A Study of Ambient Mercury in the Marine Free Troposphere

L. Krnavek[1], M. Landis[1], D. Kuniyuki[2] and A. Colton[2]

[1]U.S. Environmental Protection Agency, Research Triangle Park, NC 27711; 919-541-3330, E-mail: alvarez-aviles.laura@epamail.epa.gov
[2]NOAA Earth System Research Laboratory, Mauna Loa Observatory, Hilo, HI 96720

The NOAA Mauna Loa Observatory (MLO) in Hawaii was ideal to investigate high marine free troposphere ambient mercury transformation and transportation processes. We measured gaseous elemental mercury (Hg0), divalent reactive gaseous mercury (RGM), particulate bound mercury (Hg(p)), O_3, SO_2 and elemental carbon in high resolution from 2002 – 2009. We found no overall trend of increase or decrease for ambient mercury, but found great temporal variability when working with high resolution data. Hg0 concentrations ranged from 0.2 – 11 ngm^{-3} and geometric mean ± geometric standard deviation of 1.6 ± 1 ngm^{-3}. Hg(p) concentrations ranged between 2 – 536 pgm^{-3}, 15 ± 4 pgm^{-3} and RGM ranged between 2 – 241 pgm^{-3}, 6 ± 2 pgm^{-3}. The variability in ambient mercury concentration was due to rapid changes or air masses arriving at MLO with differing past chemical history and age. We classified air masses arriving at MLO as young and old, which relates to their local and long distances origins. Younger air masses show that chemical transformation of Hg0 is possible in the marine free troposphere. Older air masses serve as a storage and transportation media of ambient mercury. Older air masses also show a convoluted chemical history of ambient mercury at high altitude, product of chemical reactions, mixing of low tropospheric and stratospheric air masses and heterogeneous chemistry while in transport.

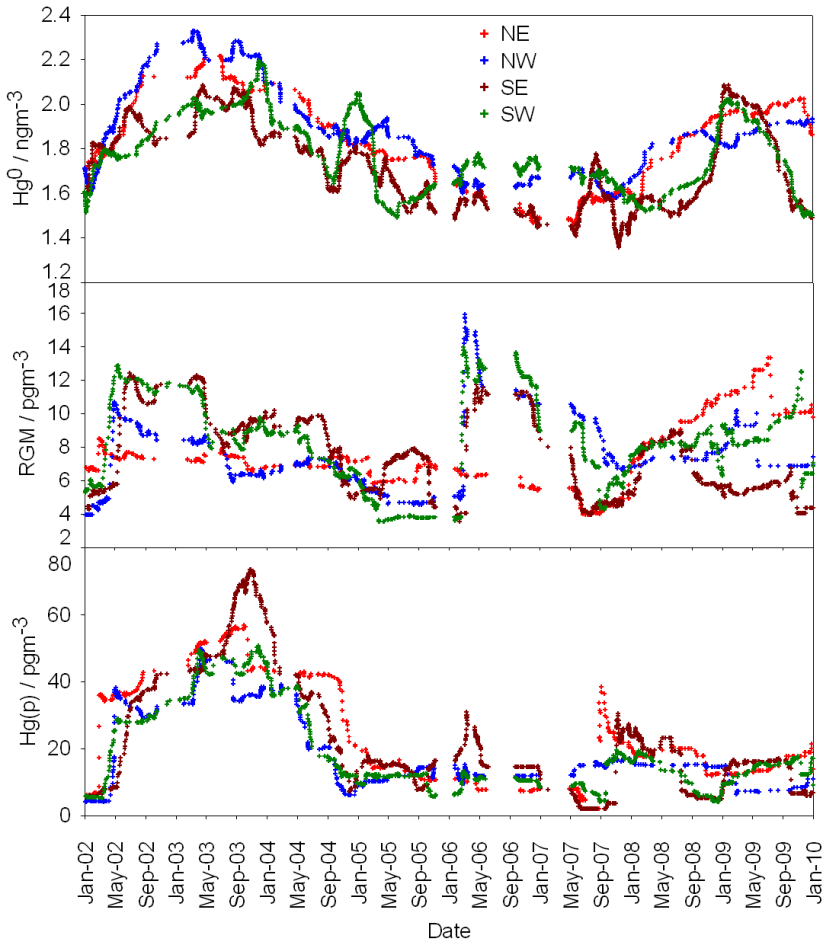

Figure 1. Hg0, Hg(p), and RGM concentration time series by wind direction collected at MLO, Hawaii from 2002 – 2009.