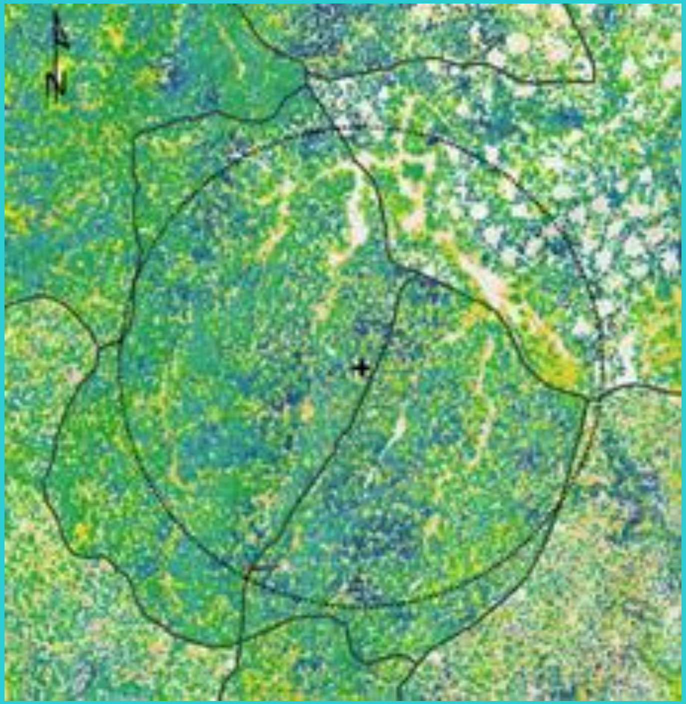
Tumbarumba updates



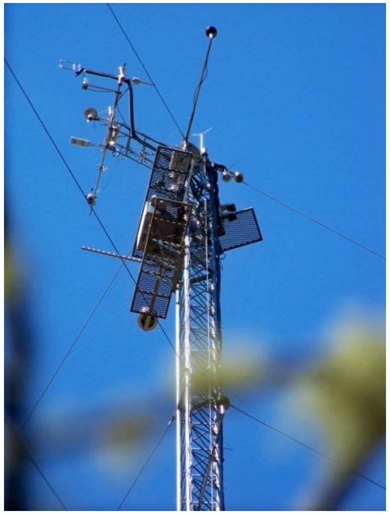
Eva van Gorsel, Dale Hughes, Steve Zegelin, Arantxa Cabello

and a sensor network setup…

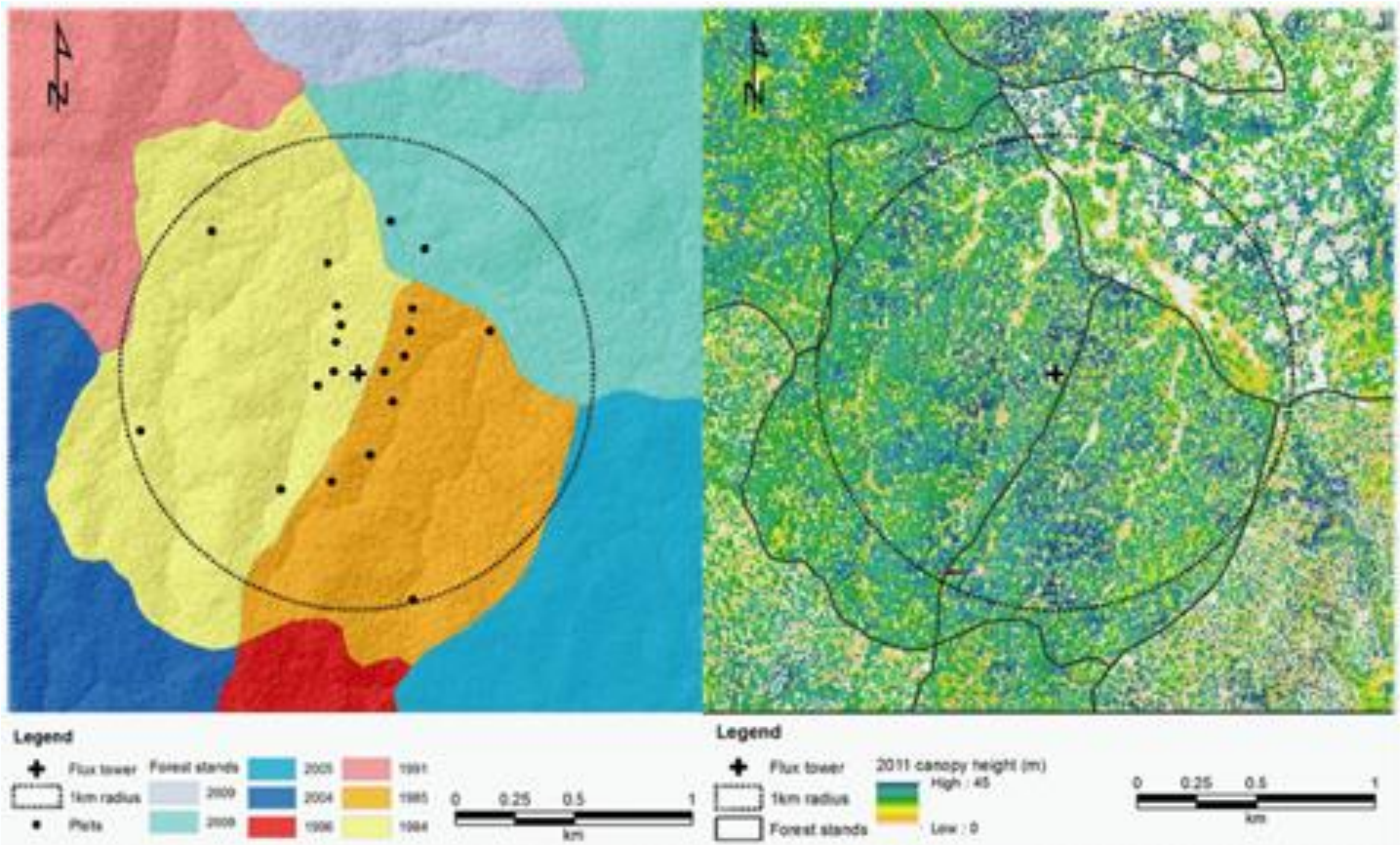
Arturo Sanchez-Azofeifa, Darius Culvenor, Alex Held, Steve Zegelin and Eva van Gorsel

8 July 2013

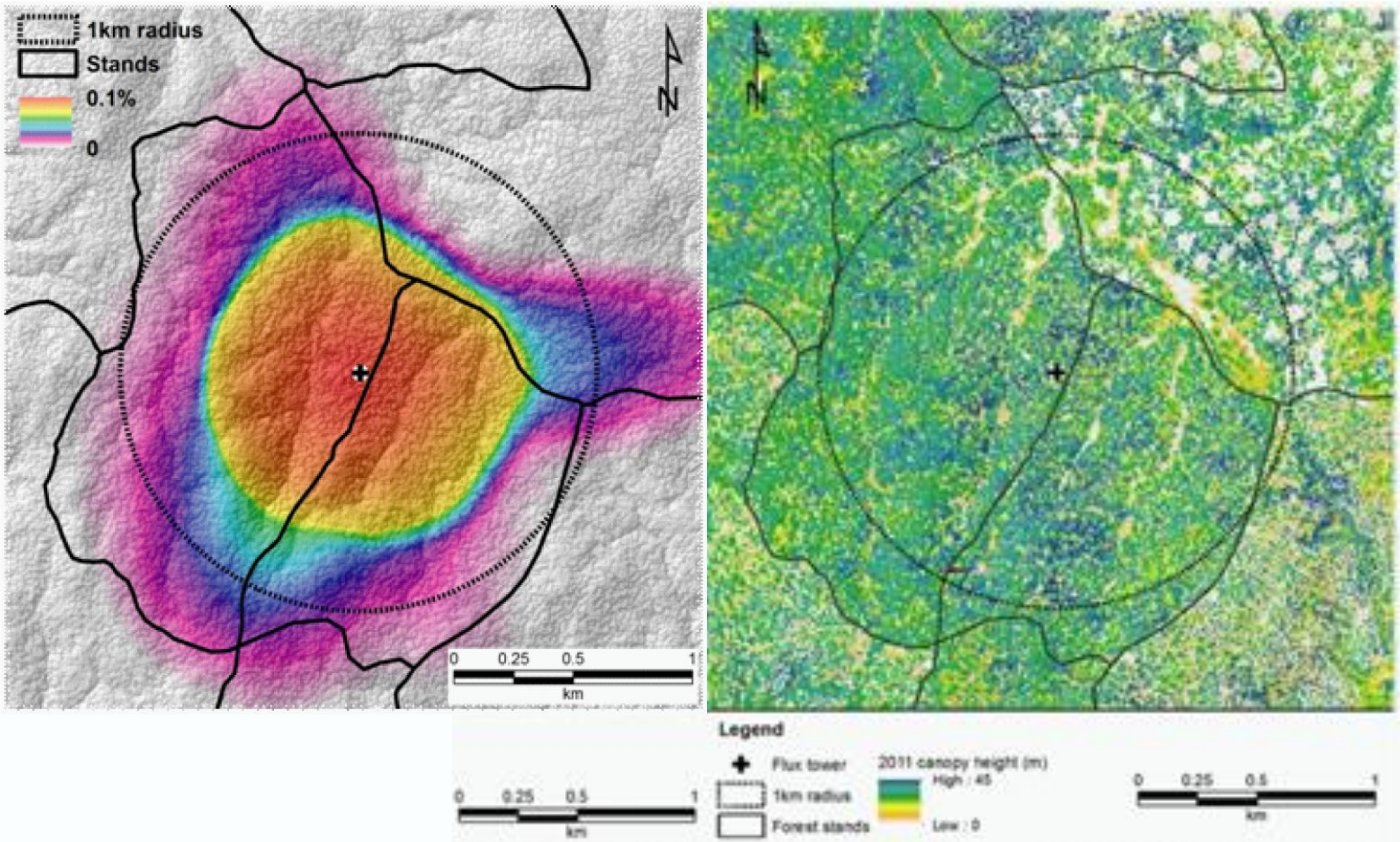
Tumbarumba, Bago State Forest



Tumbarumba, Bago State Forest



Tumbarumba, Bago State Forest



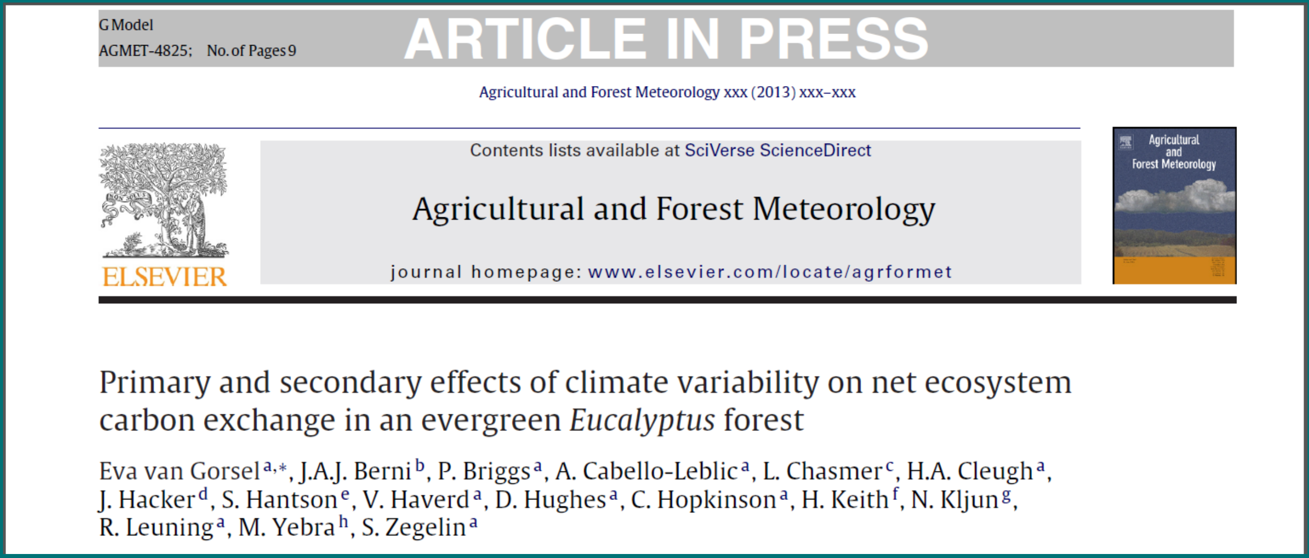
Tumbarumba, Bago State Forest

06/05/2013

Tumbarumba, Bago State Forest

Friday 07/07/2013

Effects of climate variability on NEE



G Model
AGMET-4825; No. of Pages 9

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Agricultural and Forest Meteorology

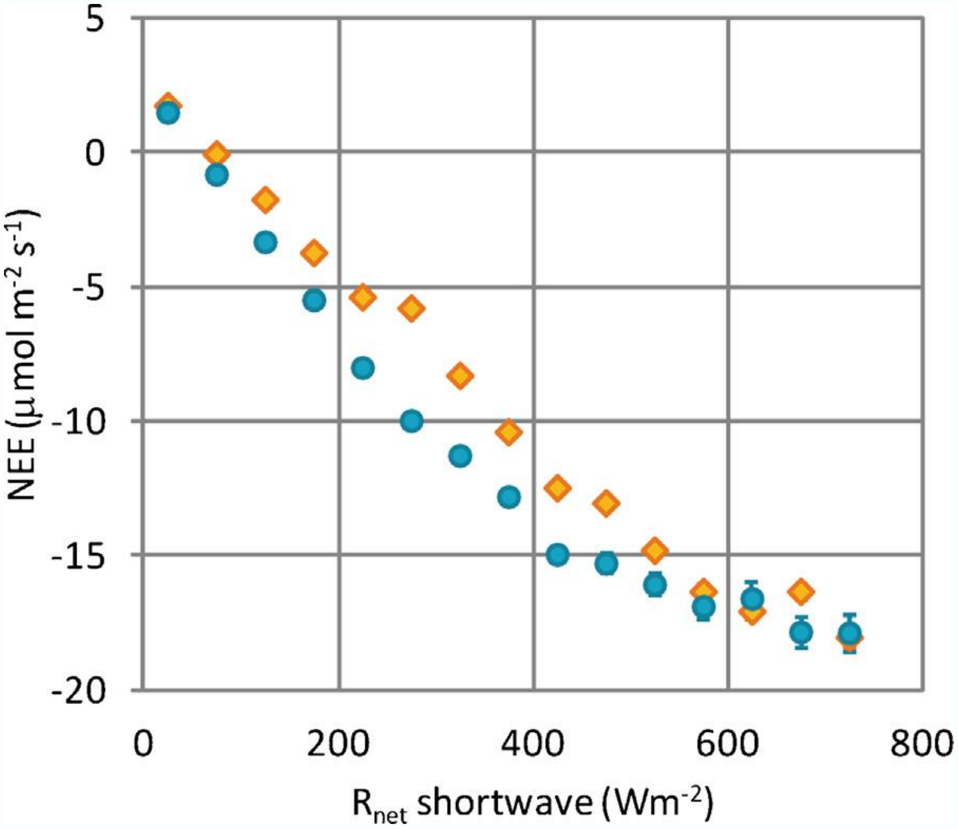
journal homepage: www.elsevier.com/locate/agrformet

Primary and secondary effects of climate variability on net ecosystem carbon exchange in an evergreen *Eucalyptus* forest

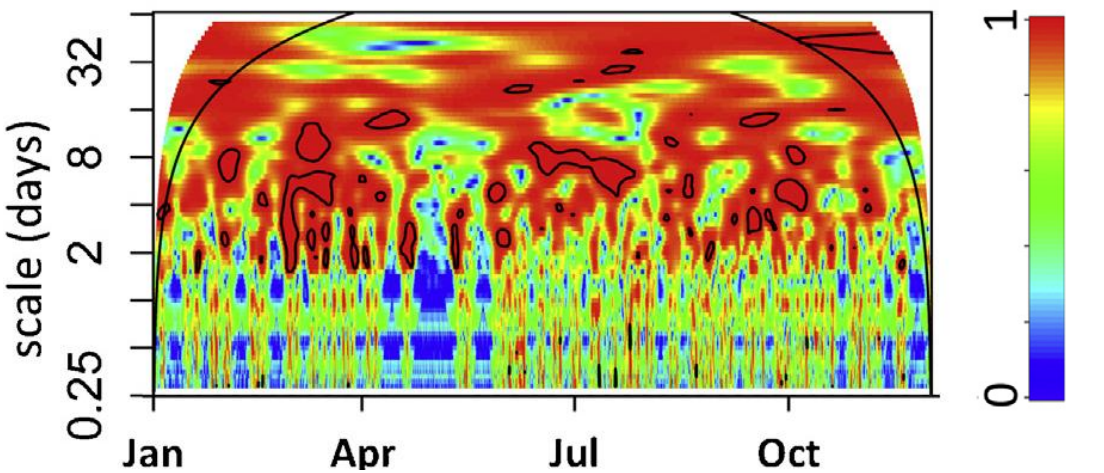
Eva van Gorsel[a,*], J.A.J. Berni[b], P. Briggs[a], A. Cabello-Leblic[a], L. Chasmer[c], H.A. Cleugh[a], J. Hacker[d], S. Hantson[e], V. Haverd[a], D. Hughes[a], C. Hopkinson[a], H. Keith[f], N. Kljun[g], R. Leuning[a], M. Yebra[h], S. Zegelin[a]

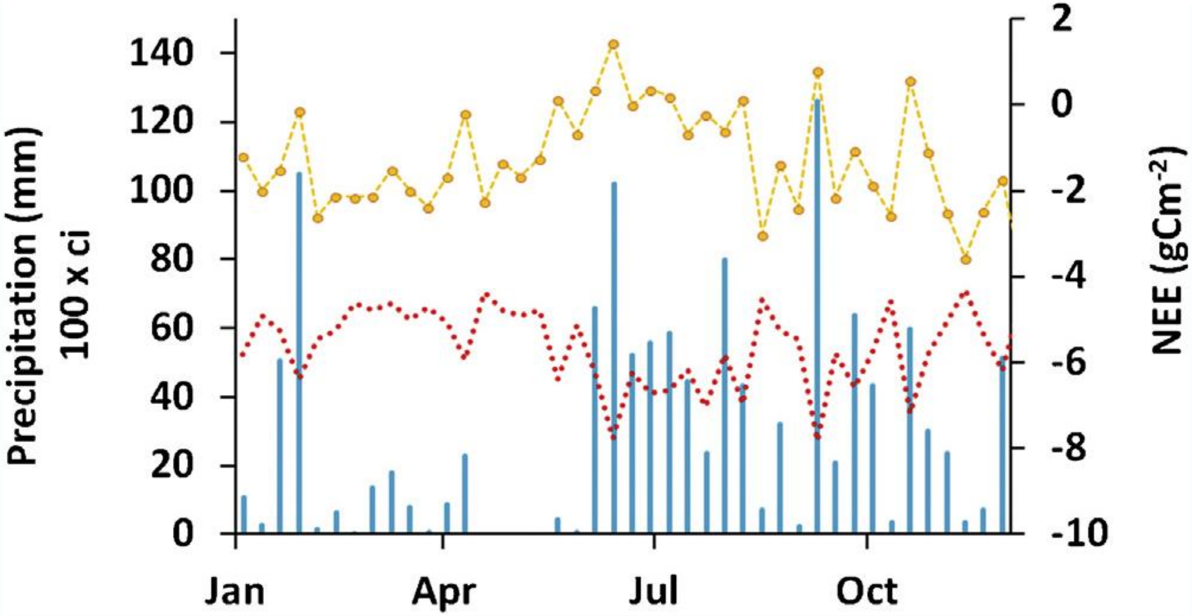
- Incoming shortwave radiation, spring minimum temperatures and NDVI explain most variance of annual net ecosystem exchange of carbon.
- The role of precipitation strongly depends on the time scale under consideration.
- Reduction of NEE due to cloud overrides effects of increased assimilation due to diffuse radiation on daily and larger time scales

drivers of carbon and water fluxes

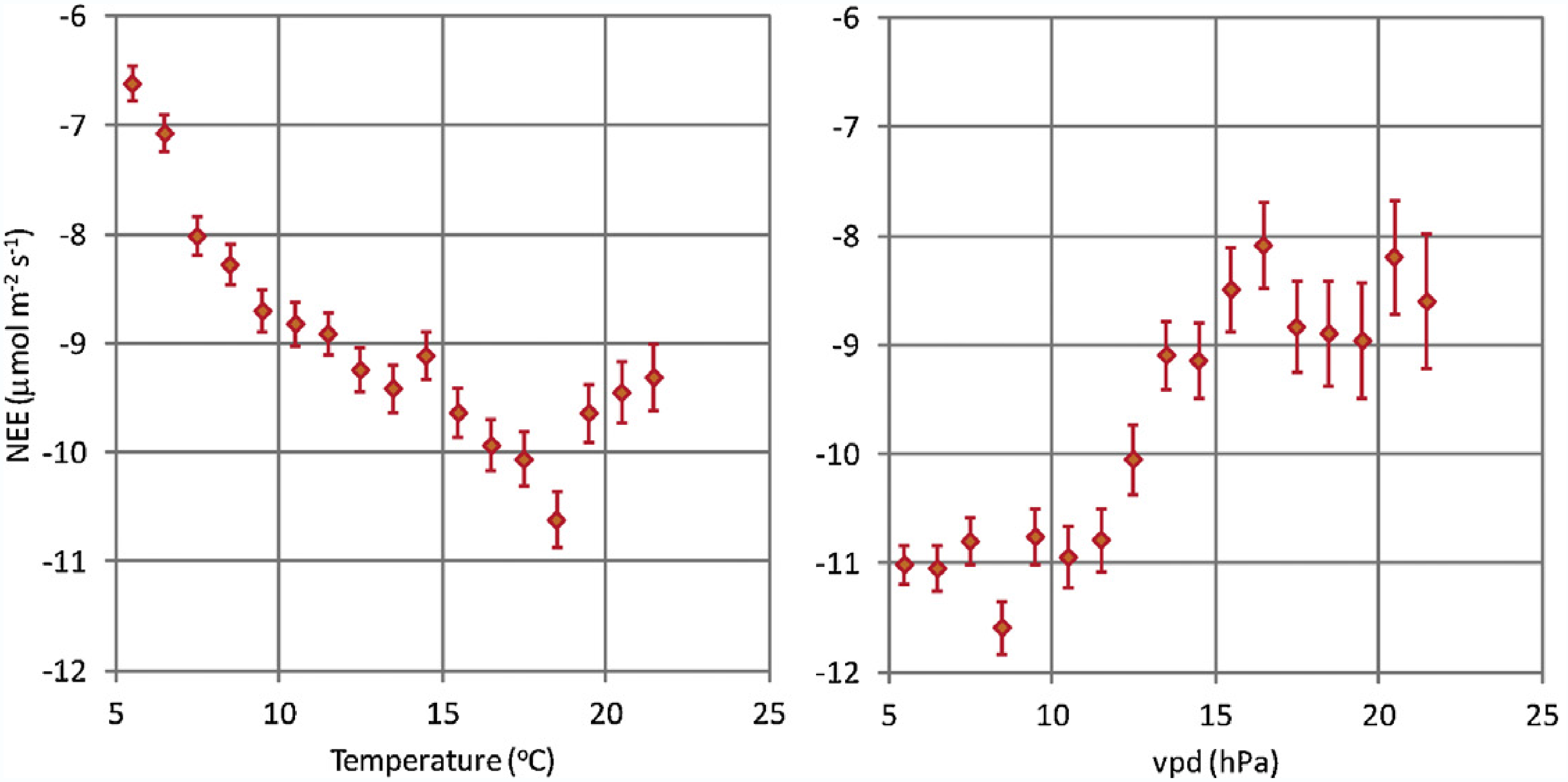


drivers of carbon and water fluxes

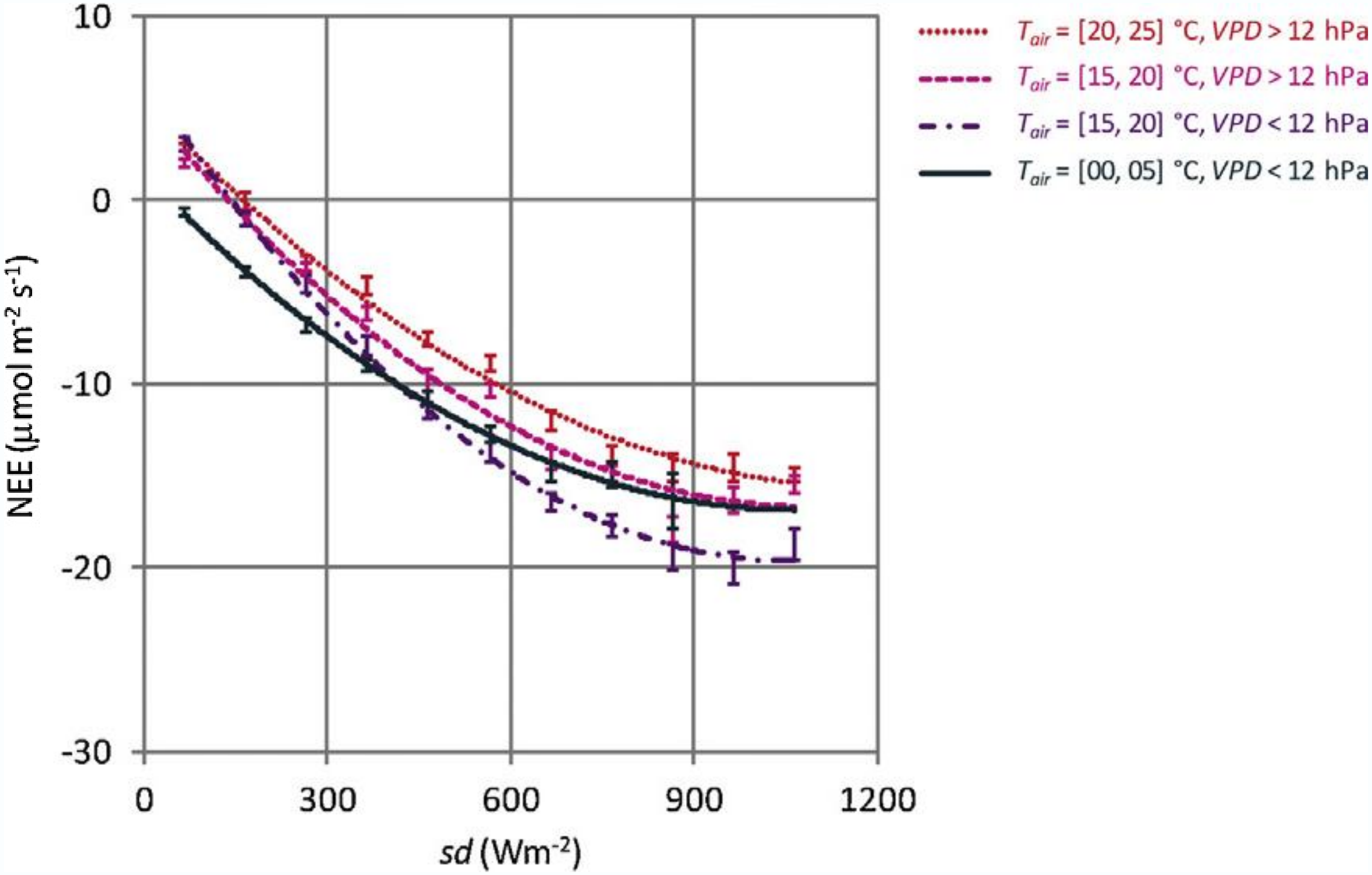




drivers of carbon and water fluxes



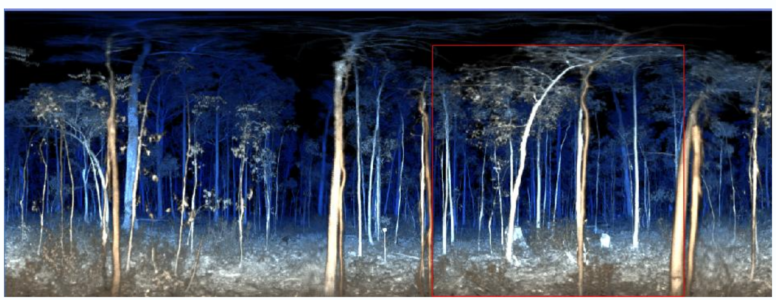
drivers of carbon and water fluxes

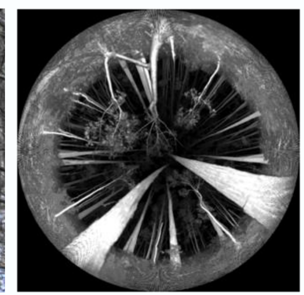


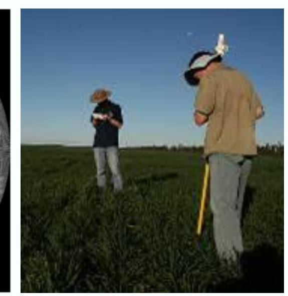
Field Campaigns Measurements + 2012

Tumbarumba, remote sensing field work

2009: field structural data was collected







Tumbarumba, remote sensing field work

Remote Sensing of Environment 136 (2013) 301–314

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Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

Integrating terrestrial and airborne lidar to calibrate a 3D canopy model of effective leaf area index

Chris Hopkinson [a,e,*], Jenny Lovell [b], Laura Chasmer [c], David Jupp [a], Natascha Kljun [d], Eva van Gorsel [a]

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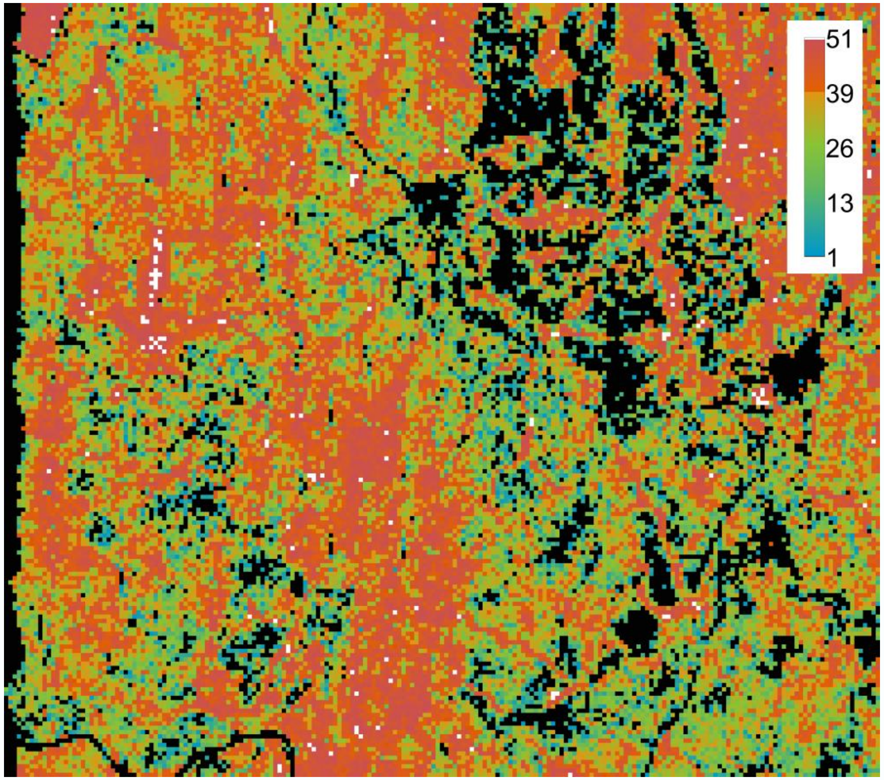
ABSTRACT

Terrestrial laser scanning (TLS) with the Echidna Validation Instrument (EVI) provides an effective and accurate method for calibrating multiple-return airborne laser scanning (ALS) point cloud distributions to map effective leaf area index (LAIe) and foliage profile within a 1-km diameter test site of mature eucalyptus forest at the Tumbarumba research site, New South Wales, Australia. Plot-based TLS foliage profiles are used as training datasets for the derivation of a scaling function applied to calibrate effective leaf area index (LAIe) from a coincident ALS point cloud. The results of this study show that: a) the mean proportion of the total number of returns within 11.3 m radius of the TLS scan station was 64%. Increasing the radius decreased the level of detail due to occlusion; b) the relationship between TLS LAIe profile and ALS foliage percentile distribution (PD) using all, primary and secondary returns are not linearly related; and c) regressions between TLS LAIe profile and ALS PD, demonstrate better correspondence using a 5th order polynomial applied to all returns ($r^2 = 0.95$; SE $= 0.09$ m^2 m^{-2}) than a quasi-physically-based Weibull scaling function. The calibration routine was applied to ALS data within a GIS environment to create a 500 m radius 3D map of LAIe. This localised 3D calibration of LAIe was then used as the basis to calculate the overhead canopy extinction coefficient parameter (k), and thereby facilitate upscaling of spatial LAIe estimates

Tumbarumba, remote sensing field work

Tumbarumba, remote sensing field work

Chlorophyll$_{a+b}$ content (µg cm^{-2})



validation needed

5 km x 5 km centred around the flux tower

Tumbarumba, remote sensing field work

comprehensive library of

- trees identified, geo-located
- spectral signature
- leaf level gas exchange (some)
- chlorophyll a+b, carotenoids and anthocyanins
- water, nitrogen and carbon content
- leaf area

Tumbarumba, sensor network

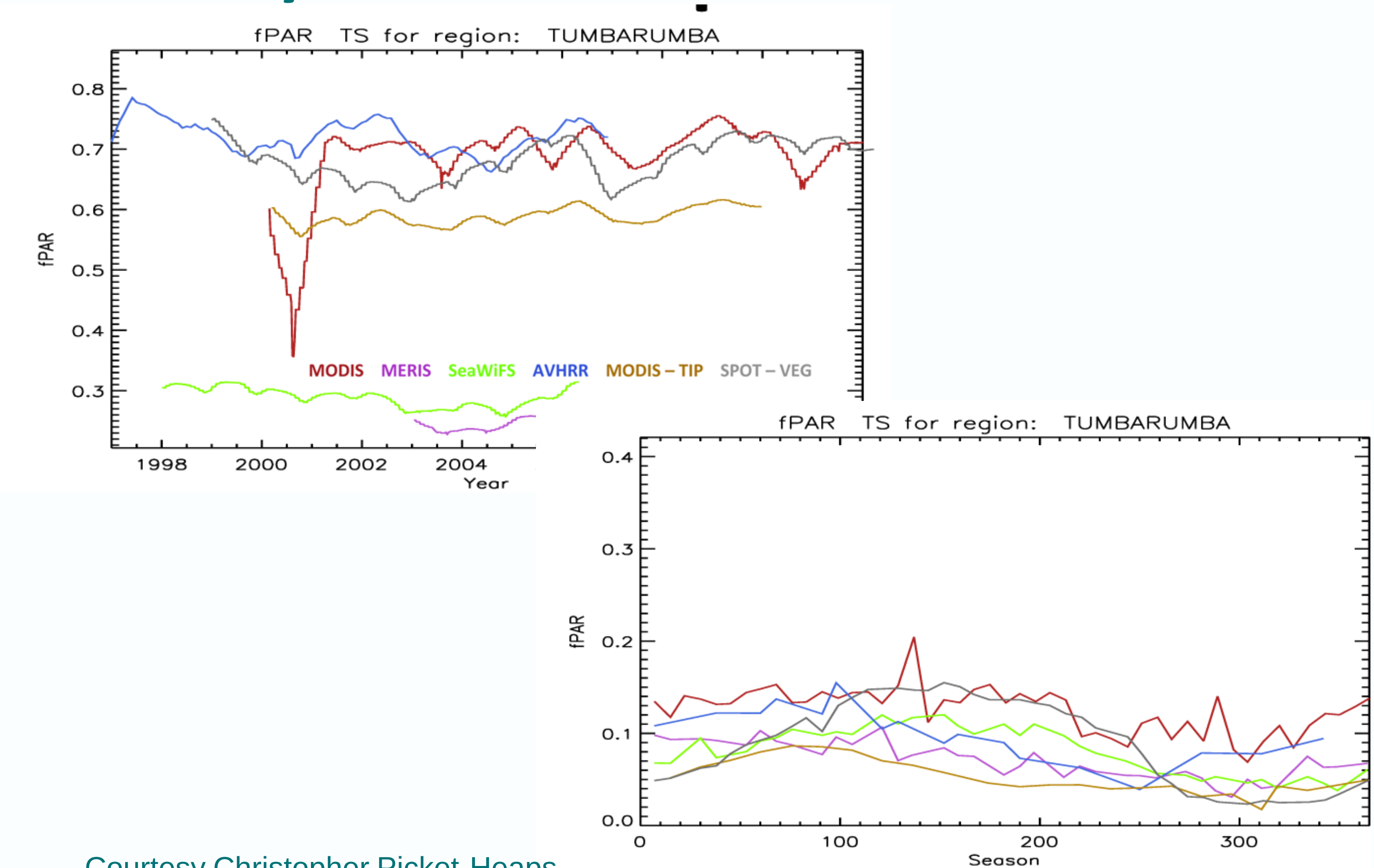
Sensor Network

- Incoming shortwave radiation, spring minimum temperatures and NDVI explain most variance of annual net ecosystem exchange of carbon.

continuous, real-time measurements of

- PAR (fapar, fipar) | tower: PAR in,ref (NDVI)
- temperature
- VPD

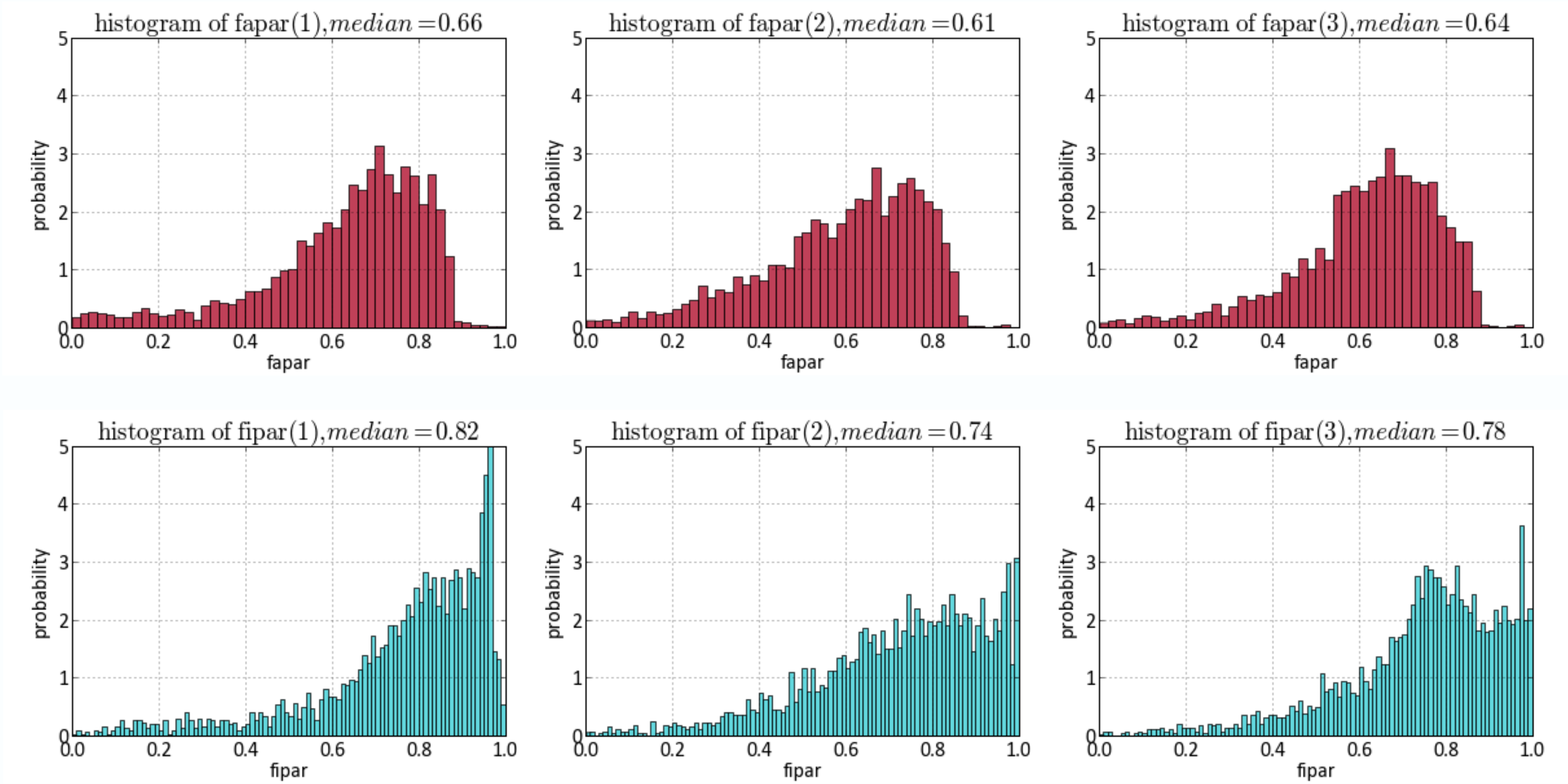
Variability of drivers of carbon and water fluxes



Courtesy Christopher Picket-Heaps

variability of fapar and fipar

In-canopy measurements PAR 11/2010-07/2011

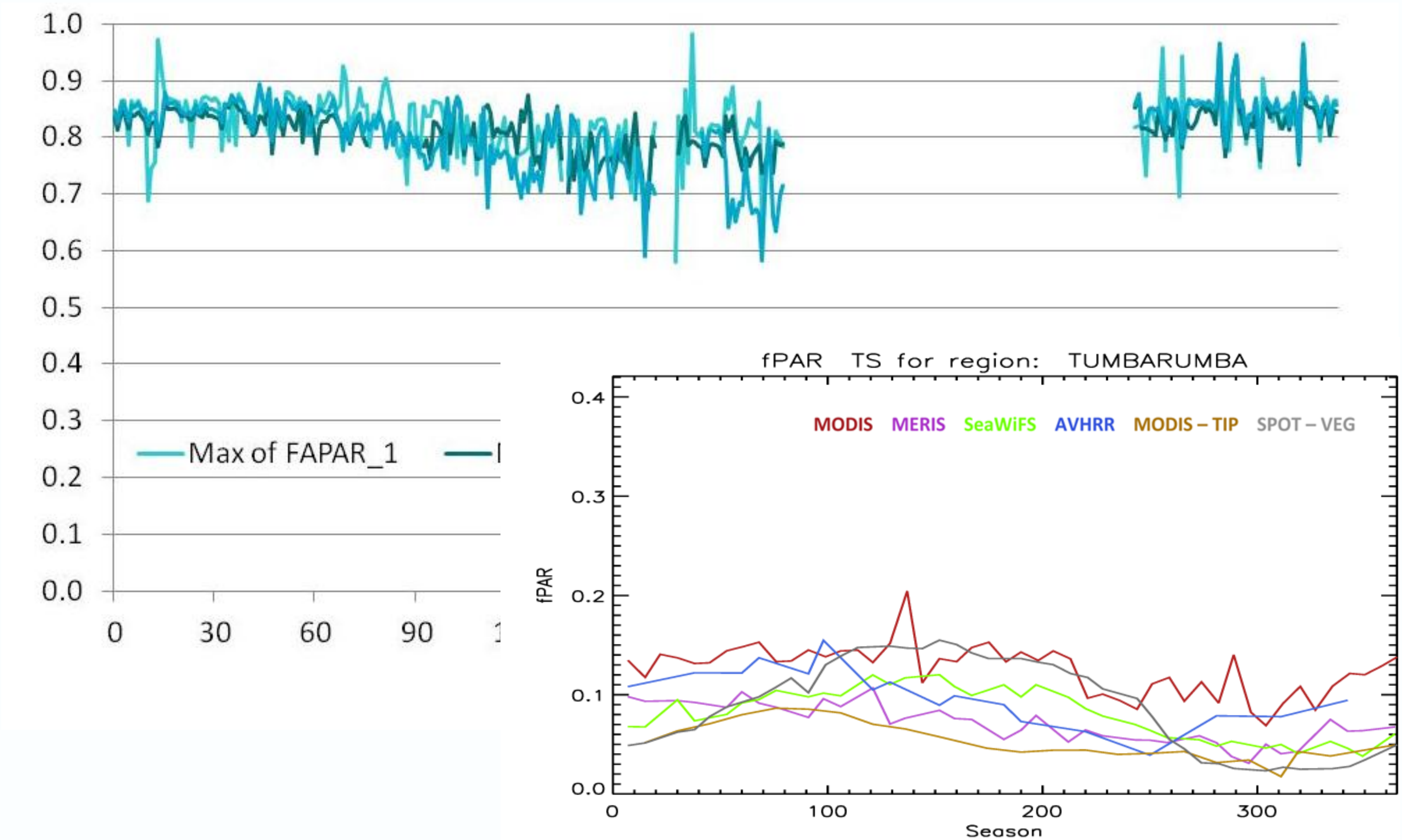


$fapar = (PAR_{(t)in} - PAR_{(t)out} - PAR_{(c)in})/PAR_{(t)in}$

$fipar = (PAR_{(t)in} - PAR_{(c)in})/PAR_{(t)in}$

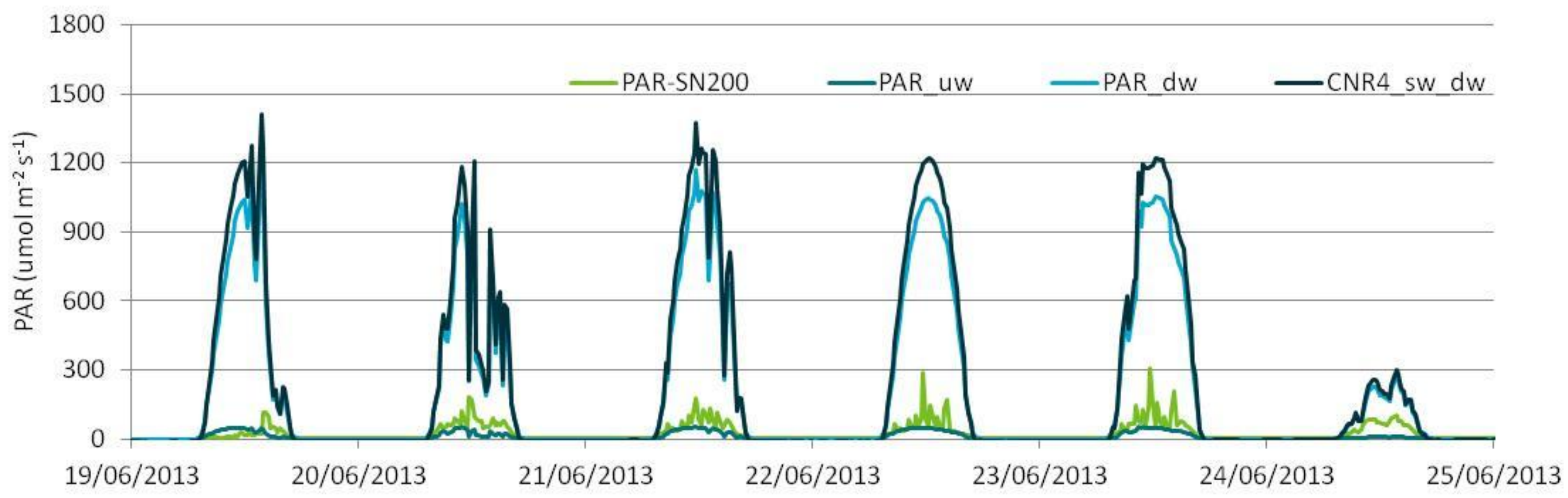
seasonality of fapar

In-canopy measurements PAR 11/2010-07/2011



FIPAR and LAI

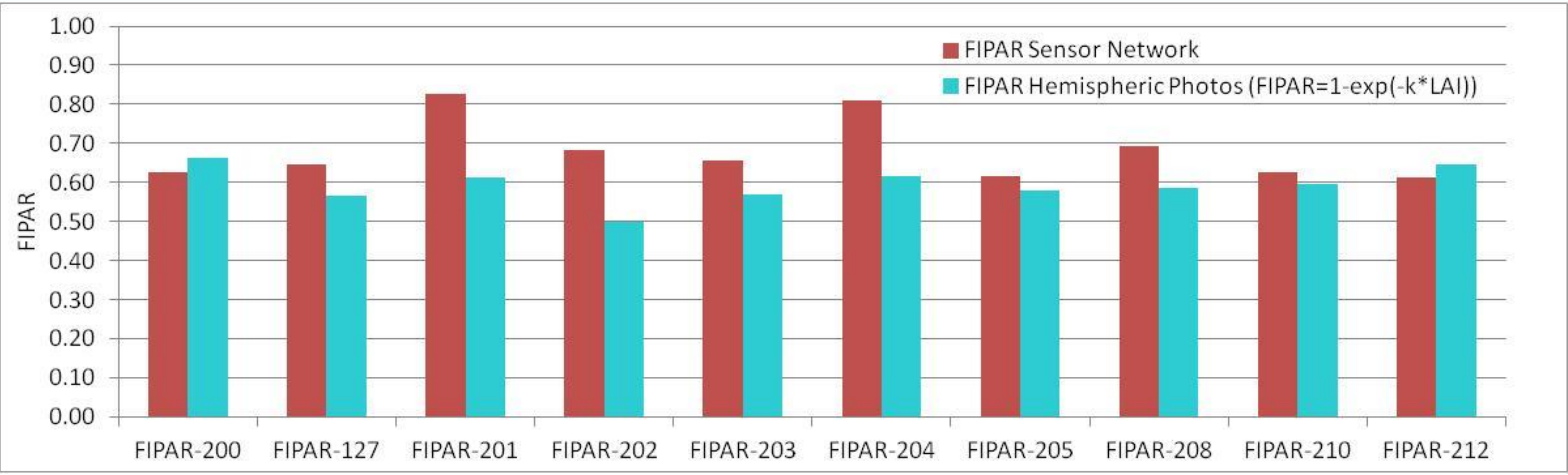
Tower PAR and Sensor Network



FIPAR = 1-exp(-k*LAI) [under overcast conditions]

FIPAR and LAI

In-canopy measurements PAR 11/2010-07/2010



Sensor Network

- PAR measurements on tower and in canopy can be used as to validate remote sensing fapar/fipar.
- useful for validation of absolute values and seasonality
- useful as input in land surface models

Incoming shortwave radiation is the most important driver for NEE and LE and temperature and vapour pressure deficit modulate the amount of carbon exchanged for a specific amount of radiation.

CSIRO

Thank you

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05