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Source Apportionment of Sulfate and Trace Elements in PM_{2.5} in New York, New York, Based on Air Trajectory Analysis

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As a part of the New York Supersite Program 24 hour PM_{2.5} aerosols were collected on 47mm Zefluor™ filters at Queens (Q), Whiteface Mountain (W) and Pinnacle State Park (P) in New York State from July 2001 to June 2002. The filters were analyzed by ion chromatography for SO₄²⁻ and for trace elements by inductively coupled plasma mass spectroscopy (ICPMS).

Generally the observed quarterly and annual mean concentration of SO₄²⁻, and the measured trace metals are highest at Q followed by P and W. At all three sites the SO₄²⁻ concentration is highest in the third quarter (July to Sept). At Q the mean trace metals concentrations are highest in the fourth quarter (Oct - Dec). The annual SO₄²⁻/Se ratio, at all three sites are around 4000 indicating a regional component. These ratios are indicative of 'aged' aerosols transported from distances of several hundreds of km. The influence of a source region on the observed concentration at a sampling site is dependent both on the concentration accumulated by the air mass during transport and the frequency of air masses. Air trajectories were determined back ward in time using the HYSPLIT 4 model at a height of 1 km. for each day ending at 0100, 0700, 1300 and 1900 hrs EST. Each trajectory was computed 72 hrs back in time and the latitude and longitude of the air parcel was extracted every 3 hrs.

The daily concentration of trace metals of interest combined with the trajectories enables us to determine the average concentration of a particular species in a particular sector. At all three sampling sites the northeast, east and southeast regions have little impact on the concentrations of the trace metals at these sites. The western quadrant has the greatest influence and would imply an influence of the Great Lakes and Ohio River Valley regions followed by the southern and northern quadrants. At Q the western quadrant contributes to about 49.7% of trace metals measured, 50.7% at P and about 54.3% at W and for sulfate it is 45%, 42% and 47% respectively [Dutkiewicz et al 2004]. The western quadrant influence implies an influence of the Midwestern States such as Pennsylvania, Ohio, Indiana, Illinois, Kentucky and West Virginia.

