EMS Annual Meeting Abstracts
Vol. 8, EMS2011-802, 2011
11th EMS / 10th ECAM

Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

Evolution of the surface turbulence and of the vertical structure of the atmospheric boundary layer at a coastal site

AM Sempreviva (1,2), CR Calidonna (1), R Wagner (2), L Deleo (1), MS Courtney (2), S Federico (1), and E Avolio (1)

(1) Institute for Atmospheric Sciences and Climate - CNR, ISAC-CNR, Lamezia Terme, Italy (am.sempreviva@isac.cnr.it), (2) Danish Technical University, Risoe Laboratory, Risoe-DTU, Roskilde, Denmark

We present results from an intensive field campaign at a unique site located 500 m inland from the coastline in a open area in the Central Mediterranean. This experiment was carried out during July 2009 to add new data on the evolution of the surface turbulence characteristics and vertical structure of the coastal flow for testing high resolution models at the coastal discontinuity.
In this contribution, we address the development of the vertical structure of the coastal flow and of the surface layer turbulence in a variety of situations from pure sea-land breeze to westerly synoptic flow.
Optical (a wind LIDAR from Leosphere and a LIDAR Ceilometer Vaisala CL31) and acoustic (SODAR from Metek) ground-based remote sensing devices were used to obtain time series of vertical profiles of wind speed (U) and direction (DIR) and to monitor the development of the layering of the ABL with respect to the aerosol content and the thermal structure. The height of the ABL was retrieved through the vertical structure of the aerosol content detected by the ceilometer. A surface standard meteorological station provided measurement of U, DIR, temperature (T), temperature difference at three levels (ΔT), relative humidity (RH), solar radiation (RAD) and a fast response ultrasonic anemometer provided turbulent fluxes of momentum and heat.
The peculiarity of the site is that the main synoptic flow is from the west and the sea-land breeze system is oriented also west-east. This results in an enhancement of the sea-breeze during the day and the weakening or blocking of the night breeze since the synoptic flow acts in opposite direction.
We present the evolution of the wind profiles and surface fluxes of heat and momentum in case of sea-land breeze, synoptic flow and a combination of the two. During sea-land breeze regime, we detect the typical continental daily cycle of the surface layer stability, i.e. stable during nighttime and unstable during daytime with different wind profiles; during the night, weak but noticeable low level jets develop . Sea breeze always develops due to the solar heating and the breeze is over imposed on the synoptic wind.
We discuss the characteristic of the surface turbulence in function of the vertical structure of the ABL as seen from the two LIDARs and the SODAR. The most interesting turbulent features are detected in the temperature time series i.e. thermals structure at the onset of the sea breeze and sudden temperature drops during night that might be connected to intermittent turbulence or to katabatic winds from the surrounding mountains.