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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Variability of $NO_x$ in the polar middle atmosphere from October 2003 to March 2004: vertical transport versus local production by energetic particles" *by* M. Sinnhuber et al.

**Anonymous Referee #1**

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This paper analyses the impact of energetic particle precipitation on the distribution of NOx as measured by MIPAS from October 2003 to March 2004, both in terms of the direct and indirect effects. The authors show that the descent of NOx from the MLT into the polar upper stratosphere/lower mesosphere in January/February 2004 overwhelms the direct effect of the October 2003 Halloween solar proton events (SPE). They analyse the relation between NOx and CO, examine NOx enhancements in both hemispheres, and provide upper bounds for the direct effect of electron precipitation at different altitudes. This is an important result since contradictory findings had been



found in the literature concerning the impact of electron precipitation in the aftermath of the Halloween SPE.

I find the paper exceptionally well-written, clear and thorough. I have only minor comments listed below. 1) There is a bit of a contradiction in the Abstract, since it says that local production by precipitating electron is unlikely, but then an upper bound (e.g. 6 ppb at 56-70km) is provided. It should say that the production is weak, smaller than the upper bound. Please clarify.

2) What the authors mean by "cross-talk" in retrieved NO between different altitudes is a bit unclear. A couple of sentence on the relevant retrieval issues could be helpful to the reader.

3) Fig 9: units for the electron fluxes on the y-axis should be included.

4) Given the results of Fig 10, wouldn't it be more relevant to show also the day-time SH NO anomalies at a level above 60km, where they are higher (rather than 48, 54 and 60 km)?

Spelling/English

P2: . . .during "high" winter. . .: unclear

P4: continuosly

P6: "for the four scenarios shown in Fig 8". Scenario might not be the appropriate word here.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 1, 2014.