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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 #2

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Review of "New concepts for the comparison of tropospheric NO2 column densities .." by Shaiganfar et al.

In this manuscript, the authors report on a systematic comparison of a large number of car MAX-DOAS measurements of tropospheric NO2 columns in Paris to CHIMERE model results and OMI satellite observations. They successively apply a number of modifications to the data (rotation of model data to account for errors in the met-fields,

use of high resolution model a priori profiles in the OMI observations, and application of spatial smoothing to the car MAX-DOAS measurements) and discuss the impact of these modifications. They present a detailed comparison of the different data versions between each other and finally use the model data as transfer to correct for the difference in spatial resolution between satellite and car MAX-DOAS data.

The paper is well written, clearly structured and reports on a nice and very thorough comparison. The methods presented are relevant for other similar studies and validation of model and satellite data with local data in general and fits well into the scope of AMT. I therefore recommend publication after minor revisions as suggested below.

General Comments

- Improved correlation is used in several places as indicator for better orientation of model data, better representation of spatial scales, and better resolution of NO2 gradients when using high resolution a priori profiles. While I think that this is a valid approach, the authors need to acknowledge that a) an improvement in correlation is to be expected if a parameter is varied until the correlation is improved (rotation, smoothing) even in a random data field and b) that the use of CHIMERE NO2 profiles would improve the correlation with CHIMERE columns even in the hypothetical case of a homogeneous OMI NO2 field (I would expect the correlation to increase from close to 0 to close to 1 in such a case).

- The rotation of the CHIMERE field is a nice approach and the improvement quite impressive for the car MAX-DOAS but the divergence between the OMI and car MAX-DOAS angles is a bit sobering and might be indicative of artificial improvement of the agreement through this "free parameter". In this context one could also speculate that the intrinsic rotation of the OMI pixels relative to the regular CHIMERE grid might introduce ambiguities.

- The smoothing approach to account for the effective spatial resolution of

CHIMERE is a good idea but again I see the risk of compensation of other problems in the model (emissions, lifetime) by the free parameter. Also, the correlation maximum as shown in Fig. 11 is quite shallow, making the result less robust than what one would hope for. Considering the native model resolution of 3km, sampling issues and numerical diffusion in the model might also be relevant for a result of 5 km optimum smoothing.

Detailed Comments

P2441, l22: two => to

P2441, l22: Sentence with Deguillaume et al. reference not really needed as VOC sensitivity is not taken up again in the paper

P2441, l27: Comparison is not to top-down inventories but rather to measurements meant to be used for such inventories

P2442, l9: synergistic use of what?

P2443, please add some details on NO2 fit such as fitting window, background spectrum used and approach to measurements blocked by buildings etc.

P2444, l13, not sure if information on GPS systems used is relevant

P2446, l25, sentence appears twice

P2450, points (d) and (e) do not fit into the list of "corrections to the original data"

P2451, l5, These discrepancies => This discrepancy

P2454, section title, Influence of => influence of applying

P2459, l25, measurements => data

P2460, l13, I find this assignment of uncertainties to CHIMERE very arbitrary!

P2464, l24, Another possible explanation for the observations would be a misplace-

ment of emissions around Paris – to my knowledge, there was a problem in some emission inventories that put all emissions to the city and nothing to the suburbs (sorry, I have no reference for that. . .)

Figure 18: Something seems wrong with that figure – why is the maximum of the OMI data smaller in the modified data set?

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