

Interactive comment on “Transport and fate of hexachlorocyclohexanes in the oceanic air and surface seawater” by Z. Xie et al.

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Review of the manuscript “Transport and fate of hexachlorocyclohexanes in the oceanic air and surface seawater” by Xie et al. (BGD-8-5537-2011).

The manuscript shows the results of gas-phase and dissolved phase concentrations of HCH from a North-South transect in the Atlantic Ocean. The data set is discussed and compared with previous reports of HCH concentrations in the Atlantic atmosphere and seawater. Technically, the work is of high quality. The discussion of the results is also of great importance to understand the regional/global fate of this important class of legacy pollutants. Especially important is the fact that the new data set allows to extend the previous data set of HCH in the Atlantic and draw conclusions on regional and temporal trends. I suggest that the manuscript is accepted after the minor/moderate

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modifications suggested below.

Specific comments:

- Abstract, line 11: I guess it should say “dissolved concentrations”, the sentence is not true for gas phase concentrations.
- Abstract, line 14: Even though the term “Cold condensation” has been used in the literature, it is false that HCHs, and other POPs, undergo cold condensation and we understand condensation as a term from thermodynamics. Condensation occurs when the gas phase concentrations are higher than their vapor pressures, and this never happens in environmental conditions. It is better to use the “cold trapping” term, when referring to the fact that at low temperatures partitioning to water is favored.
- Page 5542: Were HCH analyzed in the particulate phase? If yes, then the concentrations should be given, if not, then it should say that the concentrations in the particulate phase were “assumed” to be negligible. It is true that this is the usual assumption, but at low temperatures, for example, it is possible that HCH in the particulate phase are not so low, and previous reports have reported HCH in settling and suspended particles in the marine environment.
- Page 5543: I’m not able to see how HCH are “homogenously distributed” in the NH, in fact the authors report differences in gas phase concentrations with higher concentrations close to W. Europe and NE Africa, consistent with other studies, so these differences do not support an homogenous distribution.
- Page 5544, lines 15-19: I’m not convinced of this statement, Henry’s law for all HCH are high enough so exchange with the atmosphere will dominate their transport. If the authors think that this is due to riverine inputs, please, support the statement with the temperature-salinity data for the water mass.
- Page 5544: When providing R² for correlations, the p-value should also be given, since the R² provides the fraction of variability explained by the correlations, but does

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not provide any information on the significance, which is given by the p-value. I guess there is a typo error in the R2 in line 23.

- Page 5545: Please, be explicit when discussing the trends. It is not clear when you are discussing trends of gas-phase concentrations and when you are referring to dissolved phase concentrations. Improve the sentence in lines 18-21. I agree that the biological pump (sorption to particles and settling) could explain, in part, the decrease of concentrations in regions with high primary productivity. To estimate this is difficult because the particle-water and plankton-water partitioning coefficients are poorly constrained for the marine environment. However, in addition to settling, degradation (bacterial, photodegradation, by zooplankton) may play an important role. Recently, Berrojalbiz et al. (Environ. Sci. Technol. 45, 4315-4322, 2011) has found strong evidence that degradation plays a role explaining the lower concentrations of HCH in regions with higher biomass. Even though Berrojalbiz et al. (2011) focus on concentrations in plankton, it may also be true for water column dissolved concentrations. In fact, I think that the conclusions of Berrojalbiz et al. concerning HCH are consistent with the results and discussion shown here.

- Page 5546, last sentence. Again, I don't agree that there is evidence of river influence. Of course rivers influence the dissolved concentrations very close to the coast, but usually their influence is not relevant at open sea waters for semivolatile compounds. This is due to dilution, but also due to strong volatilization fluxes of POPs from coastal waters. The authors need to support further their sentence or delete it.

- Page 5548: note that fugacity ratios higher than 3 for most sites implies that there is an important loss term in the water column. This may be settling (unlikely in oligotrophic regions) and degradation.

- Page 5548: Line 9-13. If I look at Figure 5, I see net deposition of B-HCH in all sampling sites from the SH, and in half of the sites from the NH. I find the behavior of b-HCH similar to other HCHs.

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- Page 5549, line 19: I suggest that the authors compare the transport potential of atmospheric and oceanic currents to support this sentence.

- Equation 2. No information is given on the estimation methods of Kol. For example there are several correlations used to estimate the influence of wind speed, or for example, averaging wind speeds introduce an error in the final estimates. The exact correlations used for Kol estimation should be shown in the supplementary material, it is not enough to cite a couple of references.

Technical comments:

- Page 5539, line 15: change "legend" per "legacy".

- page 5539, lines 10-14: the sentence is not clear. There is volatilization, and HCH and other POP can be transported to the deep ocean, but nobody has yet demonstrated that POPs that have reached the deep ocean can be revolatilized.

- Page 5539, Lines 23-25: I guess it should say "dissolved concentrations".

- Page 5540, line 23: I guess that water samples (columns) were kept at +4C, not at -4C.

- Page 5541: concerning blanks, these should be provided in the supplementary material. Blanks, as field values, follow a log distribution, so the statistical descriptors of blanks should be shown. Substantiate the sentence "blank showed very low values which were generally in the ...".

- Page 5545, line 23. change "adsorption" to "sorption".

- Equation 2. Kol is the "overall air-water mass transfer coefficient".

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