Geophysical Research Abstracts
Vol. 17, EGU2015-455, 2015
EGU General Assembly 2015

Sensitivity of boundary layer variables to WRF model PBL schemes during the 2014 Athens HygrA-CD campaign

Robert Banks (1), Jordi Tiana-Alsina (2), José Maria Baldasano (1), Francesc Rocadenbosch (2), and Alex Papayannis (3)

(1) Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC-CNS), Earth Sciences Dept.; Barcelona, Spain (robert.banks@bsc.es), (2) Universitat Politècnica de Catalunya, Dept. of Signal Theory and Communications (TSC), Remote Sensing Lab.; Barcelona, Spain, (3) National Technical University of Athens, Physics Department, Laser Remote Sensing Unit; Athens, Greece

The HygrA-CD (From Hygroscopic Aerosols to Cloud Droplets) experimental campaign took place from mid-May to mid-June 2014 over the complex, urban terrain of the Greater Athens Area (GAA). Three typical atmospheric flow types were observed during the 39-day campaign: urban/continental, Etesians, and Saharan dust, which represented 41.7 %, 36.1 %, and 22.2 % of the days respectively.

In this study we evaluated the sensitivity of boundary layer variables to various planetary boundary-layer (PBL) parameterization schemes available in the Weather Research and Forecasting (WRF) mesoscale meteorological model. Eight PBL schemes (5 local, 3 non-local) from WRF version 3.4.1 are tested using daily simulations on a 1 km x 1km grid over the GAA with hourly resolution. Near-surface observations (2-m air temperature, relative humidity, and wind speed) are collected from surface meteorological instruments at multiple locations, while estimates of the PBL height are retrieved using optical backscatter measurements from a multiwavelength Raman lidar (extended Kalman filter technique) and vertical profiles of atmospheric variables from radiosondes (bulk Richardson number approach). Daytime maximum PBL heights ranged from 2.57 km during Etesian flows, or as low as 0.37 km attributed with Saharan dust episodes.

WRF model results yield drastically different solutions depending upon the PBL scheme used and the atmospheric dynamics. The largest differences between model and observations are associated with simulated values of the PBL height (> 400 m on average) during Saharan dust events. Campaign-averaged near-surface variables showed WRF tended to have a cold, dry bias with higher simulated wind speeds than the observations. Generally, it is determined non-local PBL schemes give the most consistent solutions, similar to previous works in the GAA.