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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emissions of mercury in Southern Africa derived from long-term observations at Cape Point, South Africa" *by* E.-G. Brunke et al.

Anonymous Referee #1

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Brunke and coauthors have written a valuable and careful analysis of South African mercury emissions, as constrained by atmospheric measurements at Cape Point. Their work provides clear evidence that South African emissions are tens of tonnes annually, rather than hundreds. This provides strong support for recent revisions to emission inventories. I recommend publication with minor changes.

The authors compare older emission inventories for S. Africa (~250 t/y) with with newer ones (40-50t/y). Careful readers will understand that the older inventories were almost certainly erroneous, as stated once in the introduction. Less careful readers, however, might wonder if all inventories were correct for their reference years and there has been

a large reduction in emissions over time. This would bear repeating in the discussion, conclusions, or abstract.

The abstract, section 3.4, and conclusions report 14.8+/-1.5 t /y as the best estimate of South Africa's GEM emissions. First, I think 1.5 t/y is an optimistic assessment of total uncertainty, since the standard error in GEM/CO, GEM/CO2, and GEM/CH4 slopes is around 20%. Second, if GEM is 50-78% of TGM emissions, as the authors say, then TGM emissions are 20-29t/y for South Africa. This is significantly lower than the other recent estimates of 40-50t/y. The discrepancy requires some discussion. Are 2007-2008 emissions indeed 25-50% smaller than inventories by Masekoameng, Leaner, and Dobrowski et al.? Are uncertainties in the observational constraints 25% or greater? Both seem plausible to me. Without some discussion of these issues the authors cannot claim, as they currently do, that "the observed GEM emission is in reasonable agreement with the current mercury inventories for South Africa" (Section 3.4) and similarly in conclusions and abstract.

The remaining comments address more minor issues. I refer to the last 2 digits of page numbers and line numbers.

P81 L8: "Despite all these efforts the emissions estimates are still quite uncertain" Please be quantitative here. What is the estimated inventory uncertainty (%) globally or for your region of interest?

P81 L27: Model studies by Selin et al. (2007, 2008) and Strode et al. (2007) have not been used to "constrain emissions estimates" in an inversion or optimization sense, which is what the sentence seems to imply. Rather, these authors adjusted the chemical mechanisms and natural emissions, within their uncertainties, to match the observations. I agree that the global model studies do not reduce uncertainties in global or regional emissions (L29).

Section 3.4. I suspect that the 30-50% discrepancies between the observed CO/CO2 ratios and the inventory-derived ratio is partly due to seasonality. Most pollution event

ACPD

12, C3207–C3209, 2012

observations were made in austral winter, when biomass burning is greatest, while the calculated emission ratios used annual total emissions.

P90 L24,26 Perhaps uncertainties from individual slopes (∼20%) are a better measure of the final uncertainty.

P91 L18. The remaining discrepancy between the recent inventories and this work should be noted here.

P93 L1. The term "hot spot" is vague because it is used differently by various scientists (e.g. referring to emissions, human exposure, or environmental harm) and is not defined earlier in the paper. Even with TGM emissions of 30 t/y South Africa remains the largest national emitter of mercury in the southern hemisphere, accounting for 30-50%. Since most of this mercury comes from just 10 power plants concentrated in 1 province there may still be communities with high mercury exposure (Masekoameng et al. 2010).

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 11079, 2012.