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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cold trap dehydration in the Tropical Tropopause Layer characterized by SOWER chilled-mirror hygrometer network data in the Tropical Pacific" *by* F. Hasebe et al.

Anonymous Referee #1

Received and published: 13 November 2012

The aim of this study is to investigate dehydration on horizontal transport in the TTL. This subject is relevant to the scope of ACP. As the understanding of dehydration critically depends on the accuracy of water and temperature data, much effort is made to explain and evaluate the uncertainties and correct for known effects like the response time. Water vapour sonde data from the tropical Pacific area from over a decade are analyzed. This is both a unique data set and also a thorough analysis which should be published in ACP after some revisions listed below.

Major issues

1. The comparison between the sonde temperatures and winds with ECMWF is interesting and important, however the question is whether the sonde data and ECMWF are independent needs to be answered. Are these wind and temperature observations used in the ECMWF analysis?

2. The Trajectory analysis is based on different versions of the ECMWF analyses. This may introduce avoidable differences that would not be there when using the re-analysis ERA-Interim data that is available for the full time span. If the time and effort is not too large, it would be nice to if the results change with taking this updated meteorological data set. This would be interesting since Schoeberl et al (ACP, 2012) report differences between different meteorological analyses.

3. The authors report a very large RH_{ICE} value at temperatures near 180 K within cirrus (page 25848, line 17ff and abstract line 12f) and comment that they are much higher then reported by Krämer et al. (2009). However, this is not the case, since at temperatures below about 186 K the RH_{ICE} climatology also reports values above the homogeneous freezing threshold in a few cases (compare fig. 7 of Krämer et al.). It should rather be stated that the observations are in accordance with Krämer et al. The request of further needed observational evidence in the abstract should be left out (line 12f). At least the authors have convinced this reviewer about the credibility of their data.

Minor Points

figs 8 and 12: Ozone is shown in these figures but there is little deduced from these data.

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page 25839 line3 / fig.1: Mention the source of the wind and temperature data (ECMWF...)

25840-42: The response times of the different experiments are discussed, e.g. for SW for temperatures of -30 and -60 degrees C. However, it would be also interesting to mention the response time for lower temperatures down to -90 degrees that are relevant for the dehydration process.

25844.20: There may be bifurcations and saddle points in the calculation of advection, however, I don't see those in the cited figure.

25844.27: Mention the number of trajectories per bundle.

25845.4/ fig. 7: It is not clear, how the ECMWF SMR is calculated here. Is it calculated from ECMWF H2O and temperature or from observed H2O and ECMWF temperature?

25845.11: Some explanation/reference about what geostationary satellites should be given here.

25845.14/ figures 7&11: The purple colour is hardly to distinguish from blue and black. If I read the color scale correctly it is from about -7 to -14 K. I don't think that this is a special range. So either the sentence needs to be rephrased or the color scale needs to be adjusted.

25847.1: "This is due. . . " It is not clear what is meant by this statement.

25847.28, figures 7, 10 and 11: To understand this statement it would be good to include longitude (and latitude) values on the axes of the plots.

25849.14ff: Does that mean that the trajectories that encounter temperatures $T < T_{bb}+12\,K$ are excluded from this plot?

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Interactive Comment

25849.27: Mention “about 60%” as the homogeneous nucleation threshold is temperature dependent

25851.12: change to “. . . stratospheric value of response time adopted. . . ”

Typographical corrections

25835.2 & 25838.20: balloon-borne

25844.1: There are some...

25850.4: leads

25852.9: do not correspond

figures 3, 8 and 12: type °C instead of C as temperature unit

figure 8b: replace "/" by "," to avoid confusion as this is no division

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 25833, 2012.