Geoscientific

Model Development

Discussions

[GMDD]

Interactive
comment

Interactive comment on "A parameterisation for the co-condensation of semi-volatile organics into multiple aerosol particle modes" *by* Matthew Crooks et al.

Anonymous Referee #1

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This work extends a model to account for the condensation of semi-volatile organic vapors (SVOCs) in cloud droplet activations parameterizations to multimodal aerosol populations. The authors use a dynamic approach to account for the condensation of volatile species onto preexisting aerosol particles, and parameterize their effect on droplet activation as an increase in the mean dry particle diameter at cloud base. The performance of the new model is evaluated using a well known CCN activation parameterization and comparing against parcel model simulations. In general condensation of SVOCs onto aerosol particles have a modest effect on droplet number, although in some polluted cases seems to be more important. The paper is written in considerable detail and addresses important points, relevant for the scientific community. I

recommend its publication in GMD after a few minor comments are addressed.

General Comments:

- Not only the size of the wet particles changes with the condensation of SVOCs but also their composition. This is completely missing in the manuscript but may be quite important. Modes changes in the surface tension of the wet particles may have a much larger impact on CCN activation than large changes in particle size.

- The approach that results in Equation (17) is still monodisperse in that it does not take into account the variation in the condensation rate due to variation in the droplet size distribution (e.q., the equation should be weighted by the size distribution of the wet aerosol). Please note this and estimate its impact on the resulting activated fraction.

Technical comments:

Line 25. It must be "the" precipitation rate.

Line 50. There is an even more recent version of the Fountokis and Nenes (2005) parameterization. See: Morales Betancourt, R. and Nenes, A.: Droplet activation parameterization: the population-splitting concept revisited, Geosci. Model Dev., 7, 2345-2357, https://doi.org/10.5194/gmd-7-2345-2014, 2014.

Line 120. Remove the words "that is".

Line 156. Is this wet or dry diameter?

Line 409 and Figure 6. DCP seems to overpredict the activated fraction at high aerosol concentration.

Figures 3-7. Please add a legend to the Figures to improve readability.