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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.

K. W. Hoppel et al.

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We thank the reviewer for his/her generous and constructive review comments.

1. The typographical error in footnote 2 (page 8460) has been corrected.

2. Section 3.1 (Page 8463) already explicitly defines the innovations as y-H(x_b) (lines 5-6), and in the next sentence (lines 9-10) states that they are also referred to as O-F. The term A-F has been removed from the Fig. 2 caption (see comment #5 below) and is not used anywhere else in the manuscript.

3. As stated in Section 3.2, the horizontal resolution of the MLS/SABER measurements is better than the model resolution so that the profiles can be treated as a single point

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in latitude/longitude. The horizontal "spreading" of the correction field is determined by the background error covariance in Eq. 1. The larger the specified horizontal correlation length for the background temperature covariance, the larger the spreading of the correction. The text in section 3.4 has been modified slightly to make this point clearer. In geographic regions far from any MLS/SABER data, the correction field is zero. Fig. 2 illustrates the spreading effect, although the map projection results in the appearance of larger spreading near the poles.

4. As the reviewer suggests, changing to SABER version 1.07 can be expected to impact the SH forecast error shown in Fig. 9 (upper right panel). However, the negative forecast error (forecast temperature too low) near the mesopause that is seen in Fig. 9 cannot be explained by the low-bias in SABER v1.06 data (described in section 3.3) because it has the wrong sign. Also, since SABER is yawed northward (see Fig. 2) during most of this time, it only contributes to the analysis north of ~ -50 degrees latitude. We believe that the observed forecast error is most likely related to shortcomings in the tuning of the nonorographic gravity wave drag parameterization in the forecast model.

5. The Fig. 2 caption has been modified to add the definition of the correction, x_a-x_b, as defined in Eq. 1.

6. A legend has been added to Fig. 3b to indicate that MLS is the black line and SABER is the red line.

7. Fig 4a plotted the original SABER temperatures without the bias correction that was used in the assimilation. We have updated this figure to show the bias-corrected SABER data, which are more appropriate for comparison with the analysis. We thank the reviewer for finding this discrepancy. We have also removed the sentence from the caption that says the temperatures are calculated diagnostically from the geopotential. As the reviewer suggests, the forecast model outputs both temperature and geopotential. Because they are in hydrostatic equilibrium, the plotting program can recompute one quantity from the other, and this is a detail that is not relevant to the content of the

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figure.

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