Geophysical Research Abstracts,
Vol. 11, EGU2009-1039, 2009
EGU General Assembly 2009

Quantification of black carbon in soil: introducing a sliding scale with NEXAFS spectroscopy

K. Heymann (1), J. Lehmann (1), J. Baldock (2), J. Skjemstad (2), E. Krull (2), M. Schmidt (3), R. Blyth (4), and T. Regier (4)

(1) Department of Crop and Soil Sciences, Cornell University, Ithaca, New York, USA (kbh26@cornell.edu/607-255-1730), (2) CSIRO Land and Water, Glen Osmond SA 5064 Australia, (3) Department of Geography, University of Zurich, CH8046 Zurich, Switzerland, (4) Canadian Light Source, Saskatoon, Saskatchewan, Canada S7N0X4

Quantification of black carbon in soils continues to be one of the greatest challenges in advancing our understanding of black carbon properties and dynamics. This challenge mainly arises from the fact that black carbon constitutes a continuum of substances with a range of different properties. Previous methods have used specific chemical property limits to define whether a certain form of carbon is considered black carbon or not. These chemical cutoff points are difficult to define. In addition, different study objectives as well as diverse environments may necessitate a range of definitions for black carbon. These constraints may make a method favorable that uses a sliding scale of organo-chemical properties that can be developed for different types of black carbon or research questions. We used synchrotron-based Scanning Transmission X-ray Microscopy (STXM) in combination with Near-Edge X-ray Absorption Fine Structure (NEXAFS) to develop criteria for chemical properties that warrant defining a specific form of organic matter as black carbon. A mathematical mixing model was used to resolve total soil carbon spectra using representative bio-molecular components of soil organic carbon (carbohydrate, protein, fatty acid, amino acids, black carbon). In addition, a linear combination method was used to fit spectra of ecological fractions (plant, microbe, black carbon) to the total soil spectra. The variation in chemical forms within black carbon properties was accounted for by using a sliding scale of spectral properties determined by STXM of individual black carbon particles. This method represents an significant advance in studying black carbon dynamics in soils.