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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ice-supersaturated air masses in the northern mid-latitudes from regular in-situ observations by passenger aircraft: vertical distribution, seasonality and tropospheric fingerprint" *by* Andreas Petzold et al.

Anonymous Referee #1

Received and published: 25 October 2019

Review of "Ice-supersaturated air masses in the northern mid-latitudes from regular in-situ observations by passenger aircraft: vertical distribution, seasonality and tropospheric fingerprint" by Andreas Petzold et al.

This manuscript uses a humidity data set from commercial aircraft to analyze humidity and ice supersaturated regions in the upper troposphere. The manuscript is quite good, with careful and comprehensive analysis of the uncertainties and corrections in the data set. However, some of the analysis doesn't quite make sense, especially the discussion of thin cloud occurrence and correspondence of sign with NAO at the

end of the manuscript. That analysis needs significant modification as I outline in the specific comments below. Except for this and minor comments, this manuscript should be publishable in ACP with appropriate revisions.

Page 2, Line 67: embedded

Page 3, L78: close to the tropopause. Which tropopause? Thermal is specified in the next sentence.

Page 3, L82: again, which tropopause definition?

Page 4, L127: what is the horizontal resolution?

Page 4, L141: what does 30 - 65 hours mean? In each grid box? How many flights per grid box per season?

Page 5, L166: what is the vertical and horizontal resolution of ERAI in the UTLS?

Page 5, L178: wouldn't it be better to have PDFs in each season since it seems there are a lot of data points. More statistics than the mean it seems are available.

Page 8, L259: fig 4. The RHice line looks solid to me as well.

Page 8, L270: was Research flight data selected for the same geographic regions as MOZAIC data shown in figure 5?

Page 10, L308: might be better to state that specific humidity is lower in summer over E. N. America in the UT.

Page 11, L332: the vote part of our study focuses on the vertical....

Page 11, L353: Table 1 just restates the right column from Figure 8 correct? maybe it is not necessary? Can you put the standard deviations from Figure 2 on the plot in figure 8?

Page 13, L396: not exactly clear to me how this is different than the relevant panel in figure 8. Just adding the dynamic tropopause?

Page 14, L413: this bothers me a bit. The thermal tropopause is a robust barrier in the tropics, but here the average RH is 80% or less at the tropopause, so it does not need to be a robust barrier. Also motion is not purely vertical here., but more horizontal and isentropic. Please explain.

Page 14, L435: where does the ozone come from? Also MOZAIC I assume? Please specify. What is the minimum detectable concentration? And can you provide a validation reference and maybe a sentence or two.

Page 15, L449: please define 'their' with a reference. Assume it is the same as previous paragraph, but please be specific.

Page 16, L480: why is the thermal tropopause a transport barrier and the dynamical tropopause in extratropics not a barrier? I'm not sure I understand your logic here,

Page 18, L531: extra space in years

Page 18, L545: I don't think the casual analysis of the frequency of cirrus is helpful. Cirrus frequency is a function of instrument as you note. And cirrus layers need not be supersaturated, so there need be no link here.

Page 18, L548: I do not think you can argue that just because cirrus and ISSRs have about the same frequency (But ISSR is Lower from the best and most sensitive sensor), that most cirrus occur in ISSRs. You need to show physical and temporal coincidence.

Page 21, L607: I'm not sure I follow this here. If there is a non zero correlation then there is a correspondence of signs is there not? Not familiar with the method.

Page 21, L613: why does the same sign in a bit over half the cases mean statistical significance? Isn't 50% totally random?

Page 21, L615: How does a correspondence of anomalies correlate with the storm track?

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