Response to Anonymous Referee #2

We thank the reviewer for his/hers comments. Basically, these comments are dedicated to possible instrument artifacts including the inherent problem of passivation of the gold traps, which is definitely an important issue, in particular when evaluating Mercury Depletion Events. Unfortunately, the comments by Referee #2 do not seem to take into account the published comment of J. Fritsche dedicated to this particular issue, and our response to it.

Following the suggestions by the referee we checked whether some of the automatic calibrations coincide with the depletion events (DEs). Fig. 1 shows the raw data for a period April 16-22, 2007, with several such coincidences. Irrespective of whether the calibration was made outside or within a DE, the calibrations follow a slow decreasing trend possibly due to the aging of the mercury lamp. Fig. 1 demonstrates clearly that a temporary de-activation of the gold traps during the DEs can be ruled out.

This finding still lets open the possibility of artifacts within the sampling line. As such artifacts are usually irreversible we consider them to be very unlikely. We are aware that a standard addition at the inlet during a DE would definitively resolve this question too. However, since DEs in general are sporadic observations at mostly remote sites (in our case Cape Point is operated from a distance of some 100 km, including driving through Cape Town) this measure has not been carried out so far. Neither has it been made in the vast majority of scientific papers related to MDEs (to date more than 250 papers for polar environments).

In addition we would like to focus on the fact that the depletion events of the similar type as described by us have already been reported by others and that a real chemical transformation of elemental mercury during these DEs, albeit unexplained, has been demonstrated.

We refer to Fig. 6 of Temme et al. (2003) in which simultaneous measurements of total gaseous (TGM), elemental (Hg^0), reactive gaseous mercury (RGM) and ozone are reported for Neumayer station (Antarctica) in January 2000, i.e. in Antarctic summer. On January 1 and 2, 2000, the TGM and Hg^0 concentrations decreased by about 80% and on January 3 by about 50%. The depletion was in both cases accompanied by a simultaneous increase of RGM and ozone concentrations. The latter observation clearly distinguishes this type of DEs against the well documented polar DEs which are invariably accompanied by ozone depletion. The increase of RGM concentration also clearly documents that a chemical transformation of Hg^0 must have had occurred, even if the RGM increase represents only a part of the Hg^0 that disappeared. The first DE is accompanied by a slight increase in concentration of condensation nuclei (CN). Taking all these observation into account, it is almost impossible to believe them to be a product of analytical artifacts.

The DEs observed at Cape Point are very similar to those reported by Temme et al. (2003). No ozone depletion is observed. The DEs are initiated and end with changes in

meteorological parameters (decrease of wind speed on January 1and 2 as well as on January 3, slight change of wind direction on January 3) and they extend for similarly short periods (less than a day) pointing to a local or regional phenomenon at most. The DEs tend to be related to solar radiation. An increase of CN concentration during the DE on January 1 and 2 is similar to observation of slightly increased scattering during some of the DEs at Cape Point. Consequently, we believe that the DEs observed at Cape Point are of the same type as those described by Temme et al.

At last we would like to point out that the DEs of the type observed at Cape Point and Neumayer stations are not unique to these two places. As already mentioned in our response to the comment by J. Fritsche, the DEs were observed during the cruises of RV Polarstern over the southern and northern Atlantic Ocean in 2008 and 2009 (Joachim Kuss, unpublished results). All these observations including those at Neumayer and Cape Point have been made in marine boundary layer so far.

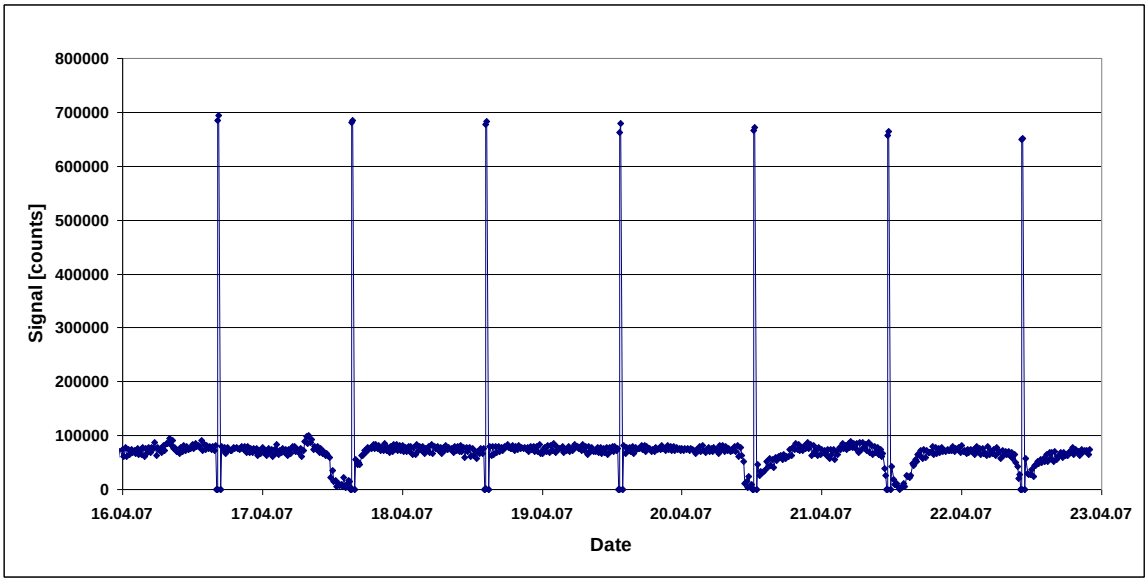

Fig. 1: Raw signal of the Tekran instrument at Cape Point in April 16-22, 2007. Note that the automatic calibrations on April 17, 20, 21, and 22 coincide with the DEs.

Reference: Temme, C., Einax, J.W., Ebinghaus, R., Schroeder, W. H.: Measurement of atmospheric mercury species at a coastal site in the Antarctic and over the South Atlantic Ocean during polar summer, Eviron. Sci. Technol. 37, 22-31, 2003.