Atmos. Chem. Phys. Discuss., 9, C11391–C11393, 2010
www.atmos-chem-phys-discuss.net/9/C11391/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling the reversible uptake of chemical species in the gas phase by ice particles formed in a convective cloud" *by* V. Marécal et al.

Anonymous Referee #3

Received and published: 6 March 2010

General Comments:

This paper reports on efforts to study parameterizations of the partitioning of atmospheric trace species to ice particles in a convective cloud. A tropical convective cloud is simulated using the BRAMS model and the model output is used to produce ice surface areas for several categories of ice particles along trajectories calculated to encounter the cloud. Uptake is modeled off-line using Langmuir adsorption for 11 species, and burial in growing ice is calculated for HNO3 based on the results reported by Kärcher et al.

The authors acknowledge that this is a preliminary effort to develop a parameterization

that can be subsequently introduced into a full cloud model simulation to study the effect of convection on trace gas distributions. This has implications for transport and removal of a number of important atmospheric trace species.

Specific Comments:

The authors explain their consideration of only uptake to pristine ice, snow, and aggregates while ignoring graupel and hail due to the assumption of liquid-like outer layers. This has the potential to make their results for trajectories that enter lower in the cloud less physically relevant due to the large uptake rates of species such as HNO3 to liquid surfaces that are likely to overwhelm uptake to pure ice.

Reference to columns and rows are reversed in the caption of Figure 1.

P24364 L22: while not the authors work, I am concerned about results that show large concentrations of ozone partitioning to ice.

P24368 L8: I am a little unclear as to the handling of ice crystal shape, which has an impact on the surface areas that are important to the uptake results. Is it assumed that the ice crystal size/shape equilibrates with changes in T and RH at each time step along the trajectories? Are the ice crystals assumed to advect along with the gas, or why would it be that gas-phase mixing ratios would recover later in the simulations?

P24373 L22: "e-g-" should be "e. g."

P24374 L25: text should read "the maximum number of molecules"

P24379 L3: The first sentence, "As the photolysis. . ." appears to be an incomplete thought, or should be connected to the second sentence? Even taken together, the two sentences in this paragraph seem incomplete.

Figures 4 and 5 might be better shown in units of surface area density for comparison with the results shown in Figures 8 and 9 due to the differences in surface area to mass ratio for the different types of ice.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 24361, 2009.

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Interactive Comment