Geoscientific
Model Development
Discussions

Open Access

Interactive comment on "Simulating Secondary Inorganic Aerosols using the chemistry transport model MOCAGE version R2.15.0" *by* J. Guth et al.

Anonymous Referee #1

Received and published: 12 June 2015

General Comments

This paper describes the development and implementation of a secondary inorganic aerosol (SIA) module for the MOCAGE model, based on the thermodynamic ISOROP-PIA II model. Global and regional results are compared to ground-based and satellite data, and demonstrate that model accuracy is generally improved after inclusion of SIA for predictions of aerosol optical depth and key gas- and particle-phase species concentrations. This work describes an important update to the MOCAGE model that will be of direct use to regional and global atmospheric modeling. The authors are asked to consider two general comments, and a few specific/technical comments. After these are addressed, it is recommended that the manuscript be considered for publication.

1.) The introduction includes a general overview of secondary inorganic aerosol. How-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

ever, it fails to put this work in the context of other efforts to include SIA formation in global models. To demonstrate the novelty of the work described here, the following questions should be addressed in the introduction: a) What treatments of SIA are currently included in other global models? b) How is the approach described here, or the nature of the MOCAGE model, expected to provide insight into global SIA that until now was not available?

2.) In general, the paper is well organized and clear. However, there are several 'uncommon' phrasings and grammatical errors in the text, and therefore the manuscript may benefit from general (non-technical) editing. At this point the quality of the writing of the paper makes it unacceptable for publication. Authors are strongly encouraged to work with an English speaker to edit the paper.

Specific Comments

P3596 L7-10. It is not clear how chlorine chemistry is related to this work. If it is just to provide an example of gas-aerosol interactions, could an example more directly related to the species involved in this work be found? Or, is this an example of multiphase dynamics/chemistry that has been added to MOCAGE? If so, it should be clearly stated, and then shown how this work relates to those efforts.

P3601 L8-11. Although the need for computational efficiency in understandable, Capaldo et al. also find that aerosol nitrate concentrations are poorly represented by the equilibrium method compared to the dynamic and hybrid methods in their box model simulations (results being off by as much as a factor of four for course-mode PM). Nitric acid concentrations in this work have a greater FGE and lower correlation compared to HTAP observations for RACMSIA than for RACM (Table 7). Could the assumption of equilibrium be a factor in this?

P3602 L13-17. This paragraph should be revised. There seems to be some confusion (possibly between $(NH_4)_2SO_4$ and NH_4NO_3?) in the first and last sentences.

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

P3604 L 23-26. What effects will the assumptions made in section 2.3.2 regarding the size distribution of SIA have on modeled AOD? Will SIA in certain size bins have more impact on modeled AOD than those in other bins?

P3605 L10-13. Do the same stations that measure sulfate also measure the other species? If not, are there significant differences in the spatial distribution of station for the other species? (It might be more useful to have color-coded species measurements and include all the measurement stations in Fig. 1, as opposed to including altitude and only the sulfate stations.)

P3605 L26 – P3606 L1. Same comment as for P3605 L10-13.

P3610 L2-4. The remaining negative bias in the model is attributed to secondary organic aerosol (SOA) not be included in the model. Can the spatial distribution of the remaining bias be used to suggest whether or not this is the primary contribution? (Aside from the specific case mentioned in L10-13.)

P3611 L17-19. Why was it important to choose a rural location for this comparison?

P3612 L13-20. See comment on the assumption of equilibrium (P3601 L8-11).

P3617 L16. How can the improvement in MNMB and FGE be interpreted in light of the decrease in correlation for PM2.5?

Technical Corrections

P3596 L2-4. This statement could use a reference.

P3596 L7-8. This statement could use a reference.

P3596 L21-22. The wording of this sentence makes it sound like the SIA module has been described previously.

P3611 L22. Is there any reason to expect Table 6 and Fig. 7 to be inconsistent? Are they not based on the same simulation data?

P3646. Fig 6 Caption. RACM and RACMSIA are referred as being in the upper and lower panels, respectively. This should be reversed according to the labels in the figure.

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper