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HISTORICAL RECORD OF ATMOSPHERIC ELEMENTAL CARBON CONCENTRATION: IMPACT ON GLABAL CLIMATE

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Elemental (EC) or black carbon (BC) aerosols originate from incomplete combustion of fossil and bio-fuels, reduce visibility, associated with serious health effects, absorb sunlight and cause global warming. Climate models use atmospheric EC concentrations, {EC}atm, to calculate temperature of the earth. These models need to be validated with long-term measured values of {EC}atm, so that they can effectively predict the future temperature of the earth. Little {EC}atm data are currently available. The objective of this study is to determine the {EC}atm for the period ~1850-2005. The EC measurements would then be used to compare with the model predictions based on consumption of fossil and bio-fuels. A novel approach is used to retrieve the long-term {EC}atm data. Assuming dry and wet deposition of EC to be the only source to the lakes, EC concentration in sediment, {EC}sed, is related to {EC}atm, by {EC}sed = K{EC}atm, where K (m3g-1) is constant for a given lake. Daily aerosols samples were collected at Whiteface Mountain (44.370N, 73.900W), NY, from 1978 through 2006 and {EC}atm were determined from monthly composites made from daily samples using the thermal-optical method. The mean {EC}atm for the 1978-86, 1987-96, and 1997-2005 period were 0.540, 0.221, and 0.065 µg.m-3, respectively. Sediment samples were collected from West Pine Pond (44.340N, 74.430W) and within the same air-shed of Whiteface Mountain. The ages of the sediment section are calculated using 210Pb dating technique. EC in sediment is chemically separated and measured using the same thermal-optical method. From {EC}atm and {EC}sed data for the period 1978-2005, K is determined to be 9600±3500 m3g-1. Using this value of K and {EC}sed, {EC}atm were determined going back to 1863. Results show {EC}atm concentration of 0.6 µg.m-3 for 1930-70 period with minimum concentration of 0.053 µg.m-3 observed for 1863-75 period.