

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-397

Anonymous Referee #1

Referee comment on "Description and evaluation of the community aerosol dynamics model MAFOR v2.0" by Matthias Karl et al., Geosci. Model Dev. Discuss.,
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This paper is an extensive presentation and evaluation of version 2 of MAFOR, an open source aerosol dynamics model coupled to a multiphase chemistry module (781 species and 2220 reactions in the gas phase, as well as 152 species and 465 reactions in the aqueous phase). First, the authors describe the structure of the model, the aerosol and chemical processes and the main updates compared to the first publication of the model. Then, they present the performance of the model with respect to its ability to predict particle and mass number size distributions. The new features of the model investigated, include the evaluation of (1) the model's sectional representation of the aerosol size distribution in a scenario of new particle formation in urban areas ("Case 1"); (2) Brownian coagulation under the condition of continuous injection of nanoparticles ("Case 2"); and (3) the dynamic treatment of semi-volatile inorganic gases by condensation and dissolution ("Case 3"). They also tested the model in a real-world scenario of a street canyon environment, in comparison with other aerosol process models (AEROFOR and SALSA) and experimental data. The authors conclude that the model is well suited for studying changes of the emitted particle size distributions by aerosol processes of organic vapours in urban environments and also for the simulation of new particle formation over multiple days. They also present some future developments of the model in view of application in urban settings.

The structure of the model is presented with clarity, giving the necessary critical information to the reader. The same goes for aerosol and chemical processes which are explained in sufficient detail to prevent potential misconceptions. Methods and data used, as well as the definitions of the scientific, regulatory and computational problem of interest are clearly stated and discussed.

The manuscript is well written, has important environmental message, and should be of great interest to the readers. Overall, it is an important study, and should be considered for publication in GMD.

I have only one remark. The authors support that the main advantage of MAFORv2.0 is the *consistent treatment* of both the mass- and number-based concentrations of PM. I think that it would be of great interest for the reader if this consistency was discussed in more detail.