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Comment

## ***Interactive comment on “Daytime ozone and temperature variations in the mesosphere: a comparison between SABER observations and HAMMONIA model” by S. Dikty et al.***

### **Anonymous Referee #2**

Received and published: 27 March 2010

The authors analyse variations of ozone and temperature during daytime in the equatorial mesosphere observed by the SABER instrument on the TIMED satellite and simulated with the HAMMONIA model. Many models still have major problems to reproduce chemistry and dynamics within the MLT region. The validation of models using observations of the mesosphere is important and necessary research.

The authors promise to go beyond the analysis of Huang et al. (2008a) by extending the data coverage in time and by using the new SABER version 1.07. In addition, the comparison of the data with the HAMMONIA model results, with the old version 1.06, and comparing infra-red and airglow band ozone retrieval should give deeper in-

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sights into the quality of model and retrieval results. It is therefore dissapointing that the authors do not analyse observations and model results to such a depth to allow to conclude where and how the model and (perhaps) data analysis have to be improved. For example, the fact that  $1.27\ \mu\text{m}$  and  $9.6\mu\text{m}$  results at 10 h and 0.01 hPa differ significantly from the model results which agree with the latter is stated shortly in the description of the results, but not even mentioned in the discussion section. Versions 1.06 and 1.07 are not compared as promised. The analysis of the model results in terms of chemical vs. transport influence remains vague and is not conclusive. I therefore cannot recommend the publication of the paper in its present form. The authors should augment their analysis by a more detailed discussion of the differences between the two ozone data sets and the influence of transport effects. In addition, they should describe the procedure of data analysis in more detail and more carefully. They should also consider to include the full diurnal cycle in their comparison between the observation and the model.

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## 1 Specific comments

Page	Line	Comment
2006	1ff	The abstract should be more concise and should report the results of the paper and not just what the authors intend to do.
2006	22	What do you mean with “not well established” (time-scale, observations, model)? The following paragraphs give a list of references of papers with quite different foci. It is not clear what the scientific problem is you are dealing with. Why do you not compare also diurnal variations with the model calculations?
2006	23	Whereas it would be instructive to have numbers for comparison the mentioned variations connected with solar variability are of quite different nature.
2007	3	Exact sunrise and sunset is altitude dependent, insert <i>approx.</i> 6h and 18h.
2007	5	Is this a result of this paper or do you quote some other authors?
2007	23	Write: ... nightfall <i>when</i> the photo-destruction ...
2008	20	This reference should go to the introductory sentences of the section.
2009	24	The description of SABER should go to line 16. Please give a reference.
2010	13	This sentence should go to line 4. In view of the results of your analysis you should explain why you put the 1.27 $\mu$ m emission at your first option.

- |      |     |  |
|------|-----|--|
| 2011 | 1   | Perhaps "Description of the model" would be more appropriate.  |
| 2011 | 13  | non-LTE: I suppose it is meant for IR-cooling scheme.  |
| 2011 | 19  | Please specify what you are interpolating (vmrs, I guess). Does your interpolation accounts for errors of the vmr values? The description of the data processing is getting clearer with the description of the yaw cycle in the following paragraph, perhaps exchange parts. As it makes a difference if you construct you daytime variations from geometric altitude grid or pressure height grid please specify what you have used for the following comparisons. |
| 2012 | 1   | What do you mean with time series? For all profiles sampled every day? Or over the whole period? Data gaps in time or in altitude? How do you justify the $3\sigma$ criterion? Have outliers something special (twilight, solar activity, etc.)?   |
| 2012 | 4ff | Do you use mean or true local solar time (accounting for the equation of time)?  |
| 2012 | 4ff | What systematic error do you estimate when constructing mean daytime variations with one data point per day and HA, shifting slightly over two months? You show in Fig. 3 that there are seasonal variations, so there should be some systematic effect on the construction of the daytime variation.  |
| 2012 | 19  | You seem to use the expression daytime variation for both: ozone vmr as a function of solar hour angle (HA) and for the anomaly expressed in percentage. Perhaps you should use different expressions.   |

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2012	20	units are ppmv or $\mu\text{mol/mol}$ , the quantity is vmr.
2012	20	Figure 3: Please specify what is shown: does a dot represent data from one interpolated profile? What altitude is given in the plot (geometric, pressure). What is shown in Fig. 4 or Fig 5, average for a specific HA? Median?
2012	25	At least for 2003 solar min conditions haven't been reached.
2013	2	I guess you mean latitude circle.
2013	7	This sounds that you have no information what is the HA in the model.
2013	18	Something is mixed up what band is shown. From the description Fig. 4 should be from 1.27 airglow.
2013	25	What is shown in Fig. 8? Derived from the whole time series? Why Fig. 3 and 8 show 1.27 airglow which shows a worse agreement with the model?
2013	25	Only Fig. 5 gives the impression of a good agreement. Absolute values differ by a factor of two in the afternoon (Fig. 8), in the morning the model cannot reproduce the observations (Fig. 3).
2015	1ff	This is very qualitative. You should give numbers. So, what is the progress with your work?
2015	6	Excentricity of the orbit of the earth should give a greater signal. You may test your hypothesis by analysing N and S equatorial region separately.
2015	14ff	The whole rest of the section is very qualitative and not conclusive. You should be able to estimate the contributions of chemistry and transport/dynamics to ozone and temperature variations for the model.
2016	19	I think you mean atomic oxygen from molecular oxygen photolysis.

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## 2 Technical comments

Page	Line	Comment
2006	2	I would prefer to use equatorial instead of tropical.
2006	20	change effected to affected.
2009	15	Change sentence to: The equator crossing time shifts by approx. 12min/day.
2024	Fig 3	Specify in the caption what altitude is given in the plot.
2025	Fig 4	Title and caption contradict in what is shown, see also Fig. 5.
2018	References	Remove links to pages at the end of the specific reference.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 2005, 2010.

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10, C972–C977, 2010

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