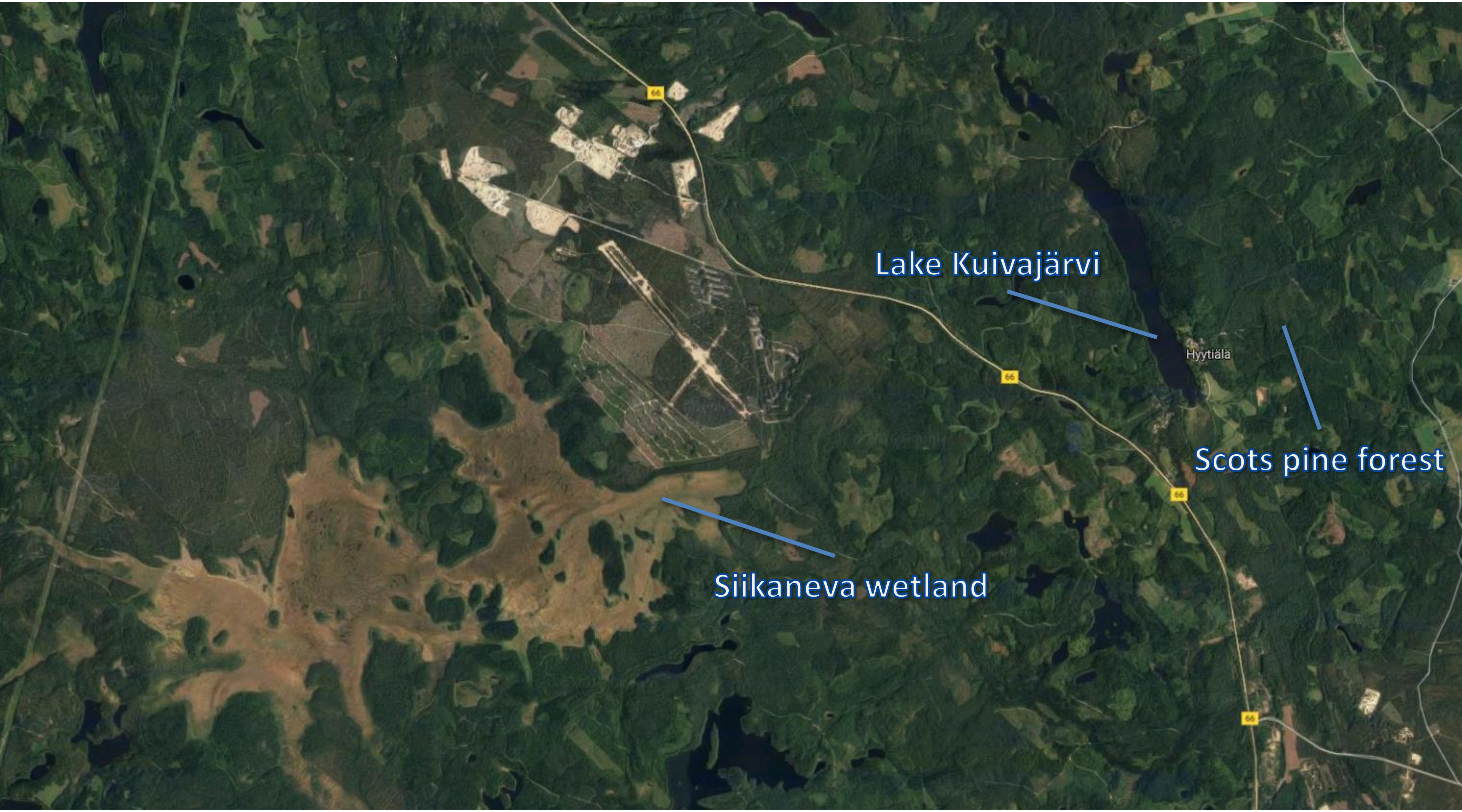
Lessons from Forest, Wetland and Lake in Hyytiälä Region

Timo Vesala
Department of Physics
Department of Forest Sciences
University of Helsinki

Thanks P. Keronen, J. Levula, I. Mammarella, A. Ojala, Ü. Rannik, E. Siivola and E.-S. Tuittila for lessons


Lake Kuivajärvi
Hyytiälä
Scots pine forest
Siikaneva wetland

- 1995: EC had to be started because EUROFLUX
- Petri Keronen instruments; Üllar Rannik processing; TV no clue on EC but PI
- Visit to Risoe (Denmark), N.-O. Jensen, P. Hummelshoej, K. Pilegaard
- EC since April -96 for CO2 and H2O
- Hyytiälä (SMEAR II), Scots pine, heterogeneous stand, small hill, 250 $gCm^{-2}y^{-1}$
- Nevertheless, one of the most used data (free data right from the beginning)
- Sub-canopy, particle number, O_3, COS, VOCs (all longest/among longest)

Agricultural and Forest Meteorology 138 (2006) 244–257
www.elsevier.com

Uncertainties in measurement and modelling of net ecosystem exchange of a forest

Üllar Rannik[a], Pasi Kolari[b], Timo Vesala[a,*], Pertti Hari[b]

[a] Department of Physical Sciences, P.O. Box 64, FIN-00014, University of Helsinki, Finland
[b] Department of Forest Ecology, P.O. Box 27, FIN-00014, University of Helsinki, Finland

Received 4 May 2004; received in revised form 21 April 2006; accepted 2 May 2006

- Two ECs separated about 30 m
- Annual uncertainty of 80 gC $m^{-2}y^{-1}$

Master of Science thesis in meteorology

UNCERTAINTY IN FOREST-ATMOSPHERE EXCHANGE OF ENERGY AND CARBON DIOXIDE BASED ON TWO VERTICALLY DISPLACED EDDY COVARIANCE SET-UPS

Lauri Heiskanen

15.5.2017

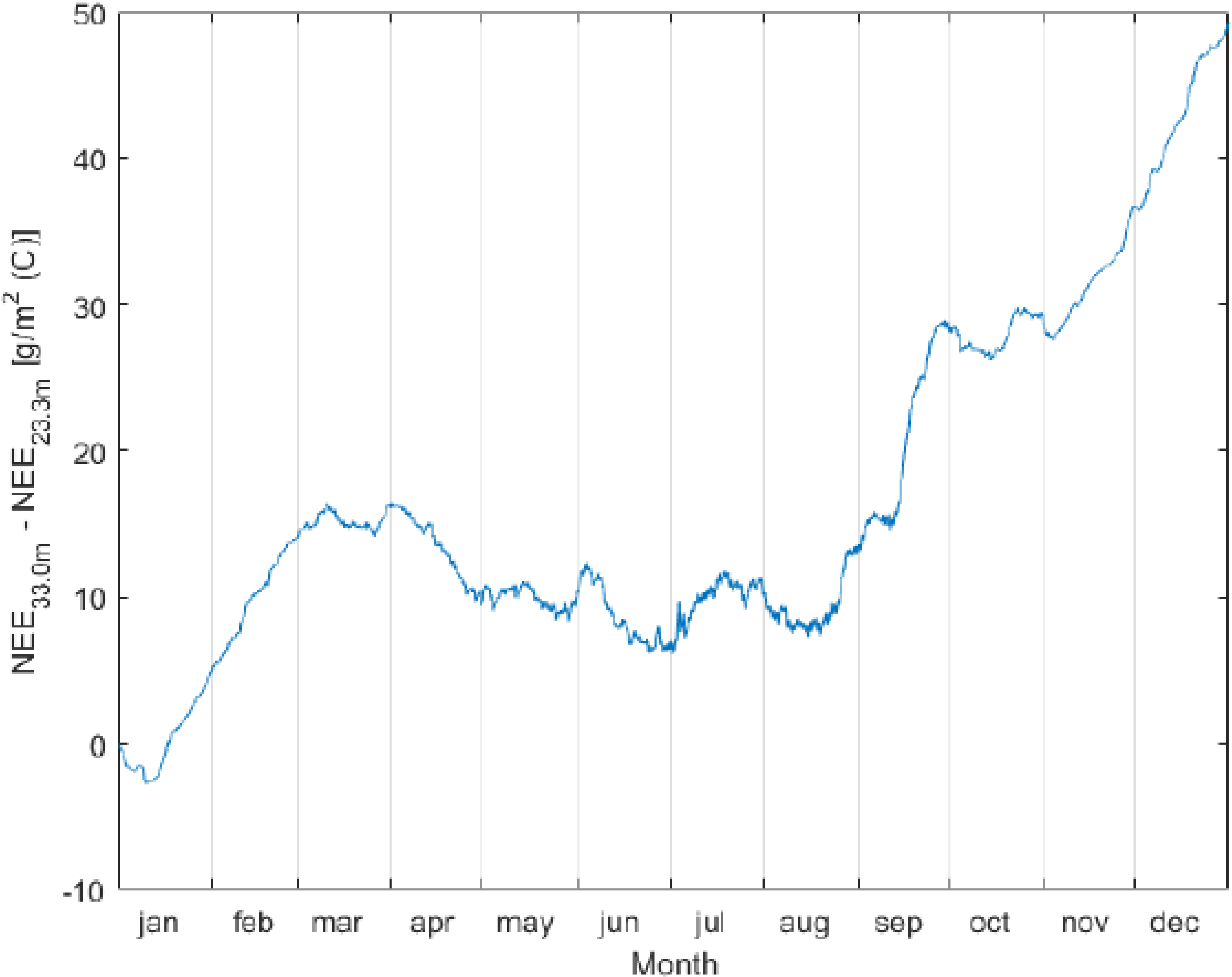
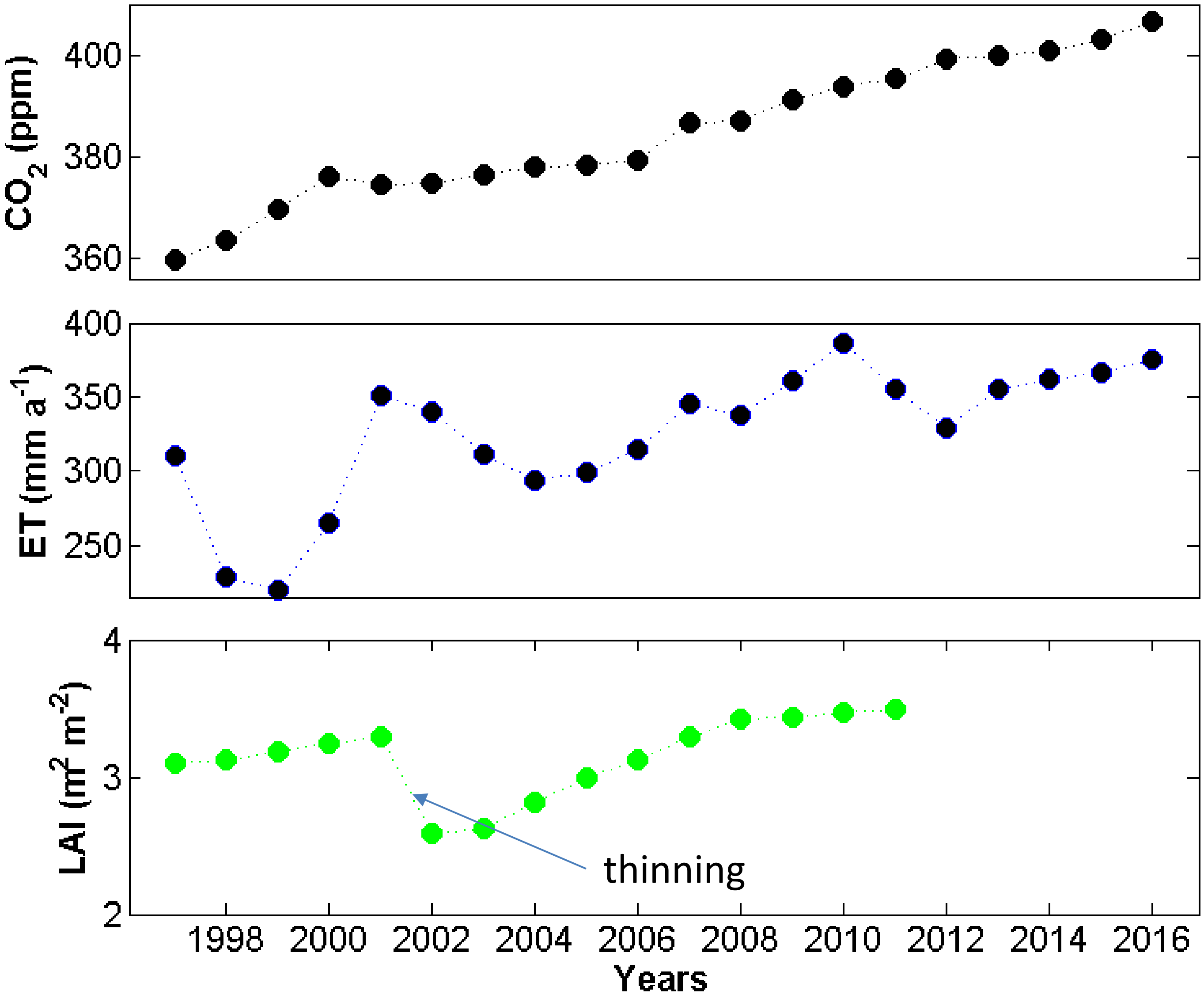
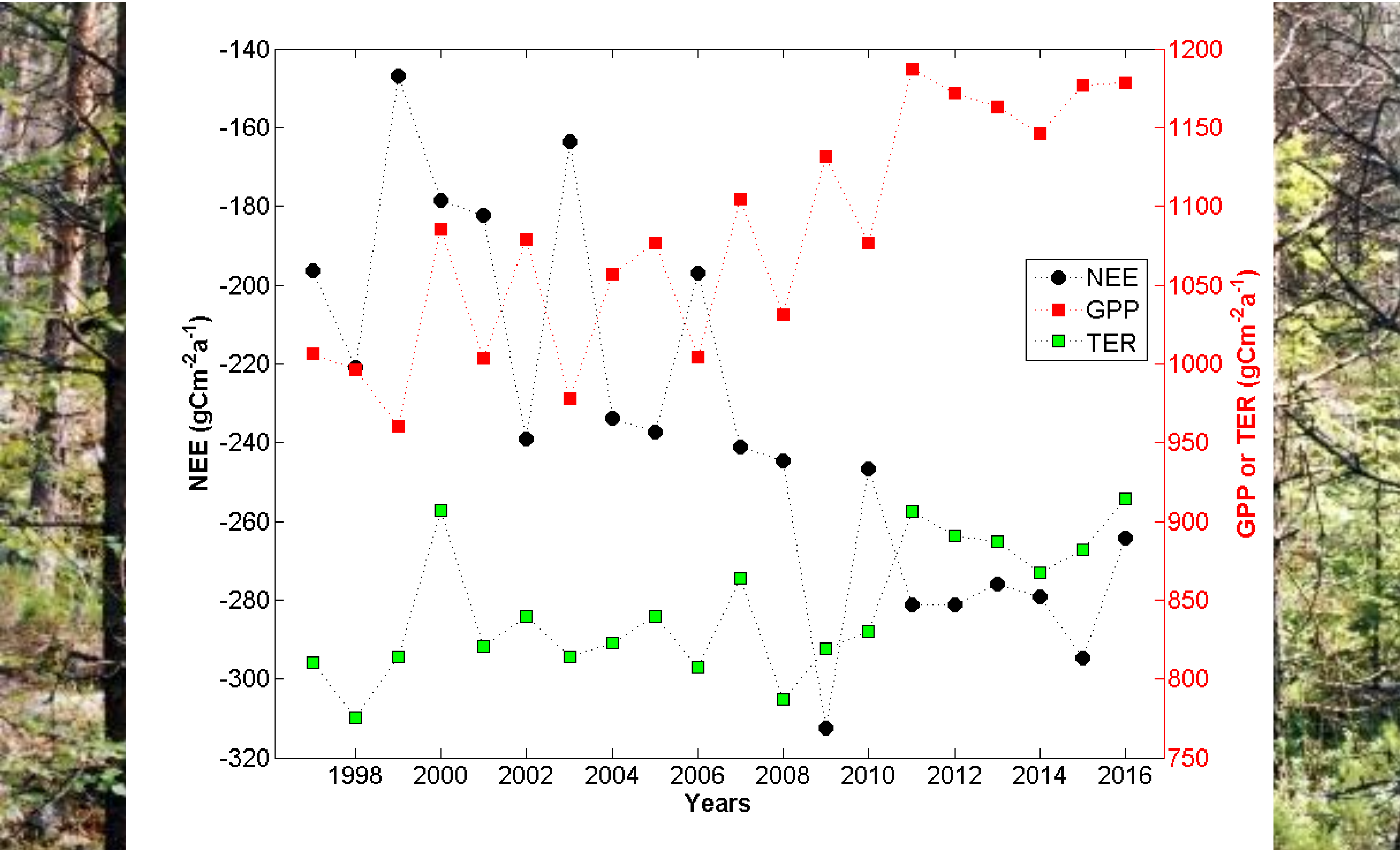


Fig. 4.22. Cumulative NEE difference over the year 2015.

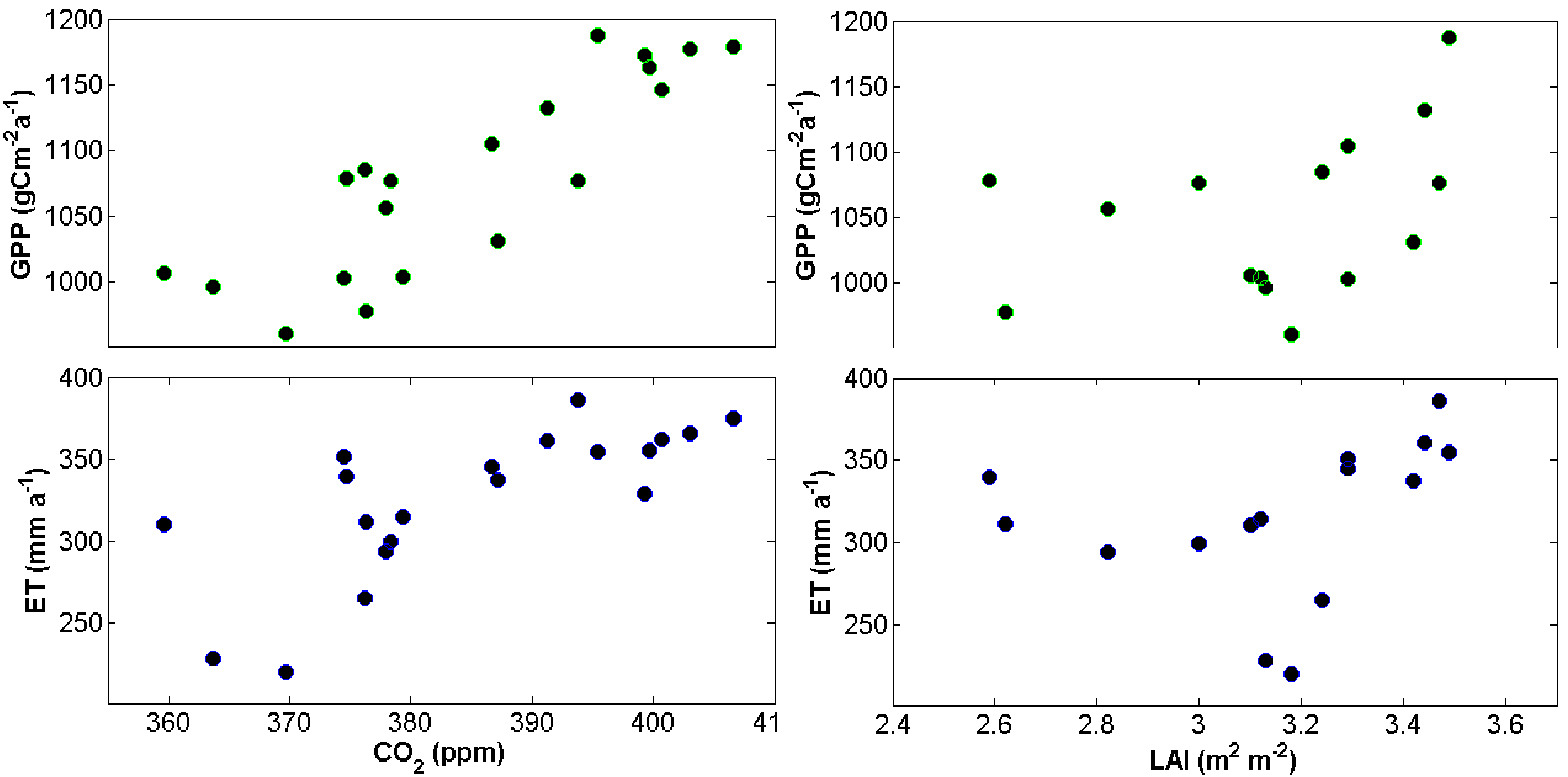
Ambient CO_2 concentration, annual ET and LAI have increased



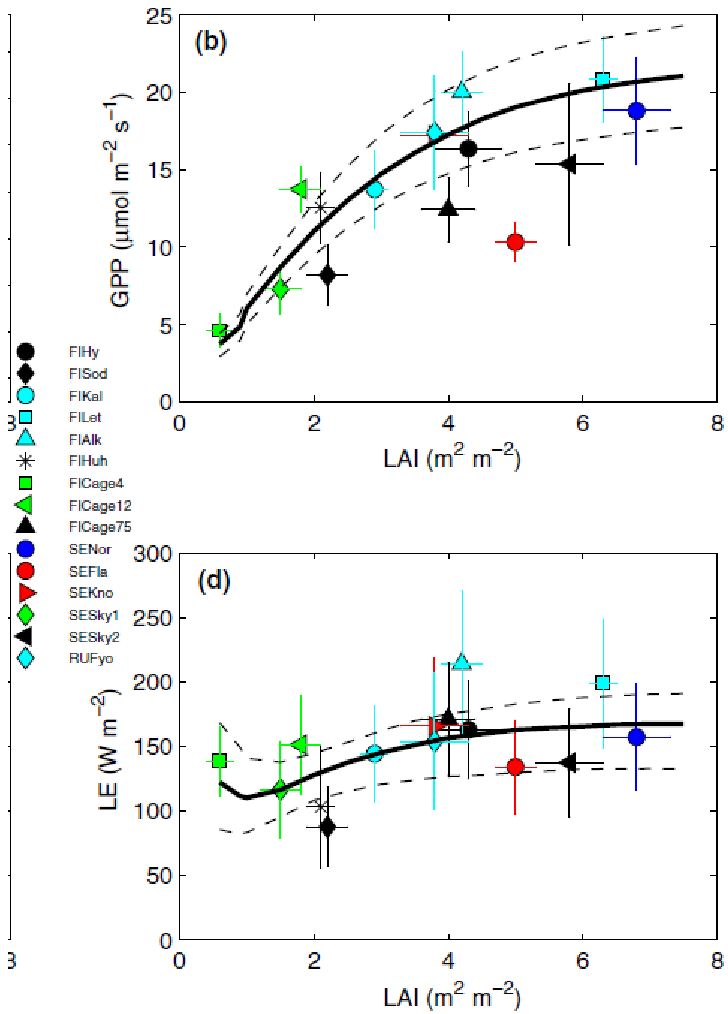
Annual NEE, GPP and TER at SMEAR II stand show increasing CO_2 sink



Could increased ambient CO_2 concentration (left) and/or increased LAI (right) explain increased GPP and ET?

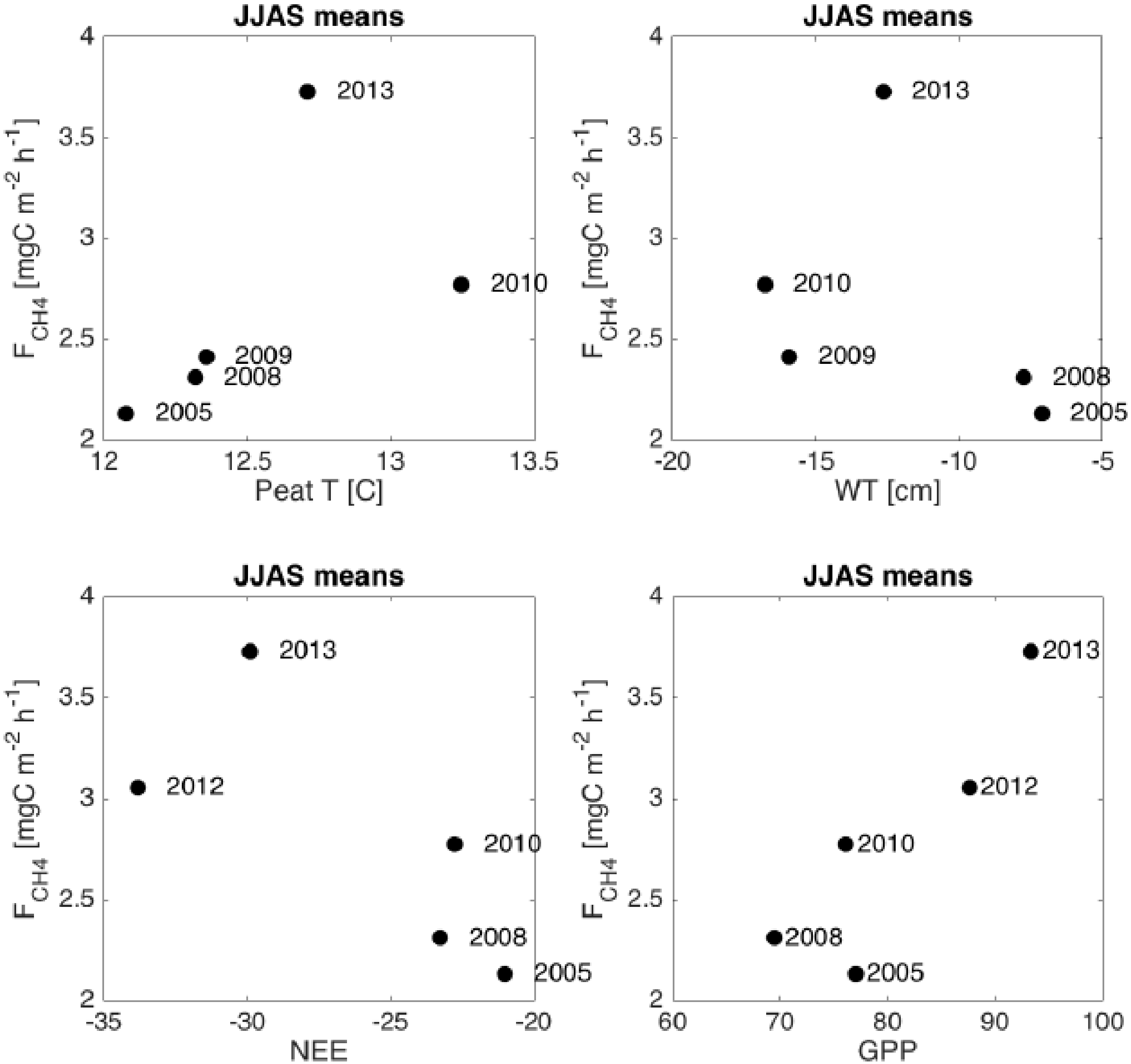


Nordic coniferous forests



Launiainen et al. 2016. Global Change Biology, doi: 10.1111/gcb.13497

Wetland (open fen)

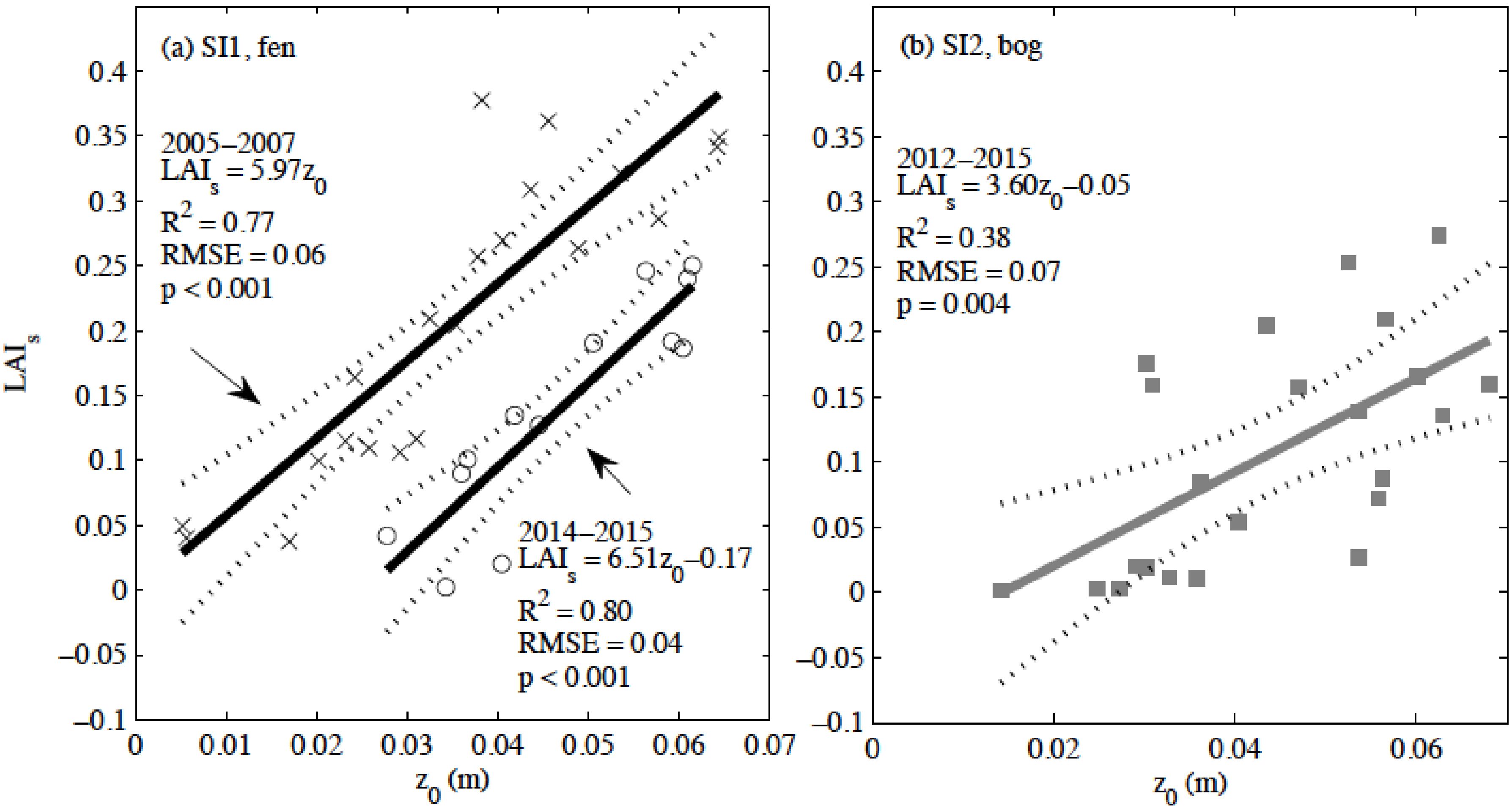


CO_2:
60 gC $m^{-2}y^{-1}$

CH_4:
-10 gC $m^{-2}y^{-1}$

J. Rinne et al., manuscript

LAI of sedges and shrubs from u*



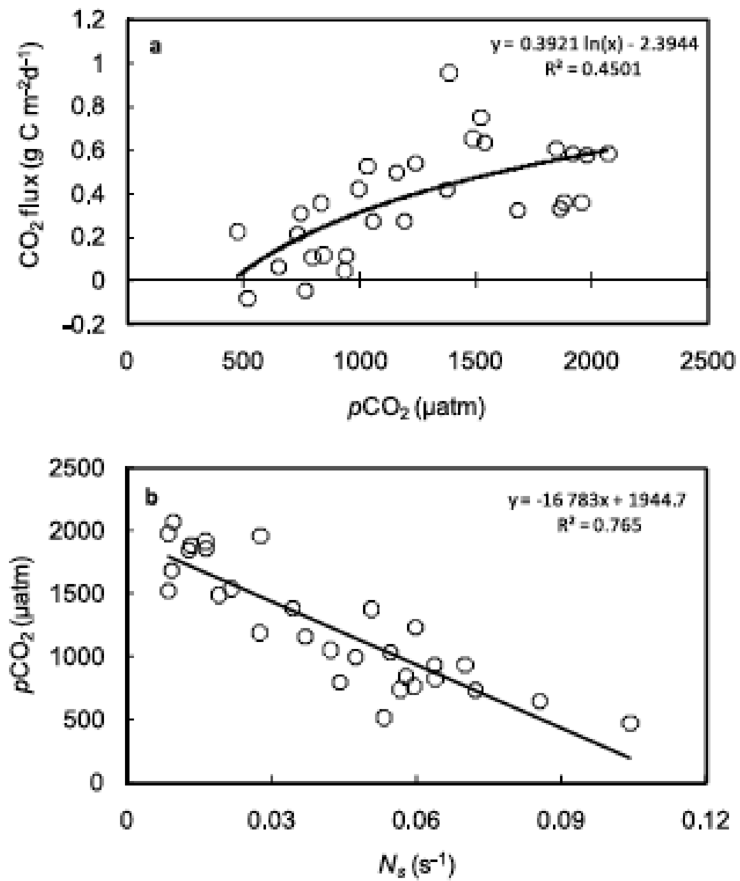
P. Alekseychik et al., accepted to GRL

Lake (humic)

GEOPHYSICAL RESEARCH LETTERS, VOL. 38, L18401, doi:10.1029/2011GL048753, 2011

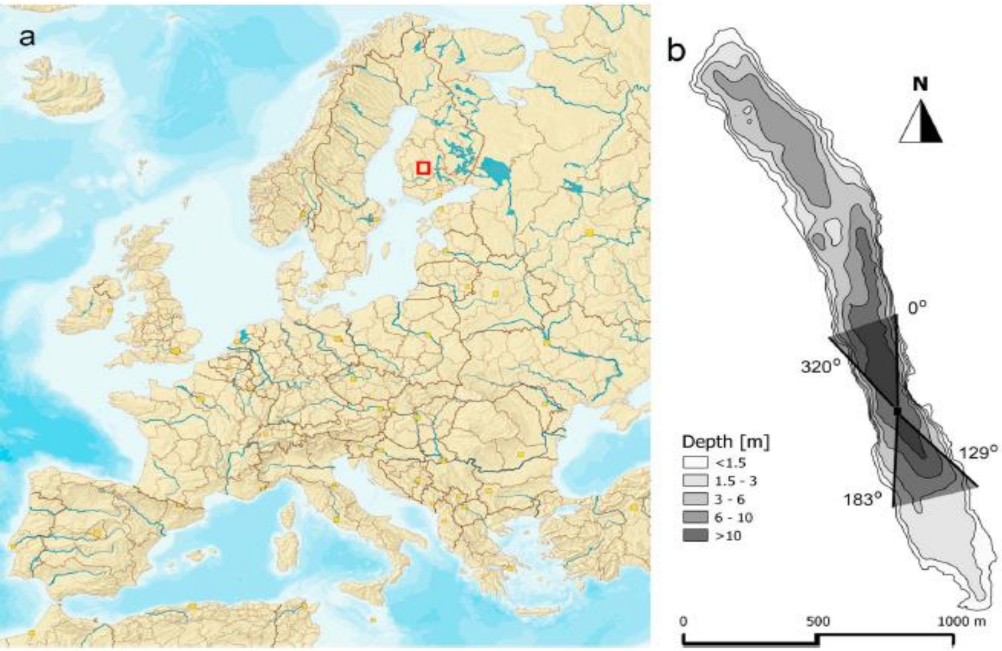
Long-term direct CO_2 flux measurements over a boreal lake: Five years of eddy covariance data

Jussi Huotari,[1] Anne Ojala,[2] Elina Peltomaa,[2] Annika Nordbo,[3] Samuli Launiainen,[3,4] Jukka Pumpanen,[5] Terhi Rasilo,[5] Pertti Hari,[5] and Timo Vesala[3]



Lake Valkea-Kotinen, Southern Finland (operation ceased after 8 years; 5 years published)

Lake Kuivajärvi



Potential measurements for a flag-ship lake site:

- Water T at several depths
- Water CO_2 at several depths
- Water PAR at several depths
- Net radiation components
- Air T and RH
- Turbulent fluxes by EC
- Accurate CO_2 concentration in the air
- Chamber fluxes
- Water velocities/turbulence
- Measurements at several locations

100 gC $m^{-2}y^{-1}$

I. Mammarella

Lessons (technical)

- avoid the open-path analyzer if frost/snow or small fluxes (in lake synthesis ½ of set-ups are open paths)
- however, adsorption/desorption in tube, especially for H_2O, if filters and sampling lines not changed
- detection of small fluxes nevertheless a challenge, special care should be taken when processing data (e.g. time lag determination)
- keep on the shelve an identical analyzer to avoid breaks
- don’t use instruments and softwares as black boxes; even though your colleagues take care of maintenance and data processing, go through the basics

Lessons (philosophical)

- look always for an ideal site, but be brave to work with non-ideal sites
- open your data for free usage
- remember synergy from other compounds; co-locate activities
- learning from other disciplines by bringing researches with different background together
- too much data and too less people to analyze and write papers

- Use several EC systems at the site (separated horizontally and vertically) to get better understand of the site and uncertainties

(Or maybe better just one system to avoid confusion)