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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An overview of snow photochemistry: evidence, mechanisms and impacts" *by* A. M. Grannas et al.

Anonymous Referee #1

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Overall comments: This paper has an impressively large list of co authors, that includes nearly all the active polar snow chemists. Overall the paper is an extensive compilation of existing knowledge about photochemistry in snowpacks, the implications, and some thoughts on what is required for future progress. It is well written and provides an excellent, detailed overview of the subject.

Specific comments: I offer a few minor comments to expand or elaborate on some of the points made.

Page: 4174 Discussion of snowpack metamorphism ought to make more of a distinction between changes to the state of individual ice grains, which do not affect the bulk composition as opposed to transformations of the total snowpack, which do alter the

bulk composition. As noted, the potential for solute redistribution as vapor moves from small to large grains is considerable and could set the stage for further physical and chemical processes. It is important to keep in mind that new snow is rapidly modified and that some of the changes may not be evident by measuring the bulk composition in a layer of snow. The evolving methods for in-situ snow analysis and nano/micro-scale physical and chemical analysis, which are discussed in section 6.2, will be critical tools to better understand snowpack metamorphism.

Page: 4178 Should lower wavelengths be considered for the Antarctic spring when ozone layer is significantly thinned for a period of time? Penetration of additional UV to the snow is a relatively recent development and will decrease as active chlorine levels in the stratosphere decline in the future.

Page: 4198 In the discussion of HOx concentrations relative to model predictions it might be helpful to have figures comparing the observed and predicted values, along with some quantification of measurement uncertainty. From the text it is not immediately clear what is the significance of differences and similarities being described. Are the disparities entirely with predictions and models, or are there possible measurement artifacts?

Page: 4217 What is the geographic range of snow algae? In temperate mountain snowpacks their abundance is high enough to make the snow surface look pink. These would be a specific example of biota contributing to organics in snow.

Page: 4219 Fluxes and gradients are related by an exchange velocity, and the magnitude of flux need not track the magnitude of gradient. Large positive gradient may be observed precisely because there is negligible exchange (very small flux) and the compound is simply accumulating or has been left behind in the stagnant layer. Although the prevalence of reduced vertical mixing above arctic snow is noted elsewhere in the text, it ought to be repeated here with the note that caution is required for interpreting concentration gradients when the exchange rate is unknown.

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In presenting the reported flux values it would be useful to note what method was used to calculate them.

Table 1: How do the sums of individual components compare to total NOy measurements during those campaigns or other campaigns at same place but different times?

Typographical errors:

4176, line 26 should be segregation

4234 line 22 should be challenges

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 4165, 2007.