acp-2012-452 (Cole et al.), Response to Anonymous Referee #2

Thank you for your comments and suggestions. Please see below for our responses.

Methods: The precision of the individual GEM, RGM, and TPM measurements should be given. Problems with RGM and TPM measurements should be mentioned perhaps using a reference to the published technique intercomparison studies.
- We have addressed this comment for TGM by adding the following to the methods section: "The precision of the TGM measurements for the CAMNet sites following earlier audits was determined to be 9% (Temme et al., 2007); this is a conservative estimate for a single site (where precision may be as good as 2% (Poissant, 2000)) that takes into account instrument and operator changes over the years."
- Precision of RGM and TPM concentrations is difficult to assess, since we cannot create standards without knowing their chemical composition. We have added the following section as suggested: "Early tests on the 1130 denuder system estimated an RGM precision of about 15% (Landis et al., 2002), though comparisons between different methods have revealed differences for RGM and TPM measurements on the order of 30-80% (Ebinghaus et al., 1999; Munthe et al., 2001; Aspmo et al., 2005). Using a consistent instrument configuration at a single site, with rigorous and consistent protocols for sample collection and data treatment (Steffen et al., 2012), we estimate a precision of 15-30% for RGM and TPM measurements. Based on the intercomparison results cited, absolute concentrations would be less reliable than the time trends discussed here."

Fig. 4 shows that Alert data are substantially more influenced by AMDEs than the Zeppelin data. This might be because of the altitude of the Zeppelin Mountain which places the Zeppelin station frequently over the boundary layer where the AMDEs are predominantly located. This might have already been discussed elsewhere, and if so, a reference should be added. The similarity of the trends at both stations, one frequently and one less frequently influenced by AMDEs, thus provides another evidence for AMDEs not being the major reason for the difference between the Arctic and mid-latitude trends.
- We agree that this is further evidence against the AMDE contribution. We have added that to the manuscript to reflect your comment, as follows: "Also, a trend in AMDE activity would likely affect Alert more than Zeppelin, since Alert experiences stronger and more frequent AMDEs, but the observed spring trends are similar at the two Arctic stations." As to the reason for the difference, as far as we are aware there is no strong evidence of a difference in AMDE frequency between Zeppelin Mountain and lower elevations (Sommar et al., 2007), though additional studies are currently underway. Possibly the difference is due to the warmer climate at Svalbard compared to Alert and the fact that it is much further away from the ice pack in some years.

Page 20213, line 17-18: "..second Teflon filter at the back of the instrument". The filter is probably upstream of the instrument, but that is not clear from this wording. Please specify.
- This was changed to "at the inlet to the instrument"

Page 20214, last line: The sentence "In lieu of RGM and TPM standards, rigorous procedures. . ." still leaves the reader at a loss, how the RGM and TPM measurements were calibrated.
- They are not calibrated as RGM and TPM. The two species are pyrolyzed to GEM and measured as such, so calibrations are performed in the 2537 unit as with GEM (both with internal and external calibration sources). We have added the following to the methods section to be clearer: "All species are measured as GEM, thus the 2537 instrument is internally and externally calibrated as described for the TGM measurements." The major source of uncertainty is therefore in the collection phase. This uncertainty is minimized by ensuring that all settings (flow rates, collection and desorption temperatures, cycle times, filters, etc.) and QC criteria are kept consistent over the years (this was expanded on in the methods section in response to Reviewer 1's comments as well). We realize this is somewhat unsatisfying and we do make a point of stressing the uncertainty of these trends in the discussion. Currently, this is the only method in place to make these measurements. The research community is working on developing standards and methods to elucidate the identity of RGM and TPM but until the technology is present, we use standardized methods to collect and analyse the data. Thus we are confident in the trends we have presented here.

Page 20125, line 28: Detection limits are mentioned but not specified.
- This was mentioned earlier in the section (3.0 pg m^{-3}).

Page 20126, last sentence: The sentence ". . .monthly trends at Alert are the same as or higher than. . ...suggesting that the overall trend at Alert is most likely less negative than . . ." is not wrong but confusing for the reader because "higher" is on absolute scale whereas "less negative" on relative one, the latter related to zero.
- We have revised the section to read: "there were no months in which the trend at Alert was significantly more negative than the trends at Kuujjuarapik or Kejimkujik (Fig. 2), suggesting that the overall trend at Alert is most likely less negative than the overall trend at those two sites as well"

Fig. 3 displays the trend data from Table 1 in graphical form and is thus redundant.
- Figure 3 also shows the time series of TGM at the sites, which some readers will like to see. It allows the reader to judge how well the linear trend represents the data. We would prefer to retain the figure, but will defer to the editor.

Sommar, J., Wangberg, L., Berg, T., Gardfeldt, K., Munthe, J., Richter, A., Urba, A., Wittrock, F., and Schroeder, W. H.: Circumpolar transport and air-surface exchange of atmospheric mercury at Ny-A°lesund (79° N), Svalbard, spring 2002, Atmos. Chem. Phys., 7, 151-166, 2007.