

Interactive comment on “Sensitivity of air quality modelling to different emission inventories: a case study over Europe” by Philippe Thunis et al.

Anonymous Referee #2

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The article presents a comparison of chemistry-transport model simulation using the EMEP model over Europe based on three different sources of anthropogenic emissions (EMEP, CAMS-REG, and EDGAR). It addresses the interesting question of model sensitivity to air pollutant emission fluxes.

I would however not recommend its publication in ESSD. First because the paper is essentially a model evaluation work, therefore more suited to a modelling journal such as Copernicus' Geos. Model Dev. In addition, the paper does not support the publication of any geophysical dataset: EDGAR is being published elsewhere (Crippa et al. 2018 is a good example of an article supporting dataset publication) and too poorly documented here to legitimate an update.

I also have the following other concerns:

- Why is EDGAR presented with more details than CAMS-REG or EMEP emission in the paper?
- The background literature is very weak in the introduction, there are more articles of relevance with the present study than Zhu et al. 2019
- Is the same LRTAP reporting year used in the EMEP and CAMS-REG emissions for 2015? Presumably not if the paper states that EMEP is available until 2017 and CAMS-REG until 2016. Can there be any influence on the national emission comparisons?. There are also inaccuracies in the data description as CAMS-REG v2.2.1 was only extending up to 2015.
- L74: what is less transparent in EMEP & CAMS-REG inventories than in EDGAR?
- L131: why not using EDGAR as reference given the stronger focus given to that emission source?
- L154: from the figure I would say that PMco inconsistencies originate from industry and traffic
- L156: how can these differences on shipping and aviation explain the discrepancy on industrial emission mentioned in the previous sentence?
- L160 to 200: and following: the comparison between EMEP/CAMS and EDGAR is not uninteresting, but also largely expected since EMEP&CAMS are based on similar national emissions (when using identical reporting years).
- L299 (and following): the three different model setup can be referred as “three simulations” but certainly not as “three models”
- L331: it is worth pointing out this difference in NO₂ performance despite similar NO_x emission, but it would be interesting to explain why
- L344: why stating here that the different model quality is related to an issue in the model itself whereas the following sentence actually point towards the sensitivity to

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observation uncertainty in the MQI design?

- L366: as pointed out by the authors, the poor performances for ozone is a concern. Also because the EMEP model is widely used for policy support, especially for ozone. I could not find the MACC-III Report reference (2013), but this feature should be further explained, for instance by checking biogenic emissions. This point again legitimates my major comment about the relevance to submit the present paper to a modelling journal.

- L418: is such a good performance for ozone consistent with earlier statements?

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