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Atmospheric Chemistry and Physics Discussions

Interactive comment on "NOGAPS-ALPHA model simulations of stratospheric ozoneduring the SOLVE2 campaign" *by* J. P. McCormack et al.

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Addendum to Authors' Comment: Reply to Referee #1

Proposed new figures

Due to an oversight, the Authors' Comment in response to Referee 1 neglected to mention in detail all of the proposed revisions to the figures in the manuscript. Here we provide a detailed description of all proposed figure revisions along with web links to allow the referees to view the drafts of the revised figures. We apologize for the inconvenience.

1. Figure 12

http://uap-www.nrl.navy.mil/dynamics/html/acp2004/draft_fig12_new.jpg

In response to comments from Referee #1, we have performed an additional NOGAPS-

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ALPHA ozone simulation which uses the GMAO-GEOS4 ozone initialization and the *Cariolle and Déqué* (1986), or CD86, photochemistry parameterization. The 96-hour total ozone distribution from this run is now plotted in Figure 12c. The NOGAPS-ALPHA simulation using the CD86 scheme and the ECMWF ozone initialization is now plotted in Figure 12d. This now makes it possible to isolate the differences between NOGAPS-ALPHA and operational ECMWF total ozone fields due only to the photochemistry scheme (i.e., Figure 12a vs. Figure 12c), or due to a combination of both ozone initialization and photochemistry (i.e., Figure 12a vs. Figure 12d).

2. Figure 20

http://uap-www.nrl.navy.mil/dynamics/html/acp2004/draft_fig20_new.jpg

In response to comments from Referee #1 concerning the lack of spatial structure in the operational 114-hour ECMWF ozone forecast along Flight Segment (FS) 2 (Figure 20), we have performed an additional NOGAPS-ALPHA simulation using the CHEM2D photochemistry scheme and the higher-resolution ECMWF ozone analyses for initialization of prognostic ozone. Results from this new simulation are plotted in a revised version of Figure 20b. The only difference between the NOGAPS-ALPHA model runs plotted in Figure 19b and Figure 20b is the ozone initialization. The NOGAPS-ALPHA 114-hour ozone field initialized with the ECMWF analyses (Figure 20b) now closely resembles the operational ECMWF 114-hour forecast (Figure 20a), with both showing little horizontal variability in ozone along the flight track between 20-30 km. A comparison of Figure 19b and Figure 20b demonstrates that the lack of horizontal variability along FS2 seen in the operational ECMWF forecast can be attributed to model initial conditions.

3. Figure 21

http://uap-www.nrl.navy.mil/dynamics/html/acp2004/draft_fig21_new.jpg

Based on comments from Referee #2, we have added an additional panel to Figure

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21. This new plot, Figure 21c, shows the 42-hour NOGAPS-ALPHA ozone distribution along FS2 from a simulation using the CHEM2D photochemistry scheme and the ECMWF ozone analyses to initialize prognostic ozone. Where a similar 42-hour NOGAPS-ALPHA simulation initialized with the GMAO-GEOS4 analyses (Figure 21b) failed to capture the observed lower stratospheric features along FS2 near hour 18, the corresponding NOGAPS-ALPHA run using the ECMWF initialization now agrees quite well both with observations and with the 42-hour operational ECMWF ozone forecast. Again, this highlights the importance of the ozone initialization procedure in determining the ozone forecast skill over the course of 1–5 days. Specifically, in the lower stratosphere, the higher-resolution ECMWF ozone analyses allow better ozone forecasts.

4. Figure 22

Based on comments from Referee #2, we have removed Figure 22, showing the NOGAPS-ALPHA "pseudo-N_2O" field. It has been replaced by Figure 21c, which plots the NOGAPS-ALPHA 42-hour ozone fields along FS2 from a simulation initialized with the ECMWF ozone analyses on 20 January 2003.

5. Figure 23 (now Figure 22)

http://uap-www.nrl.navy.mil/dynamics/html/acp2004/draft_fig23_new.jpg

To further demonstrate the global impact of different initializations on NOGAPS-ALPHA prognostic ozone, the revised Figure 23 now compares 42-hour ozone mixing ratio fields 26.7 hPa, valid 18Z Jan 21 2003, from simulations using identical photochemistry but either the (a) GMAO-GEOS4 analyses, or (b) the ECMWF analyses for initialization. At this level, the lack of high-latitude observations in the ECMWF analyses appears to produce much less horizontal structure in the ozone fields despite the much higher horizontal resolution of the ECMWF system.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 4227, 2004.