Bromocarbons in the tropical coastal and open ocean atmosphere during the 2009 Prime Expedition Scientific Cruise (PESC-09)


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Abstract. Atmospheric concentrations of very short-lived species (VSLS) bromocarbons, including CHBr3, CH2Br2, CHCl2Br, CHClBr2, and CH2BrCl, were measured in the Strait of Malacca and the South China and Sulu–Sulawesi seas during a two-month research cruise in June–July 2009. The highest bromocarbon concentrations were found in the Strait of Malacca, with smaller enhancements in coastal regions of northern Borneo. CHBr3 was the most abundant bromocarbon, ranging from 5.2 pmol mol$^{-1}$ in the Strait of Malacca to 0.94 pmol mol$^{-1}$ over the open ocean. Other bromocarbons showed lower concentrations, in the range of 0.8–1.3 pmol mol$^{-1}$ for CH2Br2, 0.1–0.5 pmol mol$^{-1}$ for CHCl2Br, and 0.1–0.4 pmol mol$^{-1}$ for CHClBr2. There was no significant correlation between bromocarbons and in situ chlorophyll $a$, but positive correlations with both MODIS and SeaWiFS satellite chlorophyll $a$. Together, the short-lived bromocarbons contribute an average of 8.9 pmol mol$^{-1}$ (range 5.2–21.4 pmol mol$^{-1}$) to tropospheric bromine loading, which is similar to that found in previous studies from global sampling networks (Montzka et al., 2011). Statistical tests showed strong Spearman correlations between brominated compounds, suggesting a common source. Log–log plots of CHBr3/CH2Br2 versus CHBr2Cl/CH2Br2 show that both chemical reactions and dilution into the background atmosphere contribute to the composition of these halocarbons at each sampling point. We have used the correlation to...