Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., author comment AC1
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Reply on RC2

Hélène Angot et al.

Author comment on "Temporary pause in the growth of atmospheric ethane and propane in 2015–2018" by Hélène Angot et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-285-AC1, 2021

RC: Reviewer Comment

AC: Authors Comment

RC: In this study, Angot et al. present an analysis of the long-term dataset (2008-2010, 2012-2020) of NMHCs in the arctic site of GEOSummit. Their findings show that the observed increasing trend of ethane and propane from mid 2009 to mid 2014 reversed from 2015-2018 temporarily. They found the decreasing trend likely due to a slowdown in U.S. natural gas production and a decrease in the leaking rate per unit of production. The paper is generally well written and is detailed when presenting data, findings, plausible explanations, and conclusions. This paper contributes to the scientific understanding of the impact of oil and gas emissions on atmospheric trace gases. Moreover, observations in the arctic regions are particularly important for models, which tend to misrepresent polar regions. I recommend this paper for publication after minor revisions.

AC: Thank you for the overall positive feedback. Our responses to the specific comments are provided below.

RC: My biggest concern is how section 3.3 is presented. I found the whole section confusing to read. First, the title says there is no evidence for change in transport from source regions, but the HYSPLIT analysis and the same section mentions there are important interannual changes in the transport from source regions. Also, I was surprised to see HYSPLIT results show that the site was mostly impacted by local/regional air masses. This made me wonder if the decision of a 5-day backward trajectory should be revised and increased in order to capture the transport from source regions as the title suggest.

AC: This section has been revised and the message clarified. First of all, we no longer state that changes in transport do not play a role here, and the title of section 3.3 has been revised accordingly (now: “Changes in transport from source regions”). The key message of this section is that changes in transport must be associated with changes in

emissions to explain the observed trends (see lines 377-385 of the revised manuscript). Changes in emissions are then discussed in section 3.4. We also tried to better link results from the back-trajectory analysis to the background provided in the first paragraph (see comments by reviewer 1). Regarding the duration of the back-trajectories: we believe that using 5-day backward trajectories is appropriate to get an idea of the origin of air masses (e.g., North America vs. Europe or Siberia). Indeed, the results we show here (GEOSummit mostly influenced by transport from North America and Europe) are in agreement with the isobaric 10-day back-trajectory study by Kahl et al. (1997) and the 20-day backward FLEXPART simulations by Hirdman et al. (2010). Considering the computing time required to generate the trajectories and the fact that we obtain results in good agreement with the literature, we believe generating longer trajectories would not bring anything new to the study.

Specific comments

RC: The authors miss to provide references in various sentences. Sometimes it is unclear whether the results presented correspond to this study or a previous one. I marked the most important sentences where references are missing and suggest doing a thorough revision of the paper by the authors to correct this.

AC: Thank you for pointing that out. The manuscript has been carefully revised to include missing references.

RC: Change wording of Lines 429-431 because it is almost copied word by word from the first line in section 3.1.1 in Tzompa-Sosa et al., 2019. Also, I suggest adding Roest and Schade (2017) as a reference.

AC: Done.

RC: Lines 277-279. Reference needed in this sentence.

AC: Done.

RC: Lines 279-282. It is unclear these results correspond to the present study or to a previous one. If If the latter, reference is needed.

AC: This has been clarified in the revised manuscript.

RC: Lines 405-409. There is no reference to the time frame and sampling locations/ares of ATOM observations considered here. A detailed explanation of the data considered is needed.

AC: This has been clarified in the revised manuscript: "This conclusion is further supported by measurements during the aircraft mission ATom *over the Pacific and Atlantic Oceans*.

Using ethane and propane data collected in the Northern Hemisphere (>20°N) remote free troposphere during the four ATom seasonal deployments (*July-August 2016, January-February 2017, September-October 2018, and April-May 2018*), we found …".

Technical corrections

RC: Line 289. Suggest changing "on the year 2015 reversal" to "on the 2015-2018 reversal period".

AC: Done.

RC: Lines 293-294. Suggest adding "(dotted lines)" to this sentence, because the solid line is the predominant line, it tends to be the one the reader focuses on.

AC: Done. Good point, thank you for the suggestion!

References

Hirdman, D., Sodemann, H., Eckhardt, S., Burkhart, J. F., Jefferson, A., Mefford, T., Quinn, P. K., Sharma, S., Ström, J., and Stohl, A.: Source identification of short-lived air pollutants in the Arctic using statistical analysis of measurement data and particle dispersion model output, Atmospheric Chem. Phys., 10, 669–693, https://doi.org/10.5194/acp-10-669-2010, 2010.

Kahl, J. D. W., Martinez, D. A., Kuhns, H., Davidson, C. I., Jaffrezo, J.-L., and Harris, J. M.: Air mass trajectories to Summit, Greenland: A 44-year climatology and some episodic events, J. Geophys. Res. Oceans, 102, 26861–26875, https://doi.org/10.1029/97JC00296, 1997.

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