Geophysical Research Abstracts
Vol. 13, EGU2011-865, 2011
EGU General Assembly 2011

Vertical structure of the sea breeze at a Bulgarian Black Sea side

Damyan Barantiev (1), Mikhael Novitsky (2), Ekaterina Batchvarova (1,3)

(1) National Institute of Meteorology and Hydrology, Hydro-Meteorological Observatory, Burgas, Bulgaria (damyan.barantiev@meteo.bg), (2) Research and Production Association 'Typhoon' - Obninsk, Russian Federal Service on Hydrometeorology and Environmental Monitoring, Moscow, Russia, (3) Marie Curie Fellow: Wind Energy department, Risoe DTU, Denmark

Abstract: The breeze circulation is important for the comfort conditions for recreation at coastal sites, but also defines specific urban air pollution problems. Many large coastal cities, like Bourgas, have highly developed industry. During the warm period of the year, the dispersion of pollutants is influenced by the breeze circulation developing in the coastal area. Therefore observations and studies of the breeze circulation are highly needed. Mesoscale modeling results at coastal sites also need to be evaluated against meteorological data. Only if they reproduce correctly the breeze circulation they can be used to drive air pollution models in coastal areas.

SODAR and in-situ turbulence measurements were initiated at the meteorological observatory of Ahtopol on the Black Sea coast (south-east Bulgaria, 65 km. away from Bourgas) under a Bulgarian-Russian collaborative program. The observations started in July 2008 and go on. These observations are the start of high resolution atmospheric boundary layer vertical structure climatology at a Bulgarian Black Sea coastal site. Typhoon make automatic weather station «MK-15» with an acoustic anemometer (mounted at 4,5m height) and Flat Array Sodar without RASS extension «Scintec» were installed in Ahtopol.

The analysis of the data reveals the thermodynamic structure of the atmospheric boundary layer in the coastal zone. The role of different weather conditions for the development of the breeze circulation in the area is investigated.

A classification of the breeze situations is created based on vertical profiles of wind speed and direction from the SODAR data and the turbulence parameters.

For each class, the mean values of wind speed, wind direction, and temperature are identified. The time and intensity of passing of the breeze front is also analyzed from the sonic anemometer raw data. Turbulence parameters, in particular, the momentum flux $u_* = \sqrt{-\overline{u'w'}}$ and the kinematic sensible heat flux $H = \overline{w'T'}$ are calculated. They show specific for the different classes quite noticeable diurnal variations during breeze circulation conditions.

Five classes of breeze situations were defines as: Clearly pronounced breeze circulation (Class I); Pronounced breeze circulation (Class II); Typical breeze circulation (Class III); Weakly pronounced breeze circulation (Class IV); and Situations with elements of breeze circulation (Class V).

Class I, for example, is characterized with very abrupt change in wind direction and turbulence when the sea breeze front arrives. In addition, high wind speed (above 5 ms-1) and large diurnal temperature difference (above 10 C) are observed. The SODAR data show calm conditions in the layer 40-200 m above ground at the onset of the breeze front. After that, the wind speed starts to increase (firstly in the upper layers and then near the ground) until stationary conditions are reached. The decrease in sea breeze intensity in the afternoon starts first near the ground and propagates up with height.

The study is ongoing and will involve mesoscale model evaluations.