

Polyhalogenated Very Short Lived Substances (VSLS) in the Atlantic Ocean, and Their Linkages with Ocean Primary Production

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Bromoform (CHBr_3), dibromomethane (CH_2Br_2) and other VSLS were measured during 5 cruises from 1998 to 2010. These cruises were conducted over a large meridional ($62^\circ \text{ N} - 60^\circ \text{ S}$) and zonal transect ($11^\circ \text{ W} - 86^\circ \text{ W}$) in the Atlantic Ocean. Elevated atmospheric mixing ratio and seawater concentrations of CHBr_3 were observed coincident with regions of elevated chlorophyll *a*, such as the equatorial region, upwelling zones and coastally influenced / shelf waters, indicating ocean primary production is related to CHBr_3 production. While CH_2Br_2 seawater concentrations exhibit similar trends with CHBr_3 , it is better mixed in the atmosphere, due to its longer atmospheric lifetime. The sea-to-air flux maxima for CHBr_3 and CH_2Br_2 were observed in coastally influenced / shelf waters. Assuming fluxes measured in the Atlantic open ocean are globally representative, the resulting extrapolated CHBr_3 global open ocean annual net sea-to-air flux is $0.13 - 3.6 \text{ Gmol Br yr}^{-1}$.

During one of the cruises conducted in 2010 (HalocAST – A), we also measured pigment biomarkers, flow cytometric picoplankton counts, and other biochemical parameters to better understand the possible linkages between the production of the VSLS and different phytoplankton groups. However, none of the pigment biomarkers yield significant correlations with CHBr_3 and CH_2Br_2 . While zeaxanthin does not distinguish between *Synechococcus* sp. and *Prochlorococcus* sp, flow cytometric cell counts do allow for their separation and determination of their individual abundances, as well as providing cell abundance information for other picoeukaryotes and heterotrophic bacteria. Seawater concentrations of CHBr_3 were significantly correlated with *Synechococcus* sp. near the Northwestern African upwelling zone but not anywhere else during the HalocAST – A cruise. These findings indicate that more specific parameters are needed for assessing biogenic sources of the VSLS during large oceanographic transects due to changing biomes during the course of the cruise.

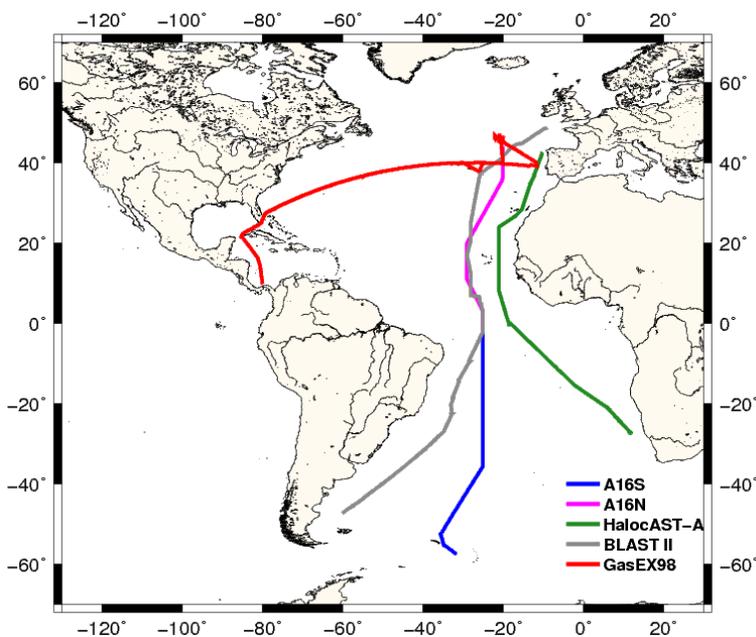


Figure 1. Ship tracks of where data were collected for cruises A16N (magenta line), A16S (blue line), HalocAST-A (green line), BLAST-II (grey line) and GasEX-98 (red line).