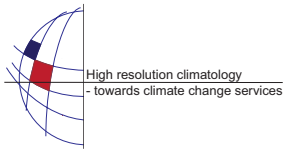
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-366, 2010
10th EMS / 8th ECAC



The afternoon and early-evening decay of turbulent kinetic energy over different land surfaces

D.F. Nadeau (1), E.R. Pardyjak (2), C.W. Higgins (1), H.J.S. Fernando (3), and M.B. Parlange (1)

(1) EPFL, Lausanne, Switzerland (daniel.nadeau@epfl.ch), (2) Department of Mechanical Engineering, University of Utah, Salt Lake City, USA (pardyjak@mech.utah.edu), (3) Department of Civil Engineering and Geological Sciences, University of Notre Dame, Notre Dame, IN, USA

Recent years have seen an increasing interest in the late-afternoon transition between the convective and stable regimes of the atmospheric boundary layer. There are several differences between the two regimes. On one hand, the convective boundary layer is characterized by an unstable stratification, turbulent mixing of mass, momentum and heat and buoyancy-driven eddies. On the other hand, the stable boundary layer is associated with a strong stable stratification that tends to suppress vertical motions generated by mechanical turbulence. One of the key processes of this complex transition period is the forcing time scale associated with the surface heat flux. Unfortunately, very few modeling studies have used realistic decaying time scales for the sensible heat flux. Therefore, in the first part of this study, we present a new function that better represents the afternoon and early-evening transitions and validate it with eddy covariance measurements over different land surfaces. The objectives are to capture the buoyancy forcing time scales observed in nature and the influence of surface properties. In the second part of the study, we show preliminary results of large-eddy simulation of atmospheric flow over heterogeneous cooling stripes. We focus our attention on the temperature advection between the different stripes as a result of their different cooling rates. Overall, this study is one of the first to model the convective decay of turbulence using realistic time scales over heterogeneous terrain.