The Ocean in Near Equilibrium with Respect to Atmospheric CH_3Br

L. Hu, S. Yvon-Lewis, Y. Liu and T. Bianchi

Texas A&M University, 4467 College Station Ave, College Station, TX 77801; 979-845-7211, E-mail: lhu@ocean.tamu.edu

During the Halocarbon Air Sea Transect (HalocAST) cruises in the Pacific (3/30 – 4/27, 2010) and the Eastern Atlantic (10/25 – 11/26, 2010), we measured the saturation anomaly of CH_3Br to assess changes in the oceanic saturation state as the phaseout of non-Quarantine and Pre-Shipment (non-QPS) uses of CH_3Br nears completion and atmospheric concentrations continue to decline. These cruises occurred 16 years after the Bromine Latitudinal Air-Sea Transect (BLAST) cruises, which were conducted in the same regions and first established a global oceanic net sink of -12.6 Gg yr^{-1} for atmospheric CH_3Br in 1994. Results from this study suggest saturation anomalies of CH_3Br have become less negative than those observed 16 years ago as the atmospheric burden has declined over the past decade. The global net sea-to-air flux was estimated at -1 to 4 Gg yr^{-1} in 2010, suggesting the ocean may be nearly in equilibrium with atmospheric CH_3Br. There are no significant differences for determined biological loss rate constants and the calculated production rates between this study and previous studies, suggesting that production rates and oceanic degradation rate constants remained relatively constant over the past 16 years.

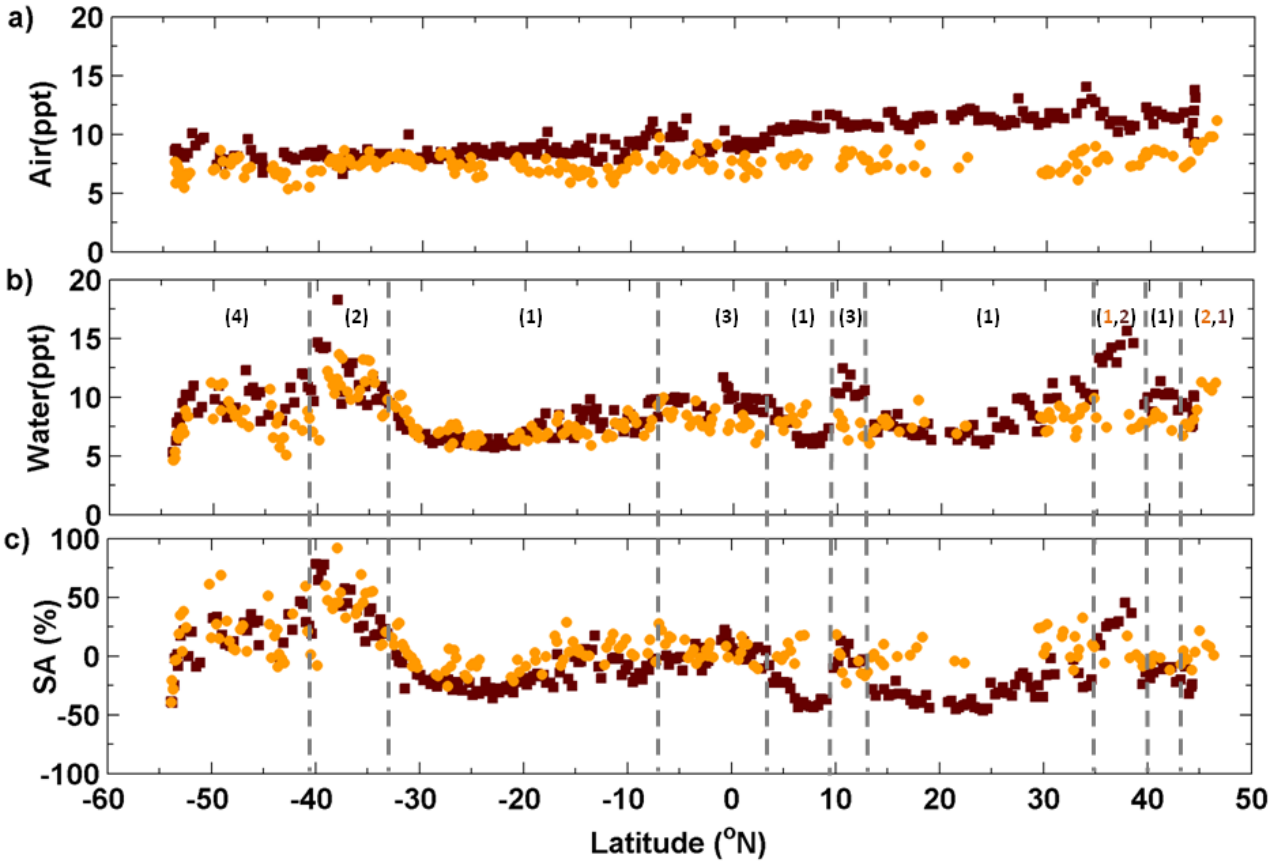

Figure 1. (a) CH_3Br atmospheric mixing ratios; (b) CH_3Br equilibrium partial pressures in surface seawater and (c) saturation anomalies for BLAST I (■) and HalocAST-P (●). The numbers between the dashed vertical lines indicate different oceanic regions with 1 = open ocean, 2 = coastal and nearshore, 3 = upwelling and 4 = coastal.