Geophysical Research Abstracts
Vol. 20, EGU2018-7464, 2018
EGU General Assembly 2018

Global scale fluvial export of resistant particulate black carbon

Alysha Coppola (1), Daniel Wiedemeier (1), Valier Galy (2), Negar Hagipour (3,6), Ulrich Hanke (1), Nascimento Gabriela (3), Muhammed Usman (3), Thomas Blattmann (3), Moritz Reisser (1), Chantal Freyond (3), Mexiun Zhao (4), Britta Voss (2), Enno Schefuß (5), Lukas Wacker (6), Bernahrd Peucker-Ehrenbrink (2), Samuel Abiven (2), Michael Schmidt (1), Timothy Eglinton (2,3)

(1) University of Zurich, Department of Geography, Zurich, Switzerland, (2) Woods Hole Oceanography Institution, Department of Marine Chemistry and Geochemistry, 360 Woods Hole Road, Woods Hole, Massachusetts 02543 USA, (3) Geological Institute, Department of Earth Sciences, ETH Zürich, Sonneggstrasse 5, 8092 Zürich Switzerland, (4) Key Laboratory of Marine Chemistry Theory and Technology of the Ministry of Education, Ocean University of China, 238 Songling Road Qingdao 266100/Laboratory for Marine Ecology and Environmental Science, Qingdao National Laboratory for Marine Science and Technology, Qingdao 266061, China, (5) MARUM-Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany, (6) Laboratory of Ion Beam Physics, ETH Zürich, Otto-Stern-Weg 5, 8093 Zürich, Switzerland

Fire-derived combustion residues, known as Black Carbon (BC), is the slowest cycling component of the biospheric carbon cycle identified up to now. Constraining the magnitude and dynamics of BC release from land to the aquatic environment and associated potential mineralization to CO_2 is critical given on-going and transformative changes in land use, hydrologic regimes, fire frequency, and severity of coastal erosion processes. Here, we examine the concentration and radiocarbon content (Δ14C values) of particulate black carbon (PBC) in 18 large and small rivers in order to assess basin-scale dynamics and estimate global flux. This assessment represents 15 to 34% of the global particulate organic carbon (POC) flux to the oceans. We show that PBC is correlated to suspended sediment yield, indicating that PBC export is primarily controlled by erosional processes. Radiocarbon measurements reveal that riverine PBC is not exclusively derived from recent biomass burning, with the presence of extensively pre-aged PBC in several high latitude rivers. The global, river flux-weighted 14C age of PBC delivered to the ocean implies extended storage in soils prior to mobilization and export. Here, we estimate a global river PBC flux to the oceans and relate it to global annual BC production. This work implies an export efficiency that is one to two orders of magnitude greater than for biospheric POC. The high export efficiency of PBC, coupled with its millennial storage in continental reservoirs, provides strong evidence for its refractory nature at the global scale. Assuming efficient burial in marine sediments, fluvial export of PBC acts as an important long-term sink for atmospheric CO_2.