EMS Annual Meeting Abstracts
Vol. 16, EMS2019-577, 2019

Numerical simulations of wind field evolution over complex terrene against sodar measurements.

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The observations and the numerical simulations of the meteorological processes occurring in urban areas are an important and challenging research task with increasing difficulty in complex orography. For cities in mountain valleys the theoretical description of the Atmospheric Boundary Layer (ABL) processes is still open question, usually solved through increased horizontal and vertical resolution and surface characteristics in numerical models. The observable intricacy of stratification and variability of the meteorological fields in the horizontal and vertical direction in such areas requires continuous improvement of the parametrizations in numerical models and modern observation techniques for evaluation proposes.
In this study the capability of the Weather Research and Forecasting (WRF) model to represent the evolution of vertical wind field structure obtained by sodar measurements (MFAS SCINTEC) in the Sofia region is tested. Two periods with typical changes in meso-scale circulation for the Sofia valley are chosen. During the first period (03-04 Aug 2018) a change in the wind direction from the east to the west quarter was observed while for the second period (16-17 Aug 2018) the transition was in the opposite direction (from west to east quarter). The model is used with fine horizontal grid of 500 meters with different schemes for ABL parametrization. The surface data are represented with very high resolution (1 arcsec for the orography and 3 arcsec for land-cover data). The acoustic sounding data (wind and turbulence profiles) with high spatial and temporal resolution (output at every 15 minutes presenting running 30-minute averages with vertical resolution of 10 m) was obtained in the sub-urban area of Sofia during the daytime (from 8 AM to 5 PM GMT+2) for both periods. In addition, during the second period continuous measurements by the same type of sodar but with RASS extension (temperature profiles available) were conducted in a rural area close to Vakarel village (25 km south-east of Sofia). The WRF model was evaluate through correlations between measured and modelled variables for both periods and locations. The results are important for the best choice of WRF setup to deal with typical for Sofia valley synoptic situations.