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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observed and simulated time evolution of HCl, $ClONO_2$, and HF total column abundances" *by* R. Kohlhepp et al.

Anonymous Referee #1

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Kohlhepp et al. present time series of total column abundances of HCl, ClONO2, and HF derived from FTIR measurements from the NDACC network. These measurements are compared to model simulations from a 2-d model as well as two 3-d chemistry-transport model and two chemistry-climate models. From both measurements and models the trend for the time range 2000-2009 is estimated. The sensitivity of the trend results with respect to fitting function, the time of year chosen and the time series length have been investigated. This is a quite interesting and important study and deserves to be published in ACP. However, before publication I would suggest the following improvements:

General comments:
Unfortunately the authors do not really motivate the intention and importance of their

study. Many questions remain open: What is the intention of this study? Why is the comparison with the models done? Why are the observations alone not sufficient? What is the outcome for the community? Though some are answered somewhere in the paper they are not answered in the important parts of the paper like abstract, introduction or conclusion and some answers are definitely missing.

Should this paper be a scientific one or a technical one? The paper begins with a lot of technical details but then turns into a more scientific paper at the end. What definitely is missing is a discussion about the trend analyses method applied in this study. Previous results of this method or trend analyses of these species (except the Rinsland et al. paper) are not mentioned or discussed at all. How should one judge how reliable the results are if the method description and discussion is missing? I would strongly recommend to include this.

Technical comments:
The paper is structured to complicated. There are too many splits in subsections. I would suggest to split section two into two sections, one for the instruments and one for the model descriptions and then skip all the sub-sub sections x.x.x. The section should also be renamed. "Instrumentation" is more adequate than "Observations" since not the observations are described but the instruments. The model description can be named "Models" as done in section 2.2. or "Model Set-up". Section 4: Include section 4.1 into section 4 and then start numbering with 4.1 and so on instead of 4.1.1. etc.

Paragraphs: They are sometimes very long and sometimes very short paragraphs (consisting of e.g. only one sentence). This should also be improved.

Description of the figures: It would be worth to mention more on what they show in the text (e.g. figures 3-5).

Tables: Tables 2-4 are of technical nature and could be provided as a supplement rather than in the paper itself. This depends however on the intention of the study. Should this be a technical paper or a scientific paper?

The title is very general. Why not already mentioning there that the focus of this study is on the trend and seasonal cycle of the species? Further, the numbering of the author's affiliations is somewhat awkward. After e.g. 5 follows 15 and 17.

Figures in general: From the descriptions in the text it would be more wise to sort the figures by species instead of what is shown (trend or seasonal cycle). As it now Fig. 7 is discussed before Fig. 5 and 6.

Specific comments:
p32087:
- p32087, l6: Are these coordinates the coordinates were measurements are available or have these coordinates been chosen?
- p32087, l8: Try do avoid line breaking of model names.
- p32087, l12: Why has this time period been chosen?
- p32087, second paragraph: Why has this comparison be done? What is the motivation? Is this comparison intended to evaluate the models? Why have these models been chosen?
- p32087, l13: What method is this? Please add a short description.
- p32087, l18: "restricted"? I remember even a phase-out of these species was reached.
- p32087, l24: Why is HF still increasing while the other species are decreasing?

p32088:
- p32088, l12-17: This sentence is quite long and should be (if possible) split into two sentences.

- p32088, l18: It should be added which species are considered as CCly and CFy. For CCly it is done a few lines below, but that sentence should be moved up.
- p32088, l20-24: This sentence is also somewhat too long and should if possible split into two sentences.

p32089:
- p32089, l2: Why "i.e."? Shouldn't it be a clear definition? Are there more species than these three considered as ClOx?
- p32089, l16: Call it by it's name: The Montreal protocol and its amendments.
- p32089, l17: It is not clear what exactly Rinsland et al. did and what data they used in their study. Did they only use measurements? What kind of measurements data did they use? Where these also FTIR measurements from NDACC? Why using model simulations in this study then Rinsland et al. used only measurements? What is the role of the models in both studies?
- p32089, l21: write " by the Montreal protocol and its amendments".
- p32089, general: It is not clear what the intention of this study is. As it is written now it sounds like that for comparing to the Rinsland et al. study measurements would be enough. Why is then the comparison to models performed? Why have these different kind of models been chosen?

p32090:
- p32090, l10: In this chapter rather a technical description of the instruments than a description of the observations is given. I would suggest to rename this section.
- p32090, l12: Please add a short description on what a FTIR spectrometer is, i.e. what does the abbreviation FTIR stand for.

p32092:
- p32092, l13: I would suggest to write "in this study" rather than "here".
- p32092, l14: Tables 2 to 4 consists of a lot of technical details which could be given

in a supplement to the paper rather than in the manuscript itself.

p32091-p32098:
- p32091-32098: Why are the measurements of some of the instruments weather dependent and from others not?

p32098:
- p32098, l22: “assist”? In what sense to assist? What is the purpose of applying model simulations in this study? Why does one needs models to investigate the trend? This can also be done (and maybe even better) by applying measurements.
- p32098, general: Can 2-d and 3-d model fairly compared with each other? Why has these different kinds of models been chosen for this study? What are the advantages and disadvantages of using 2-d and 3-d models for the purpose of this study?

p32099:
- p32099, l2: How? What is the difference in the performance of these models?
- p32099, l5: Why have these time periods chosen?
- p32099, l9: What scenarios have been used? Why have these been chosen? What is the intention?

p32100:
- p32100, l26: What is exactly done when the data is nudged? What is the difference in the results if the simulation is nudged or not-nudged?

p32101:
- p32101, l16-19: How important is it for this study to have tropospheric convection in the model? How does the model assume that the long-lived tracers are well mixed? Is that a result or and assumption? How is it then done?
- p32101, l23: What is the abbreviation MECCA standing for?

p32103:
- p32103, l3 and following paragraphs: The description of these figures is somewhat short.
- p32103, l3: How have the mean relative differences been calculated?
- p32103, l222-25: Is that discussion not also part of this study? At least a short summary of the discussion should be given here. Why is it shown here if this has already be done?

p32104:
- p32104, l3-7: Why? Do you have any explanation for these differences? Why does the 2-d model not get it? Can this already be expected due to the missing dimension of the model? - p23104, l6: The differences in the seasonal cycle concerning stations and latitude regions should be discussed more.
- p23104, l20: Why is the performance of the 2-d and the two CTMs better than the performance of the two CCMs?
- p32104, l22: Reference to Fig. 7 is missing here.

p32105:
- p32105, l20-28: This too descriptive. Some discussions what the reasons for these differences could be are missing.

p32106:
- p32106, l19-20: Why is it ok to just use this approach?
- p32106: It still has not been explained what the “bootstrap” method is.

p32107:
- p32107: put section 4.1 into section 4 and then continue with 4.1.1 as 4.1 and so on.

p32108:
- p32108: The measurement instruments and models are described in detail while the method used for the trend calculation is not described at all. What are the experiences of other scientists using this method for trend calculations? References to other studies are missing.
- p32108, l11-12 and l15-16: Why theses paragraphs consisting of a single sentence?

p32109:
- p32109, l3: Why have these time periods been chosen?

p32110:
- p32110, l6: Seems that this one reason why the model simulations have been taken into account. This should have been mentioned already much earlier.
- p32110, l14: Why has this time period been chosen?
- p32110: Up to now it has not really been explained in how far these instruments are dependent on these factors.

p32112:
- p32112, l5-6: The temporal model output is quite different. How does that affect the results? How does the application of a 2-d model instead of a 3-d model affect the results?
- p32112, l19: “do not show” instead of “not showing”.

p32112-p32113:
- p32112-32113: What are the reason for the differences found between model and measurements? How do the trend derived in this study compare to other studies? Especially, how do they compare to the Rinsland et al. study?

p32114:

- p32114, l3: It has still nowhere been mentioned why this time period has been chosen.
- p32114, l24: Finally an explanation. This really should have been mentioned much earlier!

p32115:
- p32115, l15-18: This in important fact which should have been mentioned already much earlier!

p32117:
- p32117, l8-10: It should have also been written like this already in the introduction.
- p32117, l14-19: What is the reason for this differences? This is despite the discussion not becoming clear.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 32085, 2011.