

Interactive comment on “Radiosondes stratospheric temperatures from 1957 to 2008 at Dumont d’Urville (Antarctica): trends and link with Polar Stratospheric Clouds” by C. David et al.

Anonymous Referee #1

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Balloon sondes measuring temperature well into the stratosphere are crucial to our understanding of processes and changes in the atmosphere. At high latitudes such measurements are scarce, and the presented dataset is therefore an important contribution to atmospheric science.

Outside of the core region of the Antarctic vortex, where ozone depletion is to some extent controlled by PSC occurrence and thus occurrence of low temperature events, long-term changes of temperature and low temperature events are important to monitor. The presented manuscript focuses on this issue and is therefore suited for publication in ACP after some improvements suggested below.

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General comments

1. The importance of such datasets implies a rigorous analysis. Many tools exist for time series analysis, for time series with data gaps, for time series with break points or structural breaks. In the present manuscript a multiple regression analysis is used in section 4, but other parts, especially section 2, lack a sound statistical analysis or it is not presented adequately. E.g. claims such as “the variability seems lower in spring than in winter” (p25692 line 7/8) are unnecessary and need to be revised. The abstract and section 2 are dominated by the 2.3 K/decade cooling. However, a sound statistical derivation of this trend is missing, and the claim that this is “consistent with other Antarctic studies” is not backed up with references. In fact, studies that are cited elsewhere in the manuscript show smaller trends, e.g. Thompson and Solomon (2005) identified trends between -0.45 and -0.7 K/decade for this latitude, Randel et al. (2009) show approx -0.5 K/decade (their Fig. 6). Because of the instrumentation change and the large gap of 16 years I recommend to remove this statement from the abstract, and to rewrite section 2 (see also comment to Fig. 2 below).

2. An important part of the analysis with respect to PSC occurrence is the lidar data in Fig. 9. I am not entirely sure if even Fig. 9c is derived purely from the lidar data. If it is, the entire section 5.2, covering 3 pages, is dedicated only to the lidar data. While this is an interesting analysis, it doesn't really fit under the title of the paper nor is it mentioned in the abstract. I suggest to clarify this where appropriate. If Fig. 9c is not derived from the radiosonde data, the occurrence of $T < T_{nat}$ should be shown similarly for the entire period 1979-2008.

3. The maximum height reached by balloons is influenced by several factors including temperature. In very cold temperatures the balloon will burst quickly. This raises the question if your analysis of very cold temperature events for PSCs could be biased by this effect: You might “miss” such events because the balloons always burst at too low altitudes.

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Specific comments

1. 25688-1 Please mention latitude (and maybe location: at the coast of Antarctica) of Dumont d'Urville
2. 25688-5 "consistent with other Antarctic studies", see general comment above
3. 25688-9 at what altitude are these trends?
4. 25689-14 It will also depend on the speed and manner of ozone depletion
5. 25690-14 Please provide references for this claim. In contrast, e.g., Autin et al. (2009) state on polar temperature trends "The models in general agree with trends derived from radiosondes [Haimberger et al., 2008; Randel et al., 2009], although both models and observations cover a wide possible range".
6. 25691-26 "median altitude of the PSC formation range", provide reference
7. 25692-6 Please provide the same precision as above, i.e. 1.0 K/decade. Why "roughly"? Please provide information on how you found this trend and the result to an adequate precision preferably incl an error estimation.
8. 25692-7 "seems lower" please provide quantitative information or remove statement
9. 25693-21 I don't think this is relevant for the discussion here.
10. 25693-26 I can identify the bimodal distribution only for the to level.
11. 25693-26 The Parker reference does not mention such cold biases. In addition, I'm not sure what you mean by "cold bias" - if you subtract them the other way round (it is not given which one would be the reference instrument since they are the same type of instrument) you obtain a warm bias. The bimodal distribution could e.g. be explained by high-frequency gravity waves with periods less than a few hours.
12. 25698-2,3 What do you mean by this? Please clarify.
13. 25698-17,18,19 This does not explain why the trend is opposite even if you con-
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sider only the measurements inside the vortex as mentioned at 25697-5.

14. 25699-3,4 The fact that the cooling of the stratosphere starts at higher altitudes is not related to the solar zenith angle height dependence. I recommend to remove this sentence.
15. 25702-9 Drdla and Schoberl (2003) is missing in the reference list
16. 25703-15 "false PSC detections are highly unlikely" - but at 25701-27 you say that the number of PSCs is overestimated during certain periods. Please clarify.
17. Fig 2. From my understanding you computed the average for both periods and are showing the difference between those two mean values at all heights. Since one of those numbers presents a very long time period (1979-2008) it is very difficult to interpret this Figure or compare it to other studies. A further complicating issue is the difference in instrumentation between those periods as also pointed out by the Interactive comment by S. Radanovics. In conclusion, I recommend to remove this Figure.

Technical corrections

The use of the English grammar is often not correct, especially the use of the plural form (e.g. in PSC / PSCs) as well as the use of definite and indefinite article. Please check and correct where necessary.

At least for two references the title and publication year were wrong, I therefore ask the authors to thoroughly check all references.

1. 25687 Title: "Radiosonde stratospheric temperatures ..." (remove s on radiosondes)
2. 25689-3 Please avoid using " " and range (0.3 – 0.5) for one quantity
3. 25690-25,26,27,28 Spelling: remove "s" on "details", "PSCs", "years", "temperatures", "characteristics"

4. 25691-1 Spelling: it should be "PSCs"
5. 25690-4 Spelling: "Cloud"
6. 25691-9 please correct grammar in sentence
7. 25691-11 please correct grammar in sentence
8. 25691-21 remove "old"
9. 5691-26 correct grammar: "represents the lower stratosphere well".
10. 25692-1 "overview" instead of "global view"
11. 25692-4 remove "global"
12. 25693-1 What does the abbreviation PTU stand for?
13. 25692-5 How was this trend deduced? Linear fitting?
14. 25704-27 "... in 1957", please add "with a gap of 16 years".
15. 25704-1 "prior to 1989"
16. 25711-20 Title wrong, "Recent Stratospheric Climate Trends as Evidenced in Radiosonde Data: Global Structure and Tropospheric Linkages." and formatting corrupt
17. 25709-20 Title (should be "TOWARDS A CONSISTENT GLOBAL CLIMATOLOGICAL RAWINSONDE DATA-BASE) and year (should be 1995) wrong.
18. 25711-22 Check indentation
19. Fig. 3 Please increase the size of the labels
20. Fig. 8 b) It is not quite clear what the unit of the y-axis is for both quantities shown

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