3.4 STABLE ESTIMATE OF OC/EC RATIOS

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ABSTRACT

In fine particulate matter studies, the primary OC/EC ratio plays an important role in estimating the secondary organic aerosol contribution to PM2.5 concentrations using the EC tracer method. In this study, numerical experiments are carried out to examine the influence of errors in both OC and EC measurements on the estimation of OC/EC ratios. Various estimation techniques are tested and compared. It is found that random measurement errors in EC generally create an underestimation of the slope and an overestimation of the intercept of the ordinary least-squares regression line. The Deming regression analysis performs much better than the ordinary regression, but it tends to overcorrect the problem by slightly overestimating the slope and underestimating the intercept. Averaging the ratios directly is usually undesirable because the average is strongly influenced by unrealistically high values of OC/EC ratios resulting from random measurement errors at low EC concentrations. The errors generally result in a skewed distribution of the OC/EC ratios even if the parent distributions of OC and EC are close to normal.

The best and most robust estimator of the OC/EC ratio turns out to be the simple ratio of the OC and EC averages. It not only reduces random errors by averaging individual variables separately but also acts as a weighted average of ratios to minimize the influence of unrealistically high OC/EC ratios created by measurement errors at low EC concentrations. The median of OC/EC ratios ranks a close second, and the geometric mean of ratios ranks third. This is because their estimations are all insensitive to questionable extreme values. However, if the measured OC contains a significant amount of non-combustion OC then Deming regression should be applied to estimate the representative primary OC/EC ratio. A real world example is given using the ambient data collected from an Atlanta STN site during the winter of 2001-2002.