Geophysical Research Abstracts
Vol. 19, EGU2017-317, 2017
EGU General Assembly 2017

Quantifying the relationship between visibility degradation and PM2.5 constituents at a suburban site in Hong Kong: Differentiating contributions from hydrophilic and hydrophobic organic compounds

Yugen Li (1), Hilda X. H. Huang (2), Stephen M. Griffith (3), Cheng Wu (1), Alexis K. H. Lau (1), Jian Zhen Yu (1,2,3)

(1) Division of Environment, Hong Kong University of Science & Technology, Hong Kong, China (envr@ust.hk), (2) Institute of Environment, Hong Kong University of Science & Technology, Hong Kong, China (envr@ust.hk), (3) Department of Chemistry, Hong Kong University of Science & Technology, Hong Kong, China (chemhead@ust.hk)

Fine particulate matter (PM) is capable of scattering and absorbing light and is the main culprit of visibility degradation. Major PM chemical components have been characterized for their light absorption and scattering efficiency, but separating the organic components has yet to be fully parameterized with light extinction coefficients. In this study, light extinction data and PM2.5 chemical composition data were monitored at a suburban site in Hong Kong over a two-year period (2013-2014). Using the IMPROVE formula to reconstruct the light scattering coefficient under-estimates the measured scattering coefficient (slope = 0.85), but explains the data variability well (R2: 0.92). A multilinear regression analysis using the 'local' PM2.5 composition data and measured extinction coefficients was performed to empirically establish mass scattering and absorption efficiencies (i.e. MSE and MAE) for the different PM2.5 components. During this process, the stepwise separation of organic matter (OM) was performed according to water solubility: water soluble organic carbon (WSOC) and water insoluble organic carbon (WISOC); then according to water affinity: hydrophilic carbon (HPI) and hydrophobic carbon (HPO), the latter being the sum of humic-like substance carbon (HULISc) and WISOC. The localized formulas predict the measured extinction coefficients (i.e. σsp and σap) very well (slope = 0.99 for both). The results showed that the dry MSE of ammonium sulfate and ammonium nitrate were comparable with those used in the IMPROVE equation while MSE for OC is noticeably larger in the localized formula (13.1 vs. 7.2 m2 g-1). Splitting the OM into different fractions revealed the MSE for hydrophilic carbon (16.1 m2 g-1) was distinctly higher than for hydrophobic carbon, including HULIS (11.0 m2 g-1) and WISOC (12.8 m2 g-1). Regression analysis of light absorption against EC and OC indicates that absorption is not fully accounted for considering only EC. OC also contributes to light absorption.