

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-376

Anonymous Referee #1

Referee comment on "Effects of vertical ship exhaust plume distributions on urban pollutant concentration – a sensitivity study with MITRAS v2.0 and EPISODE-CityChem v1.4" by Ronny Badeke et al., Geosci. Model Dev. Discuss.,
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General comment

This paper aims to investigate the effect of vertical distribution of ship plumes on modelling of ground level concentrations at small spatial scale, i.e. a few kilometres from the source. The topic is of interest even because the impact of ship emissions at berth in port cities is actually concentrated at small distance from the port. Considering that specific parameterizations to be included in models are provided, I believe that it is a topic suitable for the Journal. It must be said that in a previous paper of the same authors, a very similar input dataset was used and the same modelled ship, I believe that there are elements of novelty in this analysis, however authors are invited to better clarify this aspect. In addition, some aspects of discussion and interpretation is not very clear, see my specific comments, and a revision step will furnish benefits to this paper.

Specific comments

Authors should explain better what are the elements of novelty compared to the previous paper because a similar modelling approach and the same input ranges are actually used.

Lines 28-32. Here it would be useful to put a priority in nitrogen oxides that could be significantly impacted by shipping leading to overcomes of the legislation threshold in specific areas of port cities. SO_x is certainly a ship-related pollutant but less relevant for maintaining local air quality standards. However, it could lead to formation of secondary aerosol (sulphate) that could have non negligible impacts at local and regional scales.

In the introduction, chain citations of a lot of papers together such as in lines 50-54 is not a good practice because it does not give to the reader any real clue of why these papers have been cited.

In the introduction is given a brief overview of the impact of ships to local air quality. I would like to suggest to consider the recent review Contini and Merico (*Atmosphere* 2021, 12, 92) in which an global overview of these impacts is provided.

Lines 89-93. I believe that the over prediction effect is not only due to plume rise, rather, the uniform distribution of emissions on such a large grid could influence results.

Lines 264-265. This is not clear. Probably you mean that you modelled gases as passive tracers because you analyse small spatial and temporal scales so that transformations are limited?

I suggest to include a discussion relative to the applicability to real cases. All the paper is based on modelling of a single ship and the influence of considering (or not considering) the plume rise is discussed for this specific cases. However, in real cases, there would be a mixture of ships in which several parameters relevant to plume rise (like exhaust temperature and momentum flux) are not known. The total emission itself is generally rather uncertain as you also mentioned. So my question is if this approach to take into account vertical distribution would have a relevant practical implication in real cases or the uncertainties are large enough that this is a second order effect?

Title of section 5.5. Better "Comparison of the effects of different input variables".

Line 444. There is a non-necessary parenthesis.