Review

On the origin of the occasional springtime nitrate concentration maximum in Greenland snow

Geng et al.

Geng et al. present and interesting study on the origin of occasional nitrate concentration maxima detected during springtime at Summit, Greenland snow. By using stable nitrogen and oxygen isotopes of nitrate in the context of photochemical processes, they linked the nitrate maxima with a weakened stratospheric ozone layer during the studied episodes that enhanced photochemical reactions in the snow surface. They further compare nitrate ice core record with satellite ozone measurements during ~20 years.
The manuscript is well written and present solid arguments linking nitrate maxima with low stratospheric ozone periods. However, some issues need to be addressed before the manuscript can be fully accepted for publication, especially regarding snowpit dating.

Major comments:

The collection and storage of the snowblocks must be described in more detail. Where they collected in bags or boxes? Did they suffer compaction during transport and storage? Including density profile of the snowblocks and snowpit would be convenient. It is hard for me to imagine transporting those snowblocks without disturbing their stratigraphy.
A description of the sampling methods and tools is also missing. I assume that clean protocols (clean overalls, gloves, etc.) were followed but this should be described in the text.
In section 3.1 the peaks in figure 1.d were chosen arbitrary. There are two peaks in between 2007 and 2006 that have moreless the same concentration than peak 1 and 3 (second) (black line) but were not considered as candidate peaks. Also peak 3 (and second 3) need to be re-labelled since it is confusing having two peaks "3".
In page 9, line 19, peak 3 (black line) is located in February (winter) while in the SP-1 record (gray line record) is located even earlier in the winter 2005. What is the dating error of the snowpits?
When calculating the winter means (fig.1 c), blue dots overlap with two red dots (2004/2005), how were winter and spring delimited then?
When using the t-test, samples should come from a normal distribution, is this the case for the isotope samples?

Minor comments

P.3.L.7: NOx are emitted
P.3.L.9: cycle
P.6.L.14: which kind of plastic bags? Where they pre-cleaned?
P.7.L.19: were samples filtered before isotopic analyses?
P.8.L.17: following
P.8.L.18: indicate the bacteria strain
P.13.L.20: state the accumulation rate at Summit during the study period.
P.14.L.26: NOx that are