

## ***Interactive comment on “Middle atmospheric ozone, nitrogen dioxide, and nitrogen trioxide in 2002–2011: SD-WACCM simulations compared to GOMOS observations” by Erkki Kyrölä et al.***

### **Anonymous Referee #1**

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This manuscript presents a comparison between GOMOS observations and WACCM simulations with nudged stratospheric dynamics for ozone NO<sub>2</sub> and NO<sub>3</sub> profiles in the middle atmosphere. This kind of comparison is very valuable because model outputs are widely used. Models provide information on a global fixed geographic-altitude grid and at any local time, which is not the case for satellite observations, making the use of the data much easier. WACCM is one of the most used models in the atmospheric community. GOMOS is probably the best instrument for mesospheric ozone and the only instrument measuring NO<sub>3</sub> in the stratosphere. It is also one of the few instruments acquiring data in the polar night, which allows for instance to follow the descent of mesospheric NO<sub>2</sub> layer in the polar winter mesosphere. However GOMOS data are

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not easy to use due to the large variety of spectra from the 180 different stars and the irregular geographic coverage of the observations. The methodology applied to select the valid GOMOS data is particularly rigorous, giving confidence to the results. I recommend the publication of the manuscript in Atmospheric Chemistry and Physics after minor revisions as listed below.

- In equation (2), page 7, the scaling factor is computed using GOMOS data  $f_k(z)$ . It may cause some problems when GOMOS values are small compared to their uncertainty with the problem of negative values within the error bars. Why not to use WACCM data  $f_k(z)$  instead?
- Page 7, line 13, from where is coming the factor  $3 \times 1.4826$  for the elimination of outliers. Does it correspond to 3 sigma in the median statistic? This is not the same factor that the one given in equation (1) in Kyrölä et al. (2010a).
- Page 7, lines 22-27, the discussion on regions defined with  $t\_value > 2$  is not clear. Please try to reformulate it.
- Page 13, figure 8, do you have any explanation for the larger interannual NO<sub>2</sub> variability in WACCM than in GOMOS? In general observations exhibit a larger variability than model outputs.
- Page 20, line 14, there is an extended discussion in Marchand et al. (2007) on the relation between GOMOS NO<sub>3</sub> concentration and temperature with the same conclusion that NO<sub>3</sub> is a good proxy for upper stratospheric temperature. Please cite this paper: Reference: Marchand et al., 2007, Temperature retrieval from stratospheric O<sub>3</sub> and NO<sub>3</sub> GOMOS data, Geophys. Res. Lett., 34, L24809.
- Page 21, figure 20, it would be better to plot the NO<sub>3</sub>-temperature diagram with NO<sub>3</sub> in log-scale in order to show the exponential relation .

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