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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Two decades of in-situ temperature measurements in the upper troposphere and lowermost stratosphere from IAGOS long-term routine observation" *by* Florian Berkes et al.

Anonymous Referee #1

Received and published: 22 July 2017

This study presents a very valuable data set of 18 years of IAGOS temperature measurements in the UTLS region. Trend estimates are derived and compared with ERA-Interim reanalyses. The results are relevant and novel, and the paper is generally well written. However, a few very important aspects of the study are not clear and require clarification. I therefore recommend to accept the paper subject to major revisions.

Major comments:

A) An 18-year time period is short for trend analyses. I still think that the trend calcula-

tions in this study are useful, and I very much appreciate the efforts of the author team to produce such a long high-quality data set, but the time period issue must be discussed in the paper. I would like to see two additional trend calculations: (i) for IAGOS, how do the trends change if you skip the first or last year of your 18-year time series? Such a "sensitivity test" could be interesting to assess the robustness of trend values from 18 years compared to 17 years. The additional values could be included in Fig. 8. (ii) for ERA-Interim, you could compare the trends for the 18-year period with the full ERA-Interim period. Again, this would tell us something about how trends depend on the duration of the time period considered. A brief discussion of this should also be included in the concluding section.

B) I appreciate the efforts in data calibration, but I find it a bit disappointing that IAGOS data is only available until December 2012. Adding some of the recent years would also help with the issue mentioned above. Is there no way how you could include a few more years?

C) Unfortunately, I don't understand the method to distinguish between LMS, TPL and UT. I understand how you determine the pressure of the thermal TP from ERA-Interim; so the TPL is a 30-hPa deep tropopause-following layer, which varies in space and time (is this correct)? Then I am lost what "max(TPL)" and "min(TPL)" mean on p. 5: max and min over what? time or space? and how to you measure max/min? does it refer to pressure? It seems to me as if TPL is tropopause-following, but LMS and UT have fixed horizontal bounds, I find this very confusing.

D) p. 6 lines 13-15: It is very important whether IAGOS data has been assimilated in ERA-Interim, or not. This is not clear from the text. The first sentence says that "aircraft and other" data are assimilated in ERA-Interim, it seems that this does not include IAGOS. The next sentence then says "Note that IAGOS ... observations are not assimilated in any other NWP model ..." which sounds as if IAGOS is assimilated only in ERA-Interim, but I assume it is not assimilated by any reanalysis system. Then the "other" would be very misleading. Please clarify.

Minor comments:

1) p. 1 line 21: "temperature bias between observation and model data" sounds strange to me; do you mean the bias of the observations or the bias of the "model data" (note that reanalyses are not really just model data) or do you mean that both have a bias but that the biases differ?

2) p. 1 line 28: delete ";" after reference to Seidel et al., 2016

3) p. 2 line 7: "suffers" –> "suffer"

4) p. 2 line 15: first introduce abbreviation for LMS

5) p. 2 line 29: "Petersen et al., 2015" should read "Petersen, 2016" (single author, and paper appeared one year later)

6) p. 2 line 30: "including" is strange here, do you mean "assimilating"?

7) p. 2 line 31: "Drue" –> "Drüe"

8) p. 3 line 12: not clear what is meant by "both types of profile measurements"

9) p. 4 line 22: most readers are not familiar with the AIRTOSS-ICE campaign. What "research aircraft" has been used, and what type of temperature sensor?

10) p. 4 line 31: I understand "air temperature" but what is "total air temperature"?

11) p. 5 line 3: "maintained" sounds strange, maybe "made"?

12) p. 5 line 4: I find this a strange remark, it sounds as if the DWD model was used as a reference to test the accuracy of the observations ... maybe delete this sentence.

13) p. 5 line 21 and in other places: use "p" as symbol for pressure, not "P"

14) p. 5 line 30: it is fine that you use here the thermal tropopause, but the long list of chemical, ... tropopauses does not help the reader and is not relevant here. I suggest to delete the last 3.5 lines on this page.

15) p. 6 line 2: of course the Coriolis parameter is defined near the equator, but it is zero! Therefore PV goes to zero and the 2-pvu surface is not defined.

16) p. 6 line 19: Reichler et al. 2003 is not in the list of references

17) p. 6 line 21: this statement is very strange, the time resolution of ERA-Interim is 6 hours, so it cannot be reduced to 1 minute. Please explain how you interpolated 1-min values from ERA-Interim, by linear interpolation in time?

18) p. 8 line 3: "it is assumed ...": do you have a reference for this?

19) p. 8 line 6: "in this region" appears twice in the same sentence

20) p. 8 line 12: what do you mean by "local tropopause", maybe delete "local"?

21) p. 8 line 30: "where" –> "when"

22) p. 9 line 21: "then" –> "than"

23) p. 9 line 26: "annual averages of the monthly deviation": sounds complicated to me and it should be the same as just "annual deviation"?

24) p. 10 line 16: references should be in chronological order

25) p. 10 line 19: I don't understand this sentence: what aircraft measurements are you using here? IAGOS or AMDAR, and what is assumed to be similar?

26) p. 11 line 20: what is meant by "use IAGOS observations as anchor point"? Do you suggest to calibrate AMDAR data with IAGOS? And why do you not suggest that IAGOS observations should be assimilated in, e.g., ERA-5?

27) p. 15 line 13: I did not find a reference to Kuo et al. in the text

28) p. 16 line 9: volume and page numbers are missing

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