

# Welcome to the 2012 OzFlux Workshop

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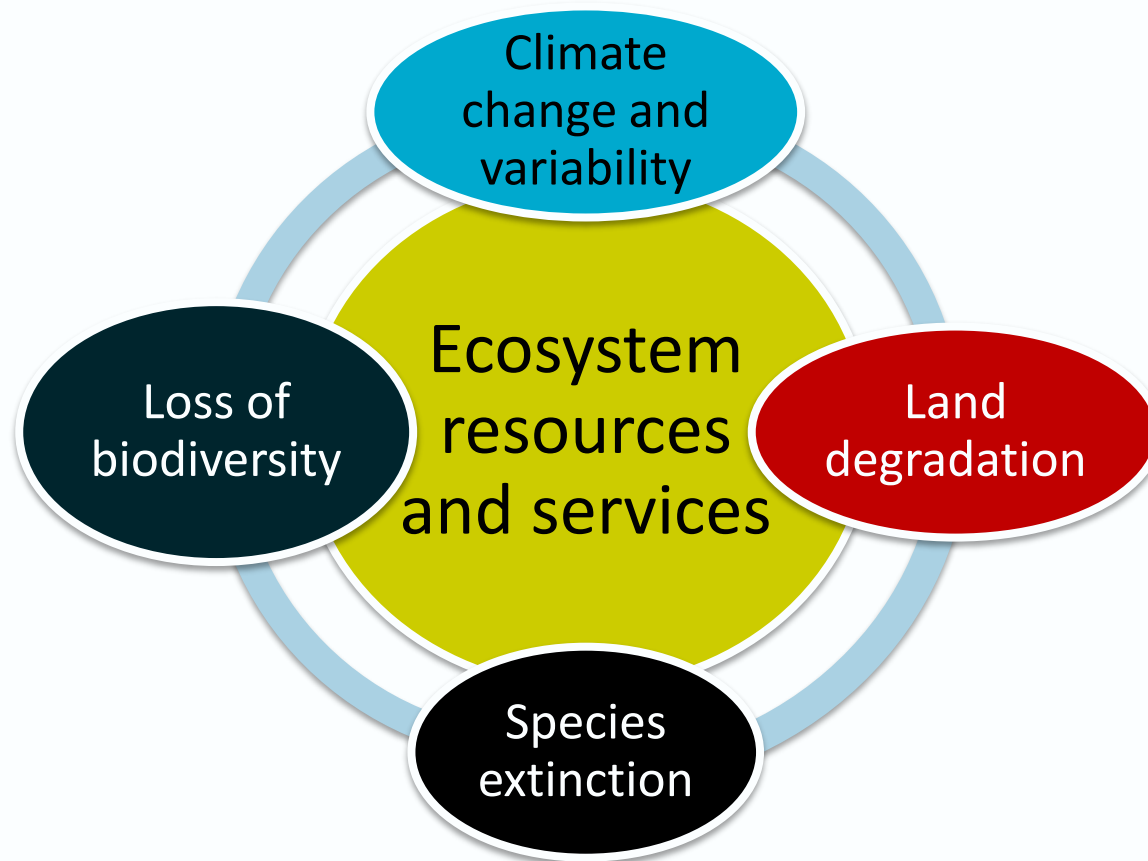


Australian and New Zealand Flux Research and Monitoring

# Australia's Terrestrial Ecosystem Research Network (TERN)

Helen Cleugh and Eva van Gorsel  
CSIRO Marine and Atmospheric Research

Information and knowledge needed for the sustainable management of ecosystems, and the services they provide, in the context of significant environmental change



# Key Ecosystem Research Questions

How are ecosystems changing – including the spatial distribution of plant and animal species – over time?

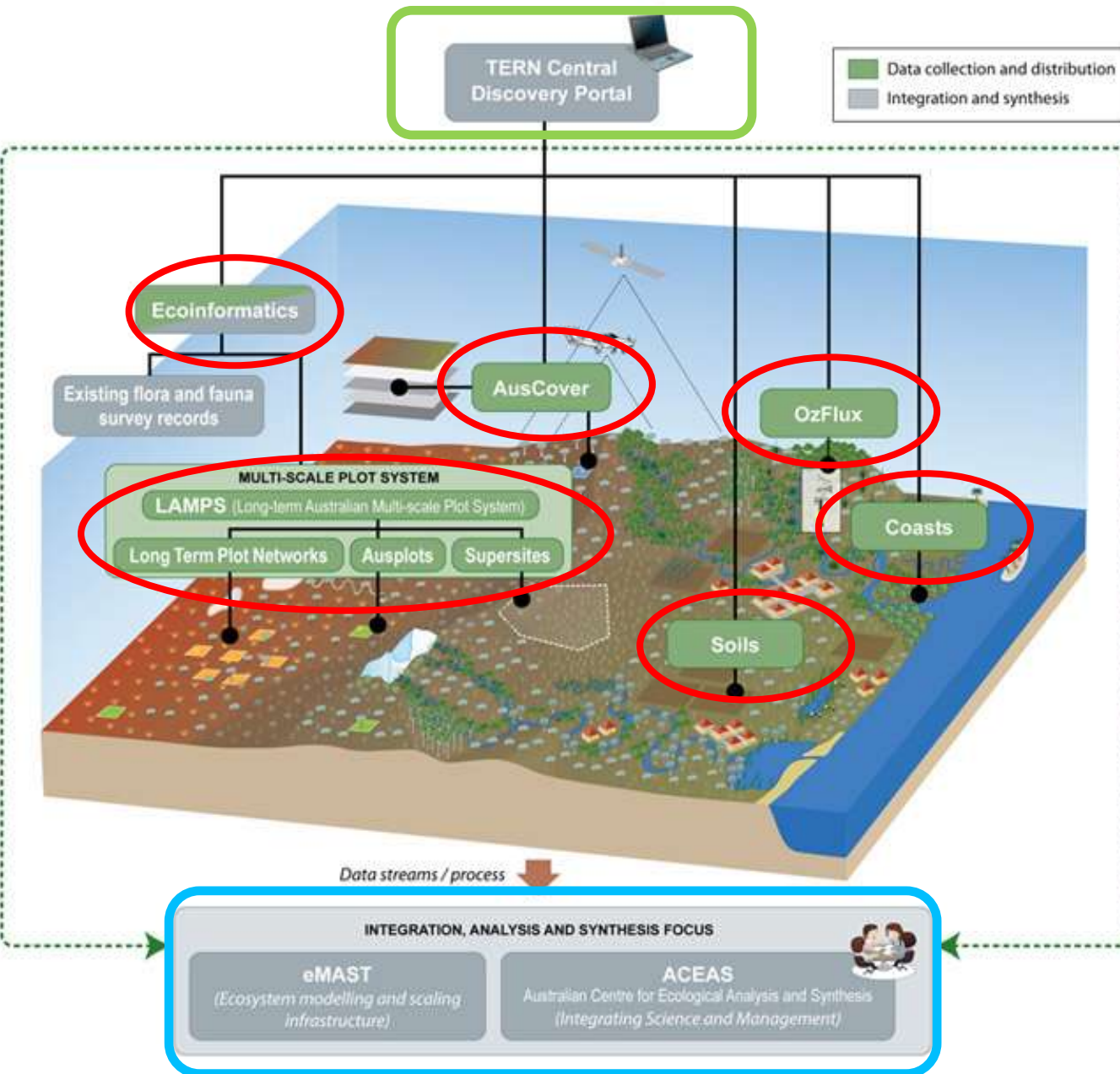
How do land management and climate drivers affect ecosystems and ecosystem processes?

- Terrestrial carbon, water and nutrient cycles
- Greenhouse gas emissions
- Biodiversity
- Soil and water quality

What is the impact of natural disturbance regimes and how are they changing?

# TERN – a virtual network enabling integration and sharing of data, information and knowledge

- Data collection, validation, curation, discovery and sharing
  - Standardised methods and calibrations
- Research infrastructure
  - Establishing new, and maintaining existing, research facilities
  - Digital infrastructure for storing and publishing data
- Integrating data across scales and domains; into knowledge and management
- Overarching goal of establishing a framework that promotes scientific interaction and planning for a long-term, ecosystem observation network
  - Bringing ecosystem and climate science communities together



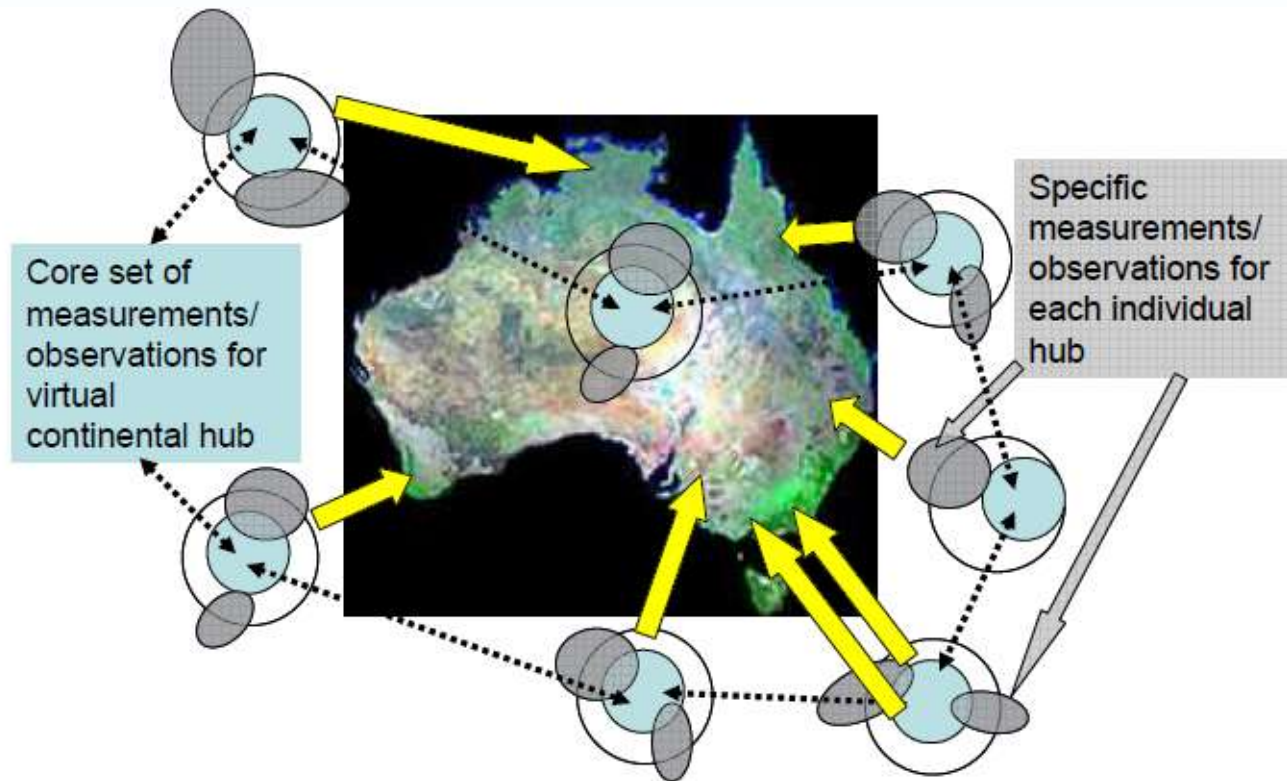
## TERN Central (U. Qld)

- TERN Director
- Coordination
- Communications
- TERN data portal

## Research Facilities

- Data collection
- Integration & synthesis

# OzFlux: A continental network of flux stations delivering nationally consistent observations of energy, carbon and water fluxes



*Green - core observations made to standard measurement protocols*  
*Gray - 'constellation' measurements specific to each site*

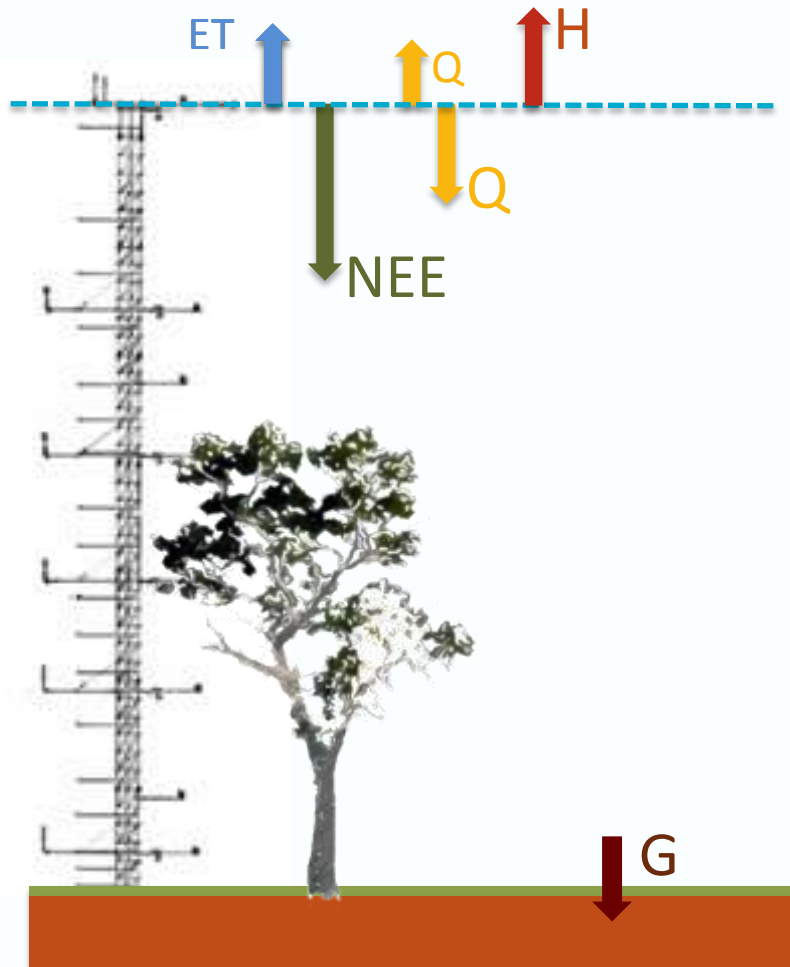


# OzFlux: A continental network of flux stations delivering nationally consistent observations of energy, carbon and water fluxes

- Inform and test ecosystem and land surface models for Australian ecosystems
- Quantify and understand ecosystem responses to climate change – water use and carbon sequestration under existing and future climates
- Advance climate and Earth system science especially CABLE – the land surface scheme in Australia's global climate model (ACCESS)



# OzFlux: a continental network of flux stations



Purpose is to measure ecosystem fluxes

- CO<sub>2</sub> and water vapour using eddy covariance method
  - Water ( $\lambda E$ , ET) and CO<sub>2</sub> (NEE)
- Energy
  - Radiation (Q) and heat (H, G)
- Above canopy; spatially-averaged
- Continuous: hourly to multi-annual

# OzFlux: a continental network of flux stations

Flux towers measuring vineyard and forest CO<sub>2</sub> and water fluxes



Purpose is to measure ecosystem fluxes and ...

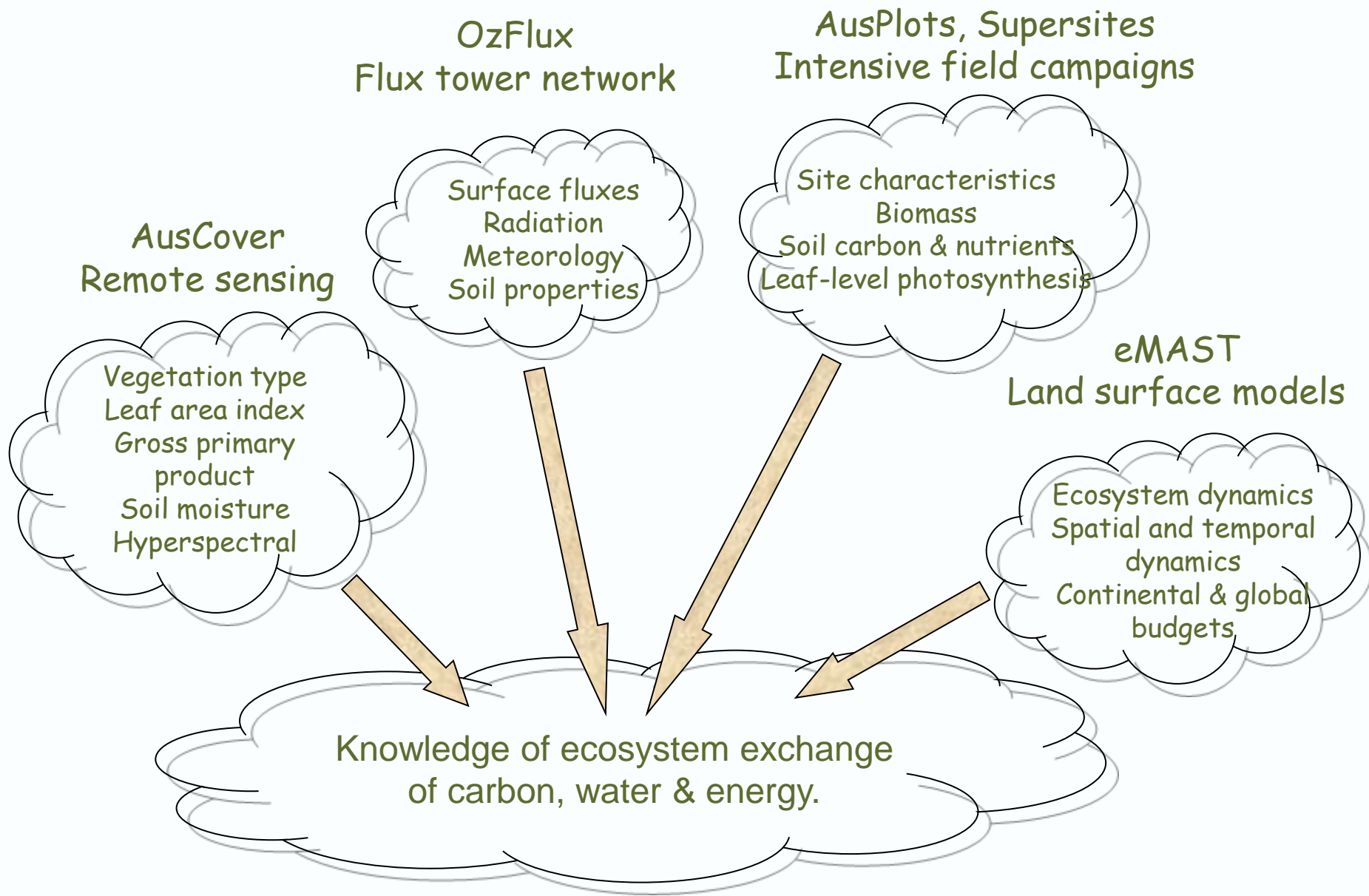
## Drivers:

- Above-canopy meteorology
- Soil temperature and moisture

## Data for analysis & interpretation:

- Within-canopy temperature, CO<sub>2</sub>, humidity and wind profiles

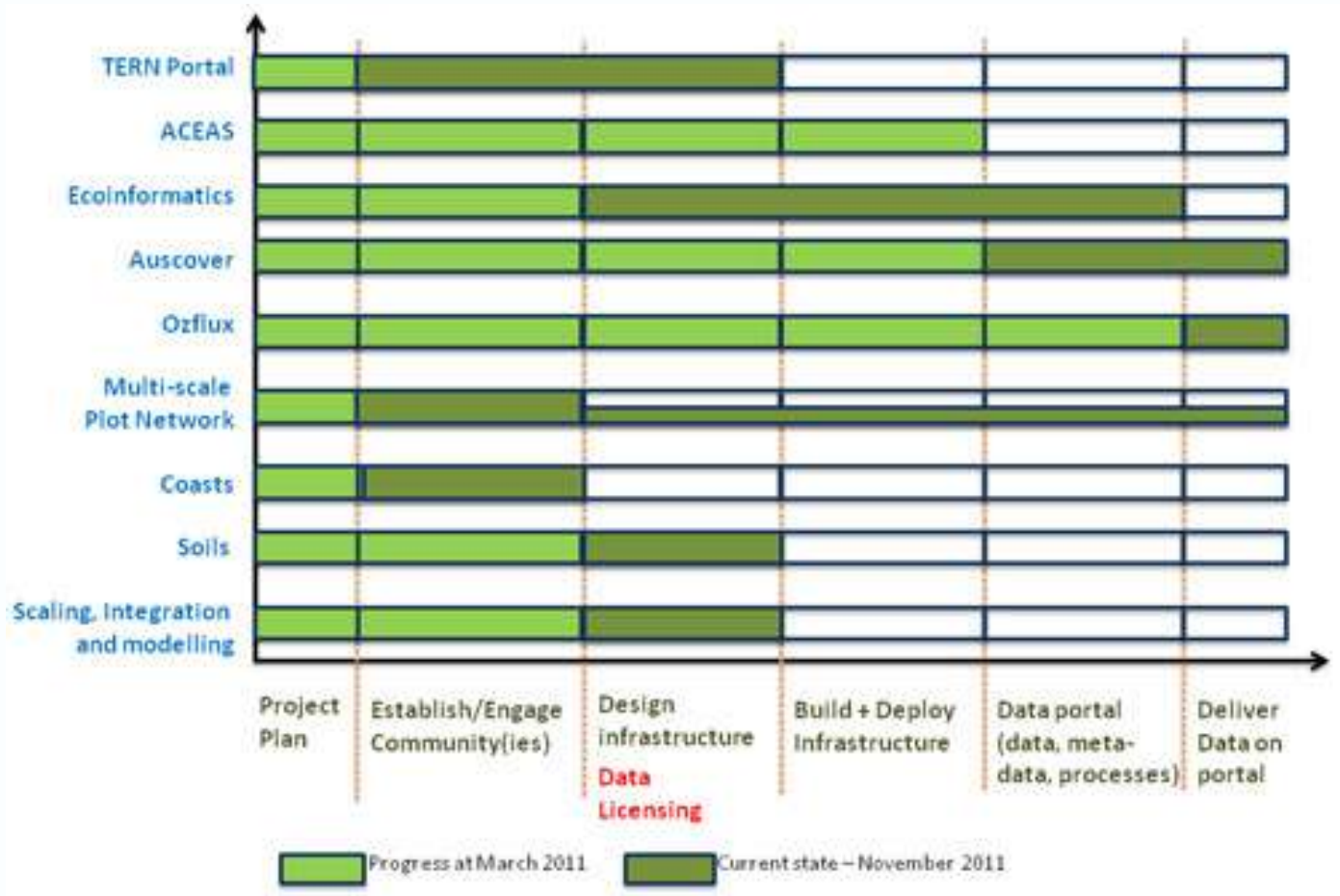




# Resources and status

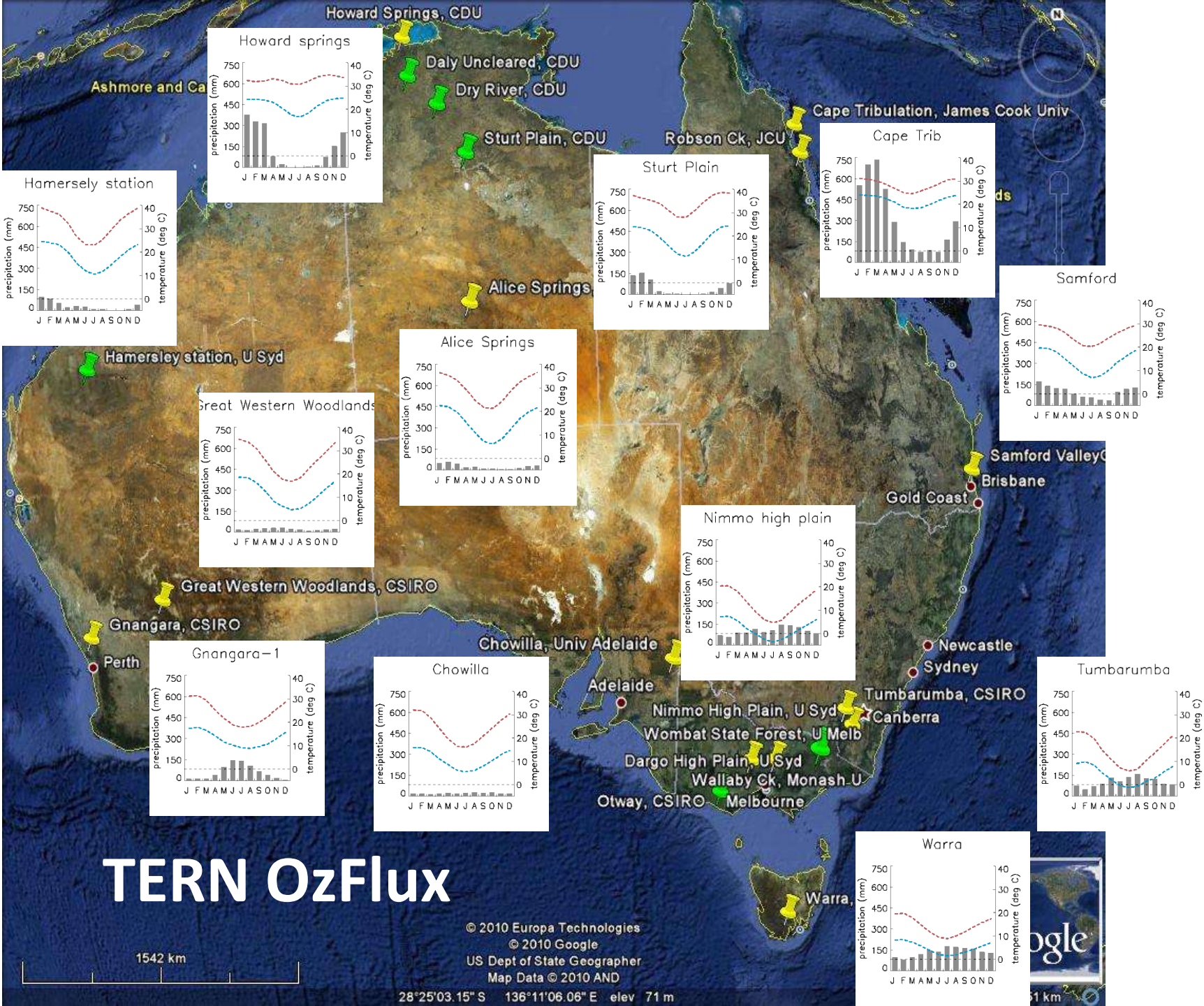
2009 - 2011: \$20m from National Collaborative Research Infrastructure Strategy

2011 - 2014: \$25.63m from Education Investment Fund for a second phase TERN-EIF

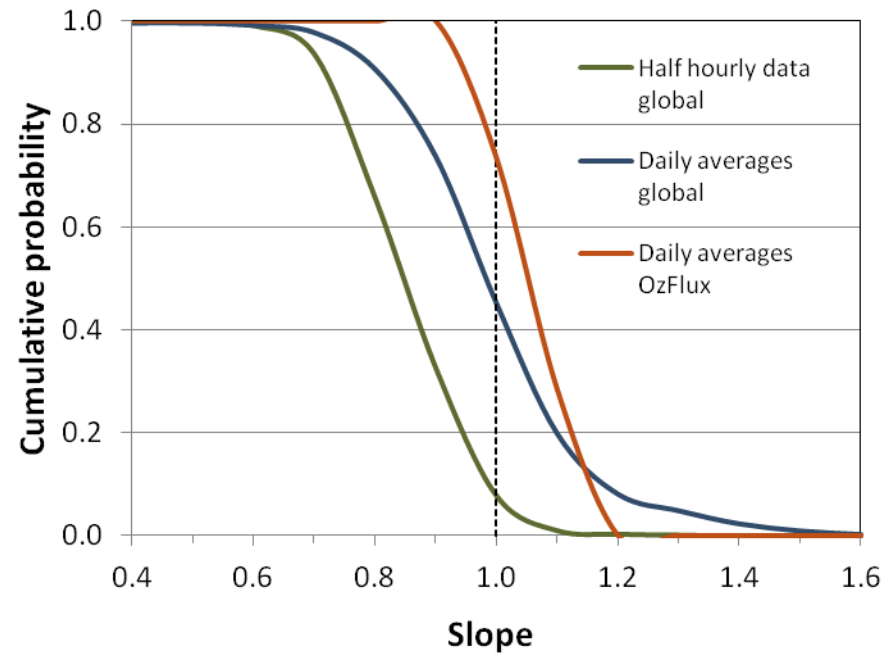
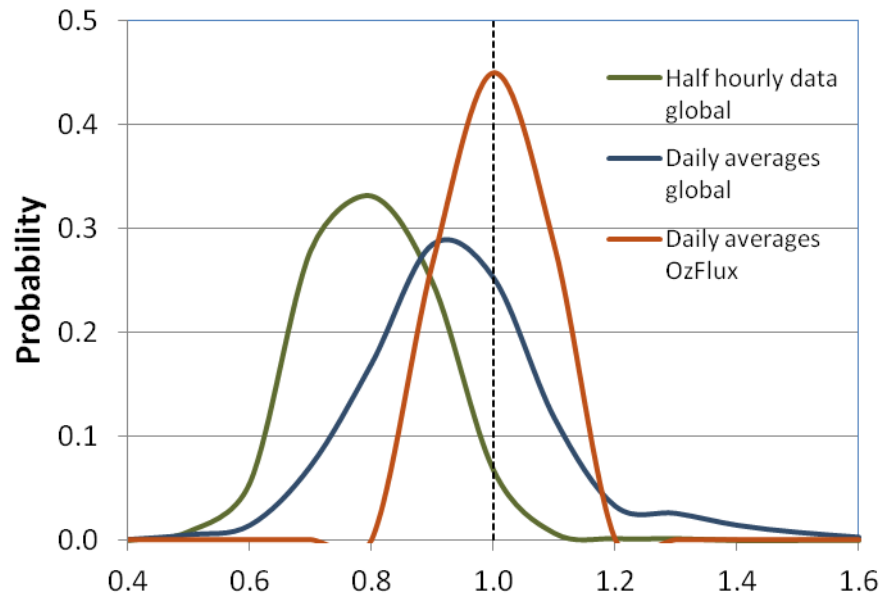


# TERN OzFlux Status and Science





# 1. Quality of OzFlux Data: energy balance closure

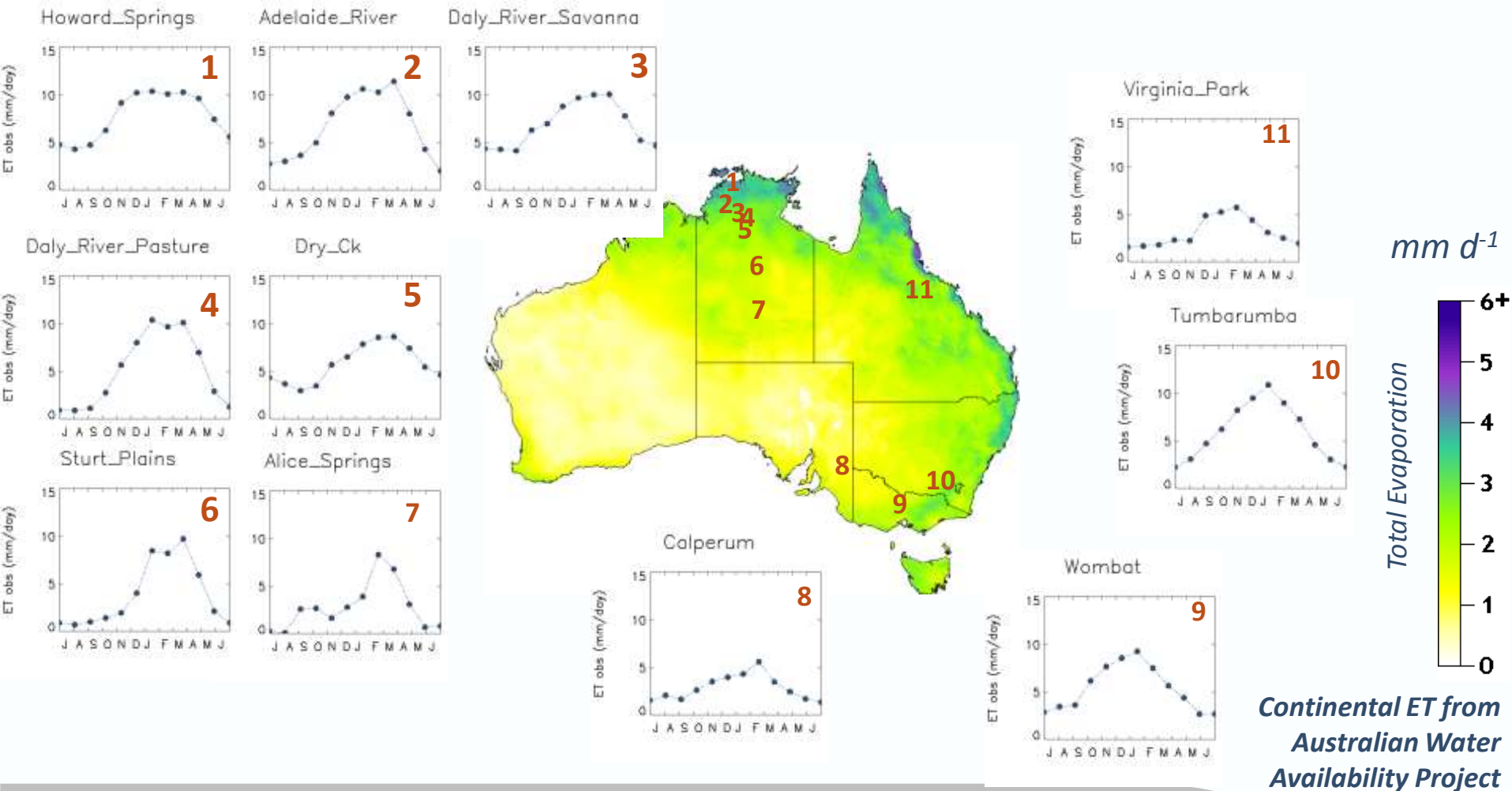


Energy balance closure: Fluxnet\* (948 site years) & OzFlux (60 site years)

\* from Leuning R. et al. 2012, doi:10.1016/j.agrformet.2011.12.002

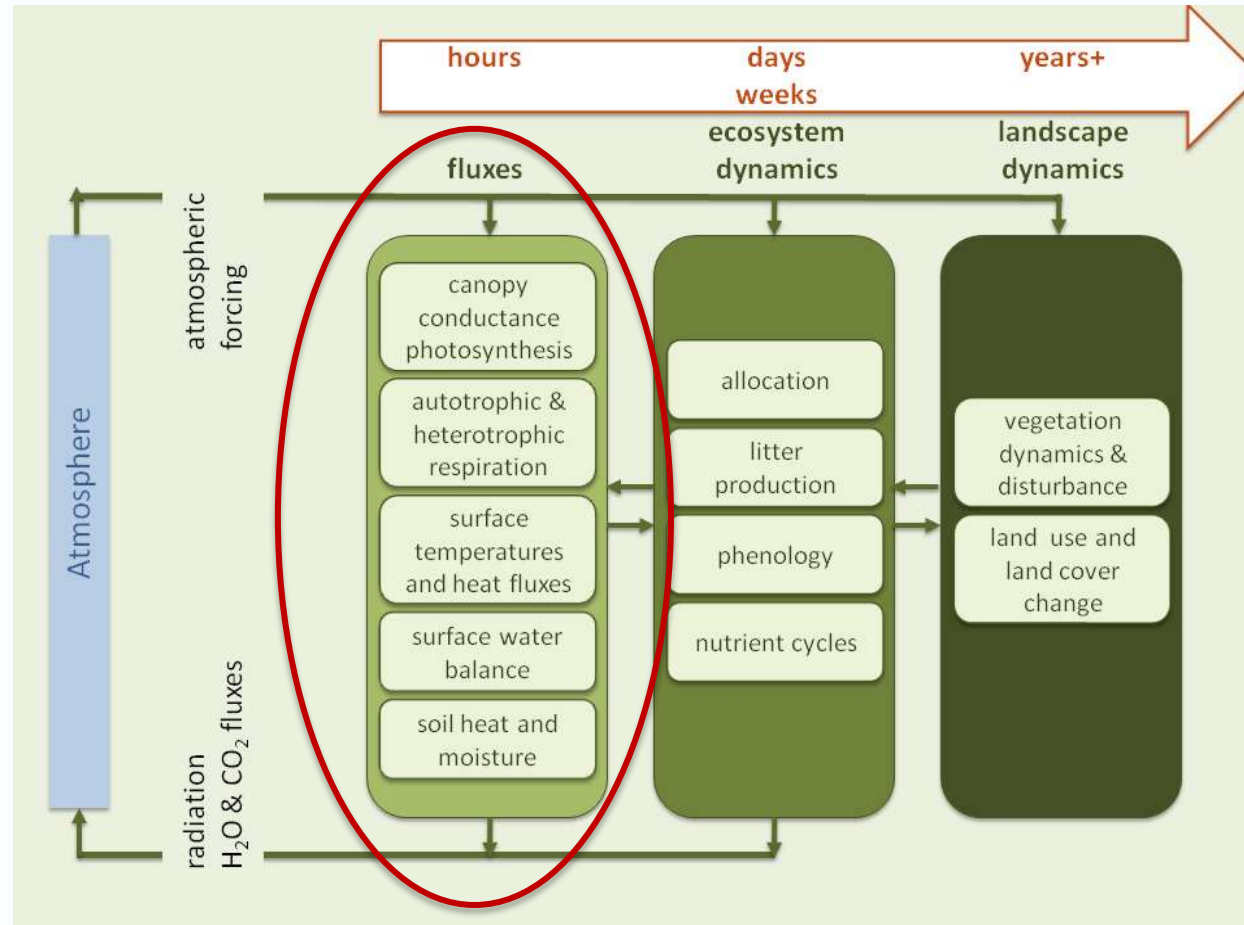


## 2. OzFlux Science: Space-time information on ecosystem processes



### 3. Evaluating land surface and ecosystem models

Focus is CABLE - the land surface model in ACCESS



from M. Williams et al., [www.biogeosciences.net/6/1341/2009/](http://www.biogeosciences.net/6/1341/2009/)

# Using multiple observation types to reduce uncertainty in Australia's terrestrial carbon and water cycles (Haverd et al, 2012)

CABLE = Community Atmosphere-Biosphere-Land Exchange model

Water, energy, carbon fluxes

Wang et al. (2011)

SLI = Soil-Litter-Iso

Soil hydrology, soil evaporation

Haverd et al. (2011)

CASAcnp = Biogeochemical model

Soil and plant C, N, P dynamics

Wang et al. (2007)

AWAP = Australian Water Availability Project

Met and soil data

Continental processing framework

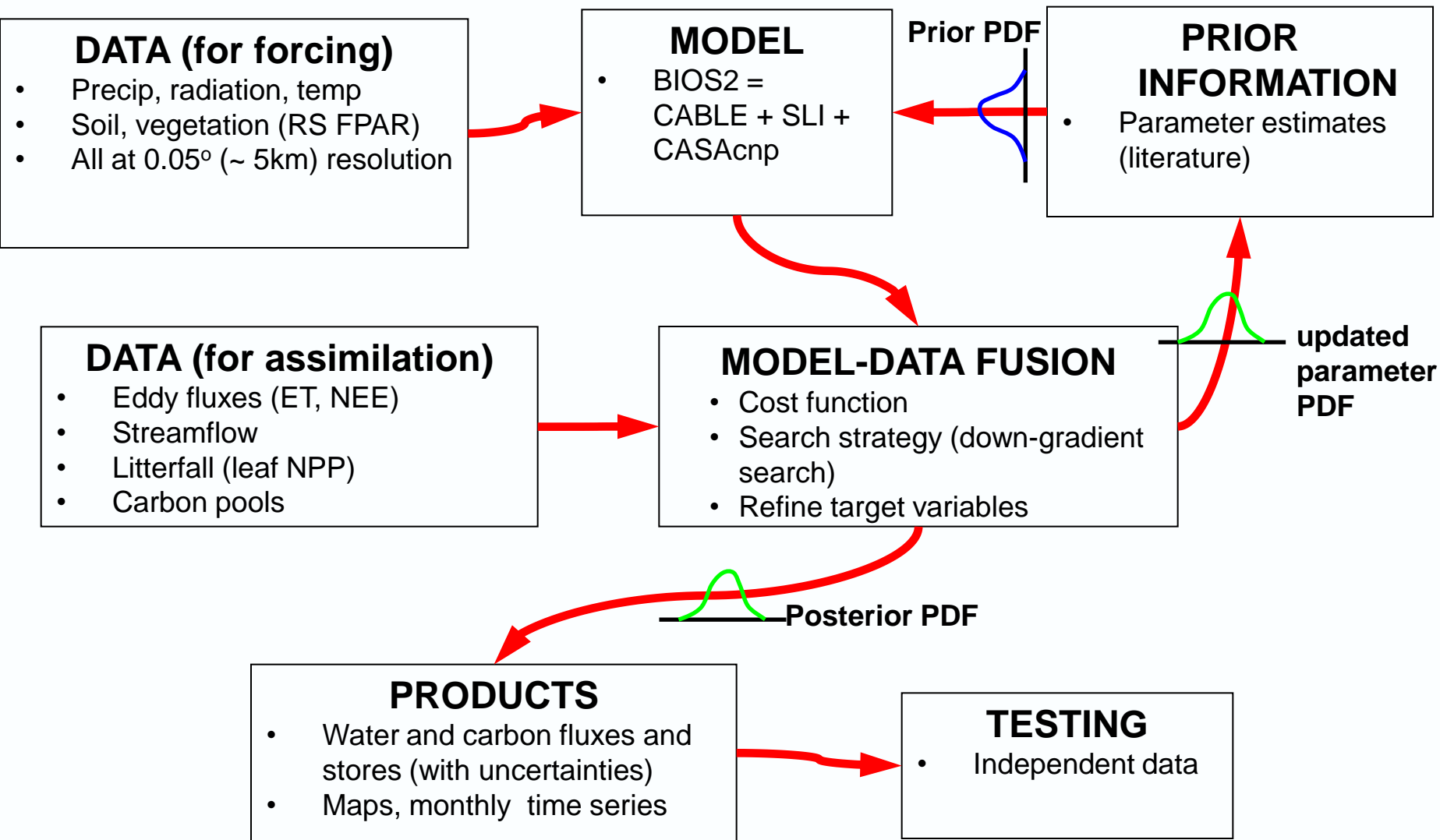
Model-Data Fusion

Raupach et al. (2009)

## BIOS2 = CABLE-SLI-CASAcnp in AWAP operational framework

Haverd, V., Raupach, M.R., Briggs, P.R., Canadell, J.G., Isaac, P., Pickett-Heaps, C., Roxburgh, S.H., van Gorsel, E., Viscarra-Rossel, R. and Wang Z. (2012) Multiple observation types reduce uncertainty in Australia's terrestrial carbon and water cycles. Biogeosciences (In preparation)

# Model-data fusion

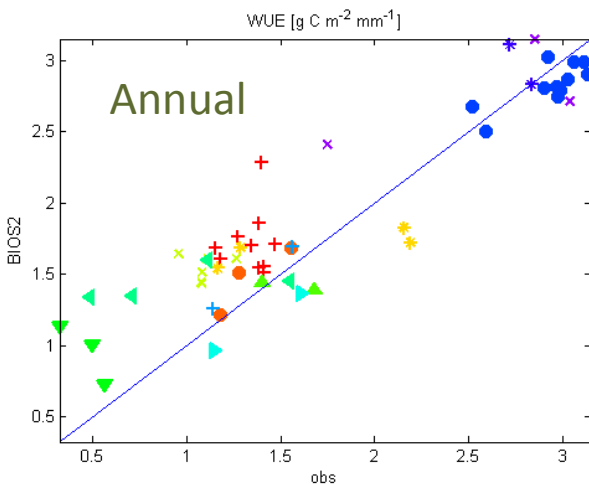
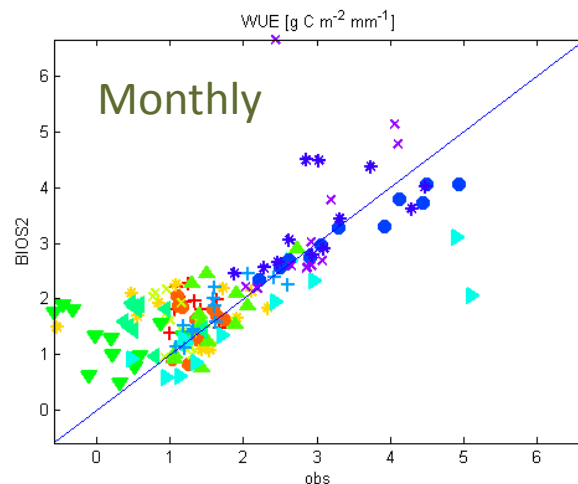
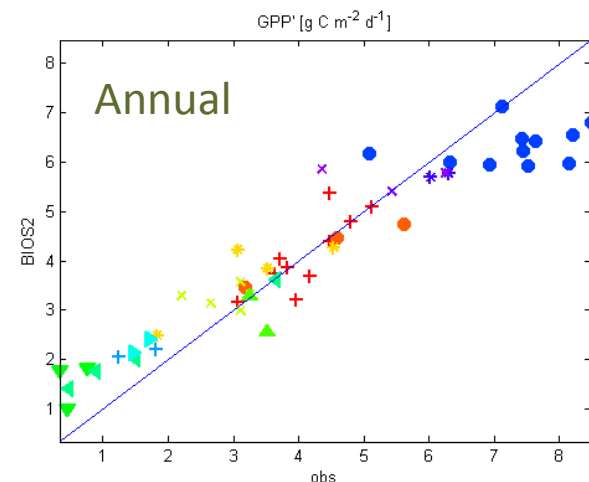
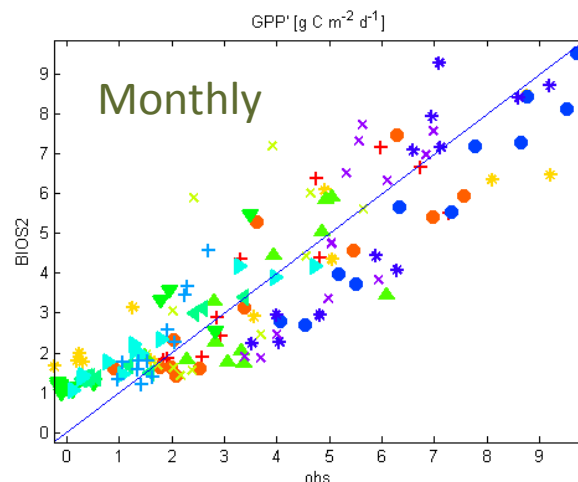
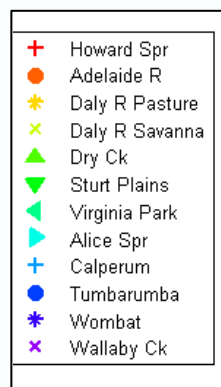


# Using BIOS2 to simulate Australian ecosystems

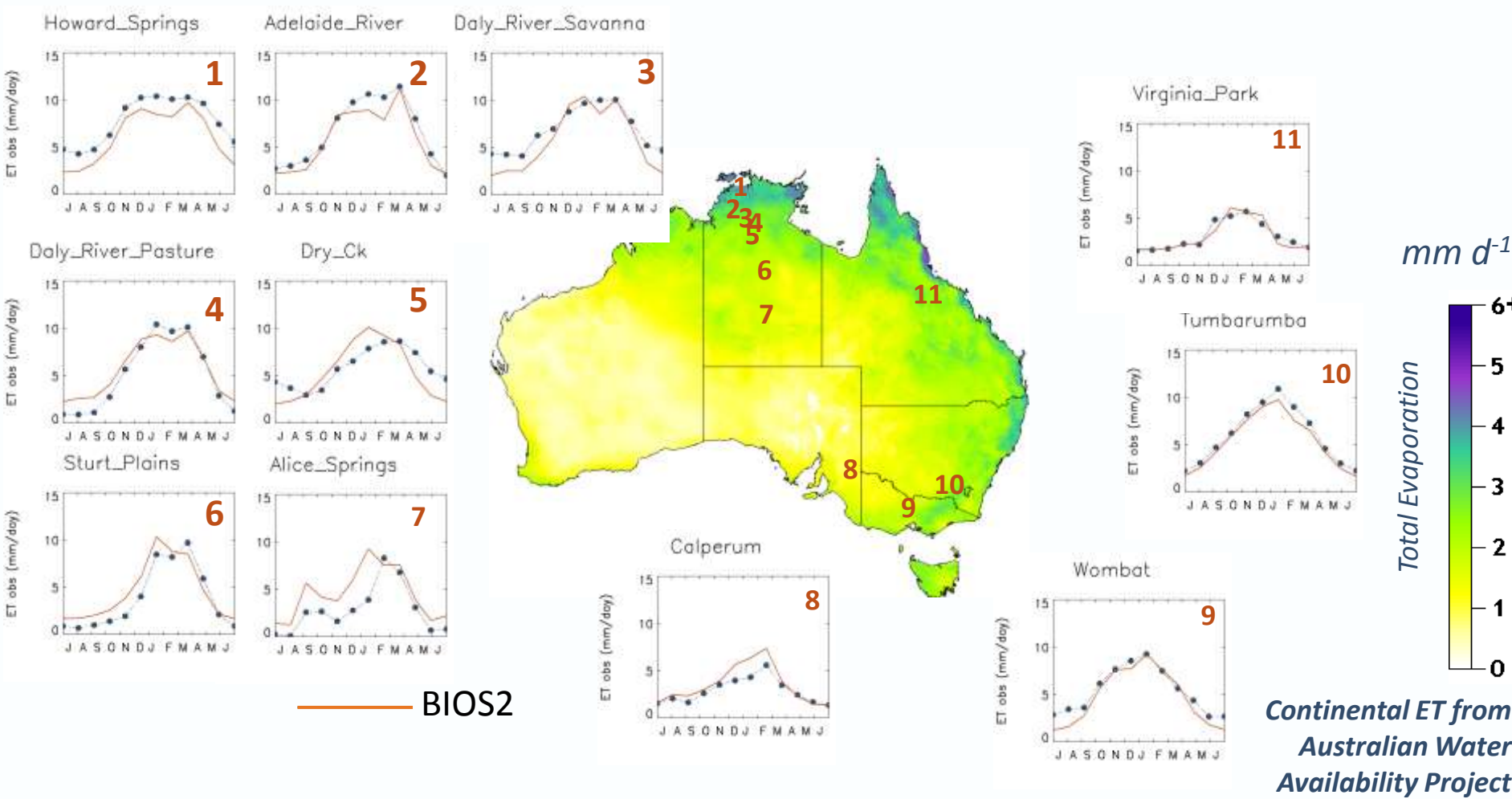
OzFlux data used to improve and evaluate:

- Process representation
- Model parameters
- Model performance

at all time scales (hours to decades)

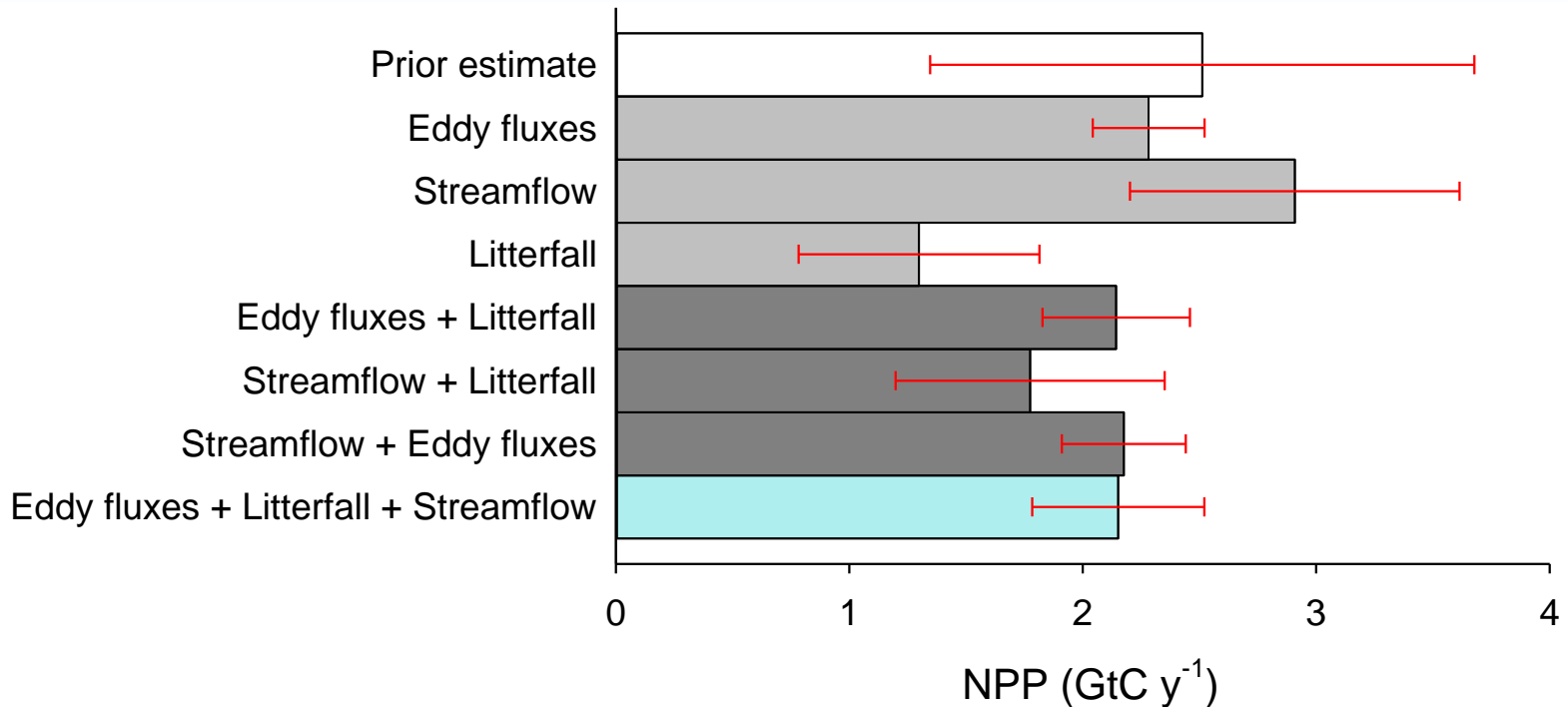


# Using BIOS2 to simulate Australian ecosystems



# Including OzFlux data to constrain BIOS2 simulations of NPP (Net Primary Production) for Australian continent

error bars = uncertainty from propagated parameter uncertainties ( $1\sigma$ )

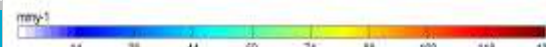
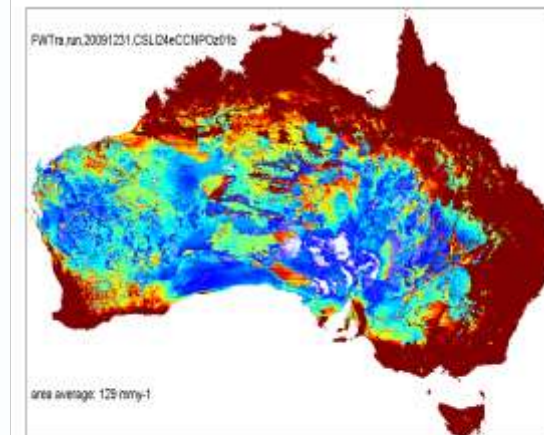
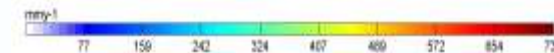
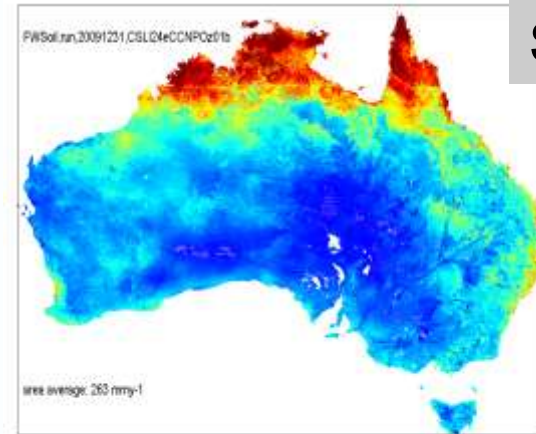
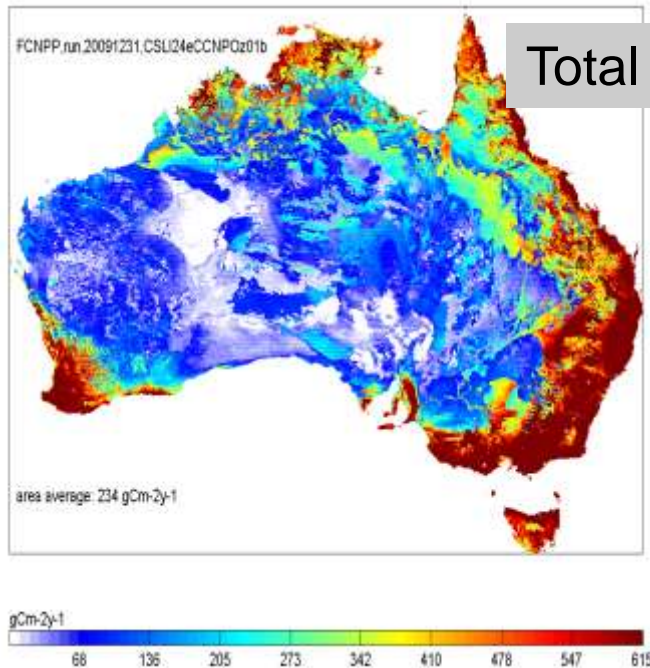


**NPP = Net Primary Production = 2.1 GT C / y**



# Australia's water and carbon balance from BIOS2

- Energy, carbon, water budgets
- 1990 – 2009 (monthly)
- 5 km resolution
- Using BIOS2 (CABLE + SLI + CASAacnp)



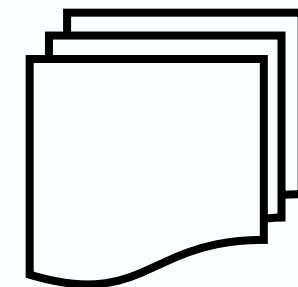
# 4. OzFlux Data Path: High Level



MONASH University



Forestry Tasmania



OzFlux Data  
Portal

OzFlux  
Community

eMast

AusCover

RECCAP

FluxNet  
Community

Bureau of  
Meteorology

General  
Public

## HOME

## MONITORING SITES

[Adelaide River](#)  
[Alice Springs](#)  
[Burdekin Delta](#)  
[Calperum](#)  
[Cape Tribulation](#)  
[Daintree](#)  
[Daly River Pasture](#)  
[Daly River Uncleared](#)  
[Dargoo](#)  
[Dry River](#)  
[Fogg Dam](#)  
[Gingin](#)  
[Great Western Woodlands](#)  
[Hamersley](#)  
[Howard Springs](#)  
[Kopuatai](#)  
[Nimmo](#)  
[Otway](#)  
[Oxford](#)  
[Riggs Creek](#)  
[Samford](#)  
[Scott Farm](#)  
[Sturt Plains](#)  
[Tumbarumba](#)  
[Virginia Park](#)  
[Wallaby Creek](#)  
[Wombat](#)

## DATA

## MEETINGS

## PUBLICATIONS

## Monitoring Sites

**OzFlux** is a network of micrometeorological flux stations located at various sites within Australia and New Zealand.

**OzFlux** is part of a global network (see [LINKS](#)) of over [500 sites](#) (March 1, 2010) where exchanges of carbon dioxide, water vapour, and energy between terrestrial ecosystem and atmosphere are measured continuously over long periods.



Note: map shows more sites than listed, they will be added soon.

## SITES SUMMARY

SITE NAME (ACTIVE)	Landcover	Annual Rainfall	Temp Range °C	Locations	Group	Status	Contact
	semi-arid muloa			Pine Hill cattle station, Northern	University of	Running	

# OzFlux Data Portal Screenshots



Home

All Collections

All Collections

**Adelaine**  
Ecosystem  
Bacterial  
Created

**Alice S**  
Data from  
Created

**Calper**  
The Soil  
Environment  
Created

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## Local File Import

Please select a file [Choose File](#) No file chosen

Extract the Metadata ☒

[Import](#)

Name	Site Name	Level			
DalyUncleared_2012_L3.nc	DalyUncleared	L3	<a href="#">View Data</a>	<a href="#">Export</a>	<a href="#">Delete</a>
DalyUncleared_2012_L2.nc	DalyUncleared	L2	<a href="#">View Data</a>	<a href="#">Export</a>	<a href="#">Delete</a>
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DalyUncleared_2007_L1.nc	Daly Uncleared		<a href="#">View Data</a>	<a href="#">Export</a>	<a href="#">Delete</a>



# Thank You



## Acknowledgements

### TERN HQ

#### OzFlux

- Ray Leuning
- OzFlux PIs
- Steering Committee: Mike Liddell, Lindsay Hutley, Jason Beringer, Wayne Meyer, Alex Held, Peter Isaac, Eva van Gorsel

#### Collaborators

- Vanessa Haverd
- FluxNet

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