TRANSPORT OF ELEMENTAL CARBON ACROSS
THE NORTHEASTERN UNITED STATES

L. Husain (1,2), A.J. Khan (1), J. Li (2), and A.R. Khan (1)

(1) Wadsworth Center, New York State Department of Health, Albany, NY 12201-0509, (2) Department of Environmental Health and Toxicology, School of Public Health, State University of New York, Albany, NY 12201-0509

Elemental carbon (EC) is emitted directly during the incomplete combustion of fossil and biomass fuels. It is a light absorbing component of carbonaceous aerosols and exerts a large warming influence on global climate. It is suggested that climate radiative forcing is underestimated by 0.54 W m\(^{-2}\), if this contribution is neglected. Also, EC constitutes \(\sim 10\) to 40\% of PM\(_{2.5}\) aerosols. Long-term exposure to combustion-related fine particles in the air is an important risk factor for mortality due to cardiopulmonary diseases and lung cancer. Due to these findings, the presence of EC in the atmosphere is being extensively studied. Owing to its long atmospheric residence time, EC can be transported over long distances. However, few Lagrangian or quasi-Lagrangian studies have been conducted to elucidate the atmospheric transport of EC. We have conducted several such studies for SO\(_4^{2-}\) and trace element bearing aerosols across New York State. In these studies SO\(_4^{2-}\) and trace-element concentrations were determined in aerosol samples collected at two locations across New York State. Using air trajectories and regional elemental signatures, we established that the high SO\(_4^{2-}\) and trace element concentrations observed during periodic pollution episodes were associated with air masses from the high coal-burning regions of the midwestern United States. Large quantities of coal burned in the Midwestern US can also be reasonably expected to significantly contribute to EC emissions. In this study we have investigated the influence of emissions from the Midwest on the observed EC concentrations across New York State. We have determined the EC concentrations in samples from five high SO\(_4^{2-}\) episodes from 1983 to 1991 at a site in western New York State, Mayville, and at Whiteface Mountain in the northeastern part of the state, 530 km downwind from Mayville. Relationships between the air trajectories and EC and SO\(_4^{2-}\) concentrations
were used to study the transport of EC-bearing aerosols.

Daily aerosol samples were analyzed for EC by the thermal-optical method, and for \( \text{SO}_4^{2-} \) by ion chromatography. Concentrations of \( \text{SO}_4^{2-} \) and EC at Mayville were generally twice those at Whiteface Mountain. Backward-in-time air trajectories were used to establish relationships between the observed concentrations and the regions contributing the EC and aerosol \( \text{SO}_4^{2-} \). During the episodes of August 14-20, 1990, July 16-24, 1991, July 18-28, 1989, September 5, 1989, and September 1-10, 1983, it was evident that the peak concentrations at both the sites were associated with airflows from the midwestern United States. Apparently, coal burning in the midwestern United States is a dominant source of the atmospheric burden not only of \( \text{SO}_4^{2-} \) and trace elements in the Northeastern US, but also contributed significantly to the EC burden in this region.