

# Global and regional emissions of 1,2-dichloroethane derived from AGAGE and NOAA observations

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**Comment:** This paper describes measurements of 1,2-dichloroethane (DCE) at sites within the AGAGE and NOAA networks. The measurements are described and used in global and regional modeling to estimate global emissions and regional emissions for NW Europe and California. The global emissions are consistent with a previous study by Hossaini, but the regional emissions are much lower than Hossaini.

- 5 The paper is very clearly written, the results are significant and I recommend publication after addressing some minor comments.

**Reply:** We thank the referee for their helpful input and address their comments (in black) below (in blue).

- 10 **Comment:** Line 366-369 - The authors say that the increasing trend in DCE mole fraction in the archive samples is qualitatively consistent with increasing emissions after 2002 derived by Hossaini, but that it is not possible to provide a top-down estimate of global emissions. Is it possible to be a bit more quantitative, e.g. using scenarios of global emissions in the forward model, starting with the Hossaini emissions, with a specified latitudinal emission distribution consistent with Hossaini et al or the inferred distribution in this study? Couldn't a couple of different scenarios run forward in the 12-box model give some indication of the global emissions? I accept that there are not enough archive observations for the global inversion, but  
15 it still might be possible to be more quantitative.

- Reply:** We agree that a more quantitative analysis was needed here in order to draw meaningful conclusions. Having explored some different possibilities we believe that the posterior emission estimates from the 12-box model using the archive data, while highly uncertain, do in fact contain the most useful information for comparison against the Hossaini emissions. We have added these box model results and an associated discussion to Appendix E of the paper. An important point here is that the  
20 total uncertainty on the posterior emissions is dominated by the systematic component, associated with uncertainty in the lifetime of DCE. Consequently, the total uncertainty on the pre-2017 emissions is very similar to the total uncertainty on the post-2017 emissions (in fact slightly smaller in absolute terms, as the lifetime uncertainty is proportional to the estimated emissions). However, the uncertainty on the emission growth (i.e. the trend in emissions) does not include this systematic term and is much larger for the pre-2017 period.

- 25 Given these uncertainties, our results are consistent with Hossaini sc05 emissions both in terms of magnitude and trend. Our central estimate shows a larger rise in emissions since 2002, starting at a lower value, with close agreement from 2009 onwards. But because the sparse coverage of the archive dataset yields such high uncertainty on the emissions trend derived using the box model, we cannot confidently conclude that the Hossaini emissions underestimate the trend during this period.

- 30 **Comment:** Figs 7, F2 and F4 - I understand that it is difficult to show the prior and posterior emissions with the same linear scale. Have the authors tried a non-linear scale (e.g. such as used in Fig 6 of Manning et al., 2021 listed in the reference list)? It would be nice to be able to see more of the details in both the prior and posterior maps, but this is hard with the linear scale.
- Reply:** We have followed this suggestion and replaced Fig. 7 with an equivalent plot on a logarithmic scale. This allows both the prior and posterior to be shown on the same scale without such heavy saturation of the prior. The original linear Fig 7 plots
- 35 have been combined into Fig. F2, which now shows the prior on two linear scales as well as the posterior on a linear scale. We think it is useful to keep these linear versions in the SI because they better highlight the point sources of DCE identified by the inversion. We have left Fig. F4 on a linear scale as it seems to us to be the better way to compare the different posterior results (i.e. we are most interested in comparing where the significant emission sources are located).
- 40 **Comment:** Line 477 - this is the first mention of the toxicity of DCE, it could be mentioned in the introduction.
- Reply:** We now included a sentence on DCE's toxicity and resulting regulatory controls in the introduction as well. It reads: *“Due to the recognised toxicity of DCE, its use is subject to regulatory control in several countries and regions, including the United States and the European Union (ECHA, 2022; EPA, 2020b, 2024, 2026; Sherwood, 2018; UNEP, 2022).”*
- 45 **Comment:** I do think the paper would benefit from a Conclusions section, even if relatively short, and this is consistent with the Guidelines for authors at [https://www.atmospheric-chemistry-and-physics.net/policies/guidelines\\_for\\_authors.html](https://www.atmospheric-chemistry-and-physics.net/policies/guidelines_for_authors.html). There is an Implications Section, which could stay as it is, but there is no summary of the main results relating them to the objectives, other than in the abstract, and I think this is missed at the end of the paper. The abstract is at maximum length, perhaps that could be shortened and some detail moved to the Conclusions. The paper ends too abruptly without a summary at the end.
- 50 **Reply:** We have now amended the last section to incorporate a summary of our main findings in the form of conclusions. In order to comply with ACP's guidelines, we have renamed this section from 'Implications' to 'Conclusions'. We also removed the final sentence of the abstract as this is better placed in the Conclusions section.