

Abstract

Please use abbreviations in case they are introduced!

Page 1 / Line 12: ~~the~~ polar stratospheric clouds → PSCs

Page 1 / Line 14: Polar stratospheric ice clouds → ice PSCs

Page 1 / Line 17: decrease of ~~the~~ water vapor

1 Introduction

Page 2 / Line 51: Please add a citation for the increase in radiative cooling

Page 2 / Line 52: Rex et al. (2006) found an increase in the PSC volume trend

Page 2 / Line 54: (see also Dameris et al., 2014)

Page 2 / Line 54: Please reformulate the sentence. For example: However, the relationship between increasing greenhouse gas concentrations and increasing PSC occurrences remains a controversial issue.

Page 2 / Line 57: ~~Overall~~ The result of a climate model study ...

Page 2 / Line 58: would lead to an increase in the total ozone column ...

Please check carefully the use of articles in the entire manuscript! I will not comment on this further.

Page 4 / Line 108: Solomon et al. (2010)

Page 4 / Line 109: Hegglin et al. (2014)

Page 4 / Line 112: Recently, Urban et al. (2014) reported ...

2.1.1 Water vapour and PSC measurements

You introduced already satellite names, PSCs etc.

3 Water vapour distribution

Page 9 / Line 1: MLS observations calculated over winters 2004 – 2014. In Figure 2, the period 2005 – 2014 is mentioned. Please check!

4 The origin and long term variability of water vapour

Page 10 / Line 327: values for the ~~years~~ period 1990 – 2014

Page 10 / Line 329: positive trends

Caption Figure 5: (b-d) Same as panel (a), but levels 10, 56 and 100 hPa. -> Sentence not necessary anymore since you replaced the panels labelling by levels.

Page 10 / Line 334: "At 10 hPa the increase stopped by 2014 but at 1 hPa it did not stop until the end of the time series." -> I am confused because your time series ends 2014!?

Page 10 / Line 336: lower and upper stratosphere, which suggests that ...

Page 10 / Line 343: QBO index (QBO, equatorial winds at 50 hPa)

Table 2: The meaning and units of the numbers are missing. I guess the first line are water vapour values in ppm. I don't understand the meaning of the second and third line.

6 Case study: Winter 2009/2010

Page 13 / Line 425: Temperatures were / The temperature was

Page 13 / Line 426: In the lower stratosphere temperatures ~~dropped~~ below 195 K

Page 14 / Line 453 – 458 and Figure 9: On 17 Jan, areas with low water vapor coincide with areas where temperatures are coldest. The water vapor is frozen and with proceeding time, ice particles grow and sediment. The sedimentation of ice particles results in a redistribution of water vapour. 20 – 23 Jan: You can nicely see in your FinROSE simulation how the dehydrated air masses (no ice present) move around the pole. Here, minimum water vapour values do not coincide with coldest temperatures!

Figure 9, CALIPSO – FinROSE comparison: I am still not convinced if this comparison is fair. CALIPSO sees massive ice PSCs on e.g. 17 Jan and your plot looks like only sparse PSC coverage has been observed by CALIPSO. This is of course due to the fact that CALIPSO measures only single orbits. However, you may find a way to improve this comparison.

Page 14 / Line 476 + Page 15 / Line 500 and Line 504: ICE PSC -> ice PSC

7 Conclusions

Page 14 / Line 481: "The full chemistry in FinROSE can add the water vapour to the ECMWF ERA-Interim water vapour." -> I don't understand the meaning of this sentence.

Page 15 / Line 500: "10 out of 25 simulated winters" -> I thought that 12 out of 25 winters show ice PSCs (see page 12, line 386)

Page 15, Line 511: reported by Khaykin et al. (2013)

Acknowledgements

Page 15 / Line 517: Sodankylä

I would highly recommend proofreading the whole article by a native speaker before final publication.