Atmos. Chem. Phys. Discuss., 12, C10072–C10074, 2012
www.atmos-chem-phys-discuss.net/12/C10072/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of factors controlling global secondary organic aerosol production from cloud processes" *by* C. He et al.

Anonymous Referee #2

Received and published: 3 December 2012

This paper examined the dependence of global SOA production from clouds on six variables including some focused on the meteorology (liquid water content, temperature) and some related to chemistry (parent hydrocarbon reaction, oxidants). The production rate of SOA in clouds was relatively well represented as a function of liquid water content (LWC) and total carbon loss (TCloss). The paper would be stronger with more details on the derivation of the parameterization (statistical thresholds used to include or eliminate variables, analysis of covariance between variables, independent verification, etc). Furthermore, it is unclear if this parameterization would remain valid in another model or different configuration of current model.

General comments:

1. Units. Values should always be presented with their associated units. For example,

Table 2 shows partial regression coefficients, but there are no units. Please indicate unitless if appropriate. In addition, parameters alpha, beta, and gamma are often discussed without units. Given the units of alpha (which seem to involve $m^{-1.8}$ and $s^{-0.6}$ if gamma is dimensionless) could alpha be tied to any physical process?

2. Derivation of parameterization. What is the take away message from table 1? Use of the log based values points to all parameters being relevant. How did you go from Table 2 with coefficients from the multiple linear regression based on logarithms to a function of the form of equation 2 with pre-exponential as well as exponential coefficients? Are the coefficients in equation 2 also in Table 2?

3. Applicability to other models/configurations. Section 2.2 indicates model outputs are archived every 3 hours. I assume these outputs are used both to develop the parameterization (equation 2) as well as compare the parameterization to the base model. Given how nonlinear your parameterization is, would you expect equation 2, with your fitted parameters, to still hold if implemented on a one hour timestep within your model (a common global chemical timestep)? Changes in horizontal dimensions might also cause the parameterization to perform poorly given how well models do or do not represent the spatial extent of clouds.

4. Evaluation. The parameterization seems to be evaluated with the data used to create it. The authors could have evaluated it using some sort of independent verification in which a subset of the model outputs were withheld from the parameterization and used only for purposes of evaluation. Also, if equation (2) is meant to be implemented inside a model to parameterize SOA production, a good test would be to put it inside the model and compare that to the base model. Another useful option would be to add observations to determine if places where the parameterization performs poorly may or may not be correlated with poor performance of the process based model.

Specific comments:

1. Page 26937, line 18-19, what fraction of the spatial and temporal outputs are cov-

ACPD

12, C10072–C10074, 2012

ered by the threshold criteria?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 26929, 2012.

ACPD

12, C10072–C10074, 2012

Interactive Comment