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Biogeosciences Discussions

Interactive comment on "Mercury distribution and transport in the North Atlantic Ocean along the GEOTRACES-GA01 transect" *by* Daniel Cossa et al.

Anonymous Referee #2

Received and published: 4 January 2018

General comments:

This study presents an impressive set of high resolution THg measurements in the North Atlantic Ocean (NA), along a transect from Lisbon (Portugal) to the Labrador Coast (Canada) as part of the GEOTRACES programme. The NA, where water masses mixing and deep water formation occur, is a location of interest to assess inputs of Hg to ocean water. This study also uses an interesting approach, extended Optimum Multiparamater (eOMP) analysis, to characterize THgUNF. concentrations relative to source water masses and to assess the anthropogenic Hg contribution to water masses.

While there is a fully detailed oceanography context on the formation of the water masses, a more complete description of the biogeochemistry of Hg in oceans, especially Hg evasion and deposition at the air-water interface which is identified as an important mechanism driving oceans THg concentrations, might be useful to the reader

Description of the Hg vertical patterns in the different oceanographic regions could be condensed focusing on stations of interest where influence of water masses or specific oceanographic conditions are observed

Are the mean THgUNF concentrations statistically different in LS, IrS and IcB??

Since SWTs are characterized by potential temp, salinity and nutrients, it might be interesting to see the plot of these parameters in SI. Please specify the nutrients used for the characterization of the SWTs

Adding a salinity distribution plot with the water masses or SWTs superimposed on figure 2 might help the reader through the results and discussion sections.

The authors conclude atmospheric deposition is driving THg concentrations but they do not provide strong arguments (e.g. deposition rates, GEM concentrations etc.) to support this statement

Specific comments:

Line186: How was the Hg-free seawater sample used as blank solutions prepared? Did you use the same blank solution during the cruise?

Line 221: specify which macro-nutrients were used for SWT characterization

Line 267: suggest "in addition, lowest and highest . . ."

Line 268: Rather speculative statement. Do you have additional data, e.g., wind forcing, other gases such as CO2, flux, GEM in atmosphere or THg in particulate matter or high OM content at stations where elevated THg concentrations were recorded to

support this statement

Line 292: Typo error “0.63” instead of “63”

Line 298: Is Hg evasion and/or PM content in this basin of greater importance than in the other areas so that they can explain the variations in surface THg concentrations (observed at Stn 38 only)?

Line 393: typo error? “SPMW7” instead “SPMW8”

Lines 401-404: The authors explain the departure of estimated THg concentrations from the THgUNF vs AOU line, thus Hg enrichment, in SAIW6 and ENACW12 by atmospheric deposition. They state further that atmospheric deposition is a significant source of Hg to NA. However, THgUNF in these SWTs are relatively low (see Table 1). Hard to reach such a conclusion based on THgUNF concentrations in SAIW6 and ENACW12. While these results suggest that a process other than AOU, most probably atmospheric deposition is the main source of THgUNF in surface water (Upper limb of AMOC), it is of minor contribution compared to ocean circulation in NA water column. As mentioned in lines 406 – 408, OM regeneration and hydrological processes are the main factors controlling THg in NA waters. When OM regeneration not occurring THg concentrations are low stressing the lesser importance of other sources i.e., atmospheric deposition. I suggest to replace the term “significant”by “dominant”.

Figure 4: is the relationship linear or should a non-linear relationship be investigated

Technical corrections:

Line 252: Numbering error, results is section 4 instead of 5? Subsections should be corrected accordingly

Line 324: “. . .abundance of phytoplankton, whereas the position of the lower peaks, which is close to the maximum of Apparent Oxygen Utilization (AOU) that rose above 70 μmol L-1 (Fig. 2), suggests a dependence . . .”, report r-values for relationships and/or show plot of Chla / fluorescence distribution in SI

Line 342: add a salinity plot in SI

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