy across the boundary layer. The results are also used to develop improved models for effective roughness length scales and to obtain new optimal spacing distances among wind turbines in a large farm. This work is a collaboration with M. Calaf, J. Meyers, R. Cal, J. Lebron, H.S. Kang, and L. Castillo, and is supported by the National Science Foundation.