

# ***Interactive comment on “Evaluation of the LOTOS-EUROS NO<sub>2</sub> simulations using ground-based measurements and S5P/TROPOMI observations over Greece” by Ioanna Skoulidou et al.***

## **Anonymous Referee #1**

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Review on the manuscript: “Evaluation of the LOTOS-EUROS NO<sub>2</sub> simulations using ground-based measurements and S5P/TROPOMI observations over Greece” by Skoulidou et al.

The manuscript describes the comparison between LOTOS-EUROS NO<sub>2</sub> model simulations and in situ, max-doas and TROPOMI data. The comparison shows that the model reproduces well the spatial variability of in situ measurements and TROPOMI NO<sub>2</sub> observations. Overall the agreement changes with the season and at different sites. The paper is scientifically sound, but it is missing deeper analysis of the uncer-

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tainties and it is quite busy. The manuscript could be published after addressing the following points:

Specific comments:

1) As a general point the paper is not enough focused in my opinion. The results are a bit scattered (presented for many instruments and conditions) and it is difficult to derive a clear take home message. Perhaps the authors could try to rewrite more clearly the abstract and conclusions (now they are just summaries), for example highlighting under which conditions the model performs best and worst and the main reasons for discrepancies and ideas for improvement. Most of this is perhaps already indirectly mentioned in the text, but I think it could be rewritten in a different manner, so that the model capabilities and limitations can be better highlighted.

2) sect. 2.2.1 you mention that "For this reason, stations characterized as urban traffic stations, localised close to busy traffic roads of the city and showing very large values, are excluded from the validation." But then you analyse some urban traffic stations in the results. Which criteria you used to exclude these stations? Also, I think you will still have differences in spatial representativeness, also when NO<sub>2</sub> values are not "very large": please clarify.

3) It would be useful to plot the actual grid of the model for the Greek (nested) domain (0.1x0.05 deg ) in figure 1 and 2. This would show that actually sometimes more than one in situ station fall into one grid cell of the model (at least in Thessaloniki). Did you try (if applicable) to average spatially the values from the stations within one grid cell and see if it reduces some of the discrepancy in the representativeness between model and point measurements?

4) The discussion on the uncertainty is a bit qualitative sometimes. Many figures lack errorbars (see technical points below). For example, what are the uncertainties associated with individual max-doas measurements? If you use an average over time, could you include some estimation of the variability in this time range? Also, how much

do you expect your geometric AMF calculation to change the result compared to the calculation that takes into account the actual NO<sub>2</sub> profile? The same applies for the comparison with TROPOMI NO<sub>2</sub>. A more quantitative description of the uncertainties would also help in understanding how the discrepancies you find compare with these uncertainties.

5) Sect. 3.2 Maybe I lost this information but which direction you use for AUTH: 1 or 2?

6) Sect. 3.3 Could you please clarify how do you apply the averaging kernels of TROPOMI to the model? How do you spatially and temporally collocate TROPOMI and the model? How do you interpolate vertically? Which level you use for the tropopause (from TROPOMI perhaps)?

Technical comments

7) Table 7 you write in the caption: "The positive biases are shown in bold." But there is no bolded text in the table. Also, one horizontal line is missing.

8) Figure 7. The y-axis title of the second panel is not visible here

9) Figure 7 and 10 should have errorbars.

10) Figure 9. Please write in the caption what the errorbars are.

11) Overall, the paper is a bit figure and table -heavy in my opinion and a bit repetitive sometimes. Maybe you can try to shorten some text throughout. For example, while it is useful to have these summaries at the end of each paragraph, it could be written in a more concise manner. Also, some of the tables and figures could go to the supplement. For example, Fig. 4, Fig. 13, Table 7 could be moved to the supplement. Perhaps some figures could be also grouped together.

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