



TERN

Terrestrial Ecosystem
Research Network



www.csiro.au

Water and carbon balances in a groundwater recharge area, Gingin, WA

Trish Lambert, Richard Silberstein, Craig Macfarlane,
John Byrne, Chris Johnstone and Natalie Smart

<http://www.ozflux.org.au/monitoringsites>

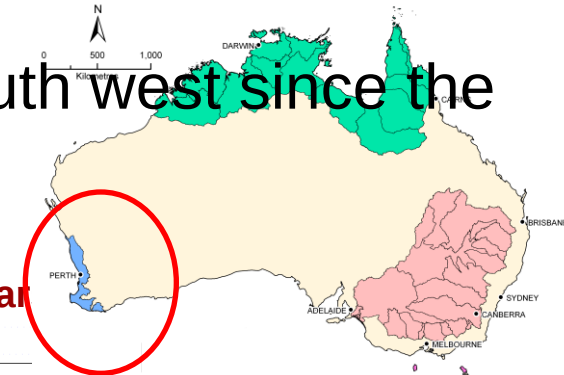
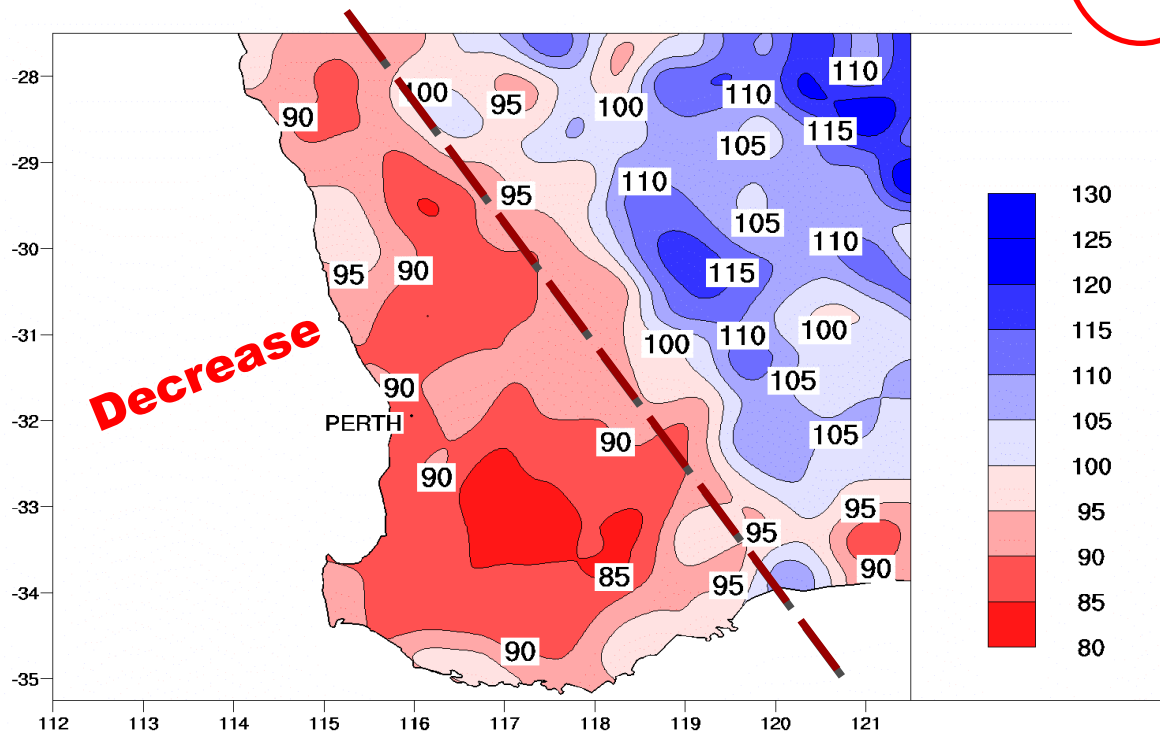
Oz Flux



South-west Western Australia has had a major climate shift since the early 1970s

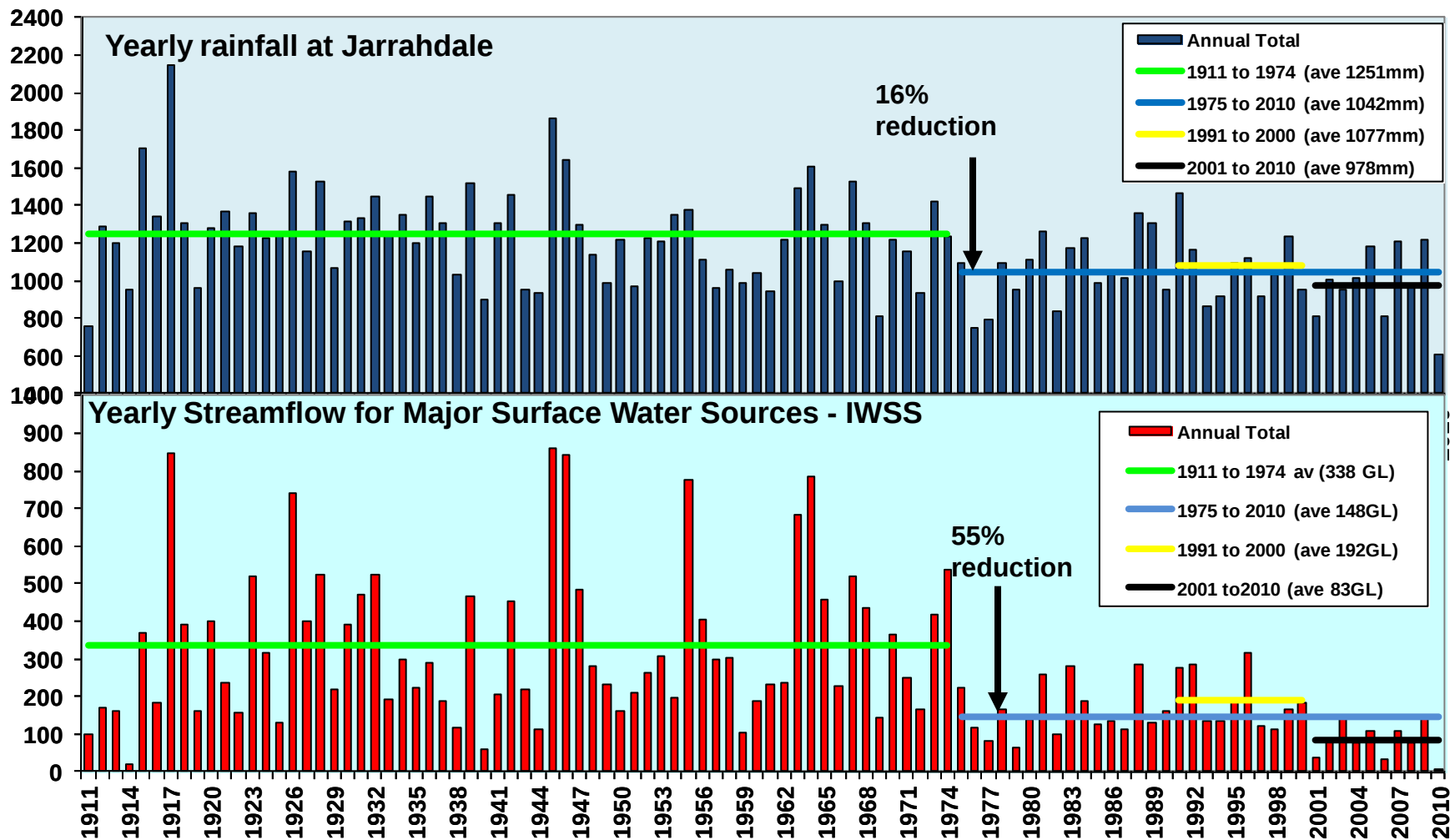
with a major reduction in rainfall in the south west since the early 1970s

Last quarter century winter rain as % of previous 75 year



16% reduced rainfall but 55% reduced recharge

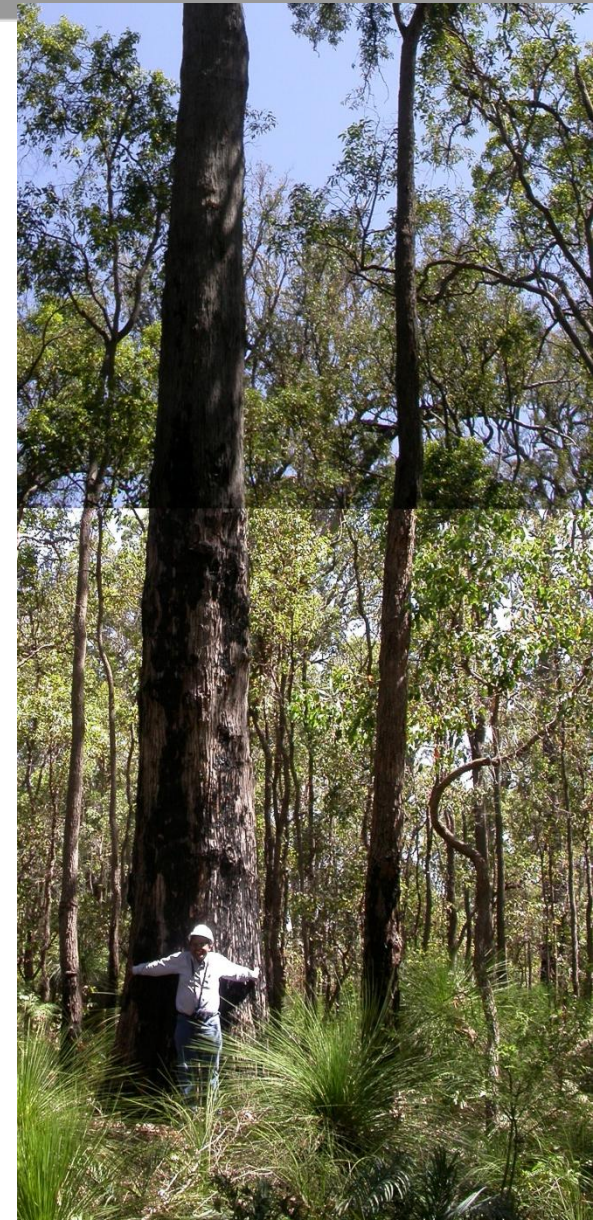
Total Annual Rainfall at Jarrahdale (mm)



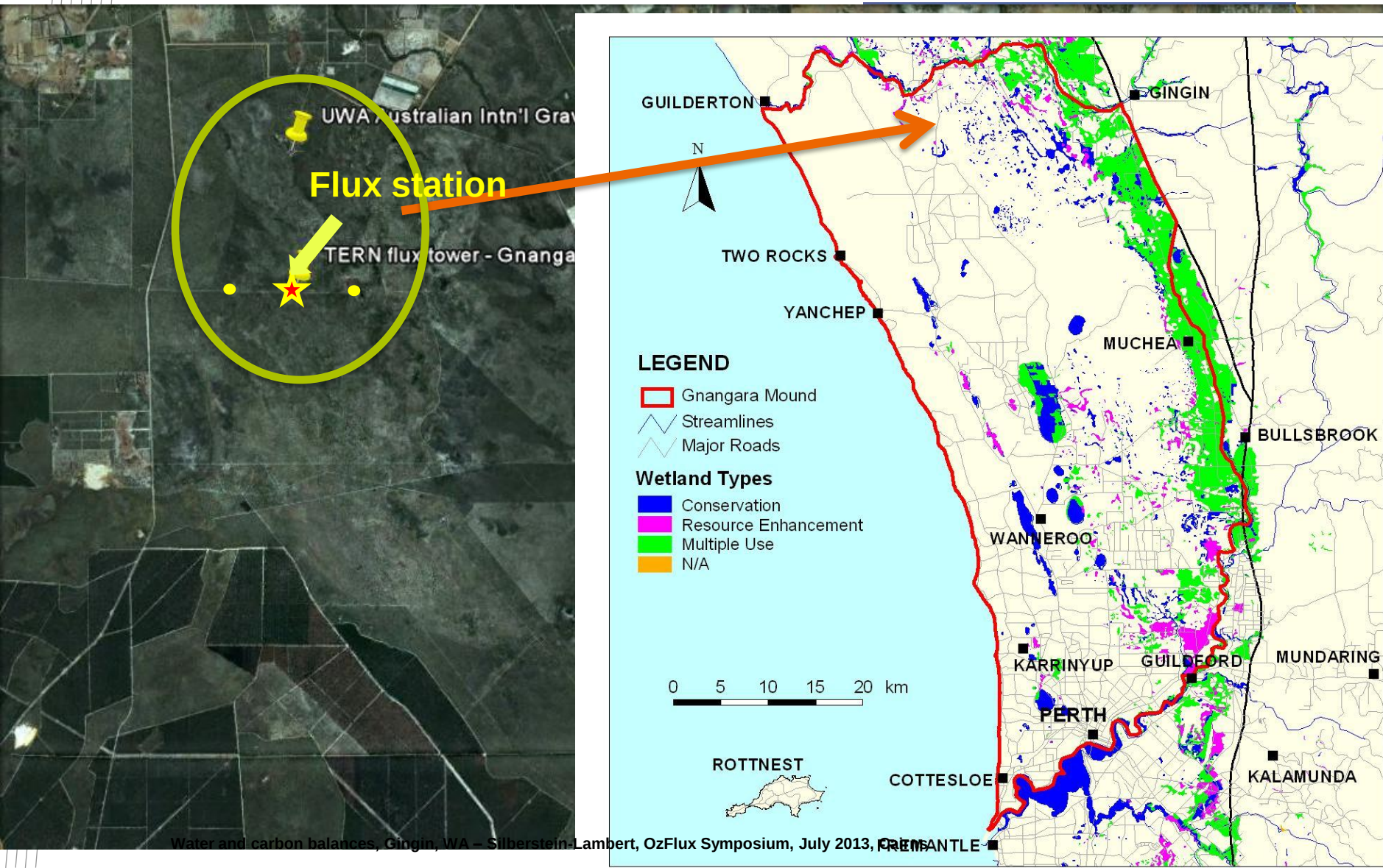
Total Annual Inflow to Perth Dams (GL)

Water Issues

- Drying of forest soils & changing forest structure causing reducing stream flow into water catchment dams
- Population increase and urban expansion causing increased water demand
- Increased reliance on groundwater (5% to 75% from 1970 to 2010)
- Decline in aquifer storage at 50GL/yr ~ \$1b NPV (based on sea-water desalination)
- Desalination now 25% of water supply soon to rise to 50%



The Gingin site is in the recharge area 70km north of Perth CBD



The Gingin region is subject to fire and other stresses



Site selected with Noongar approval ...



The site is chosen to understand the water use and carbon balance of the native bush,

and (hopefully) contribute to sustainable management of Gnamangara ecosystem and groundwater

About 1,000km² of native woodland

Annual rainfall ~ 750mm,

Potential evaporation ~1600mm,

Actual evapotranspiration ~ 600mm



Long-term piezometer of the Dept of Water

Department of Water

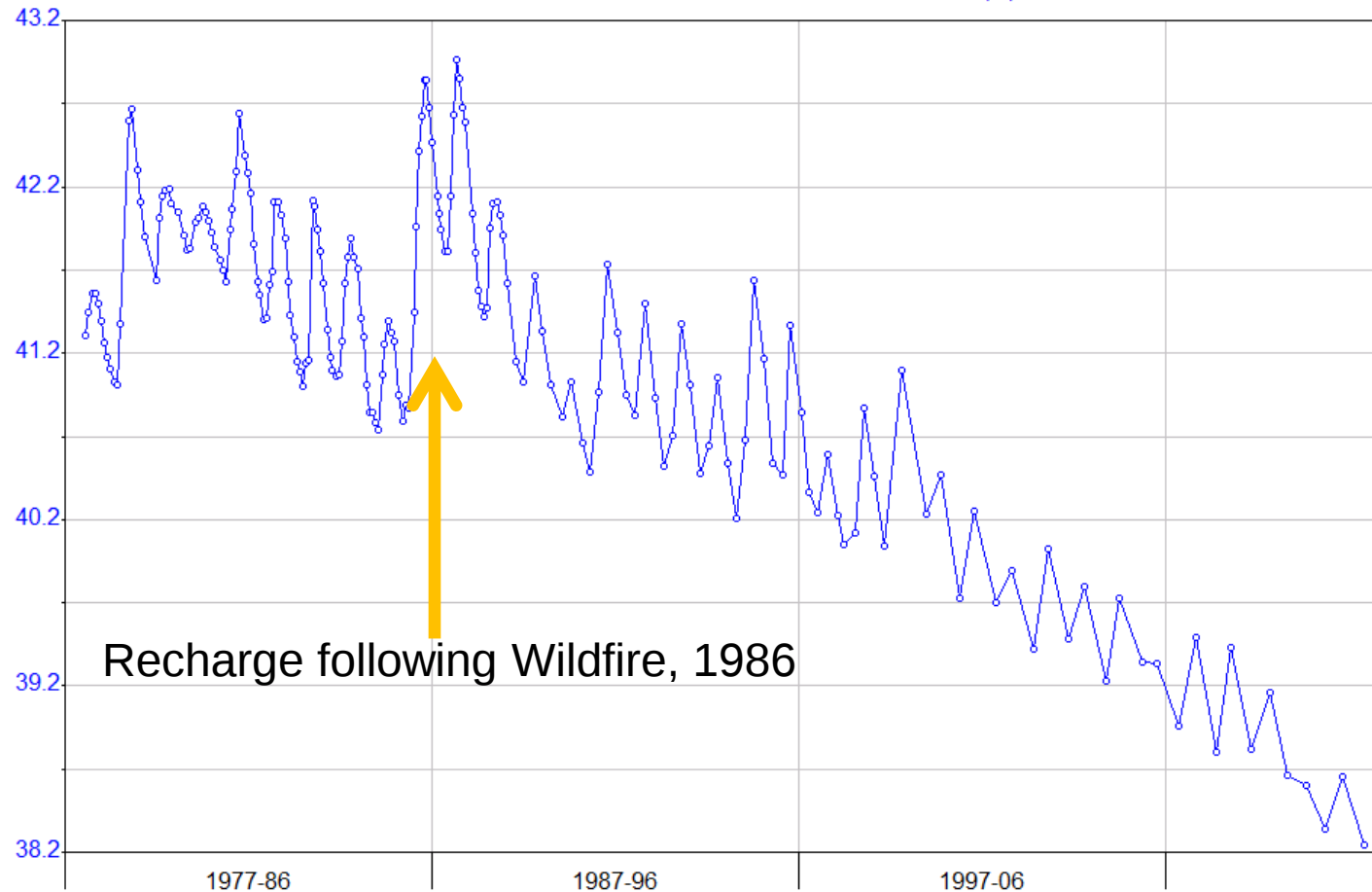
HYPLOT V133 Output 17/10/2012

Period 36 Year Plot Start 00:00_01/01/1977

1977-13

Interval 1 Month Plot End 00:00_01/01/2013

61710077 GB15 6268.00 Line/Point Water Level AHD (m) GWL



Instruments

Usual tower array plus
Digital cameras monitoring phenology
CosmOz moisture sensor
Neutron access tubes
"Nested" piezometers
Additional east & west sites



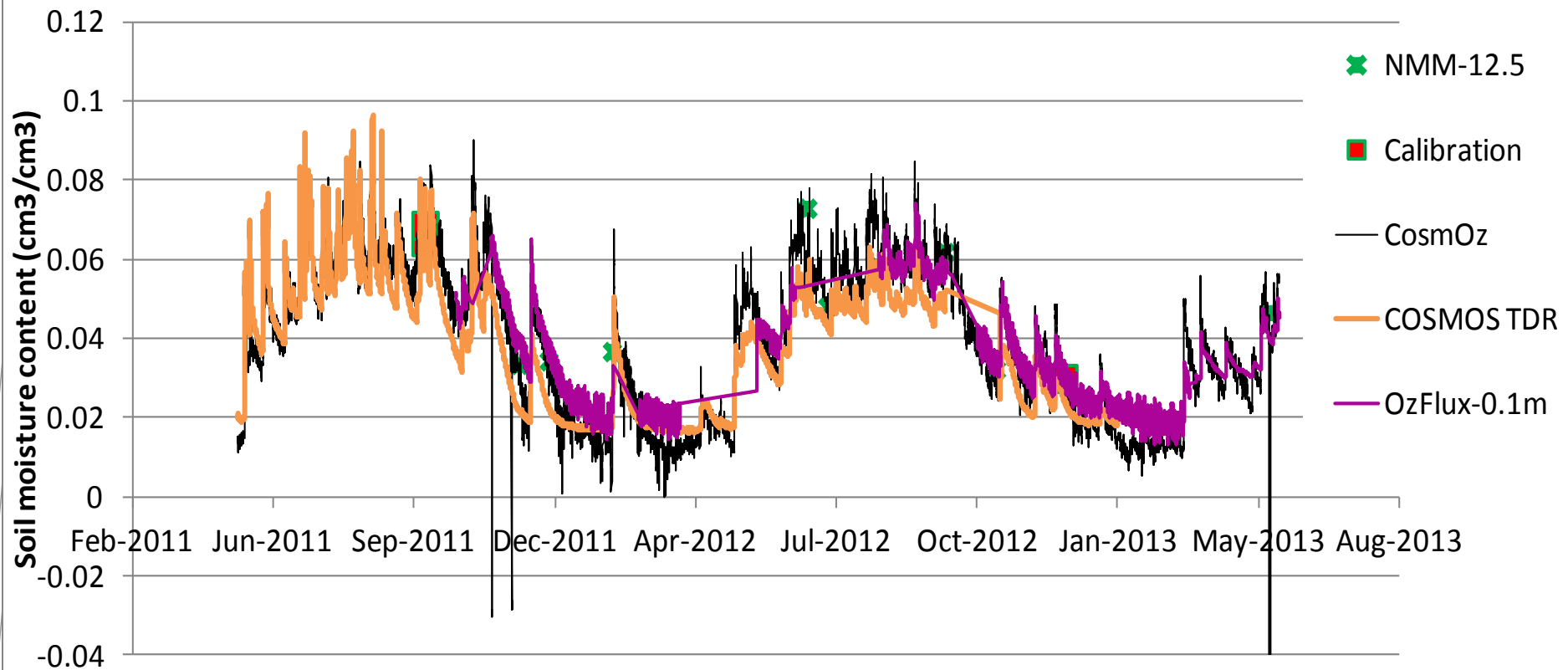
CosmOz uses cosmic rays for soil moisture

giving average moisture content to about 80cm
over a radius of about 200m

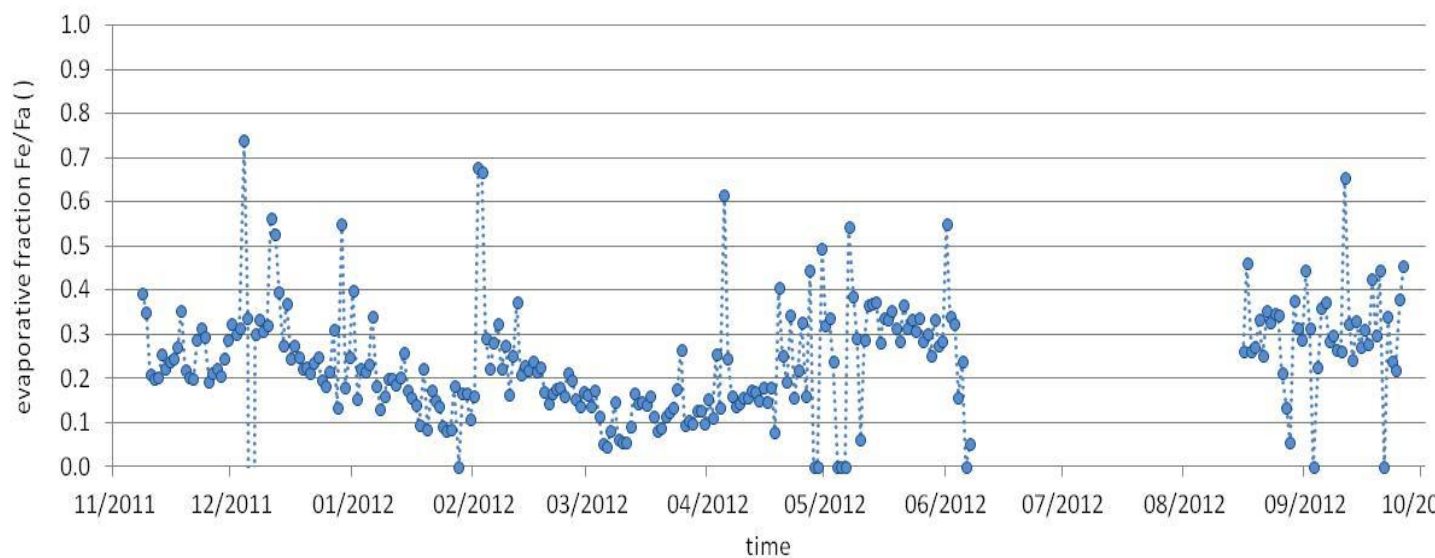
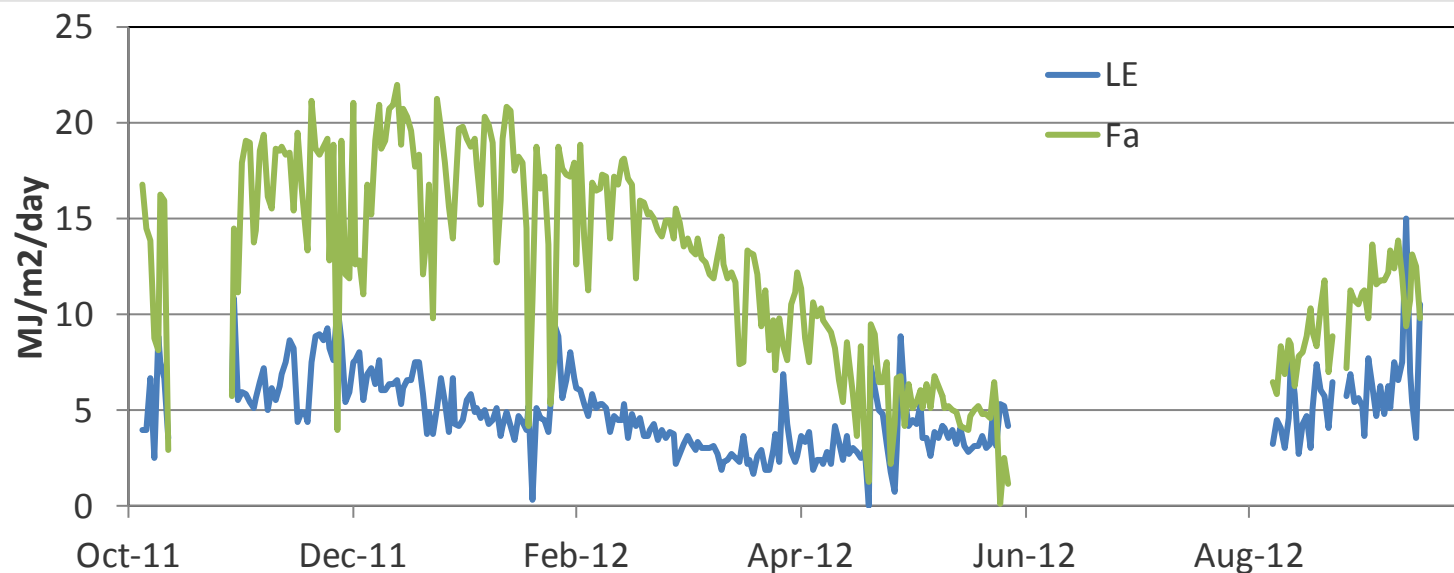


CosmOz soil moisture

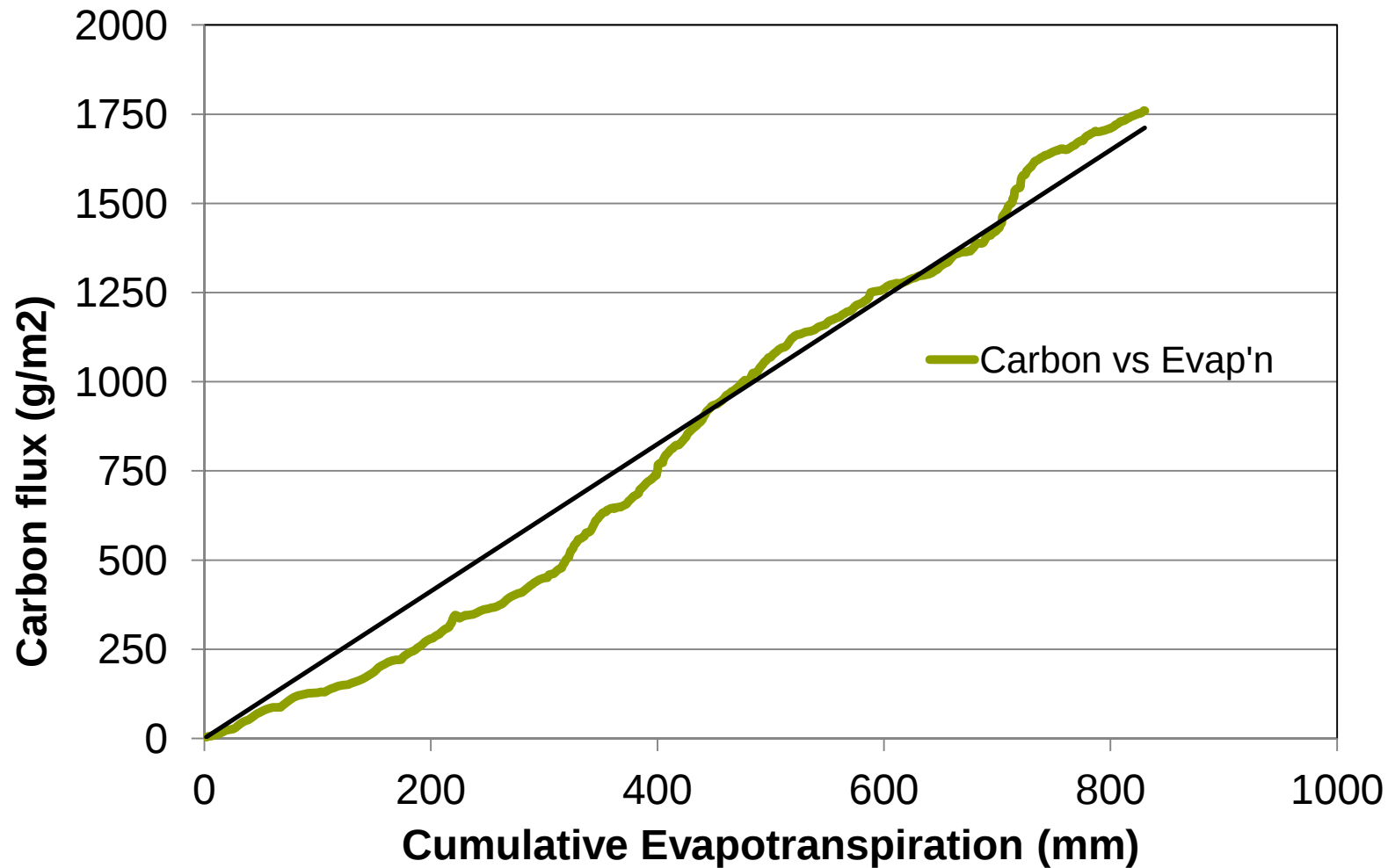
6hr average soil moisture content



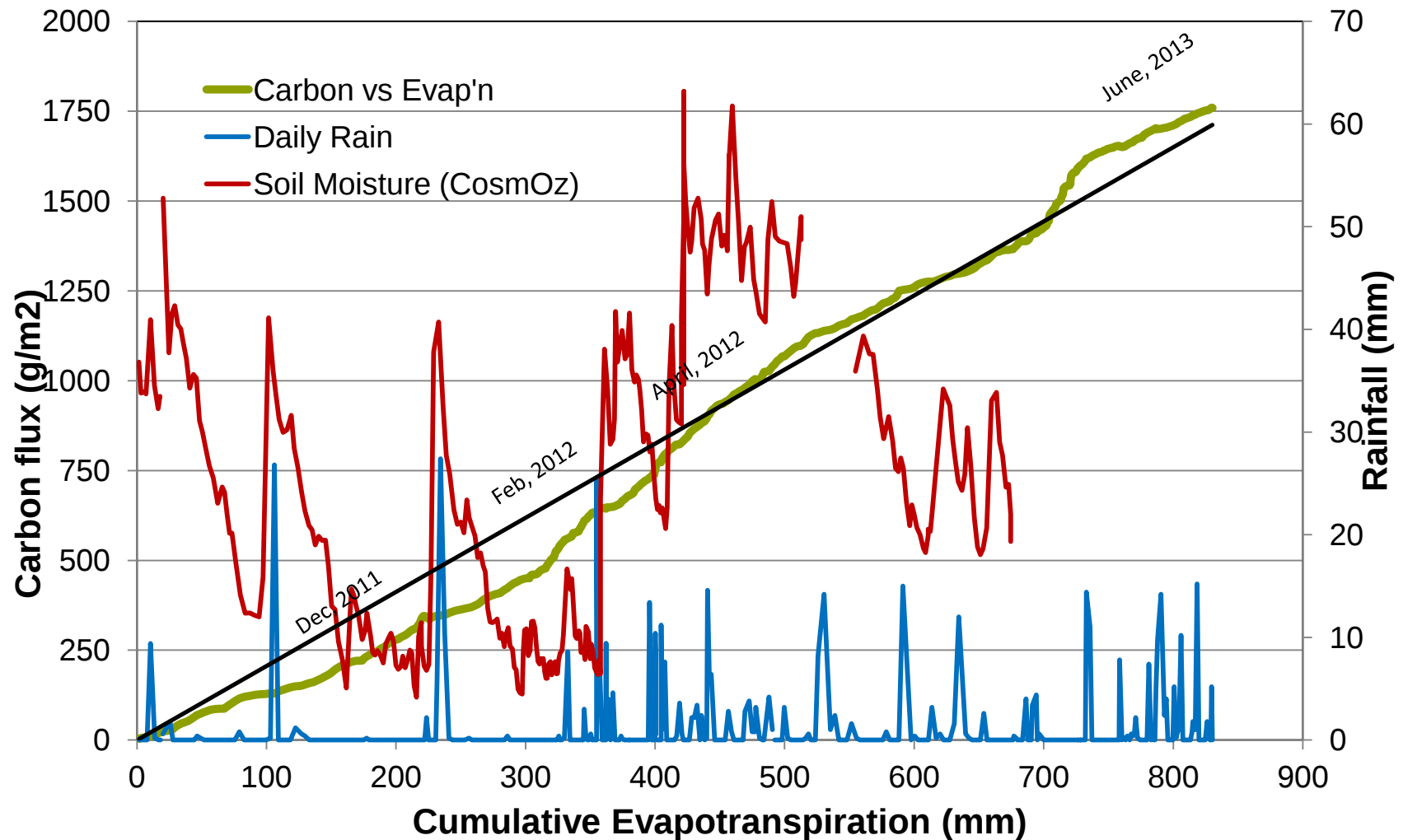
Water fluxes at Gingin



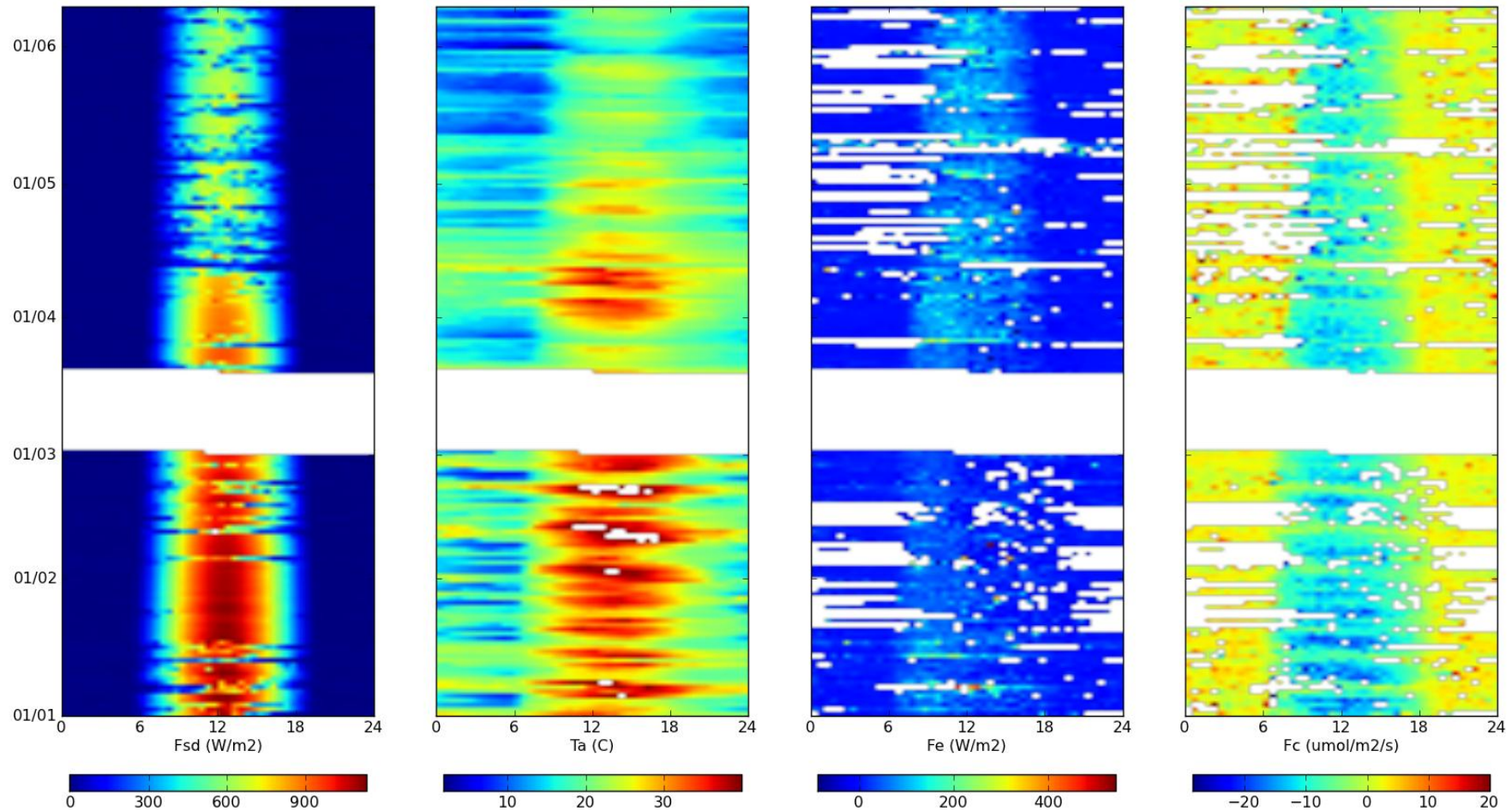
Cumulative carbon flux vs cumulative evaporation



Carbon flux vs evaporation + rain + soil moisture



Down-welling short wave radiation, Air Temp, Available energy, carbon flux



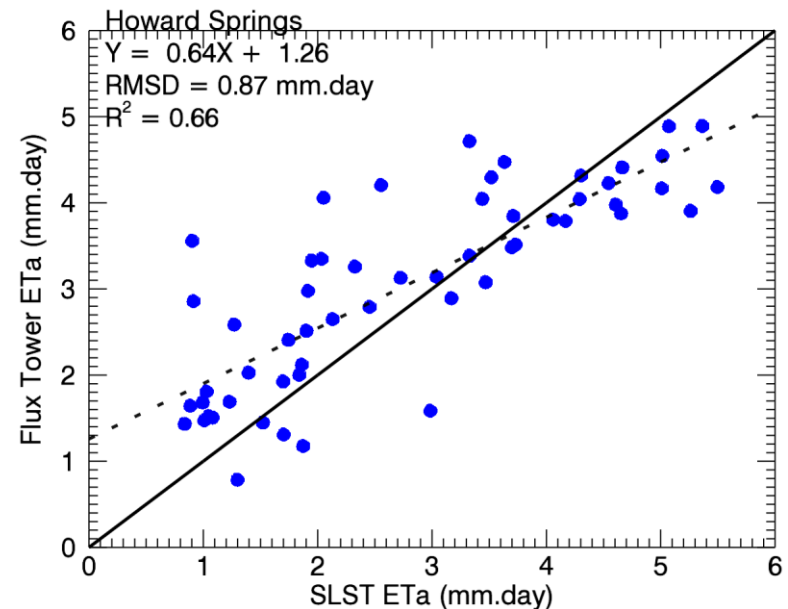
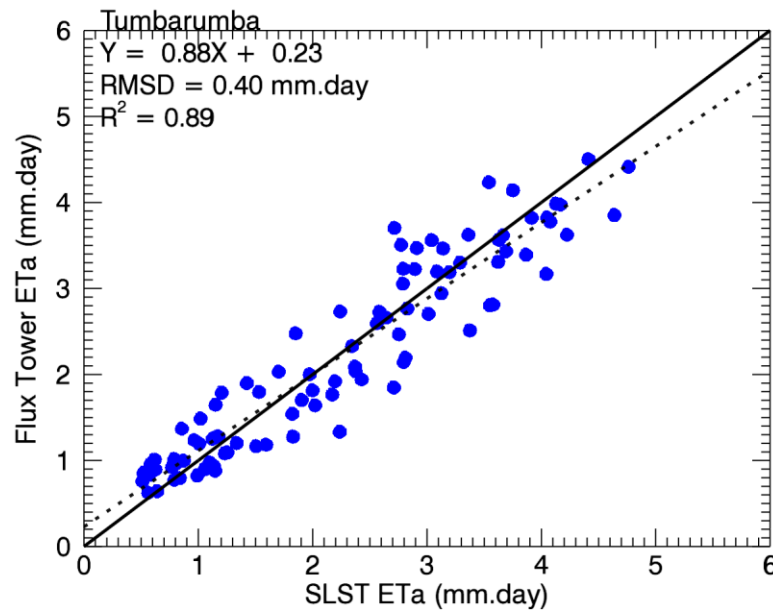
Problems & Issues

- Insufficient power capabilities to run the fast instruments at the top of the tower
- Insufficient infrastructure to get that power to the fast instruments
- Irregular cleaning and calibration of instruments
- Soil moisture probes and multiplexer problem – ongoing

LESSONS

- Documentation and protocols
- Look at and process your data regularly
- Get to know people in the OzFlux network

Next steps: Putting this together with a model and finding what's wrong



Model SLST – Tom Van Niel

Status:

- Gnangara COSMOz running since May 2011
OzFlux station ~running since October, 2011
- What next?
- Tie in with remote sensing, analyse flux data – gap filling!
- Test remote sensing ET algorithms
- Improve estimate of recharge
- Modelling recharge, evaporation and carbon flux
- ...

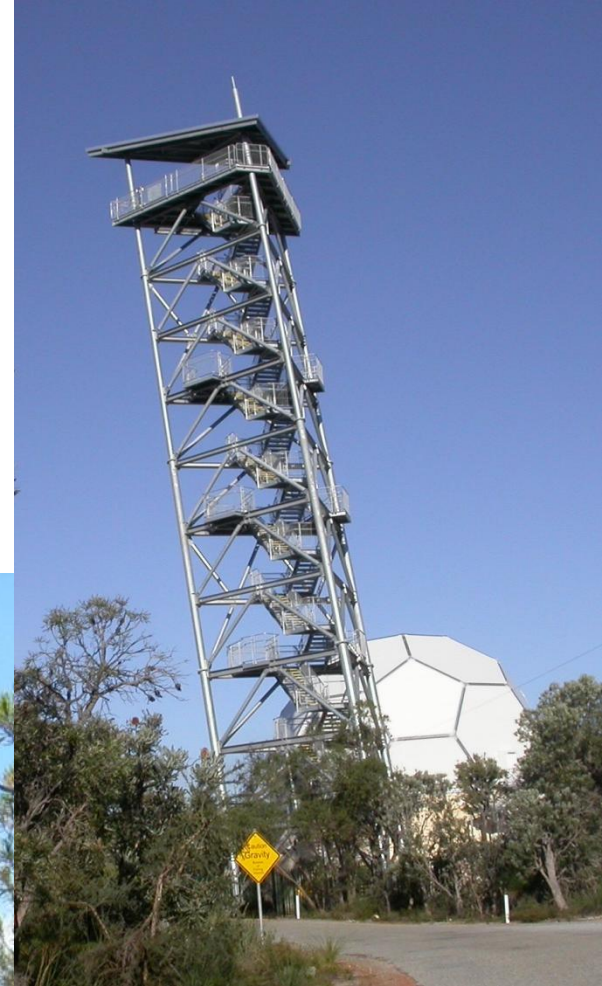


Acknowledgements

- Ray Leuning, Helen Cleugh, Eva van Gorsel for inspiration, leadership and advice
- Peter Isaac (TERN) for tremendous data processing support
- Craig Macfarlane, John Byrne, Chris Johnstone, Natalie Smart for hard work
- Dave McJannet and Aaron Hawdon for CosmOz
- TERN for money



Do come and visit



Water and carbon balances, Gi

Cairns

Thank you

www.csiro.au

CSIRO Land and Water

Richard Silberstein

Phone: 08 9333 6000

Email: Richard.Silberstein@csiro.au

Web: <http://www.csiro.au/people/Richard.Silberstein.html>

Contact Us

Phone: 1300 363 400 or +61 3 9545 2176

Email: enquiries@csiro.au Web: www.csiro.au

Water and carbon balances, Gingin, WA – Silberstein-Lambert, OzFlux Symposium, July 2012, Cairns

