Combustion-derived dissolved organic matter in rivers and estuaries of the sugar-cane area of Southern Brazil

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Introduction

Pyrogenic organic carbon (black carbon, BC) has been recognized as a significant component in dissolved organic matter (DOM) in surface waters. Since BC is produced by biomass burning, it is an important source of DOM in South Brazilian catchments where the burning of sugar cane occurs during the dry season. In this study, detailed spatial profiles were sampled along transits of estuarine and coastal areas in southern Brazil. Furthermore, we assessed the export of BC within the rivers draining to the catchments.

Discussion of Results

Black carbon was quantitatively determined as benzene-polycarboxylic acids (BPCAs) using high performance liquid chromatography (HPLC). All DOM samples yielded significant amount of BPCAs, ranging from 3 to 29 mM, representing roughly 3 -9 % of dissolved organic carbon (DOC). The concentrations of BC, as well as the relative contributions of BC to the DOC pool, were largest in riverine and estuarine DOM. Qualitative identification of molecular formulas by ultrahigh resolution Fourier-transform ion cyclotron resonance mass spectrometry (FT-ICR MS) identified more highly condensed aromatic structures in these same samples. The abundance and composition of combustion-derived DOM from terrestrial sources such as southern Brazil are necessary for a better understanding of global biogeochemical cycles.

Estimates of Earth system climate sensitivity

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Climate sensitivity to CO_2 refers to the change in global temperature due to the radiative effects of a doubling of CO_2 combined with rapid climate feedbacks such as changes in atmospheric water vapor, sea ice, and cloud/aerosol distributions. Over geologic timescales, the global temperature response, defined here as 'Earth-system' climate sensitivity, also includes the effects of other climate responses such as changes in continental ice volume, terrestrial ecosystems, non-CO_2 greenhouse gas production, and other parameters. Assessing Earth-system climate sensitivity requires estimates of CO_2 concentrations and global temperatures during discreet time intervals in Earth history. While uncertainty persists in these estimates, available temperature and CO_2 records provide some constraint on magnitudes of Earth-system climate sensitivity with time. Current records provide evidence that Earth's climate sensitivity varies with the climate state. Very high climate sensitivities are associated with ice-house conditions, and there is little support for climate sensitivities lower than ~3°C per CO_2 doubling during ice-free conditions.