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Urban PBL evolution determined by ceilometer and weather prediction model in fair weather over Sofia

Ventsislav Danchovski and Reneta Dimitrova
Sofia University, Bulgaria (danchovski@phys.uni-sofia.bg)

The evolution of the atmospheric boundary layer over an urban area with complex topography is simulated using Advanced Research WRF (ARW) mesoscale numerical weather prediction model for several consecutive fair weather days during summer of 2016. High resolution simulations are used to test performance of eight PBL schemes in predicting of boundary layer height against retrieved one from ceilometer profiles. Different gradient detecting algorithms for determination of PBL height from ceilometer data are also compared. Radiosonde data is used as a reference for validation of numerically simulated and ceilometer detected PBL heights. Despite using of different proxies' ceilometer and radiosonde retrieved PBL depths around noon are similar which indicate that ceilometers are suitable instruments for determination of convective PBL height in fair weather. In some periods, especially at night, analysis of ceilometer profiles does not allow an unambiguous determination of PBL height as it presumes a uniformly distributed aerosol. Therefore significant lack of concurrence with simulated values is not unexpected. Numerical simulations also reviled that influence of urban area on boundary layer evolution is mostly discernible between late afternoon and evening PBL transition.