Atmos. Chem. Phys. Discuss., 4, S1794–S1796, 2004
www.atmos-chem-phys.org/acpd/4/S1794/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Using GOME $NO_2$ satellite data to examine regional differences in TOMCAT model performance" *by* N. H. Savage et al.

**F. Dentener (Editor)**

FRANK.DENTENER@JRC.IT

Received and published: 15 September 2004

As editor of this paper I would like to draw the attention to one remaining issue raised by Dr. Eskes, that could not be addressed by the authors. Nevertheless I decided to accept the paper. Please find below an excerpt of the discussion between authors and Dr. Eskes.

Dr. Eskes:

One aspect which I still find disappointing is the collocation issue. The procedure was not very clear to me from the original paper, but the authors confirm that sampling was not performed at equal times. This is a very crucial issue: GOME measurements



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are most valuable for cloud-free scenes. These cloud-free episodes have conditions for wind speed and direction, convection, photolysis, NOx removal etc... which are all not representative of the monthly mean. Furthermore, the number of GOME pixels contributing to the monthly mean is often very small. For a good intercomparison it is therefore needed to sample the model at the same location and time as the measurement. It is also preferred to perform this comparison in "measurement space", ie at the satellite footprints as opposed to the model grid cells. The authors mention in their reply that TOMCAT is based on photolysis from cloud climatology, which reduces the variability and the need to sample at the same time. However, this is not a good excuse because the other aspects remain.

In fact I do not understand why the authors did not choose to perform this space-time collocation. According to them it is a lot of extra work. However, as mentioned ".. profiles of NO2 are taken from daily TOMCAT .." for the air-mass factor calculation. Are these AMFs really calculated daily, or only monthly-mean ?? Please explain this more clearly in the manuscript. However, when this is really done on a daily basis with 10:30 local time fields, and when so much effort is done to improve the AMF, it is trivial to also evaluate the TOMCAT-GOME differences at the correct place and time by interpolation to the GOME measurement location, because the daily 10:30 TOMCAT fields are available!

Answer of authors:

Dr Eskes is correct to say that it is preferable to sample the model at the location in time and space of the GOME pixels. However to date I am not aware of any other global model studies which have followed this approach. It is certainly the case that any future studies should use this approach and this aspect has been stresed further in the manuscript.

However I do not believe that for the current study we are able to follow this method. While the method proposed by Dr Eskes is simpler than that originally envisaged (i.e.



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rerunning the model for 1997 with on-line interpolation to observations) it is not a trivial. matter. This still requires the following additional work: 1) it would first be necessary to use the GOME position information to interpolate the 10:30 model output for every date and location where there is GOME data. 2) the analysis of the model results compared to observations redone. This would require a new set of routines to be written for the new type of data (it would not be gridded data but a series of points with position and time information and also would certainly have more datapoints than the old monthly mean gridded data). 3) the manuscript would possibly have to be rewritten.

This would in effect mean submitting a completely revised paper once this work had all been performed. We think that the novelty of our present approach merits publication at this stage, while accepting that future studies could go even further.

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Interactive comment on Atmos. Chem. Phys. Discuss., 4, 2569, 2004.