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Interactive comment on “²²²Rn calibrated mercury fluxes from terrestrial surface of southern Africa derived from observations at Cape Point, South Africa” by F. Slemr et al.

F. Slemr et al.

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We thank to anonymous reviewer #2 for a detailed, insightful, and constructive review. Before going into the details we would like to note that we are well aware that our approach is simplified. We believe that issues such as flux calculations, event duration weighing, and the correction for ²²²Rn decay could be much better addressed by inverse modeling. We have been and are trying to find collaboration with several modeling groups but, unfortunately, so far without success. We hope that this paper will stimulate the interest of modelers and perhaps even shift this topic a notch or two up in their priority list.

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Specific comments

1. Tekran calibrations

More details about Tekran calibration and Rn measurements are now given. We do not refer to Brunke et al. (2002) for details on mercury measurements because they used a manual technique with a different sampling and analysis protocol.

2. Data analysis protocol

Depletion and pollution events appear as outliers in Hg vs ^{222}Rn scatter plots. Their elimination was cross checked using time series plots.

As mentioned now the time resolution of ^{222}Rn measurements was 30 min.

3. Wet deposition measurements

In this comment the reviewer addresses two different issues: a) the stimulation of mercury emission by rain along the backward trajectories of an event and b) measurements of mercury wet deposition at Cape Point. The issue a) is now clearly stated in the revised text. The precipitation at Cape Point is irrelevant for this issue. The issue b), the measurement of mercury wet deposition at Cape Point, is not part of the regular WMO-GAW program and we omitted its description for this reason. As it is a part of a research project by University of Connecticut we deem the reference to their paper sufficient.

4. Error in mean values

We now use consistently standard error of the mean. This is mentioned explicitly in the text.

5. Time weighing of event duration

Following the suggestion of the reviewer we recalculated the overall flux by weighting it by the durations of the events. The result is somewhat different and is reported now in

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addition to the un-weighted statistics. We compare the un-weighted mean flux with the flux measurements elsewhere and the event duration weighted flux with the modeled fluxes.

6. RGM contribution to total Hg flux

The reviewer addresses two issues: a) the applicability of RGM data by Soerensen et al (2010a) for estimation of RGM flux at Cape Point and b) the possible impact of the depletion events observed at Cape Point.

Ad a): We refer to measurements by Soerensen et al (2010a) because, to the best of our knowledge, there are no other speciated mercury measurements in air above and around South Africa. But we agree that they are not fully adequate for this discussion for reasons stated by the reviewer. An additional reason may be that the data by Soerensen et al. (2010) were collected in the marine boundary layer where higher RGM concentrations can be expected because of the halogen chemistry. But we are also aware that concentrations are not fluxes and that the RGM deposition with much higher RGM deposition rate could still be significant even at very low RGM concentrations. In fact, model simulations by Smith-Downey et al. (2010) predict substantial RGM dry deposition and are now mentioned in the discussion.

Ad b): Brunke et al. (2010) reported the occurrence of short depletion events at Cape Point from March 2007 to June 2008 but were unable to unravel the mechanism behind them. Despite data now being available until the end of 2012 the mechanism still remains obscure and that is the major reason for excluding them from the analysis. As mentioned by Brunke et al. (2010) the short duration of the depletion events suggest them to be a local rather than a regional phenomenon. With some 50 depletion events per year lasting each ~ 5 h it is unlikely that they can influence the regional fluxes discussed in this paper.

We extended the discussion of RGM flux contribution accordingly.

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7. Correction for ^{222}Rn decay

As each measurement point represents a spectrum of transport times from points along its backward trajectory and each event consists of a large number of points with their respective backward trajectories, the ^{222}Rn decay can explicitly be corrected for only by inverse modeling. Other ways to correct for it are all grossly simplified. Based on typical backward trajectories, we deem 2 days of transport time corresponding to about 1000 km distance from Cape Point a reasonable assumption.

Technical corrections

Most of the technical corrections have been made as suggested unless mentioned below

23. The reference to Griffiths et al. was eliminated.

Figure 2: A significant slope of 0.00 pg mBq^{-1} is surely impossible but there were two significant slopes of -0.0068 and $+0.0034 \text{ pg mBq}^{-1}$, well within the bin. We do not find the figure confusing. The labeling “Signif” has been changed to “significant”.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 8213, 2013.

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