Geoscientific

Model Development

Discussions

[GMDD]

Interactive

comment

Interactive comment on "In-cloud scavenging scheme for aerosol modules" *by* Eemeli Holopainen et al.

Anonymous Referee #2

Received and published: 26 August 2020

This manuscript presents a new physically-based parameterisation for in-cloud aerosol scavenging for use in size-resolved aerosol schemes within atmospheric models. The approach aims to model the scavenged fraction more explicitly than the common approach of using fixed coefficients for each size/composition/solubility class of aerosol. An evaluation of the scheme is presented in terms of the impact on vertical distributions of both number and mass, using measurements from the ATom flight campaign as a reference. These show that the scheme as initially applied leads to excess aerosol aloft with too long a lifetime, but a number of sensitivity studies show that re-tuning the size and solubility of aerosol at emission leads to much better performance.

The manuscript is clear and well presented, linking well to previous works on scavenging and the vertical distribution of aerosol, and is well suited to publication in GMD,

Discussion paper

subject to the minor comments listed below:

Detailed comments

Line 84: is there any significance to liq/ice sometimes appearing as superscript and sometimes as subscript? I would suggest consistently using one or the other, or clearly explaining the difference in notation if this is significant.

Lines 181–194: please explain how SALSA fits into the framework of ECHAM-HAMMOZ, ECHAM and HAM, as this is not mentioned here and thus unclear.

Line 229: ECMWF does not make meteorological observations. Please clarify if this refers to a specific archive of third-party observations curated by ECMWF, or (as I suspect is more likely) to a *reanalysis* product such as ERA-5 or ERA-Interim rather than actual observations. Please cite the relevant dataset if possible.

Line 289: less $\longrightarrow$ fewer.

Lines 298–299 and 304: please clarify that this specifically refers to ECHAM-HAMMOZ using SALSA (the widely-used modal scheme may behave differently).

Figures 5 and 6: please include baserun_old as a reference on these plots – otherwise it's hard to judge how the new scheme compares to the old against the actual observations.

Table 2: consider including a measure of the AEROCOM spread as well as its mean (or median) here; otherwise it's hard to say how "significantly" outside the pack a configuration is.

Line 401: some discussion of the caveats involved in assuming that the AEROCOM mean is the right target to tune towards would be welcome here.

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