MANGANESE CONCENTRATION AND SPECIATION IN COASTAL RAINWATER, SOUTHEASTERN NORTH CAROLINA

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ABSTRACT

Manganese exists in mainly two oxidation states in the atmosphere, Mn(II) and Mn(IV). Divalent manganese, Mn(II), is a soluble oxidation state whereas tetravalent manganese, Mn(IV), is found as a particulate. Mn(II) is therefore found in higher concentrations in rainwater. Manganese is released into the atmosphere by natural and anthropogenic sources. Rainwater is thought to be a main removal mechanism for atmospheric manganese. The concentration and speciation of manganese were determined in rainwater from Wilmington, NC, from April 2, 2005 to March 24, 2006. Volume weighted averages for Mn_{total}, Mn(II), and Mn(IV) were 11 ± 3 nM, 11 ± 3 nM, and 1.2 ± 0.4 nM respectively.

All manganese species were present in all seasons with higher concentrations of Mn_{total} and Mn(II) in winter relative to summer season with no significant difference in Mn(IV) between seasons. All manganese species were considerably lower during the fall. Concentrations of Mn_{total} and Mn(II) were higher in terrestrial storms relative to marine storms with no significant difference in Mn(IV) between storm types. Diurnal variation was seen where Mn_{total} and Mn(II) concentrations were lowest during the afternoon hours when Mn(IV) was at a maximum. Mn(II) and Mn(IV) concentrations were not correlated with one another. Mn(IV) showed a positive correlation with Fe_{part} whereas Mn(II) correlated with Fe_{diss} and Fe_{part}. A positive correlation was observed between Mn(II) and the pollutant indicators H^+, NO_3^-, and NSS. No correlation was observed for Mn(IV) and the pollutant indicators. Highest concentrations of manganese species occurred in small volume rains and lowest concentrations in high volume.

Atmospheric global inputs by natural and anthropogenic sources, 3.28 x 10^{11} g per year or 6.0 x 10^9 moles per year, as compared to calculated total global flux of manganese removed via wet deposition, 2.47 x 10^{11} g per year or 4.5 x 10^9 moles per year, suggests that
approximately 75% of atmospheric Mn is removed by wet deposition with the remaining 25% removed by dry deposition.
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