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Atmospheric Measurement Techniques Discussions

Interactive comment on "Characteristics of tropopause parameters as observed with GPS radio occultation" *by* T. Rieckh et al.

Anonymous Referee #1

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General comments

This paper presents a study of lapse rate tropopause characteristics (height and temperature) based on GPS radio occultation (RO) data from CHAMP, GRACE, and FORMOSAT-3/COSMIC for the time interval 2001-2012.

The study covers the interpretation of single tropopause measurements, the annual cycle, and inter-annual variability of tropopause height and temperature in the RO dataset. The authors describe several relationships between tropopause characteristics and natural variability as ENSO, QBO, and sudden stratospheric warming events within the used time period.

Generally the paper is well structured and written and gives a nice overview about RO

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tropopause measurements and whose interpretation, although most of the results are not new and were already described in former publications (see references).

Some questions arise with respect to the tropopause algorithm that should be considered before publication. For details please see below.

The paper gives a good introduction into the RO dataset as well as the interpretation of lapse rate tropopause features and should be published with minor revision.

Detailed comments and suggestions in the order of occurrence:

Page 4696, lines 14-15 After my knowledge the first RO-tropopause study was from Nishida et al. (2000) using GPS/MET data.

Nishida et al., 2000, Seasonal and longitudinal variations in the tropical tropopause observed with the GPS occultation technique (GPS/MET), J. Meteorol. Soc. Japan, 78, 691-700.

Page 4698, lines 1-10 The authors should describe on which vertical grid the temperature profiles are interpolated.

Page 4698, Tropopause algorithm Here the authors must give more details. The WMO (lapse rate) tropopause definition is very simple, but the application to high vertical resolution datasets (as RO) is not straightforward.

How are outliers handled within the 2 km interval? A discussion of these features and an according tropopause algorithm can be found in Birner (2006) for radiosonde data that could be also applied for RO data.

Birner, T., 2006, Fine-scale structure of the extratropical tropopause region, J. Geophys. Res., 111, D04104, doi:10.1029/2005JD006301.

How is the lower bound of the tropopause height defined exactly? Son et al. (2011) e.g., define this altitude also latitude dependent using the relation TPH_min=7.5+2.5cos(2*latitude).

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Beside the definition of the upper and lower bound on the basis of heights I would recommend a definition by pressure, e.g. searching a tropopause between 500 and 70 hPa.

Another detail in lapse rate tropopause determination is the vertical resolution of the used dataset. Supposing a 100 m vertical grid and applying the WMO definition gives the tropopause height at the lowest level where the condition is fulfilled, that means only on the according sampling point. But the lapse rate tropopause could be also between this level and the level below (see also Birner, 2006 or the tropopause algorithm from Reichler et al., 2003). Both tropopause algorithms consider this and define the tropopause level at the intersection between the temperature profile from above and below the possible tropopause height(by consideration of a useful number of data points).

Reichler, T., et al., 2003, Determination of tropopause height from gridded data, Geophys. Res. Lett., 30, doi:10.1029/2003GL018240.

Why did the authors only search for three tropopauses? The so-called “second” tropopause in this context should be the last tropopause in the according height range. This is also the general definition in the literature.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 4693, 2014.