Geophysical Research Abstracts
Vol. 20, EGU2018-2724, 2018
EGU General Assembly 2018

A landscape perspective of Holocene organic carbon cycling in coastal SW Greenland lake-catchments

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Arctic organic carbon (OC) stores are substantial and have accumulated over millennia as a function of changing climate and terrestrial vegetation succession. Arctic lakes are also important for C-cycling as they are sites of OC production and CO_2 emissions but also store large amounts of OC in their sediments. This sediment OC pool is a mixture derived from terrestrial and aquatic sources and sediment cores can therefore provide a long-term record of the changing interactions between lakes and their catchments in terms of nutrient and C transfer. Sediment carbon isotope composition (δ13C), C/N ratio and OC accumulation rates of 14C-dated cores covering the last $\sim$10,000 years from six lakes close to Sisimiut (SW Greenland) are used to determine the extent to which OC dynamics reflect climate and lake-catchment development. Sediment δ13C range from –19 to –32‰ across all lakes, while C/N ratios are <8 to >20 (mean = 12), values that indicate a high proportion of the organic matter is from autochthonous production but with a variable terrestrial component. Temporal trends in δ13C are variable among lakes, with neighbouring lakes showing contrasting profiles, indicative of site-specific OC processing. The response of an individual lake reflects its morphometry (which influences benthic primary production), the catchment:lake ratio, and catchment relief, lakes with steeper catchments sequester more carbon. The multi-site, landscape approach used here highlights the complex response of individual lakes to climate and catchment disturbance but broad generalisations are possible. There is a regional effect of Neoglacial cooling (from $\sim$5000 cal yr BP) on the lateral transfer of terrestrial OC to lakes with three lakes showing clear increases in OC AR. The lakes probably switched from being autotrophic (i.e. net ecosystem production>ecosystem respiration) in the early Holocene to being heterotrophic after 5000 cal yr BP as terrestrial OC transfer increased.