

Interactive
Comment

Interactive comment on “Partitioning of reactive nitrogen (NO_y) and dependence on meteorological conditions in the lower free troposphere” by C. Zellweger et al.

Anonymous Referee #1

Received and published: 18 January 2003

General comments:

The paper describes a two-year period measurement of NO , NO_2 , total NO_y , and PAN as well as campaign-based seasonal measurements of HNO_3 and particulate nitrate (NO_3^-) at the Jungfraujoch (JFJ) observatory located in the lower free troposphere. The authors present the mixing ratio levels, partitioning, and short-term and long-term (seasonal) variations of these reactive nitrogen species, and found that regional meteorology strongly perturbs the free tropospheric condition by giving rise to the pollutants levels and modifying the partitioning of NO_y species at JFJ. The authors well demonstrate how boundary layer (BL) pollution transport affects the clean free troposphere air. Instrumentation and measurements are of high quality. Although seasonality of

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

speciated NO_y species is valuable information for understanding relative importance of photochemistry and transport of ozone in regional scales, "full" seasonal cycles of "speciated" NO_y are rather limited, and the paper shows the first results in Europe, as far as I know. Overall, the paper is a significant contribution to the community. Significantly new data are included, and definitions of meteorological filters are rather sound. Therefore I believe that the paper should be published in ACP. However, there are a couple of important points that should be addressed before being published in ACP.

It seems to me that the main subject of this paper is vague. The authors mention that their meteorological filters used here could be applied to other mountainous sites. However, definitions for filters strongly depend on orography and location of the sites. While European Alpine mountainous sites have similar orography, the authors could show applicability to other sites.

In addition to meteorological filters, it is a great advantage of this study to derive "detailed" seasonality and climatology of speciated NO_y species from long-period measurements. However, these are discussed only on time series and season basis, not on representative illustration. I suggest the authors to present 2-year integrated seasonal cycles for speciated NO_y (and ozone, CO, NO_x/NO_y), and to discuss more quantitatively how their levels and fractionation change depending on meteorology patterns and months, to well characterize the impact of the BL pollution transport on the seasonality at JFJ. At present, it is difficult to see general seasonality (maximum/minimum timing, seasonality shape) in detail from Figure 4. I believe this would improve the discussion greatly and help demonstrate the usefulness of the filters.

Specific comments:

At this stage, comparison with other measurements is not meaningful (page 2268–2269). In particular, Schefferville/PROPHET are not helpful, since both are the US boundary layer sites, and data are only available in summer. I think the comparison here is not necessarily needed.

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

page 2270, line 17-20: In addition to less wet deposition, efficient photochemical production of HNO_3 (via $\text{NO}_2 + \text{OH} \rightarrow \text{HNO}_3$) in the BL may contribute to the summer maximum of HNO_3 , NO_3^- , and aerosols.

Page 2271, line 19-21, and Figure 5: The authors implies that the higher levels of NO_x , NO_y , PAN, and CO in North Foehn (NF) than in South Foehn (SF) are due to heavier "pollution levels" in the Swiss plateau than in Po basin. Are there published results suggesting this? Which is the main factor for heavier pollution in the south? More sunlight availability or more NO_x emissions in the south?

Page 2274, line15-16: Efficient wet deposition of HNO_3 during foehn events also may increase NO_x/NO_y ratio.

Figure 7: Plots for NF are missing. More analysis on the seasonal variability of the ratios in NF, SF, THER, and SYN, and comparison to other aircraft measurements over Europe (if available) would improve the discussion greatly.

Figure 8: I can find no discussion on Figure 8 in the text.

Technical corrections:

page 2262, line 16: NO, $\text{NO}_2 \rightarrow \text{NO}$ and NO_2

page 2263, line 23: If the conversion \rightarrow When the conversion

page 2266: line 4: north (NF) \rightarrow North (NF)

page 2267, line 23: (March to May, summer \rightarrow (March to May), summer

page 2268, line 8: of NO, NO_x and $\text{NO}_y \rightarrow$ of NO_x and NO_y

page 2269, line 21-22: for the winter (...) and summer (...) \rightarrow autumn/winter (...) and spring/summer (...)

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 2259, 2002.