Trends in aerosol acidity and constraints on past ammonia derived from 20 years of Canadian Air and Precipitation Monitoring Network (CAPMoN) data.

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Aerosol acidity is important for its role in influencing particulate chemistry, as well as in moderating the impact of particulate matter in terms of both human and ecosystem health. Because if this it is important to understand trends in aerosol acidity and the factors that drive them. As the primary atmospheric base, gas phase ammonia plays an important role in controlling particle acidity, however the long term gas phase data needed to understand ammonia trends is generally lacking. Using 20 years of particulate data from the Canadian Air and Precipitation Monitoring Network (CAPMoN), spatial and temporal trends in aerosol strong acidity were investigated at 8 geographically diverse sites. Statistically significant decreases in strong acidity were observed at all sites, as well as a clear seasonal periodicity which differed between sites. Sites closer to anthropogenic influence showed summer maxima, while more remote sites had greater strong acidity during winter, a contrast which can be understood in terms of the relative importance of different inorganic species as drivers of aerosol acidity. Combining this particulate information with precipitation and gas-phase data from these same sites, the possibility of constraining past ammonia concentrations was investigated, using the thermodynamic Aerosol Inorganic Model (AIM) to calculate the ammonia concentrations necessary to replicate available gas and particulate data. This estimate could contribute to our understanding of ammonia trends and their influence on aerosol acidity despite the scarcity of long term measurements.

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