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Title
Temporal coherence in surface-atmosphere CO_2 exchange among forests, wetlands and lakes: Implications for regional climate sensitivity

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Body
To predict response of regional carbon cycling to climatic variation, an integrated understanding incorporating both the terrestrial and the aquatic components of the landscape may be required. We are interested in how factors such as warm conditions leading to early lake ice out, water table changes and an early spring greenout jointly interact to modify the net carbon and water exchange across a region. We have undertaken a novel statistical coherence study to better understand whole ecosystem interannual variability in carbon and water cycles and its sensitivity to climate variability. This study involves a synthesis of ongoing observations of multi-time scale observations of fluxes in eleven upland and three wetland Ameriflux towers, and 34 lakes in the North Temperate Lakes LTER, all located within the subboreal northern highlands of Wisconsin. Our central questions are: (1) To what degree is there synchrony in evapotranspiration, respiration, and photosynthesis within and among forest stands, wetlands, and lakes in northern Wisconsin at diurnal to interannual timescales? (2) Where coherence is found, which environmental factors are most associated with it? (3) How can these findings be used to improve regional models of climate change impacts to north temperate regions? We hypothesize that temporal coherence is positively related within ecosystem types but negatively related across ecosystem types according to hydrologic regime (wet/dry). Confirmation of this hypothesis would imply that hydrologic coupling of lake-wetland-upland complexes is needed to accurately predict climate change impacts to carbon cycling in this region. Preliminary results of the study indicate synchrony in annual CO_2 fluxes among groups of small clear water lakes, and among groups of small humic lakes. Temporal coherence at an annual scale was also observed between a wetland and mature hardwood forest site, but little coherence was found between lakes and uplands at this timescale. As a next step, orthoganal wavelet analysis will be applied to flux data to query a broad range of timescales from hourly to interannual for emerging patterns of synchrony *within* and *across* ecosystem types.