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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivity model study of regional mercury dispersion in the atmosphere" *by* Christian N. Gencarelli et al.

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Dear Prof. Dibble,

thank you for your comment on our paper, and our apologies for the tardy reply. The HgBr + OH rate constant is taken from the assumptions made in Holmes et al. 2010 (Global atmospheric model for mercury including oxidation by bromine atoms, Atmos. Chem. Phys., 10, 12037–12057), thank you for pointing that out, we will correct the reference if and when the article is accepted.

We have actually added the reactions suggested in your 2012 article in our box model (AMCOTS, Sprovieri et al. 2010, An investigation of the origins of reactive gaseous mercury in the Mediterranean marine boundary layer, Atmos. Chem. Phys., 10, 3985–3997) assuming that the radical/compound + HgBr reaction is barrierless. We still fail

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to reproduce the measured RGM values in the Mediterranean, due to the rapid rate of HgBr dissociation. We use the case of our studies in the Mediterranean because of the anticyclonic conditions which render the box model at least partly valid due to the atmospheric stability.

The Abstract from Wang et al. 2014 (Enhanced production of oxidised mercury over the tropical Pacific Ocean: a key missing oxidation pathway, Atmos. Chem. Phys., 14, 1323-1335) states: "We conclude that the key pathway that significantly enhances atmospheric mercury oxidation and deposition to the tropical oceans is missing from the current understanding of atmospheric mercury oxidation", and we would agree.

The stability of the HgBr radical is fundamental, and certainly in polar regions and one assumes, the free troposphere, where its thermal stability is less of an issue then it is very important in the procuction of Hg(II).

As has been suggested a number of times (for example, Subir et al. 2012, A review of the sources of uncertainties in atmospheric mercury modeling II. Mercury surface and heterogeneous chemistry – A missing link, Atmos. Environ., 46, 1-10), perhaps homogeneous oxidation of Hg in the atmosphere is only part of the equation.

The primary aim of the article is to look at the impact of Hg emission speciation and emissions vertical distribution. We are currently working on an extended chemical mechanism for the Bromine initiated Hg oxidation chemistry option, we hope to have finished the update soon, and should be running simulations this winter, with the hope of publishing the results earloy next year.

Best regards, Christian and Ian

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