Date: November 30th

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Dr. Fernando Porte-Agel

University of Minnesota

Title: *"Modeling turbulent fluxes in heterogeneous thermally stratified boundary layers"*

Abstract

A common challenge in numerical models of atmospheric boundary layer flows (e.g., large-eddy simulations and weather models) is the parameterization of grid-averaged surface fluxes. These fluxes are often calculated from the simulated velocity and scalar fields using Monin-Obukhov similarity theory. Since this approach is strictly only valid over homogeneous surfaces, its application to heterogeneous boundary layers can result in significant errors. Particularly challenging is the estimation of surface heat fluxes in heterogeneous stably stratified flows, where the assumption of constant surface-layer flux breaks down.

This seminar will give an overview of recent research efforts aimed at improving surface flux models for heterogeneous boundary layers. Wind-tunnel experiments and large-eddy simulations are used to test surface flux parameterizations in both neutral and stably stratified heterogeneous boundary layers. Models based on Monin-Obukhov similarity show a significant bias in the prediction of the average surface heat flux. In particular, models that break the domain into homogeneous subareas grossly underestimate the heat flux magnitude over relatively colder subareas, due to their inability capture flux enhancement associated with local advection. Motivated by these results, a new flux parameterization is proposed based on local similarity theory and the assumption of linear (instead of constant) flux distribution over each subarea. The new model yields improved predictions of average surface fluxes.