**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Technical note: A new comprehensive SCAVenging submodel for global atmospheric chemistry modelling" *by* H. Tost et al.

Anonymous Referee #1

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General comment

This paper presents a new scavenging scheme designed for modeling of aerosol and gases removal from atmosphere by clouds and precipitation. The study is somehow a natural development following other work done by the same research group to address various numerical modules needed for a comprehensive atmospheric chemistry modeling with coupling between various processes. In this respect, to understand the full significance of this paper, the reader would benefit from reading the previously published studies concerning: 1) MESSy (Modular Earth Submodel System) standard (Jöckel et al., 2005) which provides a modular framework for treating coupling between various subsystems in the Earth System; 2) MECCA (Module Efficiently Calculating

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the Chemistry of the Atmosphere) (Sander et al., 2005) which describes a new way to address atmospheric chemistry problems in numerical models. Within this framework, SCAV module addresses a set of important processes involving aerosol/gases-cloud interactions, processes leading to removal of such constituents from the atmospheric domain. The paper is well written and the proposed scheme is flexible and can be adapted with other future developments or improvements in the area of gases and particles scavenging. Overall, the authors provide an interesting new framework that could prove valuable for treating chemistry in clouds at various scales, and for approaching complex cases simulations. I recommend the paper for publication after some suggested revisions described below.

Specific comments

Page 11159, Line 26-27. It will be useful to discuss the role of the assumption of monodisperse cloud droplet spectrum used in this study. What are the implications on the scheme results? To address this problem, one alternative is to consider a cloud droplet size distribution with two parameters (Pruppacher and Klett, 1998), and study the sensitivity of results to such cloud droplet size distribution.

Page 11160, In the "Model description" section, I suggest authors discuss also the limitations of current formulation and recognize some other processes like snowfall scavenging, aerosol interactions with solid hydrometeors (snow, ice crystals), and the problem of mixed phase clouds even during warm seasons (the case of deep convective precipitation for example).

Page 11160, Line 27: The list of input variables should be complete here.

Page 11162 Line 18: Use: Henry's law coefficients.

Page 11174, Conclusions. A short outlook of future applications to test and validate the scheme will be useful. Such outlook can provide some insight on what improvements can be made in SCAV in future, as well as provide a guide on what applications can be

performed to validate the SCAV against observations.

Page 11177, Figure 1. I suggest Figure caption should have full names of SMIL and SMCL. Give the full list of input - output or if list is too long, refer to the text.

Page 11178. Figure 2. Figure will show probably better in a linear scale on the scavenging ratio axis, with aerosol diameter between 1E-8 and 1E-6 m, and scavenging ratio between 0 and 1. Also the figure x-axis shows "aerosol diameter", while the caption refers to "aerosol radius" (The same observation for Figures 3 and 4). Also in the text, when presenting the scavenging ratio, it will be useful to include a discussion on scavenging ratio dependence on local supersatration of water vapor and aerosol chemical composition.

Some spelling and editorial corrections:

Page 11174, Line18: In the second reference, "Easter" should be "Eastern".

Line 19: Correct spelling of "terminal".

Page 11175, Line 16; Correct spelling of "formulations".

Line 24: Correct spelling of "Precipitation", and on the next line "Publishers".

References

Jöckel, P., Sander, R., Kerkweg, A., Tost, H., and Lelieveld, J.: Technical Note: The Modular Earth Submodel System (MESSy) - a new approach towards Earth System Modeling, Atmos. Chem. Phys., 5, 433-444, 2005, SRef-ID: 1680-7324/acp/2005-5-433. 11159, 11160, 11172

Sander, R., Kerkweg, A., Jöckel, P., and Lelieveld, J.: Technical Note: The new comprehensive atmospheric chemistry module MECCA, Atmos. Chem. Phys., 5, 445-450, 2005, SRef-ID: 1680-7324/acp/2005-5-445. 11159, 11162, 11163, 11165

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