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Interactive comment on "A framework for expanding aqueous chemistry in the Community Multiscale Air Quality (CMAQ) model version 5.1" *by* Kathleen M. Fahey et al.

Anonymous Referee #2

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Fahey et al. developed a new cloud chemistry mechanism (AQCHEM-KMT) for use in large-scale models and implemented it into CMAQ. AQCHEM-KMT allows for the investigation of aqueous-phase chemical reactions that could not be implemented into the aqueous-phase chemistry mechanism that is currently implemented in CMAQ (AQCHEM) because of its explicit consideration of processes such as mass transfer limitations. As most large-scale models use an aqueous-phase chemical mechanism similar to AQCHEM, this development represents a significant step forward in examining the influence of aqueous-phase chemical reactions on the chemical composition of the atmosphere in large-scale models. The paper is well written, and I recommend publication in GMD after some very minor issues are addressed.

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Discussion paper

The authors find much larger differences between AQCHEM-KMT and AQCHEM for sulfate than for SOA, but the reasons for this difference could be more explicitly discussed than they currently are. What other aqueous-phase reactions or types of reactions can now be implemented in AQCHEM-KMT that was not possible with AQCHEM? Are there other sulfate production mechanisms that are better suited for AQCHEM-KMT than AQCHEM that are not currently included in the model, or do the authors expect sulfate to almost always be similar for AQCHEM-KMT and AQCHEM on monthly time scales?

In the introduction, it would be good to specify that when you refer to the aqueous phase you are referring specifically to cloud droplets and not liquid water associated with aerosols.

Page 3 line 13: Refer to Table S3 so one can readily find the seven oxidation reactions, or list them here.

Many abbreviations/acronyms in the text and tables are not defined (e.g., MPAN). Perhaps add a table of abbreviations/acronyms in the SI.

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