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Sea Breeze Structure at a Bulgarian Black Sea side based on sodar and eddy correlation measurements

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The breeze circulation is important meteorological factor for the recreation role of the Bulgarian Black Sea coast, as well as for wind power assessments and urban pollution studies. Typically for Bulgaria, only standard synoptic measurements are available for evaluation of weather forecast and research-meteorological models simulations. Therefore, data on the vertical structure of the coastal boundary layer are highly needed for theoretical and practical applications.

In this study, data from automatic weather station «MK-15» which includes ultrasonic anemometer (Typhoon make, Obninsk, Russia) and a Flat Array Sodar «Scintec» are analysed. The instruments were installed at the Meteorological observatory near Ahtopol, 65 km south of Burgas in summer 2008 under a Bulgarian-Russian collaborative program. The availability of data during the 3-year period and the quality of the data base are discussed in the paper.

Further, a classification of the observed breeze circulation events is derived using criteria as the onset time of the sea breeze and sharpness of change in air temperature, wind direction and other meteorological parameters. The synoptic situations leading to these different properties of the breeze circulation are also investigated.

Five classes of breeze situations were defined 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 amplitude (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 later mesoscale model evaluations.