PROPOSAL FOR FLUXNET SYNTHESIS PUBLICATION

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Collaborators needing access to data: none

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DATASET PROPOSED

LaThuile or Opened Gross Primary Productivity and Net Ecosystem Exchange Data

TITLE OF PAPER AND OUTLINE

Spring Hydrology Determines Summer Net Carbon Uptake in Northern Ecosystems

Increased photosynthetic activity and enhanced seasonal CO_2 exchange of northern ecosystems have been observed from a variety of sources including satellite vegetation indices and atmospheric CO_2 measurements. Most of these changes have been attributed to strong warming trends in the northern high latitudes (≥50°N). Here we plan a synthesis of interannual variability of summer net carbon uptake of northern ecosystems from atmospheric CO_2 measurements, satellite-derived vegetation productivity, i.e. NDVI, and flux tower eddy covariance (EC) measurements. The objective is to investigate how spring hydrology and summer temperature regulate the interannual variability of summer vegetation growth and regional net carbon (CO_2) uptake in northern ecosystems based on the above measurements at different spatial scales.

Main hypotheses:

1. Large precipitation or snow cover conditions in spring generally promotes summer net carbon uptake independent of air temperature effects as indicated by both the atmospheric CO_2 seasonal cycle and tower EC measurements.

2. Regional warming still promotes northern vegetation growth especially in the tundra areas, indicated by satellite NDVI measurements, while boreal forest is less benefited from summer warming than tundra due to stronger water stress, especially during the later growing season.

3. A similar response of photosynthesis and respiration to warming leads to reduced sensitivity of net ecosystem carbon uptake to temperature of northern ecosystems, which explains the discrepancy between satellite NDVI measurements and atmospheric CO_2 measurements and model inversions.

4. Strong regulation of spring hydrology on soil respiration in relatively wet boreal

and arctic ecosystems and a positive correlation of summer net carbon uptake with early growing season surface soil moisture indicated by tower EC measurements could explain the important role of spring hydrology in regional carbon uptake of northern ecosystems.

Our work will document the importance of spring hydrology in boreal/arctic carbon cycle and contrast with prevailing assumptions of dominant cold temperature limitations to high-latitude ecosystems, and indicate potentially stronger coupling of boreal/arctic water and carbon cycles with continued regional warming trends.

PROPOSED SITES TO BE INVOLVED

We propose using 27 sites in the boreal/arctic (≥ 50 °N) region with more than two years of measurements covering at least part of the summer period (from June to August). Please see table below for site lists. Asteriks denote data policy availability according to SynthDataSummary.xls from fluxdata.org.

*Lathuile, **Open, ***Fair Use

SiteID	Name
SE-Fla* **	**Flakaliden**
FI-Hyy*	**Hyytiala**
FI-Sod*	**Sodankyla**
FI-Kaa*	**Kaamanen Wetland**
US-Ivo*	**Ivotuk**
US-Atq*	**Atqasuk**
US-Brw*	**Barrow**
RU-Zot*	**Zotino**
RU-Che*	**Cherskii**
RU-Ha1**	**Ubs Nur- Hakasija**
RU-Cok*	**Chokurdakh**
CA-Oas*	**SK-Old Aspen**
CA-SF1* **	**SK-1977 Fire**
CA-SF2* **	**SK-1989 Fire**
CA-SF3* **	**SK-1998 Fire**
CA-Obs*	**SK-Southern Old Black Spruce**
CA-SJ2*	**SK-2002 Jack Pine**
CA-SJ1*	**SK-1994 Jack Pine**
CA-Man* **	**MB-Northern Old Black Spruce**
CA-Ojp*	**SK-Old Jack Pine**
CA-SJ3*	**SK-1975 (Young) Jack Pine**
CA-WP1*	**AB-Western Peatland**
CA-NS7*	**UCI 1998**
CA-NS4*	**UCI 1964 wet**

CA-NS2*	**UCI 1930**
CA-NS1*	**UCI 1850**
CA-NS5*	**UCI 1981**

PROPOSED RULES FOR CO-AUTHORSHIP

We will follow guidelines of the La Thuile data policy and we will be responsive to the needs of the Tower Principal Investigators regarding intellectual property rights of their data. Co-authorship may also be granted to individual PIs who contribute to the intellectual development of the project.