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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Redistribution of trace gases by convective clouds – mixed-phase processes" *by* Y. Yin et al.

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General comments: The manuscript is the follow-up of the paper "Simulation of trace gas redistribution by convective clouds - Liquid phase processes" published in the same journal. This paper provides a significant contribution to the actual lively research on the impact of convective clouds on chemistry. Transport of pollution from the boundary layer up to the upper troposphere can be severely modulated by the scavenging of the soluble species. The measurement of crucial gas properties such as the gas retention coefficient is complex, especially in real clouds. Experimental values of retention coefficient or gas burial efficiency are rare, providing little constrain on the modeling of the impact of ice on chemistry. In this work, the authors propose an integrative view of scavenging in mixed clouds based on academic simulations, covering a large range of values for the gas properties. The study is based on a cloud-resolving model with de-

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tailed description of the microphysics and aerosols. By identifying the major processes involved in the scavenging, this high resolution model provides a reference for global and regional models. The paper is well written and pedagogical.

Specific comments: Voisin et al. [2000] performed in-cloud field measurements to study the scavenging processes of acidic gases and ammonia in mixed clouds. These authors found that strong acids are well retained in rimed ice. For these species, riming is the main process that determines the composition of the snowflake. At lower solubility, the authors found that riming is still important but gas uptake during the growth of snowflakes can not be neglected. Could the authors comment on that point with regards to their simulation results? [Voisin et al., Scavenging of acidic gases (HCOOH, CH3COOH, HNO3, HCl, and SO2) and ammonia in mixed liquid-solid water clouds at the Puy de Dome mountain (France), JGR, 105, 6817-6835, 2000.]

Evolution of the cloud structure and precipitation The three times illustrated in figures 4 and 5 could be labelled as "Cumulus stage" (at 24 minutes) characterised by an updraft throughout most of the cell, "Mature stage" (at 40 minutes) characterised by the presence of downdrafts and updrafts, "Dissipation stage" (at 64 minutes) characterised by weak downdrafts throughout most of the cell.

In figure 6, could the authors explain why does the integrated trace gas masses increase for gas solubility higher than 10ˆ7 mol/dm3/atm in the continental case?

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 875, 2002.