

PROPOSAL FOR FLUXNET SYNTHESIS PUBLICATION



Initial coordinators:: Yonghong Yi, John S. Kimball, Hank Margolis

Collaborators needing access to data: none

Affiliations: Numerical Terradynamic Simulation Group and Flathead Lake Biological Station, University of Montana, Missoula, MT; Centre for Forest Studies, Faculty of Forestry, Geography and Geomatics, Laval University, Quebec, Canada

DATASET PROPOSED

LaThuile or Opened Gross Primary Productivity and Net Ecosystem Exchange Data

TITLE OF PAPER AND OUTLINE

Recent climate and fire disturbance impacts on boreal and arctic ecosystem productivity estimated using a satellite-based terrestrial carbon flux model

We have developed a satellite-based terrestrial carbon flux model framework to simulate gross primary productivity (GPP) and net ecosystem exchange (NEE) fluxes. The carbon model integrates information on photosynthetic canopy cover retrieved from satellite optical-Infrared remote sensing and surface moisture and temperature derived from satellite microwave remote sensing with model reanalysis meteorology. NEE is a fundamental measure of the balance between carbon uptake, i.e., GPP and carbon losses through ecosystem respiration. Together with accounting for losses of carbon through disturbance including fire, harvest and herbivore, it gives an estimate of net ecosystem carbon accumulation, i.e. net biome productivity (NBP), between land and atmosphere. We hope to demonstrate the value of these remote-sensing based NEE and GPP products as an available resource for the flux tower community, and also the atmospheric community, to help reduce uncertainty in terms of quantifying the spatial and temporal variations of land sink activity under scenarios of warming temperatures and possible increasing frequency of droughts and fires especially in the northern latitudes.

The proposal investigators are members of the NASA Soil Moisture Active and Passive (SMAP) Mission Science Definition Team and are responsible for developing a model based level 4 carbon (L4_C) product for operational estimation of global daily NEE over vegetated land areas during the post-2014 SMAP operational period. The results of this study will be used to inform L4_C product development for SMAP, including algorithm calibration and uncertainty assessment relative to tower observation based carbon flux estimates for boreal-Arctic land areas. This study will simulate GPP and NEE fluxes from 2000 to 2010 using ancillary inputs from MERRA reanalysis daily surface meteorology, satellite NDVI retrievals from MODIS and freeze/thaw data from SSM/I sensors. The tower observation based GPP and NEE

fluxes will be used to evaluate the uncertainty in the simulated fluxes due to uncertainty from the L4_C model structure and also model inputs. FLUXNET fire chronosequence sites will be used with MODIS EVI data and the Global Fire Emission Database (GFED) burned area product to test a new approach that accounts for fire disturbance recovery impacts on the L4_C model simulated regional carbon sink/source activity. The proposed study is part of a NASA funded investigation to provide new global carbon products, including GPP and NEE, and underlying environmental drivers; these results will be openly available to the flux tower community.

Objectives:

- 1) To provide satellite-based gross ecosystem productivity and net ecosystem exchange products that will be made available to the flux tower community.
- 2) To validate these products against tower flux measurements in the boreal region.
- 3) To inform development of an operational carbon product planned for the NASA SMAP mission.

PROPOSED SITES TO BE INVOLVED

We propose using at least 49 sites in the boreal ($\geq 45^\circ\text{N}$) region with data available between 2000 and 2007. Data availability may limit the number of sites used in the final results as at least one continuous year of measurements is needed to drive the carbon model. Please see table below for site lists. Asterisks denote data policy availability according to SynthDataSummary.xls from fluxdata.org.

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

SiteID	Name
NL-Ca1***	Netherlands - Cabauw
CA-Let*	Canada - Lethbridge
US-FPe*	USA - MT - Fort Peck
CA-WP1*	Canada - Western Peatland- LaBiche-Black Spruce/Larch Fen
BE-Bra*	Belgium - Brasschaat (De Inslag Forest)
BE-Jal*	Belgium - Jalhay
BE-Vie*	Belgium - Vielsalm
CA-Gro*	Canada - Ontario- Groundhog River-Mat. Boreal Mixed Wood
US-Syv***	USA - MI - Sylvania Wilderness Area
US-PFa***	USA - WI - Park Falls/WLEF
JP-Tef*	Japan - Teshio Experimental Forest
DE-Hai*	Germany - Hainich
FR-Fon*	France - Fontainebleau
US-WCr***	USA - WI - Willow Creek
US-UMB*	USA - MI - Univ. of Mich. Biological Station

FI-Sod*	Finland - Sodankyla
SE-Fla***	Sweden - Flakaliden
US-Bn1*	USA - AK - Bonanza Creek, 1920 Burn site near Delta Junction
FI-Hyy*	Finland - Hyytiala
SE-Sk2***	Sweden - Skyttorp
UK-Gri*	UK - Griffin- Aberfeldy-Scotland
RU-Fyo**	Russia - Fyodorovskoye wet spruce stand
CA-NS3*	Canada - UCI-1964 burn site
CA-NS2*	Canada - UCI-1930 burn site
CA-Man**	Canada - BOREAS NSA - Old Black Spruce
CA-NS1*	Canada - UCI-1850 burn site
CA-NS5*	Canada - UCI-1981 burn site
CA-Obs*	Canada - Sask.- SSA Old Black Spruce
CA-Ojp*	Canada - Sask.- SSA Old Jack Pine
CA-SJ1*	Canada - Sask.- 1994 Harv. Jack Pine
CA-SJ3*	Canada - Sask.- SSA 1975 Harv. Yng Jack Pine
NL-Loo***	Netherlands - Loobos
DE-Tha*	Germany - Anchor Station Tharandt - old spruce
DE-Wet*	Germany - Wetzstein
CA-Ca1*	Canada - British Columbia- Campbell River - Mature Forest Site
CA-Qfo**	Canada - Quebec Mature Boreal Forest Site
CA-Ca3*	Canada - British Columbia- Campbell River - Young Plantation Site
CZ-BK1*	Czech Republic - Bily Kriz- Beskidy Mountains
CA-Qcu**	Canada - Quebec Boreal Cutover Site
IT-Ren*	Italy - Renon/Ritten (Bolzano)
IT-Lav**	Italy - Lavarone (after 3/2002)
US-Wrc*	USA - WA - Wind River Crane Site
CA-NS6*	Canada - UCI-1989 burn site
CA-NS7*	Canada - UCI-1998 burn site
US-Bn2*	USA - AK - Bonanza Creek, 1987 Burn site near Delta Junction
US-Bn3*	USA - AK - Bonanza Creek, 1999 Burn site near Delta Junction
CA-SF1***	Canada - Sask.- Fire 1977
CA-SF2***	Canada - Sask.- Fire 1989
CA-SF3***	Canada - Sask.- Fire 1998

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. Remote sensing products developed through this study will continue to be openly available to the scientific community.

CVs of Proposers included as attachment with email submission.