

Interactive comment on “Effects of model chemistry and data biases on stratospheric ozone assimilation” by L. Coy et al.

L. Coy et al.

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Authors' reply to Dr. Polavarapu comments

We thank Dr. Polavarapu for her careful reading of our paper and her insightful comments. We reply to each in turn:

1. The GOATS was developed without a meteorological assimilation component in part for practical reasons. At the time of our initial ozone assimilation work outlined here, NAVDAS was not able to run with the higher top version of the NOGAPS GCM (NOGAPS-ALPHA) that we had developed. The GOATS enabled us to begin research on stratospheric ozone assimilation using NOGAPS-ALPHA without having to wait for high-altitude NAVDAS capabilities to come online, but at the expense of high-altitude meteorological assimilation. During our GOATS research, we were also developing the

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new high-altitude NAVDAS capabilities needed to interface it with NOGAPS-ALPHA to perform both ozone and meteorological assimilation to high altitudes. That prototype system has now been developed and is being tested, and we anticipate using it for a future ozone assimilation research. We will add a note in the text to clarify this.

2. We thank Dr. Polavarapu very much for her very thorough analysis, interpretation and support for our results in terms of data assimilation theory, both for a tracer in eq. (6) and then generalizing to ozone under photochemical control in eqs. (7)-(10). These are interesting derivations and ones we wish to try using in analyzing future results we generate with our system. In the final paragraph, it is asked whether our results using parameterized ozone chemistry in (6) will also hold when using a full chemistry model. The linearized ozone photochemistry formulation given by (6) is solidly based in the detailed photochemistry of ozone. For example, as discussed by McCormack et al. [2006], eq. (6) was originally derived by direct linearization of the fundamental governing odd-oxygen production and loss rates for pure Chapman photochemistry [Lindzen and Goody, 1965], and then further generalized to include a whole series of additional HO_x, NO_x and ClO_x reactions [Blake and Lindzen, 1973; Stolarski and Douglass, 1985]. Thus, the scheme is solidly based in the real photochemistry of the ozone layer, and thus the photochemical damping dependences seen in the upper stratosphere here should also occur in assimilation systems containing complete specifications of multireaction ozone photochemistry. As suggested, we will make this clear in our discussion section in revision.

3. We agree. Again, we thank Dr. Povalarapu for her interesting analysis of our result and support for our interpretation in terms of formal data assimilation theory.

4. We agree with the reviewer that off-line, independent measurements are the best way to identify observation biases. On page 25, line 20, we state "? the best way to monitor input data biases is to look at off-line observation minus climatology statistics?." However, understanding changes in operational O-Fs may aid in tracking down changes in input data biases.

5. In revising, we will qualify summary points 1 and 2: 1. Zonal mean ozone analyses are more independent of observation biases and drift when using an ozone photochemistry parameterization at altitudes above the middle stratosphere where the photochemical damping times become short. 2. Mean ozone O-Fs are more sensitive to observation drifts when using and OPP at altitudes above the middle stratosphere where the photochemical damping times become short.

References

Blake, D. and Lindzen, R. S.: Effect of photochemical models on calculated equilibria and cooling rates in the stratosphere, *Mon. Wea. Rev.*, 101, 783-802, 1973.

Lindzen, R. S. and Goody, R.: Radiative and photochemical processes in mesospheric dynamics: Part I, models for radiative and photochemical processes, *J. Atmos. Sci.*, 22, 341-348, 1965.

McCormack, J. P., S. D. Eckermann, D. E. Siskind, and T. J. McGee, CHEM2D-OPP: A new linearized gas-phase ozone photochemistry parameterization for high-altitude NWP and climate models, *Atmos. Chem. Phys.*, 6, 4943-4972, 2006.

Stolarski, R. S. and Douglass, A. R.: Parameterization of the photochemistry of stratospheric ozone including catalytic loss processes, *J. Geophys. Res.*, 90, 10 709-10 718, 1985.

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