

Review of

# **Simulating Secondary Inorganic Aerosols using the chemistry transport model MOCAGE version R2.15.0**

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## **1 General summary**

The study presents the development and evaluation of a Secondary Inorganic Aerosol (SIA) scheme within the chemical transport model (CTM) MOCAGE. Global and regional evaluation is performed to assess the performance of the CTM with and without the SIA scheme. Overall results are consistent with other studies and indicate a better performance of the CTM with the SIA scheme, in most cases. A variety of validation datasets at the global and European scales are used in the assessment of the performance as well as established statistical measures. Overall the model version with the SIA scheme performs better in terms of modeled Aerosol Optical Depth (AOD) against satellite data. It also has better agreement with in situ measurements of secondary inorganic aerosols precursors showing a reduction in Modified Normalized Mean Bias (MNMB).

Overall the paper is well written and easy to read. It presents new model developments and it is definitely appropriate for GMD. I have a few comments below, but otherwise I can recommend it for publication.

## **2 Specific comments**

p.3595 l.2 several days

p.3595 l.11 Rephrase: “Aerosols in air quality applications are characterised in terms of Particulate Matter (PM)”.

p.3595 l.12 add “are measured quantities and used for the legal concentrations...”

p.3596 l.14 long-range transport of pollutants

p.3596 l.23 eventually

p.3597 l.14 regional ensemble forecasting system over Europe

- p.3597 1.19 give also resolution in km : have you tried the sensitivity to different resolutions? If not, what do you think the impact would be?
- p.3598 1.20 Compared with the initial RACM scheme, the sulfur cycle has been completed.
- p.3599 1.9 showed that
- p.3600 1.10-15 It's not clear to me how internal mixing is assumed when the species are treated separately, or are they all lumped into the different bins together? Please explain.
- p.3602 1.19 what are the mass conservation properties of the scheme? Has this been looked into?
- p.3606 1.4 This biogenic emissions seem too old: how can it be assessed that they are still representative?
- p.3607 1.3 In what sense misleading? Please elaborate.
- p.3609 1.6 The differences in figure 5 are really huge.
- p.3610 1.4 The bias in AOD over central Asia is also likely due to lack of adequate dust emissions as well as the lack of secondary organic aerosols. What is the positive bias over the ocean in Figure 6 due to, given the *lack* of DMS emissions (as I understood it)? Please elaborate.
- p.3611 1.7 what do you mean by "sulfate emissions combined with sea salt"?
- p.3611 1.16 I was expecting to see also the RACM simulation for comparison in table 5, table 6 and figure 7. Can this be added? It would also be good to see how other stations behave (at least one more). Is the "Sulphate" in table 6 total or corrected?
- p.3612 1.9 briefly explain how the SO<sub>2</sub> oxidation is included (i.e. parametrization, explicit chemistry, etc)
- p.3613 1.4 I find it surprising that over the United States there are no daily data!
- p.3614 1.7 Compensation of what? Please explain.

Figures : slightly larger labels in all of them, particularly the multi-panel ones, for readability.