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Comment

***Interactive comment on* “Mid-winter lower stratosphere temperatures in the Antarctic vortex: comparison between observations and ECMWF operational model.” by M. C. Parrondo et al.**

Anonymous Referee #2

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General comments

The article presents temperature comparisons between radiosounding profiles obtained at Belgrano (Antarctica) during the QUOBI campaign (2003) and operational analyses issued by ECMWF and NCEP. The comparisons shows that ECMWF stratospheric temperatures differ by a few Kelvin from observations, and in particular exhibit a -3K cold bias between 30 and 20 hPa, which leads to an overestimation of the PSC area in ECMWF analyses. The article thus gives interesting results and deserves a publication in ACP.

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However, similar results than those obtained in this study have already been reported in Gobiet et al. (2005), who used radio-occultation temperature observations. The conclusions reached by Parrondo et al. are therefore not completely new, but provide a confirmation of this previous work with a different dataset. A reference to this previous paper and its conclusions should be made in the introduction.

Finally, the article needs significant improvements before being published. In particular, several technical details (see below) have to be carefully addressed and checked.

Specific comments

- p7698, l25/p7699, l 1: Could you be more specific here, and for instance give some values for these differences in the Southern Hemisphere (SH) polar area ?
- p7699, paragraph that begins at line 2: similarly, what is a good agreement (less than 1-K differences ?), and a clear bias ?
- p7699, l11-14: this paragraph may better follow the first paragraph of the introduction.
- last sentence of the introduction: Rather than an enumeration, the reader would appreciate a presentation of the article plan.
- p7700, l9: a 0.3°C (C is lacking).
- p7700, l12: a reference to ECMWF model cy25r4 is made. However, the operational model from April 29, 2003 onwards was cy26r1, and then cy26r3 from October 7 on. Can the authors carefully checked that point ? Is is furthermore said that the spatial resolution is 1.125° x 1.125°. However, ECMWF analyses

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can be retrieved with a $0.5^\circ \times 0.5^\circ$ resolution. Did the authors use any spatial interpolation in order to compare ECMWF fields with the Belgrano radiosoundings? The kind of interpolation used should be stated here.

- p7700, I14-15: I am not sure to understand this sentence very well. Did the authors extract from the radiosounding profiles the temperature records that are the closest to the ECMWF levels, so that no vertical interpolation is performed (which, if true, should be stressed)? Furthermore, which ECMWF levels are used (“full” model levels or pressure levels)?
- p7700, I16-20: same question for the horizontal/vertical interpolation in NCEP data.
- p7701, I3: extrema rather than “singular points”.
- Section 4: p7701, I14, the authors claim that the lowest stratospheric temperatures are found at ~ 30 -25 hPa. However, if I look at Figure 6, I am inclined to think that the real lowest temperatures are found much below in the stratosphere. I strongly suggest that the authors produce an additional figure with the averaged monthly temperature profiles at Belgrano during QUOBI (and perhaps the same for the analyses), which can be very helpful to clarify this point, and which could also emphasize the unrealistic low ECMWF temperatures at 30 hPa.
- p7701, I13: What are the stations used, do they cover the whole Antarctica, how many profiles are used?
- p7701, I23: NCEP temperatures are warmer than the radiosondes by more than 1°C at 50 hPa and 200 hPa.
- p7703, I22: What are the amplitudes of the differences reported by Knudsen et al. (2003)? Do they compare well with the values reported here?

- p7704, l2: It seems to me that the results of Parrondo et al. confirm very well with those of Gobiet et al. This should be more clearly stated.
- References: Gobiet et al's reference include some mistakes: it should read doi:10.1029/2005GL022617
- Figure 2: The levels reported in this figure (namely 31.9 hPa, and 25.7 hPa) are not the ECMWF “full”-model levels on which the prognostic variables (like T) are computed, but rather the “half”-model levels, i.e. the interface between the levels. In contrast, in Figure 3, there is no dot on the ECMWF curve at 31.9 hPa or 25.7 hPa. In figure 3, the dots are at the right positions (23.3 hPa, 28.9 hPa, and 35.8 hPa). There is thus a clear need to clarify on which levels are the temperature extracted from the radiosoundings: on the “full” levels as it should be (in this case Figure 2 has to be modified accordingly), or on the “half”-levels, wrongly, in which case all the data analysis has to be reprocessed ?
- Figure 2 legend: include “2003” before “winter”, “at Belgrano” after “radiosondes”. “In the lower stratosphere”, rather than “at the lower...”. Correct the ECMWF levels if needed.
- Figure 3: the x-axis unit is lacking. The legend should state that the curves have been obtained with radiosoundings performed in several Antarctic stations. It should also state the signification of the error bars (1 standard deviation ? 2 ?...)
- Figure 4: The legend should state whether the figure has been produced with only Belgrano radiosoundings, or with other Antarctic stations.
- Figure 6: The legend should read: “Left: Areas...ACMWF analysis (top) and... Right:...”
- Figure 7: the x-axis legend should read “Day number in 2003”.

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Technical comments

English is not the referee's mother tongue and I strongly suggest that the authors contact an english-speaking colleague to improve the writing of the article. I nevertheless try to suggest some modifications below:

- p7697, I4: “operational analyses” rather than “data”
- I5: delete “at layers peaking”
- The last sentence of the abstract should be rephrased. The authors present the results AND consider etc. By the way, they not only consider but show that most of the temperature discrepancies are due to ECMWF.
- p7698, I15: “analyses” rather than “analysis”
- p7701, I16: a C is lacking after “-85”. I would rephrased as: “...temperatures below -85°C, but not at higher temperatures”.
- p7701, I18: “...that takes into account...”
- I19: “In two layers centered...”
- I20: “while in a layer inbetween...”
- I21: a y is lacking in “slightly”.
- I27: “with an almost identical...”
- p7702, I19: “the lowest line being at...”
- p7703, I16: “The most significant effect is a downward shift of the altitude associated with the largest PSC area from...”

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- p7704, l27: “hPa”, rather than “hPA”.

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