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Atmospheric Measurement Techniques Discussions

Interactive comment on "On the consistency of HNO_3 and NO_2 in the Aleutian High reigon from the Nimbus 7 LIMS version 6 dataset" *by* Ellis Remsberg et al.

Anonymous Referee #3

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The paper "On the consistency of HNO3 and NO2 in the Aleutian High Region from Nimbus 7 LIMS Version 6 dataset" uses data from the LIMS instrument in January 1979 together with results from a photochemical trajectory model to investigate an event of HNO3 increase in the warm part of a dominant wave-2 structure in the lower stratosphere (30 hPa). Two aspects of this investigation are of interest: 1) The study demonstrates that LIMS v6 observations of HNO3, NO2, temperature and ozone can be used for scientific studies. Though the measurement period of LIMS was relatively short (October 1978 to May 1979), to my knowledge no other global observations of HNO3, or NO2/ozone during night, were available at that time. 2) A dedicated photochemical model study of the role of heterogeneous chemistry in a relatively warm

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winter stratosphere is carried out, an area certainly not as well investigated as the cold stratospheric vortex; it is found that even in the warm winter stratosphere, heterogeneous chemistry on the background aerosol plays a significant role in re-distributing NOy during night. The paper is reasonably well written, and I recommend publication with a few minor revisions. Some suggestions, mostly related to readability of the text and figures, are listed below.

line 69: ... that includes the chemistry of reactive nitrogen (NOy), the sum of HNO3 and odd nitrogen (NOx) (comma instead of or?)

line 73: here as well as in other places where a zonal wave-2 signature in HNO3 is discussed: I would rather call this a "quasi-wave 2 signature", because it is likely not related to a real planetary (Rossby) wave structure, as you indeed show in the paper. You could also say that it shows a quadrupolar structure. E.g., line 76; line 171; line 382.

line 76: "independent of dynamics" but heterogeneous reactions are temperature dependent, and transport plays a role as well here. Maybe it would be better to characterize the behavior of HNO3 as driven by a combination of chemistry and dynamics.

line 86: two "unscreened" in this sentence, one of them is unnecessary.

line 137, figure: observed HNO3 is highest in the polar vortex, and particularly in the presence of PSCs. However, as HNO3 is taken up into PSCs, a decrease of gas-phase HNO3 might also be expected in the presence of (large) PSCs (von Koenig et al., JGR, 2002; Lambert et al., Atmos Chem Phys, 2008)

line 172-173: Please provide more detail about the derivation of the anomalies. Did you fit zonal planetary wave signatures as well as subtract the zonal mean? How? Why?

line 177: "... while HNO3 and NO2 have anomaly patterns of the same sign" on January 19, but not on January 27 in the Ah region.

lines 181-196, figure 4: it would be good to provide error bars in the figure, and discuss the error range of the observations in the text, to assess whether the observed zonal variation is significant. This is especially true for NO2, where variations are small. Error ranges are provided in the discussion of figure 5, but should be provided here as well.

line 188: are "observed? seen?"

figure 5: it would be good to provide error bars in figures 4 and 5. I admit figure 5 is quite busy already; however, lines could also be highlighted by color, or you could provide one error range for every species at the edge of the figure. As is it at the moment, it is difficult to asses whether the temporal evolutions of ozone, water vapor and NO2 are significant.

lines 263-264: please specify in which way the model is updated - reaction rates, heterogeneous chemistry?

line 276: "have behavior" –> "behave"

line 458: "when further chemical changes are inefficient" however, there should be uptake into PSCs if cold enough.

line 476: "values$\sim$7ppm" –> "values of $\sim$7 ppm"

figure 11: is the scatter within the single profile error of LIMS?

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