Atmos. Meas. Tech. Discuss., 8, C480–C482, 2015
www.atmos-meas-tech-discuss.net/8/C480/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "New concepts for the comparison of tropospheric NO_2 column densities derived from car-MAX-DOAS observations, OMI satellite observations and the regional model CHIMERE during two MEGAPOLI campaigns in Paris 2009/10" *by* R. Shaiganfar et al.

Anonymous Referee #1

Received and published: 1 April 2015

This paper presents a through, comprehensive comparison of three tropospheric NO2 VCD data sets from car-MAX-DOAS measurements, OMI satellite products (DOMINO v2.0), and a regional chemical transport model (CHIMERE) for a megacity. The authors report a unique and valuable data set derived by car-MAX-DOAS measurements in and around Paris, which covers two relative long-term periods with 25 days in the summer of 2009 and 29 days in the winter of 2010. They perform a detailed analy-

sis of the advantages and limitations of the three data sets, and then improve each data set by making use of the advantages of others in a synergistic way. A new and interesting result of this study is that CHIMERE model results can be improved by rotating around the center of Paris based on the plumes measured by car-MAX-DOAS. The manuscript is well written and structured in general, although the text seems to be lengthy and some parts, e.g. in description and presentation of regression results, can be more concise. I would recommend the manuscript to be published after the following comments have been addressed.

Specific comments:

While the rotation of model results around the center of Paris based on the car-MAX-DOAS measurements appears to be effective for improving the model simulation of urban plumes, the physical picture behind this operation is not clearly described.

First, it is stated that disagreements in the locations of the NO2 maximums between the car-MAX-DOAS measurement and CHIMERE simulation are caused by biases in surface wind direction used by CHIMERE, but the reason for this poor model behavior is not sufficiently explained in the paper. The paper merely refers a previous study at the SIRTA site, which is at 20 km SW from the center of Paris, for surface wind observations (Page 2454, Line 1-3). Are there any concurrent wind observational data to validate the wind fields simulated by MM5 for the experimental periods in this study? At what time intervals did MM5 provide meteorological data for CHIMERE (Page 2446, Line 3-4)? It is stated in the paper that CHIMERE data are available in hourly time steps (Page 2448, Line 1). Is it possible that the wind direction change dramatically (by up to 25 degree) within this time interval?

Second, it is acceptable if the locations of several model grid cells with peak NO2 from CHIMERE are moved (rotated) to match car-MAX-DOAS observations. However, if all the model grid cells for NO2 VCDs in a larger area are rotated around the center of a city as performed in this study, there might be a problem, e.g. in the case that

there are strong emission sources in the upwind area of the city. In that case, the wind fields instead of NO2 VCD results should be corrected. Again, CHIMERE data were available in hourly time steps while car-MAX-DOAS observations persisted 1-2 hours with 1 min for an individual observation. Therefore, it might not be necessary to match simulated NO2 VCDs in all the model grid cells outside the plume to car-MAX-DOAS measurements due to the time differences.

Overall, while the rotation method proposed in this study appears to be applicable to Paris, some assumption and limitations should be given and discussed.

Technical issues:

P2440, L10-11: This phrase needs to be polished. It can be “with the European annual limit value of 40 μg m-3 being exceeded not only at the urban traffic sites, but also frequently at urban background sites”.

P2440, L22: Add a comma between “(2012)” and “can”.

P2443, L9: should be “5$\times$22°”?

P2443, L27: Delete “(“ in front of “depending” or add “)” somewhere.

P2445, L15-: Are the diurnal variations in emission rates (e.g. from traffic) considered in the inventory?

P2462, L15: Delete “)“.

P2464, L3: It seems not so informative to use “Sects. 4 and 5” in a section title.

P2485 and P2496: There are some inconsistencies between the rotation angle values shown in Fig. 6 and in Fig. 17. On 18 July 2009, for example, it is lower than -10 degree in Fig.6, but higher than 10 degree in Fig. 17.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 2437, 2015.