

## ***Interactive comment on “On the consistency of $\text{HNO}_3$ and $\text{NO}_2$ in the Aleutian High reigon from the Nimbus 7 LIMS version 6 dataset” by Ellis Remsberg et al.***

### **Anonymous Referee #2**

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### **General comments**

This article presents the results of a validation study for the Nimbus 7 / LIMS  $\text{HNO}_3$  and  $\text{NO}_2$  v6 data sets. The study focuses on the Aleutian High region, in January 1979, when occurred a minor stratospheric warming event. An earlier analysis showed that, in the previous version of these data sets, the evolution of  $\text{NO}_2$  mixing ratios was inconsistent with the evolution of  $\text{HNO}_3$  mixing ratios, at this particular time and place. The authors have re-investigated this event using the v6 dataset, together with photochemical calculations, and showed that the data quality has improved. This

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paper presents interesting and novel results, showing that the v6 LIMS observations can be used for scientific studies. This is perfectly suited to the scope of AMT and I recommend publication after consideration of the minor revisions suggested below.

Given that the main goal of your study is to show that v6  $\text{HNO}_3$  and  $\text{NO}_2$  LIMS data products are of better quality than v5 data products, why do not you show any direct comparison of these two versions? Rather than comparing them only indirectly by referring to the findings of R93, you could for example add at least one figure and one paragraph addressing the direct comparison of these two datasets in the specific region and time period considered in your study. This is true especially for  $\text{NO}_2$ , that has changed the most. This would add value to your paper.

I think that the general readability of the paper could be improved. Some parts of the text consist of a long description of the figures, but your conclusions are not made clear enough. The presentation quality of the figures could also be improved (see specific comments below).

### **Specific comments**

L69: It would be clearer if you would change “or the sum of” to something like “, which is defined as the sum of...”. Moreover  $\text{N}_2\text{O}_5$ , which is considered in your study, is also part of the  $\text{NO}_y$  family. You could mention it.

L155: Please give more details about how anomalies are defined in your study. Over which period has the zonal mean used as a reference been calculated? In the next paragraph, when writing about the anomalies for  $\text{NO}_2$ , you mention that you took into account zonal waves also. How have you done exactly? Were the anomalies derived in a different way for different species? Please make that point clearer.

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L181: To which pressure level correspond this figure? I guess that it is 31.6 hPa, as in the previous figures. Please mention it, both in the text and in the figure caption.

L206 and 210: Why do not you represent these uncertainties in the figure? (same comment for Fig. 4)

L216-224: Please make clearer the link between this discussion on LIMS NO<sub>2</sub> L2 products and your figure 5. This paragraph sounds like a general description of the data quality, but it is not clear what is your conclusion and how this affects the interpretation of Fig. 5.

L236: "09Z on 28 January" Please explain what is this time format.

L258: "only a modest amount of aerosol surface area is necessary ..." Please quantify this statement.

L263: "an updated version of the stratospheric diurnal photochemical model" Could you briefly explain what are the differences between this version of the model and the version described in Natarajan and Callis (1997).

L300 and 304: Maybe you could add the temporal evolution of the air parcel latitude to your plot. It would thus be easier to follow the interpretation. (same comment for Fig. 9)

L454: The highest value of HNO<sub>3</sub> is 13 ppbv, according to Fig. 13.

L481-500: I am not convinced that it is useful to separate the description of what happened at high and middle equivalent latitudes into two paragraphs. It makes your text a bit repetitive. (For example, what you wrote in lines 498 to 500 sounds redundant with what you wrote in lines 486-487.)

Fig. 4: Please indicate in the caption the concentration unit for each species (ppmv or ppbv), like you have done for Fig. 8.

Fig. 5: Same comment as for Fig. 4.

Fig. 7: It would be good to find a way to better distinguish the trajectories from each other. (As it is now, it is quite difficult to distinguish the trajectory A-a from B-b.) Maybe adding thin black contour lines could help.

Fig. 8: You could add the names of the species in the beginning of the corresponding

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lines. This would make the figure clearer (same comment for Fig. 9). You should also define the red solid line in the caption, as it has been done for Fig. 9.

### Technical corrections

L29: 27 January (instead of 28).

L86: Please remove the second "unscreened".

L276: "that have behavior similar to" Please reword ("that have a similar behavior to..." or "that behave similarly..." for example).

L401: "aerosol, surface area" Please remove the comma.

L470: Please change "during sunlight" to "under sunlit conditions".

L711: "gas phase nitric" The word "acid" is missing.

L740: Please change "between 21 and 27 January" to "on 21 and 27 January".

Fig. 12: Please write the years in white instead of black.

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