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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.

Anonymous Referee #2

Received and published: 18 August 2004

This contribution introduces a new data assimilation and forecast system for the stratosphere. To validate the model, two periods during 2003 are integrated in hindcast mode. The hindcasted ozone distributions are compared to ECMWF, satellite and SOLVE2 ozone products. Generally good agreement is found, discrepancies can be traced back to either differences in the initialisation of the forecast or differences in the simplified chemistry schemes used.

The paper should be published in ACP after some clarifications and minor revisions.

The two case studies are: 11-16 January 2003 with a cold, stable vortex and 17-22 January 2003 with a strong warming event.

Even though the authors argue that heterogeneous chemistry can be neglected for short (5 day) periods, they state at the same time that synoptic PSCs have been ob-

served during the first period. If PSCs exist, heterogeneous chemistry plays certainly a role even on a short 5 day time horizon if the air parcel is exposed to sunlight? The authors compare carefully three different simplified chemistry schemes, but at the same time they note that the lower stratospheric ozone is anyway dominated by transport during the 5 day period. Wouldn't it be more useful to have a detailed comparison between the ECMWF lower stratospheric flow field and NOGAPS ALPHA? (E.g. an EPV scatter plot for an isentropic surface in the lower stratosphere for different forecast times.) There is some attempt to focus on the dynamical contribution by introducing a pseudo N_2O tracer, but the comparison to ECMWF data seems somehow arbitrary. Bearing this point in mind, I would like to ask the authors to clarify the follwoing points:

The radiative heating is calculated using climatological ozone values? Therefore part of the question posed in the beginning (possible improvement of overall forecast skill through the assimilation and the use of prognostic ozone) is not tackled here (the changing 3d ozone distributions are not used in the calculation of the heating rates)? Could the authors comment on possible implications?

The authors are replacing the climatological ozone in the simplified chemistry with the ozone climatology used in the radiation. Does this not introduce inconsistencies within the simplified chemistry (given that $(P\text{-}L)_0$ is not independent of the background ozone climatology seen by the chemistry model used to derive this term)?

The authors are only considering the first two terms in the ozone tendency - they justify this approach by the short time period modelled and the dominant effect of transport. Even though I accept this statement, I wonder if the authors could comment on the implications of the temperature term, given that during a warming the temperatures are far away from the background/mean temperatures and $T\text{-}T_0$ could potentially become large (even though the weighting coefficient is presumably small)?

In 4.2 the authors should carefully explain where (spatial distribution) and what data products ECMWF is using for the data assimilate of ozone. Looking at figure 10 I got

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the impression that ECMWF is basically reproducing the background climatology in this situation? Is ECMWF using the same background climatology of ozone as this study (I think yes, but just to make sure)?

Given the weaknesses in the ECMWF ozone forecast I was surprised by the statement that "the ECMWF ozone forecast improves more noticeably". Could this be linked to the temperature dependence in the ozone parameterisation? Or is this more a general transport issue (ECMWF is doing a better forecast of the "real" atmosphere and the ozone is transport dominated in the lower stratosphere)?

As already mentioned, I am not quite sure what additional information is provided by the discussion of the idealised N_2O study. As mentioned before, I would prefer a brief purely dynamical summary, maybe earlier in the paper and a somehow shorter more condensed presentation of the second case study.

page 10: typos "no clear" -> "not clear"

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