Atmos. Chem. Phys. Discuss., 8, S2604–S2607, 2008
www.atmos-chem-phys-discuss.net/8/S2604/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assimilation of stratospheric and mesospheric temperatures from MLS and SABER into a global NWP model" *by* K. W. Hoppel et al.

Anonymous Referee #1

Received and published: 13 May 2008

General comments

This article describes the vertical extension of the NOGAPS-ALPHA system and the assimilation of mesospheric observations from the EOS-MLS and SABER instruments. The 2006 stratospheric warming is depicted, and some quantitative assessment of the forecasts are presented. The article presents some pioneering work in the assimilation of mesospheric measurements, and assessments of mesospheric forecasts. However, some clarification of aspects of the assimilation system are needed (such as how the observation errors for these new data types were specified). Also, the quantitative assessment of forecast skill, while encouraging, may be based on too small a sample

size.

Specific comments

1. section 2: An important aspect of the model description is missing, namely, the upper boundary condition. Is there a sponge at upper levels? If so, how is it defined? Over what levels does it act? Does it act on the full fields or on departures from the zonal mean?

2. section 3.1, p. 6, line 9: "...the an..."

3. Fig. 1: This figure shows the height of data from various instruments. GPS-RO, SSMIS and AIRS data are shown here, but it is not clear if they were used in the experiments presented later. In section 3.1, (last paragraph), there is a reference to Baker et al. (2007) for a list of the observations used, but this article does not mention the use of these data types (although it is mentioned that SSMIS will be assimilated in the future). Would you clarify in the figure caption, or else in the text, which data sources are actually assimilated?

4. section 3.4, para. 1: It is noted that model levels between 0.005 and 0.0005 hPa are still important for capturing the effects of GW breaking on the mesospheric and stratospheric circulations. Are these levels in the sponge layer? This comment is related to a previous comment requesting a description of the sponge layer.

5. section 4.2, para. 1, lines 23-24: "The largest O-F differences occur near the equatorial stratopause and near the summer mid-latitude mesopause." I don't see this. In Fig. 7c, O-F bias reaches 6 K at 0.01 hPa while it is only 2.5 K in Fig. 7a (summer). It seems that the winter mesopause region has larger bias than the summer mesopause region. Please explain.

ACPD

8, S2604–S2607, 2008

6. section 4.2 last para. and Fig. 7: From the middle row of Fig. 7, it is clear that the observation error varies with latitude. How was this error specified, for both MLS and SABER? From the text, it is noted that "If the observation noise is small and the model forecast accurate, we would expect the O-F standard deviation to be smaller than the O standard deviation, because the model should capture some of the true geophysical variability represented in the observations." This statement suggests to me that that some estimation of geophysical variability has been included in the observation error variances. However, observation error normally includes only instrument error and errors of representativeness (not geophysical variability). Most assimilation schemes are derived assuming no correlation between total observation error and the background error. In this case, the O-F variance should be larger than either the O or F variance. The fact that the authors expect the opposite suggests that the observation error and background errors are correlated, violating basic assumptions used in most assimilation schemes. The bottom row of Fig. 7 shows that O and F are strongly correlated in the winter. This may indeed be due to the geophysical variability seen in O and F which dominates over observation or background errors. However, this is the correlation of the observed and background states, not their errors. Finally, would you indicate how many points were used in the statistical calculations of Fig. 7 either in the caption or in the text?

7. section 4.3, line 38: Reference to Fig. 6 should be to Fig. 7, I believe.

8. section 4.3: In assessing medium range forecast skill, why were only 12 forecasts used to compute statistics? Normally, with a forecast launched every 12 hours, roughly sixty 10-day forecasts can be obtained in a month. Operationally, a sample size of 40 or less is considered insufficient to evaluate a significant change in the assimilation system. Thus, a period of several months is considered. Can you produce statistics based on more forecasts, even over the same period? This would give a much larger sample size for your statistics.

ACPD

8, S2604–S2607, 2008

9. In Fig. 7d,e and Fig. 9-10, and in the text, it is noted that variability is low in the summer hemisphere and that persistence can do well. In this case, it would be interesting to compare model forecasts obtained while assimilating neither SABER nor MLS against the same measurements (bias-corrected SABER and MLS) to see if these forecasts are much different from those which assimilated them. In the winter, we could expect good improvement by assimilating SABER and MLS, but what about the summer hemisphere or the tropics?

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 8455, 2008.