EMS Annual Meeting Abstracts
Vol. 9, EMS2012-123, 2012
12th EMS / 9th ECAC

Characteristics of Coherent Structures in the Atmospheric Surface Layer Obtained by the KIT Dual-Doppler Lidar System

C. Stawiarski (1), K. Träumner (1), C. Knigge (2), and R. Calhoun (3)

(1) Institute for Meteorology and Climate Research (IMK-TRO), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany (christina.stawiarski@kit.edu), (2) Institute of Meteorology and Climatology, University of Hannover, Hannover, Germany (knigge@muk.uni-hannover.de), (3) Environmental Remote Sensing Group, Arizona State University, Tempe, Arizona, USA (ronald.calhoun@asu.edu)

Coherent structures, patterns in a turbulent velocity field, are well known phenomena in the atmospheric boundary layer. It is widely accepted, that the coherent structures contribute to the fluxes of momentum, heat, and moisture, although the fractions are controversial and range from about 10% to 100% of the total fluxes. The meteorological survey of coherent structures is a challenge up to now mostly approached by tower measurements, which show the drawback of spatially extremely limited data. A new possibility is provided by dual-Doppler lidar measurements, whose potential for 2D coverage of coherent structures in the surface layer was demonstrated in 2003 (Newsom et al 2007).

An up to now worldwide unique dual-Doppler lidar system consisting of two powerful, scanning lidars ("Wind-Tracer") is established at the Institute for Meteorology and Climate Research (IMK-TRO) at the Karlsruhe Institute of Technology (KIT). A new software for highly synchronised operation of the two lidars and a dual-Doppler retrieval gives the opportunity to measure both components of the horizontal velocity field with high spatial and temporal resolution. A large eddy simulation (LES) based dual-Doppler simulator supplements this state-of-the-art wind measurement tool and gives the possibility to design scan patterns adapted to the terrain and the observation object as well.

In the presentation we will show the possibilities of this new measurement technique to detect different types of coherent structures, i.e. alveolar structures during calm situations and streaks during stronger winds, based on simulated and real world data. Estimations of the correlation length and the examination of Lagrangian coherent structures demonstrate the possible progress in this research field.