

Interactive comment on “On the accuracy of analysed low temperatures in the stratosphere” by B. M. Knudsen

Anonymous Referee #2

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General comments

The article "On the accuracy of analysed low temperatures in the stratosphere" by B. M. Knudsen is devoted to the comparison between temperature measurements collected during radiosoundings with temperature fields produced by the ECMWF (re-)analyses. A special emphasis is put toward temperatures close to the thresholds associated with the formation of polar stratospheric clouds (either NAT or ice clouds). This is a very detailed study, which for instance explore the horizontal and vertical distribution of the model biases. In particular, a very interesting point (which deserves to be stated in the conclusion) is the temporal evolution of the ECMWF temperature biases (roughly from a warm bias in 1996/1997 to a cold bias in 2002/2003).

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A problem with these temperature comparisons (which is stated in the article) is the fact that the radiosounding temperatures are assimilated into the ECMWF model, so that the model is not independent from the observations. However, B. M. Knudsen also makes comparisons with first-guess fields, which seems appropriate.

I therefore recommend the publication of the article and my specific comments below are aimed at clarifying some minor issues.

Specific comments

1. Can the hypotheses used to compute T_{NAT} and T_{ICE} be clearly specified (i.e. which vapor/nitric acid content) ? and consequently what are the T_{NAT} and T_{ICE} values on the various levels ?
2. paragraph 2.2: It may be worth to give the radiosonde vertical resolution here.
3. p4414, l26-27: "...waves with wavelength longer than 7 km in the vertical, but such strong waves would usually be accompanied by waves of shorter wavelength". This statement is not at all obvious to me. Do you know any reference reporting on that ? Furthermore, do you really mean "strong" or long or both ?
4. p4415, l16: "It is evident that the observed distribution has much larger wings than the Gaussian distribution". I wonder whether this is really true. It is clear from Fig. 1 that there are some "outliers", but only a very few (<15 on a very large sample). I recommend to make a chi-2 test here to clearly test whether the observed distributions differ from the assumed Gaussian distribution.
5. p4416, l3: Could you insert here (i.e. before commenting row 3 of Table 1) the paragraph stating why you also make comparisons with the first-guess fields (which is located on p4417, l3) ?

6. p4416, I20 and following: could you state the typical temperature ranges in the article that are cited ? This may help the reader to compare more easily with the figures given in the article.
7. p4418, I11: Could you recall the figure obtained in Pullen and Jones (1997) ?
8. p4419, I13 and following: It is stated that the potential PSC enhancement by mountain waves is found to be much less in this study than in Doernbrack and Leutbecher (2001), who were interested in the Scandinavian region. This is a very important point, which is by the way in agreement with the results of Hertzog et al. ("In situ observations of gravity waves and comparisons with numerical simulations during the SOLVE/THESEO 2000 campaign", JGR, 107(D20), 8292, doi:10.1029/2001JD001025, 2002) It seems to me that the most likely reason for this discrepancy is due to the fact that Norway is a very mountainous region as compared with other parts of northern high latitudes, so that Doernbrack and Leutbecher's study might be biased toward strong mountain-wave activity.
9. Conclusion: as stated in the general-comment section, it may be worth to recall here the results on the temporal evolution of the ECMWF temperature biases.
10. Table 1: Is it possible to duplicate the most important lines (no more than 1 or 2 lines, including maybe the first-guess comparisons) for the other winters studied in the article ? This may help the reader to have a synthetic view of the model temporal evolution.
11. Figure 1: Could you state in the caption with which years are these distributions associated ?
12. Figure 5: I am not sure to understand the caption well. Are filled symbols associated with "temperatures below T_NAT" ? What is in this case the difference with the first half-filled symbols ? Furthermore, I do not understand why the

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blue half-filled symbols at $T=T_{ICE}+2.5$ K for winter 02/03 are located above the blue curve: I had understand that they should represent the mean correction for $T<T_{ICE}+2.5$ K (this is also the case with the red symbols). What have I missed ?

Technical corrections

1. p4413, l16: replace "cause" by "because".
2. p4416, l4: add "above 26 hPa" at the end of the sentence.
3. p4416, l7: add "to" between "due" and "a".
4. p4421, l5: I guess you mean "6-12 hourly forecasts".

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 4411, 2003.

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