Atmos. Chem. Phys. Discuss., 3, S1528–S1530, 2003
www.atmos-chem-phys.org/acpd/3/S1528/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulating gas-aerosol-cirrus interactions: Process-oriented microphysical model and applications" *by* B. Kärcher

Anonymous Referee #1

Received and published: 15 September 2003

Review of B. Kärcher: "Simulating gas-aerosol-cirrus interactions: Process-oriented microphysical model and applications"

The paper describes a numerical process model developed to simulate the dynamics of aerosol particles and ice crystals in UTLS conditions and discusses case studies to demonstrate its applicability to simulate relevant atmospheric processes. Although the readability of the paper would improve were it somewhat more concise, the application is well presented, scientifically sound and addresses an important topic. I therefore encourage the publication of the paper after the following minor revisions and clarifications have been made.

Specific comments:

Full Screen / Esc
Print Version
Interactive Discussion
Discussion Paper

1. The potential ways to use a process model are clearly formulated at the beginning of page 4131, and its repetition in the schematic illustration (Figure 1) appears unnecessary.

2. At the end of page 4132, the author states that the newly developed model has been tested against analytical solutions but does not discuss the results of these comparison simulations. When introducing a new model, however, the validation of the model against analytical or highly accurate numerical solutions is one of the key issues. In my view, a detailed description of the comparison simulation results in not necessary. The author should, however, briefly describe the problems for which comparisons have been carried out and discuss the model performance at least on a general level.

3. When particles experiencing condensational growth in a moving-center approach cross the upper edge of the section, they are all moved to the next section containing larger particles. Then typically, averaging in a number- and volume-conserving manner slightly overestimates the size of the very smallest particles. The tail stretching to small particle sizes in Figure 2 after 1.75 hours of simulation needs therefore some further explanation.

4. Lines 27-29 on page 4147 state that the concentration of newly formed particles is not sensitive to pre-existing aerosol parameters on a time scale of several hours. It should be clarified here that while this may be the case for UTLS conditions with low background concentrations, it does not generally hold true. Many modeling and field measurement studies indicate that the pre-existing aerosol - acting as sink for condensable vapours and newly formed particles - has a crucial effect on the onset and intensity of new particle formation as well as particle growth beyond nanometer sizes (e.g. Kerminen et al., JGR, 106, 24119, 2001).

5. As significant uncertainties surround the nucleation mechanism(s) in the atmosphere, I find the statement "The binary mixture is known to form ... by binary homogeneous nucleation" somewhat too strong (page 4136, lines 11 and 12).

ACPD

3, S1528–S1530, 2003

Interactive Comment

Technical corrections:

Reference to Jacobson (1999) on page 4135, lines 7 and 8, should be reformulated as it implies that Jacobson has discussed the size distribution representation in APSC.

Although a widely used acronym, PSC should be explained when used for the first time on page 4136, line 11.

Typos:

Page 4132, line 26: dicusses -> discusses Page 4155, line 17: imapct -> impact

---

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 4129, 2003.