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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Dissolved organic carbon (DOC) and select aldehydes in cloud and fog water: the role of the aqueous phase in impacting trace gas budgets" *by* B. Ervens et al.

Anonymous Referee #2

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This paper reports measurements of aldehydes and dissolved organic carbon in cloud/fog water at Mount Whistler, BC Canada and Davis, California USA. These measurements, literature values and assumptions were used to estimate effective Henry's law constants for dissolved organic carbon. Larger values were associated with aged air masses, consistent with a greater degree of oxidation. Field measurements were used to initialize a box model that examined how the uptake of formaldehyde, glyoxal and methylgloxal into cloud/fog water affected gas phase HO2 concentrations. While the effects of aqueous formaldehyde uptake on HO2 has been previously reported, similar work for other aldehydes has not been performed, to my knowledge. The authors found that aqueous aldehyde uptake reduced gas phase HO2 concentrations by

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two orders of magnitude, and that this effect was predominantly caused by formaldehyde; glyoxal and methylglyoxal had little effect.

This paper should be published after minor revision. The revisions below are primarily structural, rather than scientific.

1. Uncertainties should be reported for key measurements. There is no mention of field blank measurements. How do we know measurements reflect ambient concentrations and not contaminants?

2. The Box Model description needs a few more details. initial conditions for modeling (and a reference to Table 2) should be provided in section 2.3 not in results. In section 2.3, it says that "formation of formaldehyde is not explicitly simulated." But it does not say how formaldehyde is modeled. Briefly, the authors need to explain the chemistry included in the box model. What oxidants are included? Are the precursor VOCs continuously replenished or do they decrease with time?

3. DOC, OC, and TOOC concentrations are carbon concentration, e.g., DOC should be mg-C/liter, rather than mg/liter.

4. Page 10 line 23 "TOOC excludes methane and includes all other organic carbon that can be measured by standard techniques." this is very vague. One can measure total non-methane hydrocarbons as carbon.

5. Page 11 line 22. More explanation is needed as to how F(OCaq) is calculated and what it is. The fraction of what, dissolved in cloudwater, is 1-46%?

6. Page 12 line 16-17 This sentence does not make any sense to me, and makes me wonder whether or not I understand what F(OCaq) is. The authors need to clarify.

7. Sections on DOC and aldehyde measurements should be tightened.

8. Page 13, line 7 "whereas the inferred aging does not necessarily occur in the aqueous phase" The meaning of this phrase is not clear. Do the authors mean "as a result

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12, C12615–C12617, 2013

of gas (and maybe also aqueous) chemistry" ?

9. Page 13 line 11: Figure 3b should be deleted from this sentence. Page 13 line 24: Figure 3c should read Figure 3b

10. Page 17 line 22-29. This discussion is a little confusing. Do the authors mean to say that reaction times represent the aqueous chemistry happening in several cloud cycles?

11. Page 18 Might the Lee et al 2012 experiments reflect longer reaction times or reactions in aerosol water?

12. Table 1 needs a lot more explanation. Define terms used in the table, especially TOOC, so that the table will be understandable on its own. Why are there two columns under DOC? What are these concentrations? Is OCp carbon in the particle phase in clouds or in the aerosol? F(OCaq) is percentage of what? (gas+aqueous+particle??) Which of these columns are measurements?

13. Many figures need formatting. For example, larger (consistent sized) labels. No box surrounding the figure, no grid lines in Fig 1. Link references in the Figure captions to references. Indicate somewhere the time of year for the locations included.Say what error bars represent.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 33083, 2012.