DICAAR
Università degli studi di Cagliari
Dipartimento di Ingegneria Civile Ambientale e Architettura
Sezione Idraulica
Scuola di Dottorato di Ingegneria Civile e Architettura

Giornate di studio del Gruppo Italiano di Idraulica

Marchi Lecture

Cagliari 12 Giugno 2015 ore 9:15

Aula Magna di Architettura, *Via Corte d'Appello 87*

Turbulence and Fluxes in the Atmospheric Boundary Layer: Implications from Urban Street Canyon to Climate Scales

By

Harindra Joseph Fernando

Departments of Civil and Environmental Engineering and Earth Sciences and
Aerospace and Mechanical Engineering
University of Notre Dame
Notre Dame
IN 46530

Atmospheric boundary layer (ABL) is the interface between the earth surface and free atmosphere, and it plays a prominent role in determining the microclimate of an environment. The layer of ABL closest to the ground is called the surface layer, and it carries heat, momentum, water vapor and other fluxes from the ground to the layers above it up to the free atmosphere. The surface layer dynamics is dominated by turbulence and radiative processes. Large-scale processes of free atmosphere, in turn, have considerable bearing on the ABL. As such, global climatic processes and small-scale turbulence, say in urban street canyons, are linked; and a host of feedbacks modulate ABL processes at appropriate time scales. This presentation will discuss the scale symbiosis of the atmosphere, starting from a description of vertical fluxes through the surface layer, a popular topic in ABL studies. Amongst the most complicated of all ABL types is the nighttime stable boundary layer (SBL), in part because of the difficulty of describing turbulence in stably stratified fluids. Some results of the recent MATERHORN field study (2013-2014) will be presented, illustrating an assemblage of processes at work in the SBL. How upper atmospheric processes affect the surface layer fluxes will be discussed next, taking examples from a recent (February – March 2015) field study conducted across the Indian Ocean. The direction of fluxes at the ocean surface layer is of key importance for atmosphere-ocean models, particularly in climate simulations. Multiple scales of atmosphere (and ocean) appear to control such transfer processes rather than local processes as assumed in existing theories such as the Monin-Obukhov theory. Finally, the results of a nested simulation from climate to urban street canyon scales will be presented for a coastal city, illustrating how the thermal comfort, building energy consumption and snowfall respond to the global change and the role of surface layer in this response.

info: querzoli@unica.it