

## ***Interactive comment on “Particulate-Phase Mercury Emissions during Biomass Burning and Impact on Resulting Deposition: a Modelling Assessment” by Francesco De Simone et al.***

**Anonymous Referee #3**

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De Simone et al. (doi:10.5194/acp-2016-685) provide a very detailed model sensitivity study on the influence of partitioning of particulate mercury from biomass burning on its deposition patterns. Such partitioning effect has not been incorporated into most mercury chemical transport models, but it is worthy of attention in the mercury community. The topic of this study is well within the scope of ACP. However, I think the authors should address the following general and specific comments before its consideration of publication.

General comments: (1) A major weakness of this manuscript is lack of model-observation comparison. The authors point out several significant differences of the deposition fluxes in different model scenarios. Do the available observations provide

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constraints on the parameterizations of mercury BB emissions? (2) It has been suggested that the partitioning of mercury in the atmosphere depends on temperature and aerosol concentrations (for example, Amos et al., 2012). What is the treatment in this study and what is its scientific basis? (3) More details of the model parameterizations should be provided. A key process is the photo-reduction of oxidized mercury in the atmosphere. Does the model allow such process in this study? Would this process affect the major conclusion of this study?

Specific comments: (1) Title: I suggest changing “during” to “from”. (2) Page 2, line 31: What is the global average enhancement ratio? Does it fit in the observed range (for example, Slemr et al., 2014)? (3) Page 3, lines 15-20: I do not quite understand why these two schemes of vertical profiles are equal less than 4 km. Could more explanations be given here? (4) Sect. 2.4: Are there any statistical relationships among OC, PM, and FMC? I am curious since they are all linked to the combustion characteristics. (5) Page 4, line 29: Could more explanations be given about the differences of the emission (and also the deposition) patterns > 60-degree north in difference scenarios (mapping to OC vs FMC)? (6) Figure 4: It seems that the influences of different parameterization of PBL-type vertical profiles and different temporal resolutions are insignificant. Could these be due to the gross spatial and temporal resolutions of the model used in this study?

Editorial comments: (1) Page 1, line 17: add brackets for “Hg”. (2) Page 1, line 23: “asses” should be “assess”. (3) Page 2, line 6: add a comma before “however”. (4) Page 2, line 27: wrong reference format. (5) Page 4, line 2: “is of great importance”. (6) Page 4, line 28: “emissions”. (7) Page 5, line 11: “where” should be “were”. (8) Page 6, line 28: remove comma. (9) Page 7, line 12, 15: wrong reference format. (10) Page 8, line 14: remove “the”; full name of “TGM”.

Reference: Amos, H. M., Jacob, D. J., Holmes, C. D., Fisher, J. A., Wang, Q., Yantosca, R. M., Corbitt, E. S., Galarneau, E., Rutter, A. P., Gustin, M. S., Steffen, A., Schauer, J. J., Graydon, J. A., Louis, V. L. St., Talbot, R. W., Edgerton, E. S., Zhang, Y., and

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Sunderland, E. M.: Gas-particle partitioning of atmospheric Hg(II) and its effect on global mercury deposition, *Atmos. Chem. Phys.*, 12, 591-603, doi:10.5194/acp-12-591-2012, 2012. Slemr, F., Weigelt, A., Ebinghaus, R., Brenninkmeijer, C., Baker, A., Schuck, T., Rauthe-Schöch, A., Riede, H., Leedham, E., Hermann, M. and van Velthoven, P., 2014. Mercury plumes in the global upper troposphere observed during flights with the CARIBIC observatory from May 2005 until June 2013. *Atmosphere*, 5(2), pp.342-369.

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