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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 #2

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This paper analyzes passenger-aircraft IAGOS temperature observations in the UTLS for the period 1995-2012, focusing on long-term trends. Comparisons with the ERA-Interim reanalysis data are also made, and change points in ERA-Interim are identified and discussed. Very careful data analysis has been made, and the discussion on ERA-Interim is very interesting. I think the manuscript can be published in ACP after considering the following comments.

1. As the authors explain in Introduction, the aircraft AMDAR data are known to have warm biases. I would like the authors to add some more explanations why the IAGOS

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data are considered to be without such biases. Specifically, please consider (1) to add a similar figure to Figure 1 for the automated temperature instrument and (2) to add some technical descriptions for it in the last paragraph of Section 2.2. Is the temperature sensor material same? Is the instrument housing same? Is the correction method for adiabatic compression same? Are there other data processing procedures for both?

2. Please also describe the instruments for positions, pressure, and aircraft and wind speed/direction? The pressure measurement uncertainty may be important for analyzing temperature trends because there are temperature gradients in the UTLS so that pressure errors would result in slightly different temperature values. Aircraft/wind speed/direction might be important for the correction of adiabatic compression (or not?).

3. I have some questions related to the data analysis methods. (Please note that I am not asking the authors to re-do the data analysis.)

3-1. Are there any sampling biases/trends in vertical within each layer? Because there are temperature gradients in the UTLS, if the flight level would have changed systematically over the period, we would get apparent temperature trends.

3-2. Similarly, are there any sampling trends in horizontal? My understanding is that the pilots are trying to avoid turbulences i.e., the regions with strong (horizontal) shears. If the westerly jets have some trends in their locations (cf. Davis and Rosenlof, 2012; Williams, 2017), the aircraft paths may have some systematic changes that could give apparent temperature trends.

3-3. For comparison with ERA-Interim, another way could be to pick up 6 hourly data (i.e., at the times when the reanalysis data are provided) from the IAGOS data. Linear interpolations to 1 min from 6 hourly data may produce unnecessary spreads in the difference of the two data.

4. Page 7, lines 23-24 and Figure 7. The warm phase during 2006-2008 might be

related to a volcanic eruption (the Soufrière Hills at 16N on 20 May 2006). See Vernier et al. (2011).

References:

Sean M. Davis, S. M., K. H. Rosenlof (2012), A Multidiagnostic Intercomparison of Tropical-Width Time Series Using Reanalyses and Satellite Observations, J. Clim., 25, 1061-1078, https://doi.org/10.1175/JCLI-D-11-00127.1.

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Williams, P.D., Increased light, moderate, and severe clear-air turbulence in response to climate change, Adv. Atmos. Sci. (2017) 34: 576. https://doi.org/10.1007/s00376-017-6268-2.

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