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Interactive comment on “Methane sulfonic acid enhanced formation of molecular clusters of sulfuric acid and dimethyl amine” by N. Bork et al.

Anonymous Referee #2

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The authors apply a kinetic model (ACDC) and quantum chemical calculations to study the contribution of gaseous MSA to cluster formation, with and without the presence of dimethyl amine (DMA) and sulfuric acid (H₂SO₄) molecules. Like referee #1 I am not an expert on these methods. However, I find the present paper somewhat incomplete and would like to see appropriate revisions made. My specific comments are as follows:

1. The authors do not consider hydration, i.e. the potential effect of H₂O molecules and associated ligand formation on the overall contribution of MSA to stabilization and growth of clusters. At least one more paragraph and figure should be dedicated to this mechanism to provide a more realistic evaluation (see also their comment on postponing calculations for larger clusters to later work in their Conclusions).

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2. Again, in the Conclusions the authors state that "The formation mechanism of MSA rich aerosols thus remains unknown". However, they have completely missed previous studies showing that DMS oxidation pathways via DMSO and MSIA produce MSA, in particular at lower temperatures and NO_x levels (see, e.g., Davis et al., J. Geophys. Res., 103, 1657, 1998; Barnes et al., Chem. Rev., 106, 940, 2006). At least one more paragraph needs to be included to consider these (additional) sources of MSA.

3. Section 2.2: Only one value (without uncertainty range) has been adopted (from DalMaso et al.) for the condensational loss rate to preexisting particles. In view of the large uncertainties in the evaluation of such loss rates (up to at least a factor of 2, based on CN > 3 nm diameter particle measurement uncertainties alone), a rigorous uncertainty analysis needs to be included and also shown in Figs. 2 and 3. This error source has large implications for all of the following calculations and conclusions.

Further comments:

p. 18682, line 16: What are the typical uncertainties / limitations / inaccuracies of these "popular" methods? Discuss this and add at least one reference.

line 18: insert: ...is "considered" one of the...

p. 18686, line 19: Explain this "surprise".

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 18679, 2014.

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