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Long-term Observations of Atmospheric Speciated Mercury at a Coastal Site in the Northern Gulf of Mexico during 2007–2018

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Atmospheric mercury species (including gaseous elemental mercury (GEM), gaseous oxidized mercury (GOM) and particulate-bound mercury (PBM)), trace pollutants (including O_3, SO_2, CO, NO, NO_Y and black carbon), and meteorological parameters have been continuously monitored since 2007 at an Atmospheric Mercury Network (AMNet) site located on the northern coast of the Gulf of Mexico at the Grand Bay National Estuarine Research Reserve (NERR) in Moss Point, Mississippi. For the data collected between 2007 and 2018, the average concentrations and standard deviations were 1.39 ± 0.22 ng m^{-3} for GEM, 5.1 ± 10.2 pg m^{-3} for GOM, 5.9 ± 13.0 pg m^{-3} for PBM, and 309 ± 407 ng m^{-2} wk^{-1} for mercury wet deposition, with interannual trends of -0.009 ng m^{-3} yr^{-1} for GEM, -0.36 pg m^{-3} yr^{-1} for GOM, 0.18 pg m^{-3} yr^{-1} for PBM, and 2.8 ng m^{-2} wk^{-1} yr^{-1} for mercury wet deposition. The trends are statistically significant for GEM and GOM, but not statistically significant for PBM and mercury wet deposition. Diurnal variation of GEM shows lower concentrations in the early morning due to GEM depletion likely due to plant uptake in high humidity events and slight elevation during the day likely due to downward mixing of higher concentrations of GEM in the air aloft to the surface. Seasonal variation of GEM shows higher levels in winter and spring and lower levels in summer and fall. Diurnal variations of both GOM and PBM show broad peaks in the afternoon likely due to photochemical oxidation of GEM. Seasonally, PBM measurements exhibit higher levels in winter and early spring and lower levels in summer, while GOM measurements show high levels in late spring/early summer and late fall and low levels in winter. The seasonal variation of mercury wet deposition shows higher values in summer and lower values in winter due to higher precipitation amounts in summer than in winter. As expected, anticorrelation between Hg wet deposition and the sum of GOM and PBM but positive correlation between Hg wet deposition and rainfall were observed. Correlation among GOM, ozone, and SO_2 suggests two possible GOM sources: direct emissions and photochemical oxidation of GEM with the possible influence of boundary dynamics and seasonal variability. This study indicates that the monitoring site, which is located in a coastal environment of the Gulf of Mexico, might experience impacts from mercury sources that are both local and regional in nature.