

Atmos. Meas. Tech. Discuss., referee comment RC2  
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## Comment on amt-2021-115

Anonymous Referee #2

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Referee comment on "Phosgene distribution derived from MIPAS ESA v8 data: intercomparisons and trends" by Paolo Pettinari et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-115-RC2>, 2021

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### General Comments

This is a reasonably short paper, presenting phosgene retrievals from the MIPAS ESA version 8 processor. The manuscript presents the global distribution, trends and comparisons with ACE-FTS data. Overall, I would say this is an adequate study, without being particularly ground breaking. AMT seems a good match for publishing this manuscript, although firstly there are a number of points that need to be addressed.

There have been a number of previous studies utilising satellite-derived phosgene (mainly from the ACE-FTS). It isn't clear to me what the motivation is for this study, so the authors should explain in more detail what this study tells us that we didn't already know.

### Specific Comments

After reading this manuscript I am left with a number of questions that aren't addressed.

1. The manuscript glosses over the derivation of the a priori, which comes from the so-called IG2 profiles. For phosgene, these are averages of ACE v3.5/3.6 data. However, as with all satellite datasets, these ACE measurements (and therefore the a priori) are subject to bias. In fact, the ACE retrievals use completely different phosgene spectroscopy, and are likely not consistent with MIPAS spectroscopy. Additionally, using ACE data as the a priori also makes any MIPAS-ACE comparison appear

rather circular.

I would like to see a more in depth discussion of the choice of a priori, and its contribution to the retrieved MIPAS mixing ratios at each level. How does this contribution change over the profile, if at all?

2. How does the new retrieval compare with the previous one in the study of Valeri et al? I understand there are some spectroscopy differences which should be considered here.

3. Figure 9 indicates to me that the retrieval is far from perfect. There is a large offset/bias between OR and FR, which unfortunately casts doubt on the quality of the phosgene retrievals. What causes this? Is it linked to differences in the vertical resolution between OR and FR?

4. There is no detailed discussion of the difference in spectroscopy between MIPAS and ACE. Figure 7 provides a plot of differences for just MIPAS. However, differences can also arise from the use of partition functions, which I suspect are handled differently for the older ACE linelist used in v3.5/3.6.

5. Comparisons of MIPAS trends with ACE-FTS are rather qualitative. For example, there is no attempt to recalculate ACE trends over the same time interval as the MIPAS data. The ACE trend is simply taken from a previous publication.

6. How good is the retrieved MIPAS pressure and temperature and have these been validated? These are crucial in producing good quality phosgene trends.

Technical corrections:

line 31: photolysis

line 85: Fourier

line 335: resemble