

***Interactive comment on “Mesospheric N₂O
enhancements as observed by MIPAS on Envisat
during the polar winters in 2002–2004” by
B. Funke et al.***

Anonymous Referee #2

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Referee comments to the paper “Mesospheric N₂O enhancement by MIPAS on ENVISAT during the polar winters in 2002–2004” presented by B. Funke, M. Lopez-Puertas, M. Garcia-Comas, G. Stiller, T. von Clarmann, and N. Glatthor, submitted to ACD (acpd-2008-0139)

General comments

In presented paper authors demonstrate new results of N₂O observations in the polar stratosphere and lower mesosphere by the MIPAS instrument placed on ENVISAT satellite. Measurements cover the Arctic and Antarctic winters between July 2002 and March 2004. It was found, by the authors, that N₂O enhanced abundance

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ranging from 0.5 to 6 ppbv occurred at high latitudes in this period. Using the observed N₂O-CH₄ correlations authors supposed that such enhancements are of chemical rather than dynamical origin. At the same time increased N₂O abundance occurred in presence of NO_x intrusions from the upper atmosphere, which were possibly related to energetic particle precipitation. It seems also, that inter-annual variability of mesospheric N₂O correlates with observed precipitating electron fluxes. In order to understand found effects, authors supposed that observed N₂O enhancements is most likely generated under dark conditions by the reaction with atomic nitrogen at altitudes around 70-75 km in the presence of energetic particles precipitation. Authors also have in mind a possible additional source of N₂O in the middle and upper atmosphere related to excited N₂ generated by precipitating electrons with O₂, which lead to N₂O production at altitudes around 90-100 km. Then additional molecules of N₂O could descend to the mesosphere and upper stratosphere during polar winter. It should be concluded, that authors presented new interesting results, which are important for our understanding of atmospheric chemistry. At the same time some specific comments may be done.

Specific comments

- It seems that authors should give more details (page 6, line 159-162) to the explanation of stratospheric warming influence on chemical composition due to rather complicated transformation of temperature and wind fields during these periods. It should be mentioned that motions and temperature changes in the stratosphere and mesosphere are not similar. - Possible more details also are needed for the explanation of the influence of tropospheric sources on N₂O increase in the lower mesosphere (page 6, line 258). - Authors did not show calculated ionization rates (fluxes only) caused by precipitating electrons. Narrow peak (Fig. 7, bottom) caused by SPE of October 2003 does not describe the situation. The better comparison is produced molecular of NO_y by protons and electrons. - Calculation of N₂O production (Fig. 10) is not enough, because we should also need calculate the losses. - It would be interesting to have a

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look on MIPAS scans up to 170 km (page 3, line 64).

Technical corrections

- Authors should give explanation to readers, what does it mean "equivalent latitudes"; - Is not clear really what kind of correlation were found and is a final interpretation (page 15, lines 490-493). - It would be usefull to have an "Altitude"; on the Figure 1 as a vertical scale (as on Figure 2).

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 10561, 2008.

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