A carbon balance for Lake Erie

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Freshwater lakes are an important component of the global carbon cycle as they serve as a substantial storage and transformation sites of carbon in the environment. Carbon (C) budgets typically compile and summarize gains (terrestrial input, photosynthesis) and losses (respiration, outgassing, burial) of C. Carbon budgets have been completed in small to medium size lakes. However, knowledge gained from small lakes may not extrapolate to large lake ecosystems due to the large spatial scales which decouple landscape influences on carbon cycling. I will present a first level approximation of a C mass balance for Lake Erie, the smallest and most productive of the five Laurentian Great Lakes. Over 90% of water and carbon inputs to the lake originate from the Detroit River. The magnitude of dissolved organic (DOC) and inorganic carbon (DIC) exported downstream increased by 10.5% and 0.5% respectively relative to terrestrial inputs. While in-lake carbon loads were about 2-3 orders of magnitude larger than the inputs, outputs of particulate organic carbon (POC) decreased by 59% compared to inputs. Results indicate that Lake Erie is a net source of carbon dioxide to the atmosphere with the highest fluxes of CO2 from the eastern basin, while the highest levels of C burial were found in the central and western basin. Together results suggest that there is likely a substantial amount of internal C production (e.g., primary production) that drives the carbon dynamics of Lake Erie.

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