Assessment of the WRF-ARW model during fog conditions in a coastal arid region using different PBL schemes

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This study covers five fog events reported in 2014 at Abu Dhabi International Airport in the United Arab Emirates (UAE). We assess the performance of WRF-ARW model during fog conditions and we intercompare seven different PBL schemes and assess their impact on the performance of the simulations. Seven PBL schemes, namely, Yonsei University (YSU), Mellor-Yamada-Janjic (MYJ), Moller-Yamada Nakanishi and Niino (MYNN) level 2.5, Quasi-Normal Scale Elimination (QNSE-EDMF), Asymmetric Convective Model (ACM2), Grenier-Bretherton-McCaa (GBM) and MYNN level 3 were tested. Radiosonde data from the Abu Dhabi International Airport and surface measurements of relative humidity (RH), dew point temperature, wind speed, and temperature profiles were used to assess the performance of the model. All PBL schemes showed comparable skills with relatively higher performance with the QNSE scheme. The average RH Root Mean Square Error (RMSE) and BIAS for all PBLs were 15.75 % and -9.07 %, respectively, whereas the obtained RMSE and BIAS when QNSE was used were 14.65 % and -6.3 % respectively. Comparable skills were obtained for the rest of the variables. Local PBL schemes showed better performance than non-local schemes. Discrepancies between simulated and observed values were higher at the surface level compared to high altitude values. The sensitivity to lead time showed that best simulation performances were obtained when the lead time varies between 12 and 18 hours. In addition, the results of the simulations show that better performance is obtained when the starting condition is dry.