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OzFlux

Land-Atmosphere Observatory

EOS

UTS

UNIVERSITY OF TECHNOLOGY SYDNEY

OzFlux: scientific outputs 2016–2017

James Cleverly

Science Director
TERN OzFlux

Terrestrial Ecohydrology Research Group
School of Life Sciences
University of Technology Sydney

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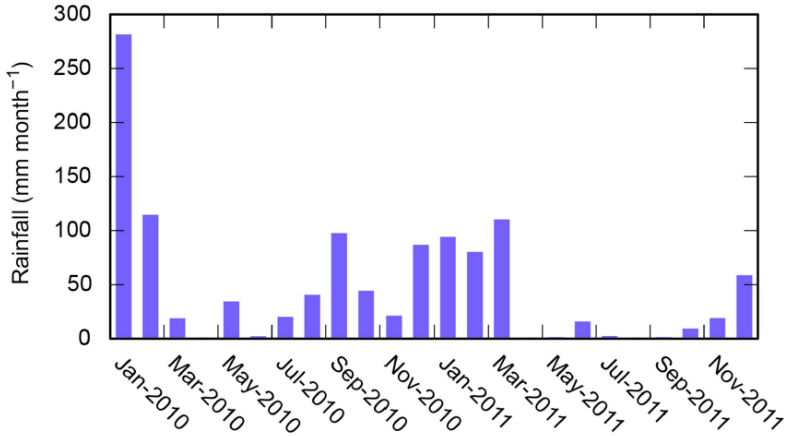
NCRIS

National Research Infrastructure for Australia

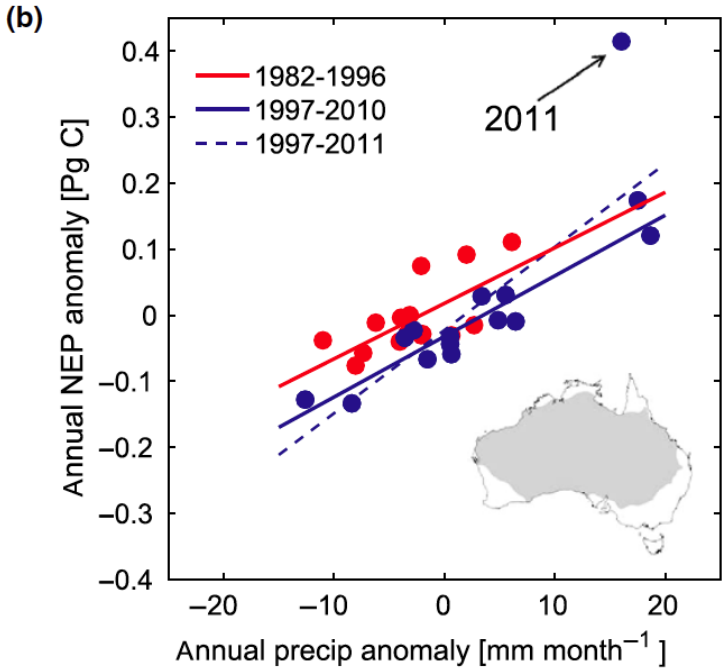
An Australian Government Initiative

Global land carbon sink anomaly of 2011

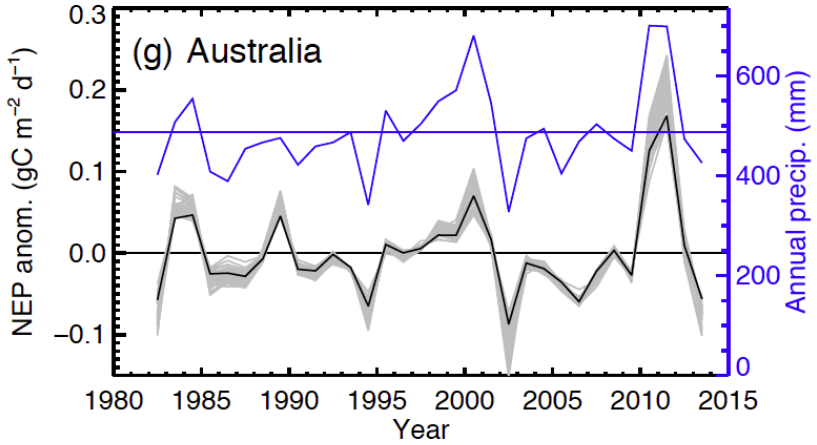
- **Annual precipitation anomaly restricted by dry months**
- **Annual Australian land C sink induced by antecedent wet months**
- **Followed 'Millennium Drought'**
- **Soil moisture a key driver of large inter-annual variability in *NEP via* ENSO**

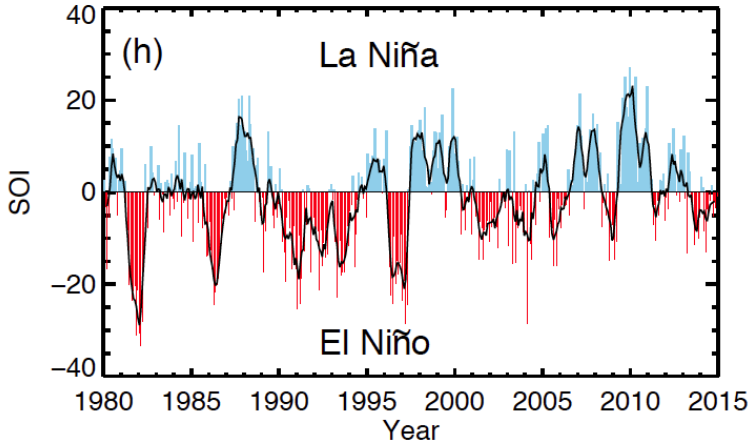


[Eamus et al. 2016 *Environmental Research Letters*]



[Haverd et al. 2016 *Global Change Biology*]





[Trudinger et al. 2016 *Biogeosciences*]

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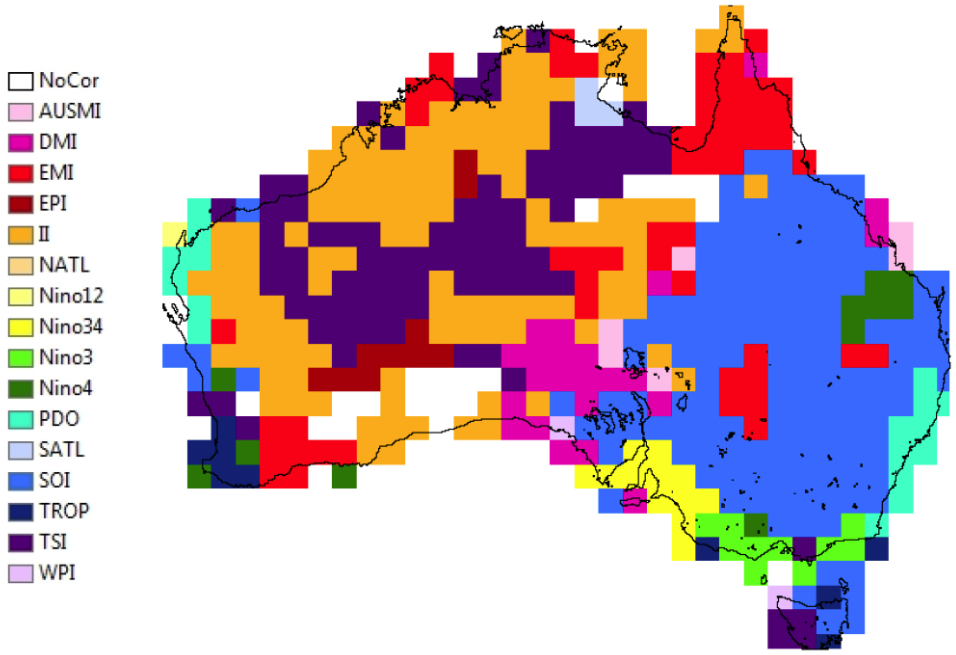
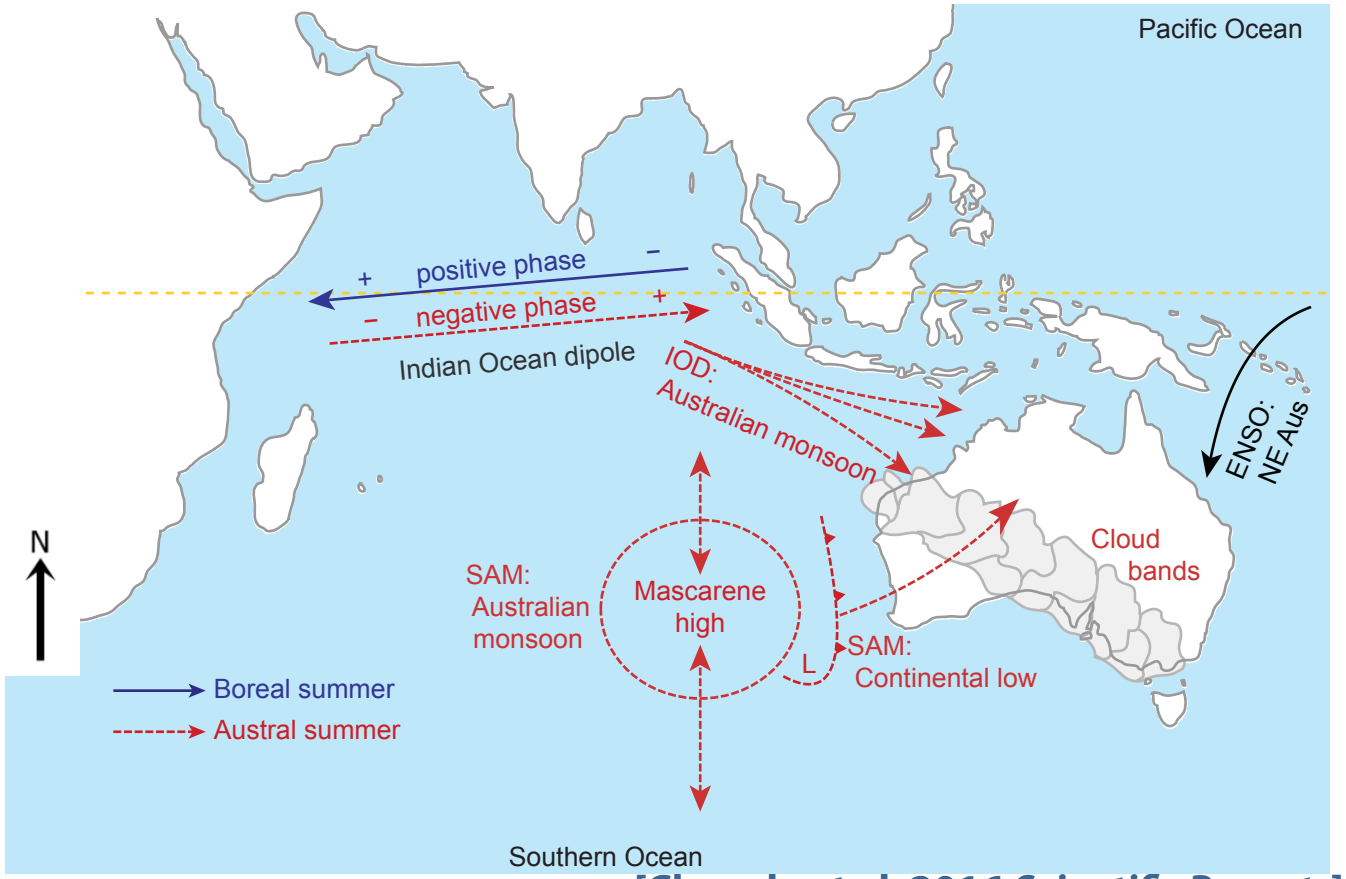
Enhanced climate variability

Multiple ocean effects on Australian climate and ecosystem productivity



[Rogers & Beringer 2017 *Biogeosciences*]



[Cleverly et al. 2016 *Scientific Reports*]

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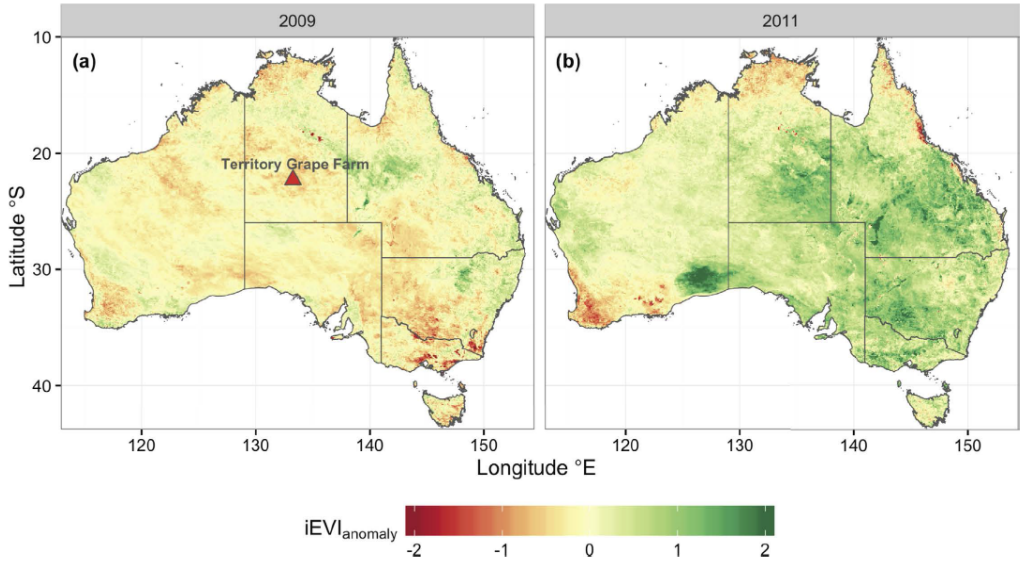
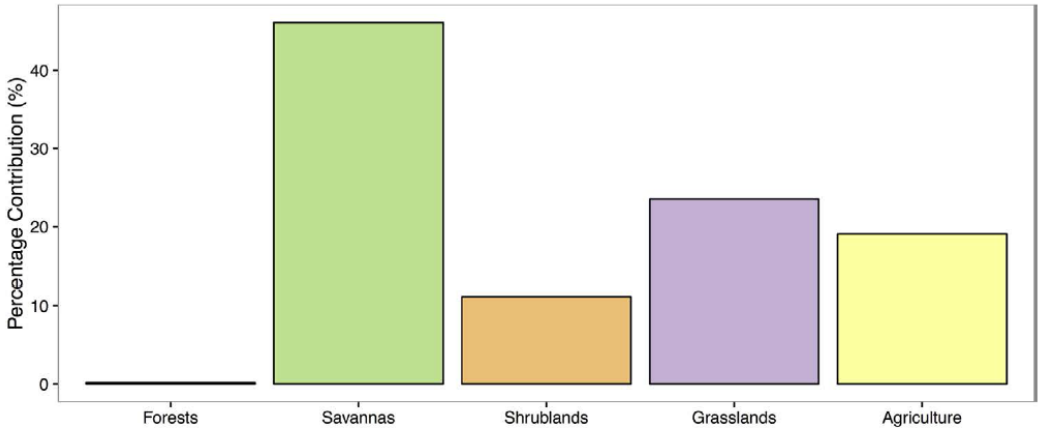
Attribution: carbon sink anomaly

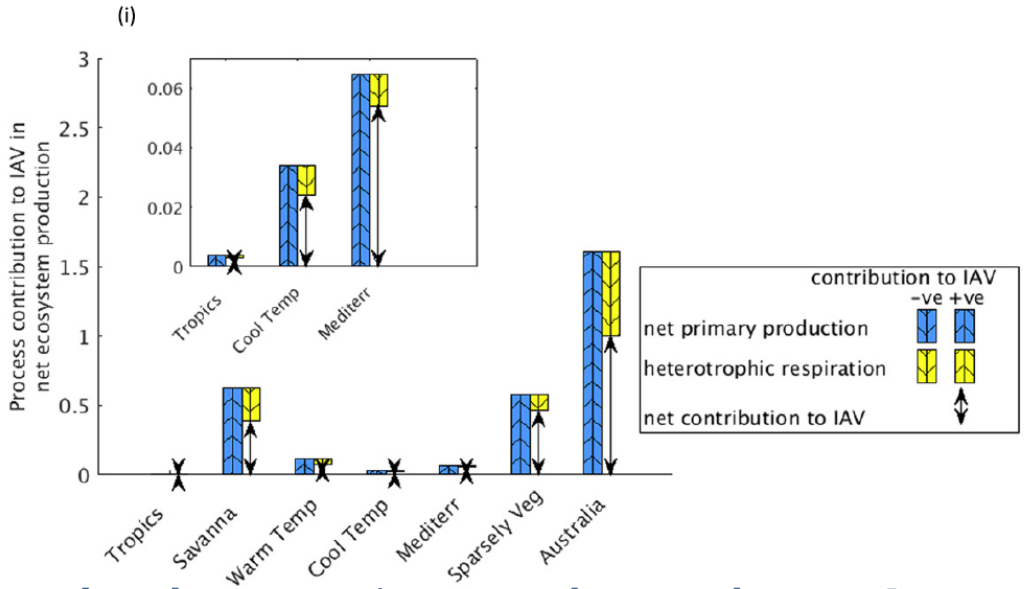


[Cleverly et al. 2016 *Scientific Reports*]



[Ma et al. 2016 *Scientific Reports*]

- **Savanna**
- **Dryland**



[Haverd et al. 2016 *Environmental Research Letters*]

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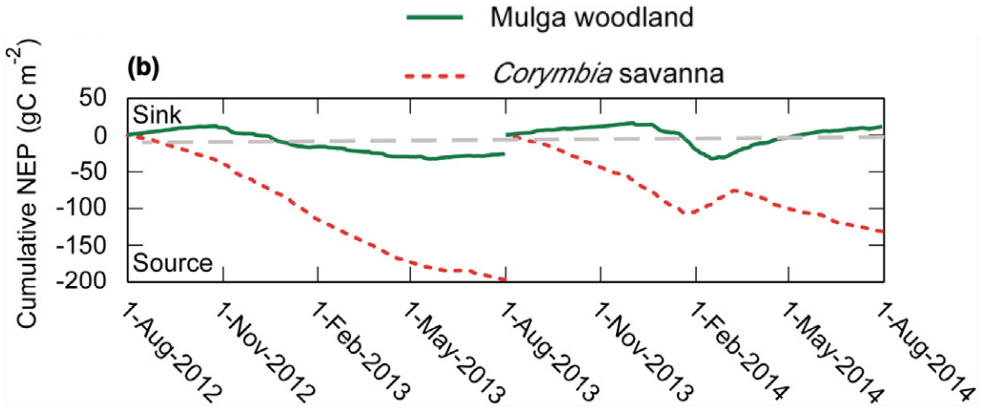
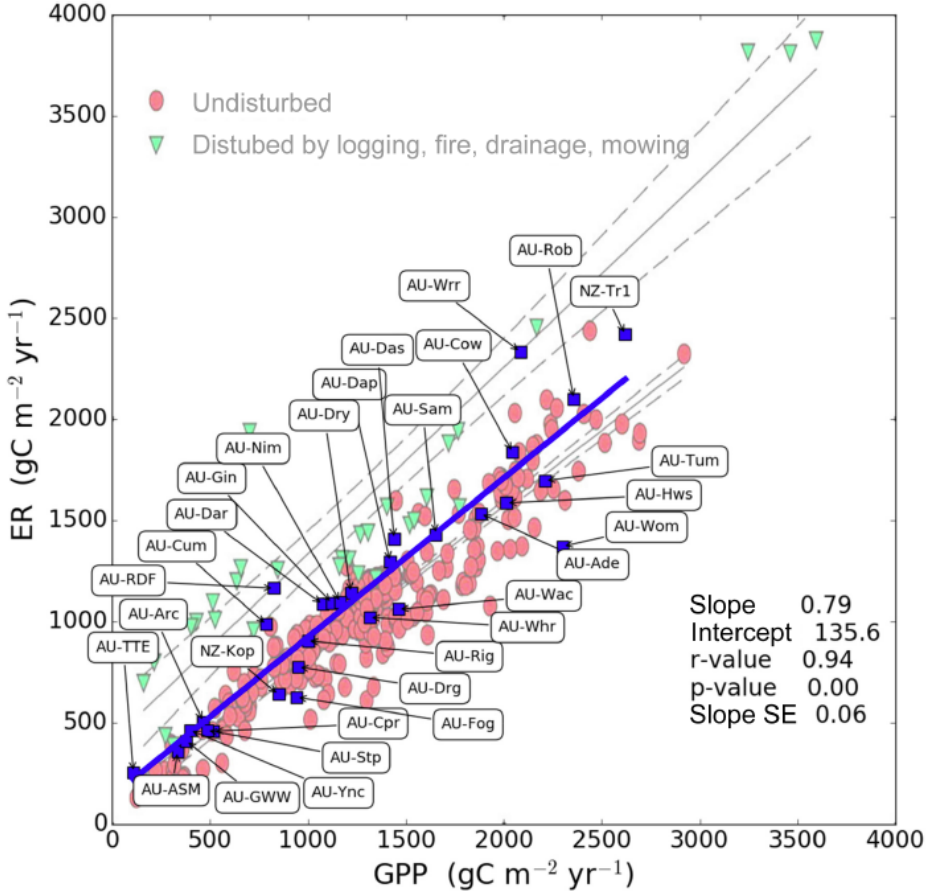
Carbon sources and carbon balance



[Cleverly et al. 2016 *Agricultural and Forest Meteorology*]



[Beringer et al. 2016 *Biogeosciences*]

- **Legacy of land sink anomaly**
  - **Strong carbon source from dryland grasses**
  - **Fire emissions during following dry year:** [Ma et al. 2016]
    - **2010–2011: 0.07 Pg C y^{-1}**
    - **2011–2012: 0.17 Pg C y^{-1}**

- **Nocturnal storage of CO_2 in canopy air spaces**
  - **See Ian McHugh's presentation on this topic** [McHugh et al. 2017 *Biogeosciences*]

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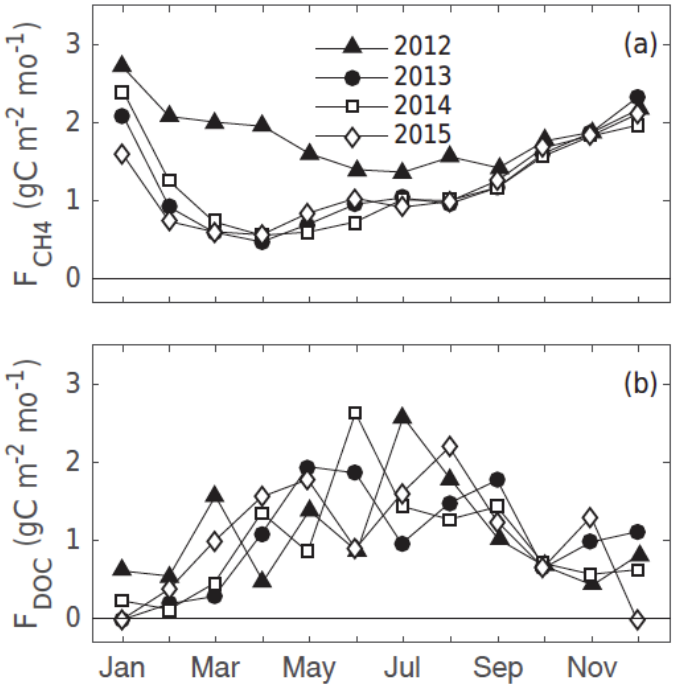
Carbon cycle: CH_4

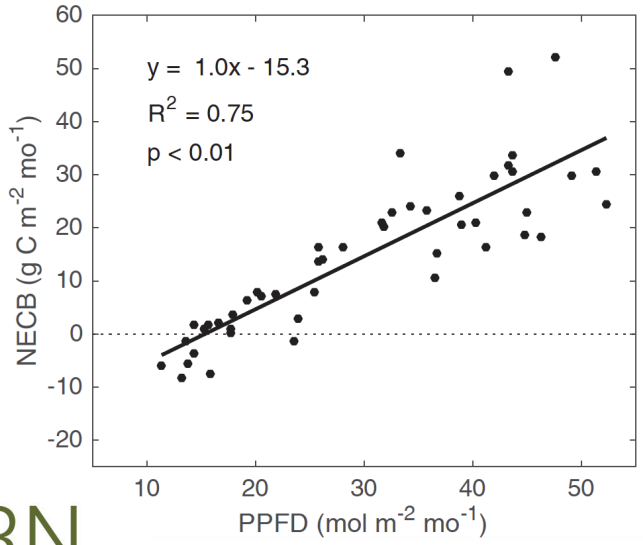


NZ-Kop:

- **methane emission 0.5–3 g C m^{-2} month^{-1}**
- **even with methane emissions, site generally in a positive net ecosystem ecosystem carbon balance (uptake)**

Trace gas	Site	All wind directions: median flux (nmol m^{-2} s^{-1})	All wind directions: *N*	Unsuitable directions excluded: median flux (nmol m^{-2} s^{-1})	Unsuitable directions excluded: *N*
CH_4	IFR	25.6	172	26.3	101
CH_4	UUW	14.0	164	8.73	96
N_2O	IFR	0.604	293	0.637	165
N_2O	UUW	0.396	279	0.289	131

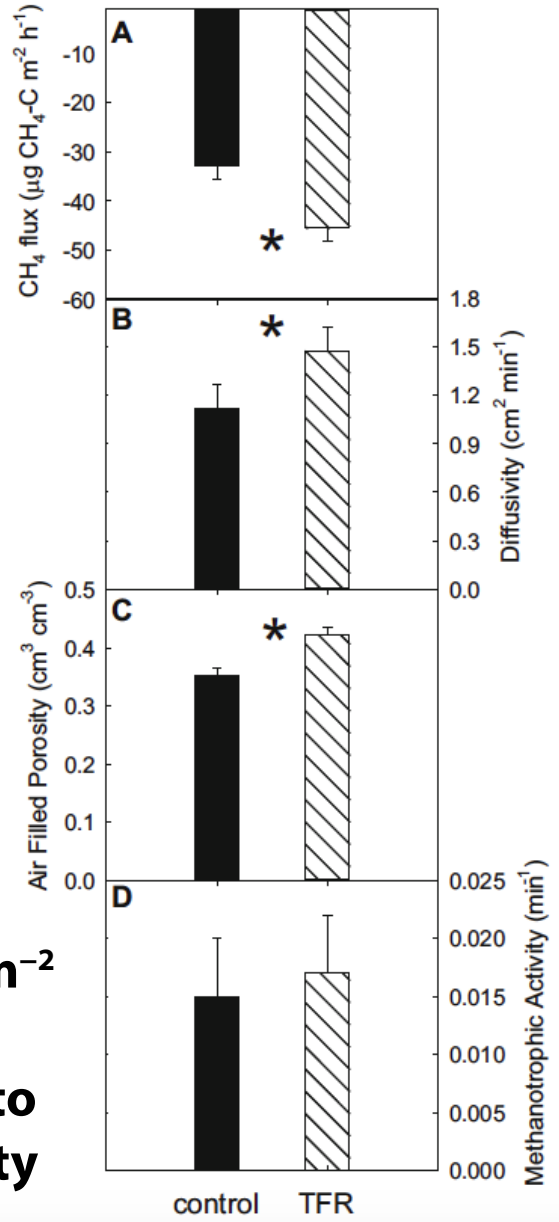
[Laubach et al. 2016 *Biogeosciences*]



[Goodrich et al. 2016 *Biogeosciences*]

AU-Wom:

- **methane uptak 30–50 µg C m^{-2} hour^{-1}**
- **reduced by throughfall due to reduction in air-filled porosity**



[Fest et al. 2016 *Biogeosciences*]

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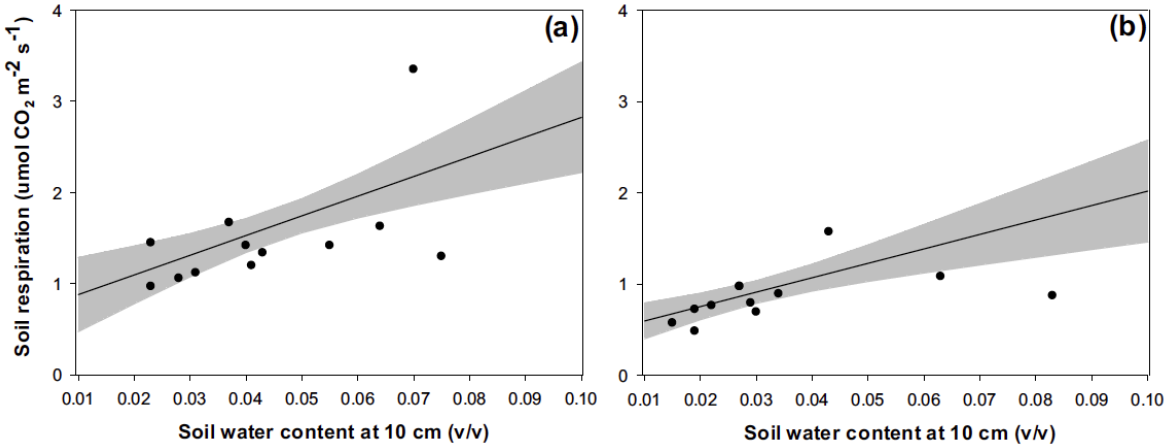
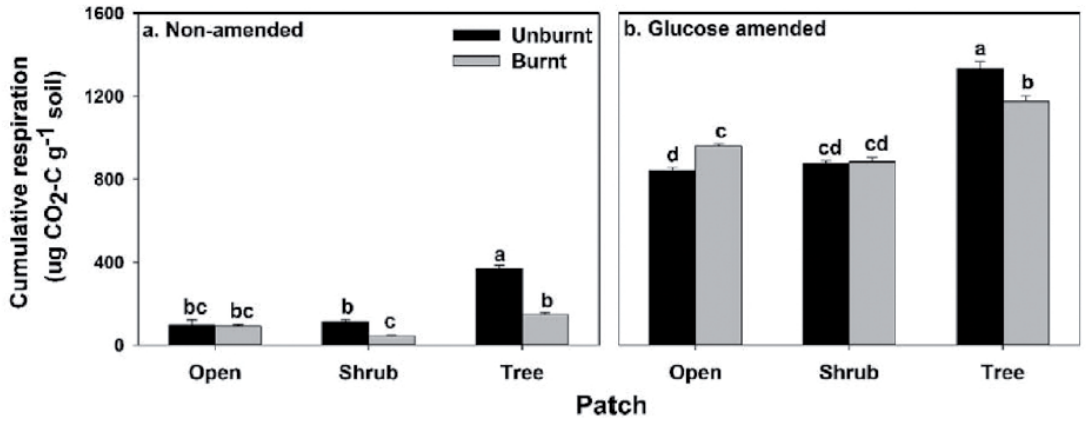
Soil respiration

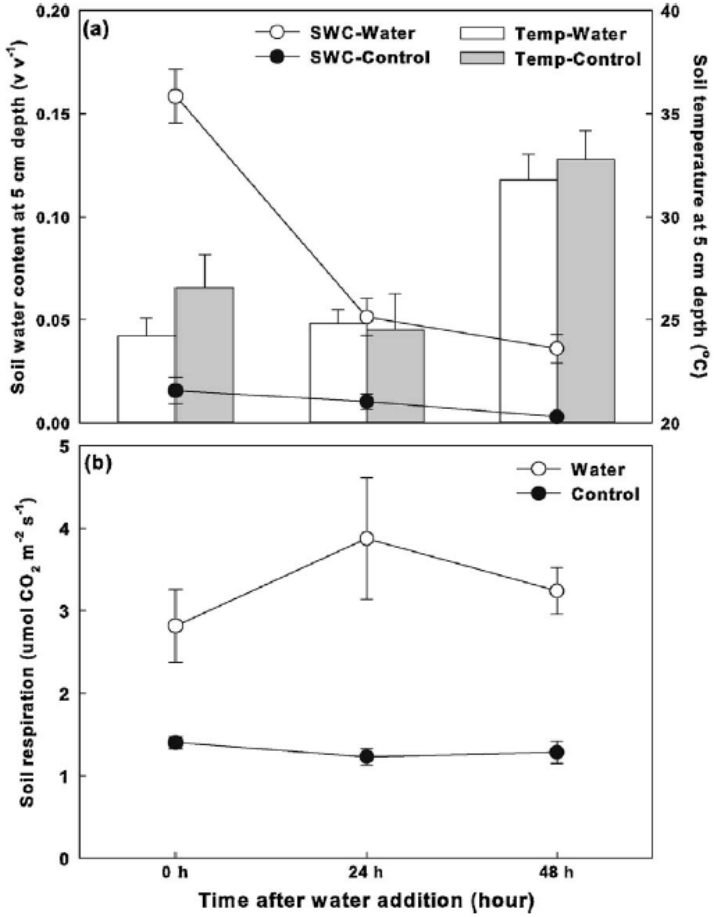


AU-Cpr

[Sun et al. 2016 *Agricultural and Forest Meteorology*]

- **Temperature, moisture and substrate limitations**
- **Weak source strength under hummocks**





[Sun et al. 2017 *Agriculture, Ecosystems and Environment*]

[Sun et al. 2017 *Journal of Soil Science and Plant Nutrition*]

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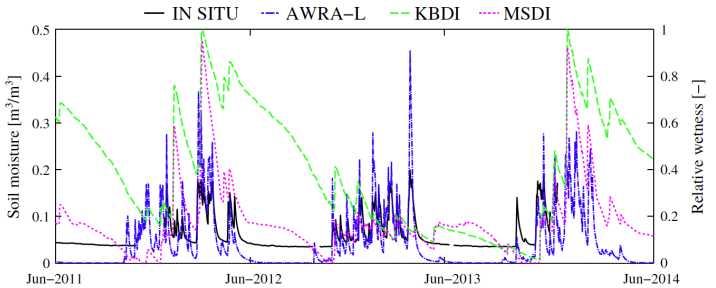
NATT water budget

Modelling of soil water content

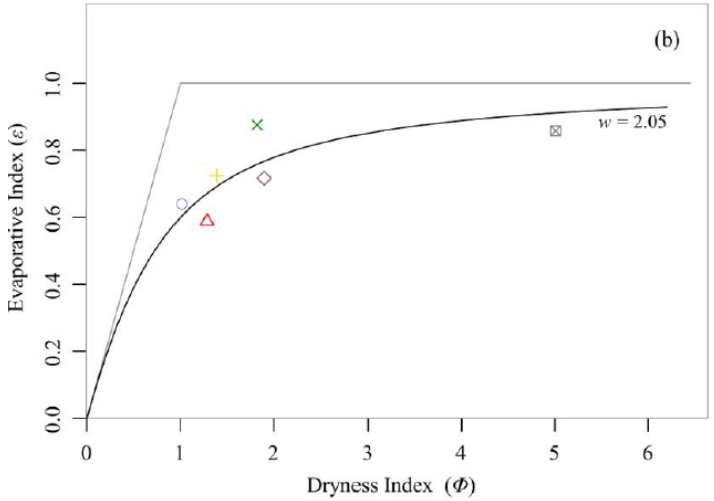
- **Matching targets remains difficult**
- **Large variability amongst models**



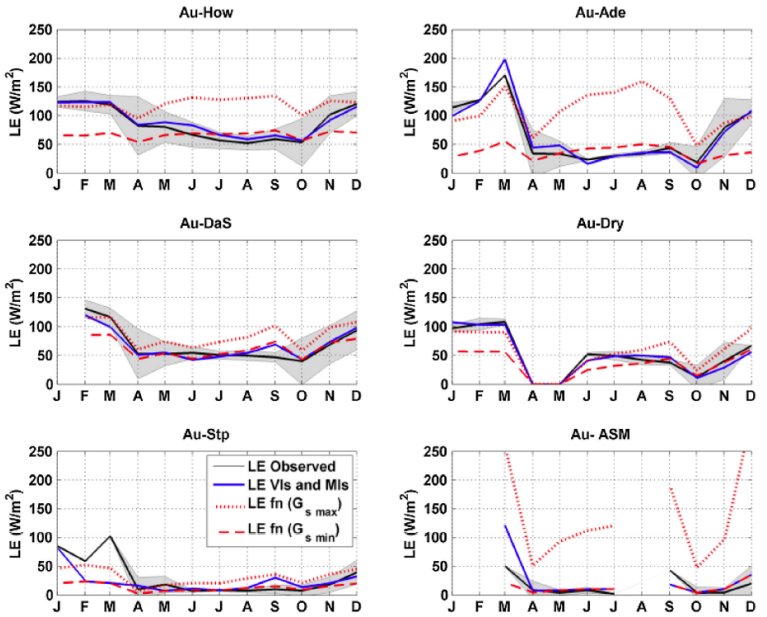
[Holgate et al. 2016 *Remote Sensing of Environment*]

Inter-annual Budyko energy *versus* water limitations

- **Northern NATT a little of both**
- **Southern NATT water-limited**



[Zhuang et al. 2016 *International Journal of Plant Production*]



[Barraza et al. 2017 *Agricultural and Forest Meteorology*]

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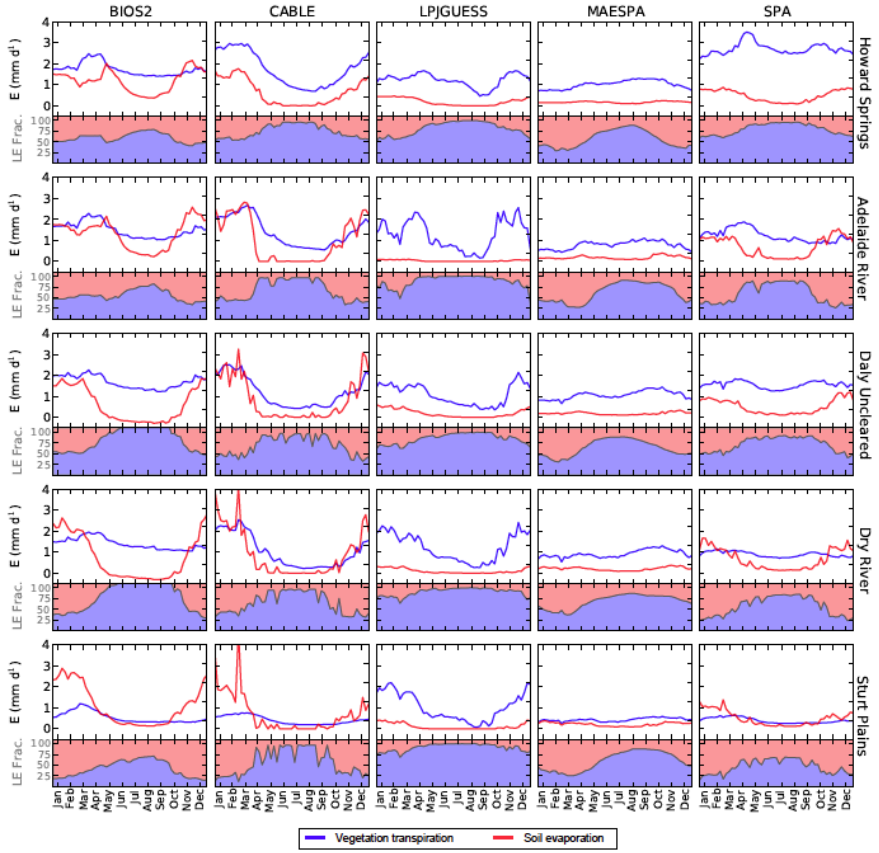
Water budget components



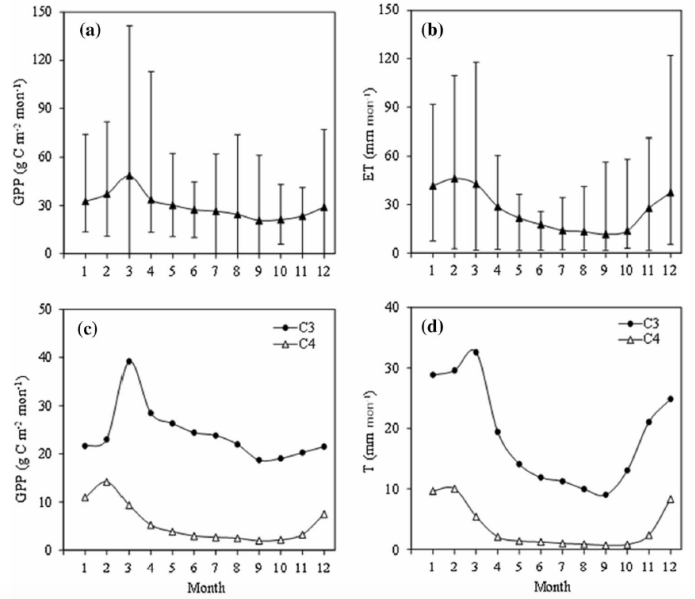
[Whitley et al. 2016 *Biogeosciences*]

Seasonality of transpiration, soil evaporation and total evaporation

- **Large inter-model × site variability in partitions**

Large variability in total monthly evaporation

- **Attributed to differences between C_3 and C_4 plants**



[Chen et al. 2016 *Ecosystems*]

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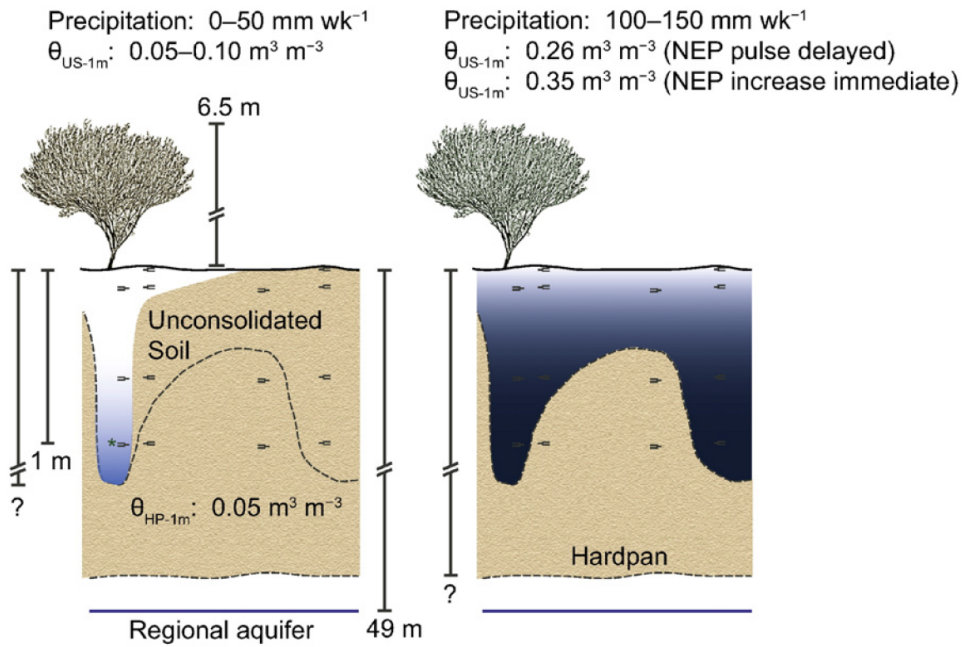
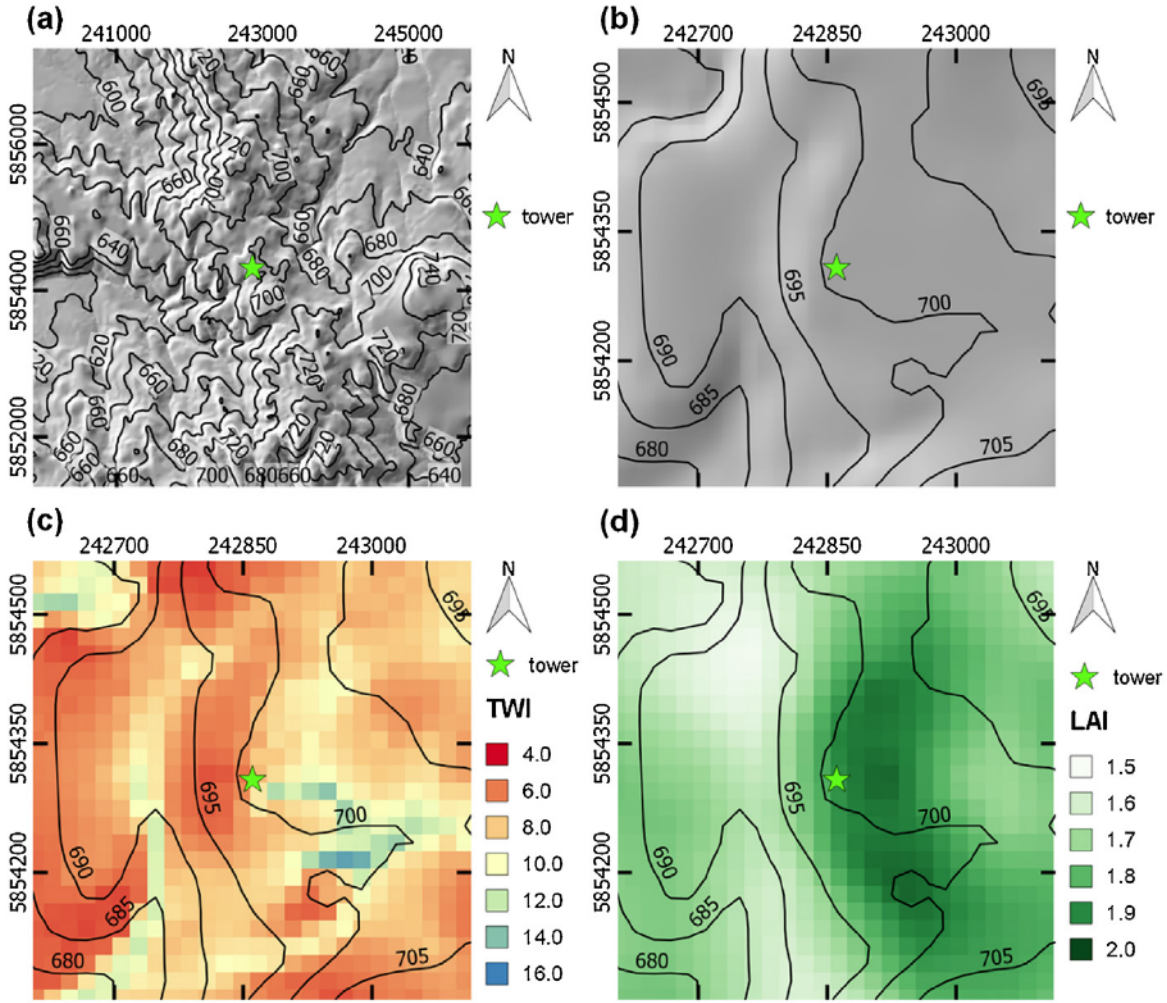
Spatial surface heterogeneity

Spatial and temporal correlations between regional weather patterns, topographic wetness index, soil water content, leaf area index, NEP and GPP



[Cleverly et al. 2016 *Science of the Total Environment*]



[Griebel et al. 2016 *Agricultural and Forest Meteorology*]

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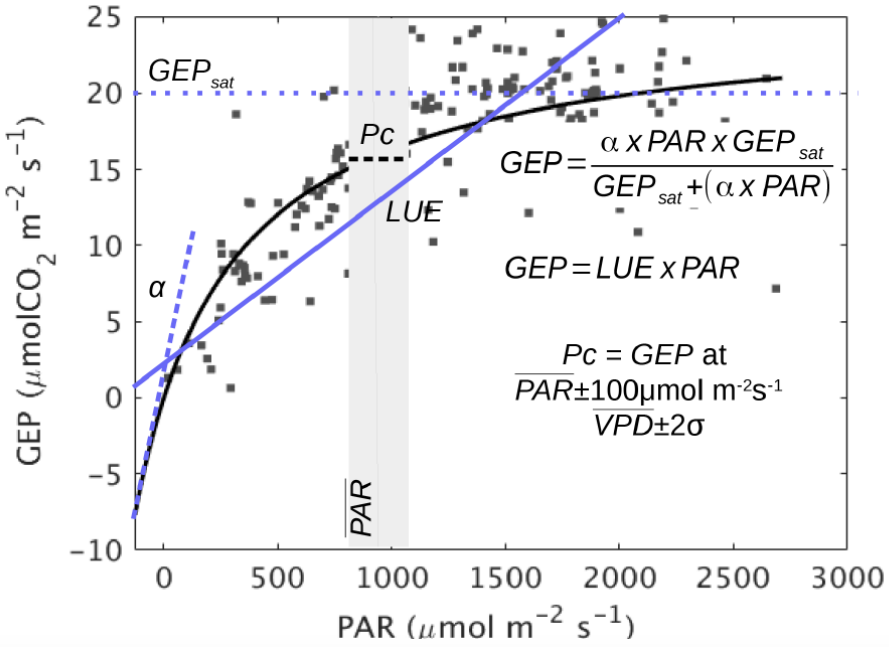
Photosynthesis & phenology

Photosynthesis

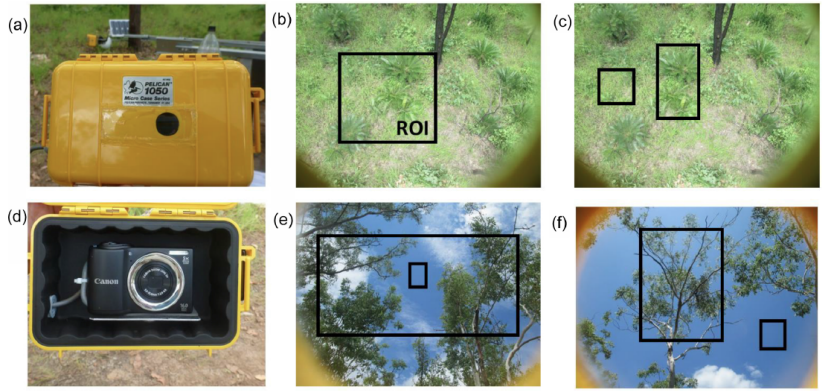
- **Fundamental relationships of carbon uptake by ecosystems**



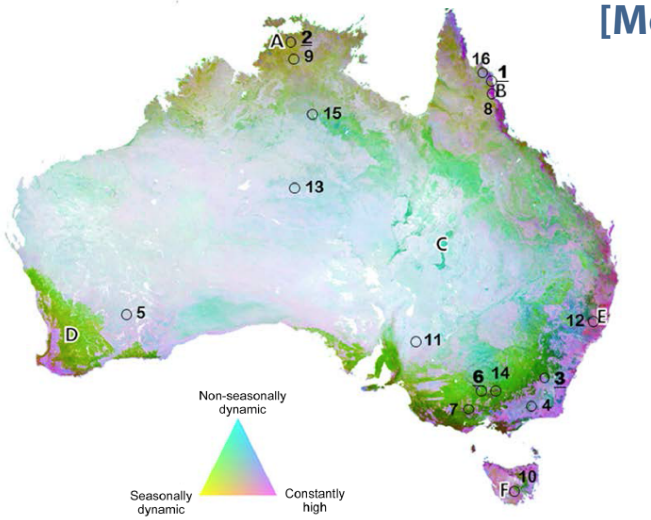
[Restrepo Coupe et al. 2016 *Biogeosciences*]

Phenology

- **Understory and canopy attribution**



[Moore et al. 2017 *Biogeosciences*]



[Moore et al. 2016a *Biogeosciences*]

EVI

- **constantly high**
- **seasonally dynamic**
- **not dynamic seasonally**

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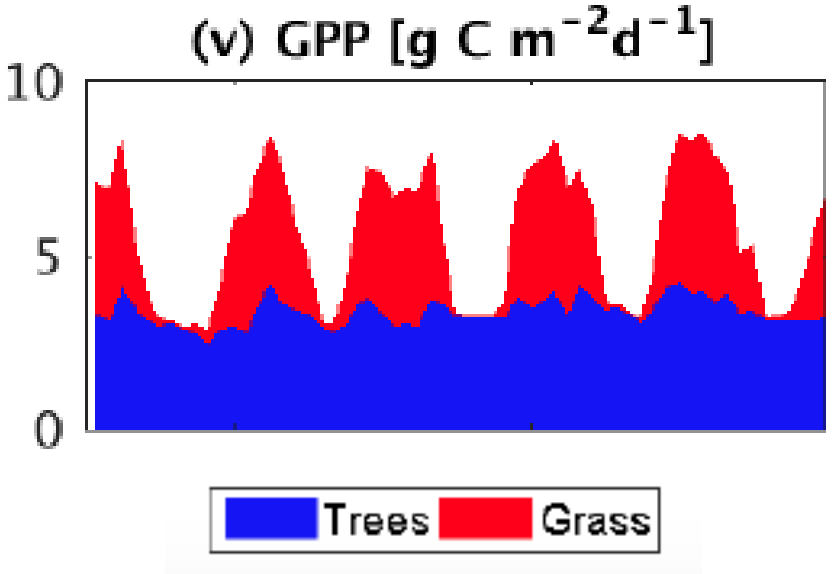
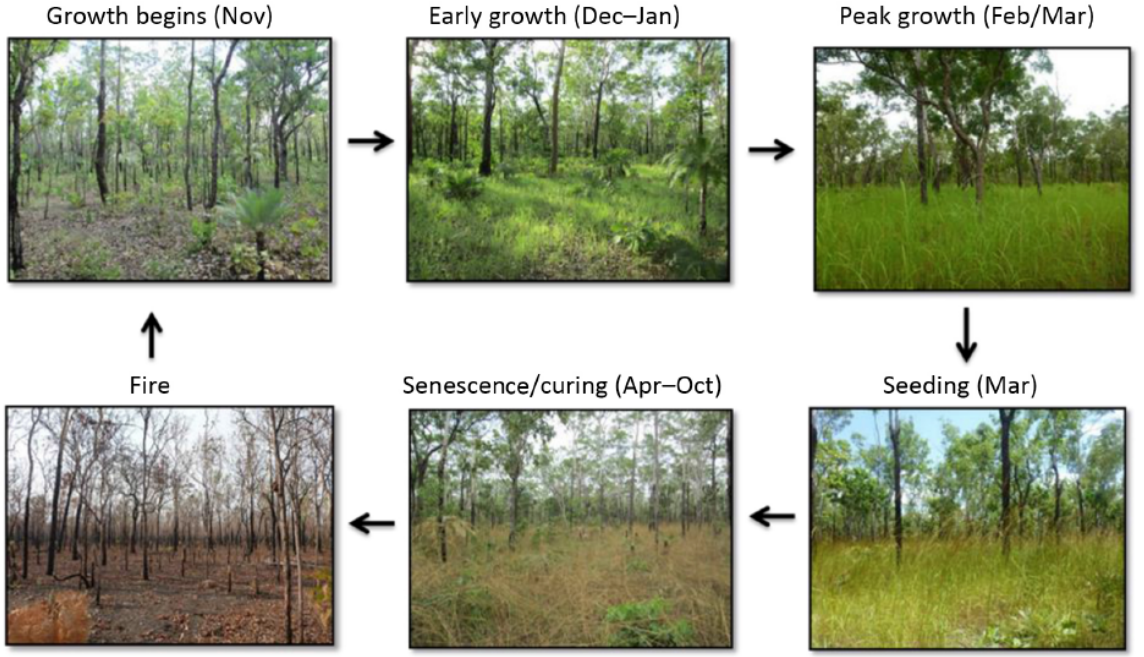
Savanna tree–grass partitioning

Strong seasonality in phenology and contributions to GPP

- **Canopy low-variability, constant carbon sink**
- **Accounting for root distributions is key**



[Haverd et al. 2016 *Biogeosciences*]



[Moore et al. 2016b *Biogeosciences*]

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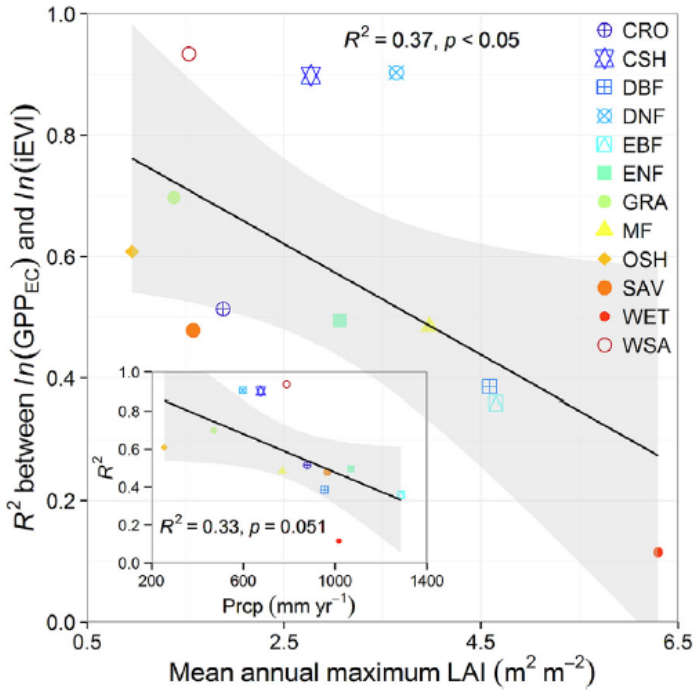
Leaf area index

Remotely sensed GPP

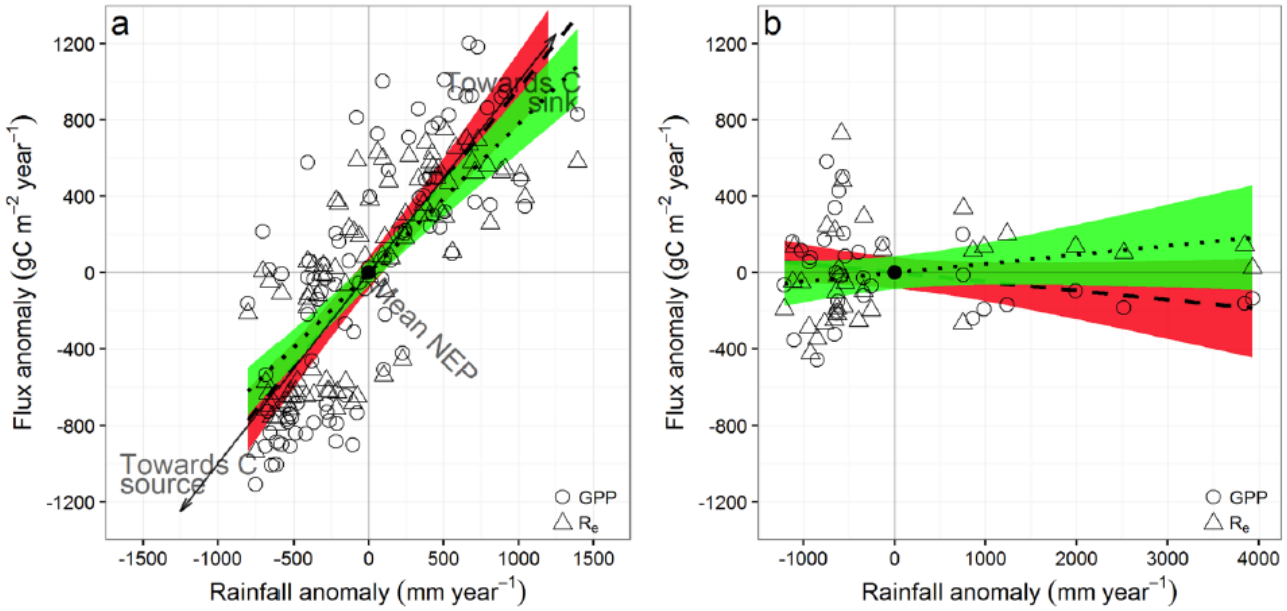
- **LAI affects coupling between vegetation index and GPP**



[Shi et al. 2017 *Ecological Indicators*]

LAI

- **affects coupling between rainfall and carbon flux anomalies, but**
  - **only for forests**



[Li et al. 2017 *Scientific Reports*]

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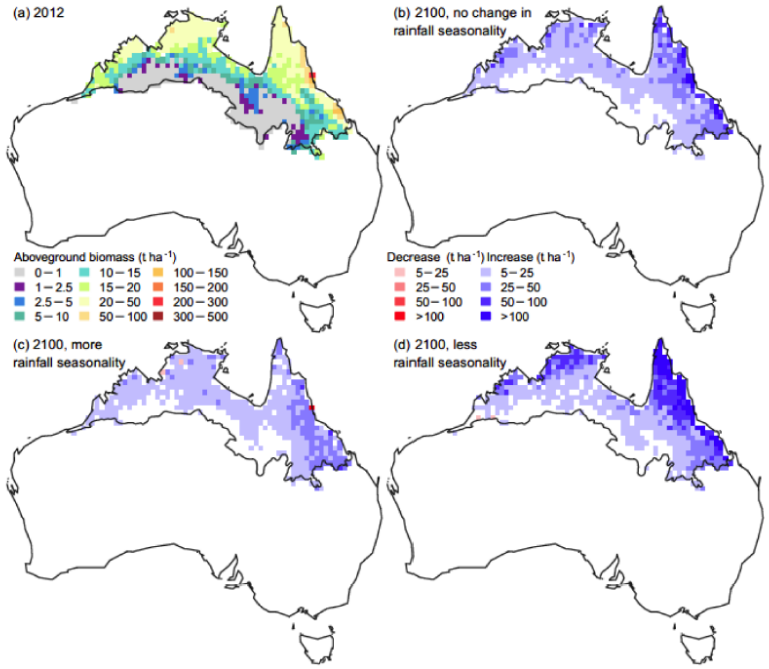
Growth and biomass

Savanna biomass is projected to increase by 2010, enhanced by reduced rainfall

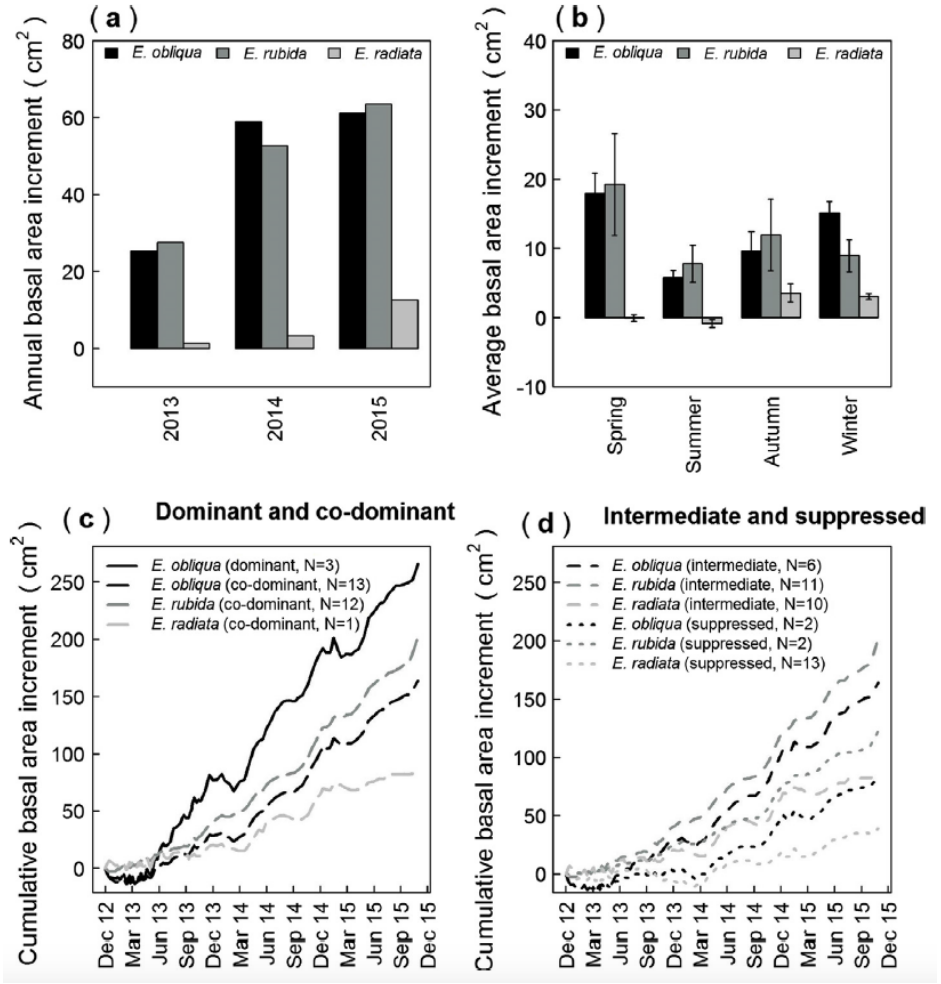
- lower seasonality > no change > more seasonality



[Whitley et al. 2017 *Biogeosciences*]

Strong tree growth at AU-Wom supports large GPP

- See Nina Hinko-Najera's presentation on this topic [Hinko-Najera et al. 2017 *Biogeosciences*]



[Greibel et al. 2017 *Forest Ecology and Management*]

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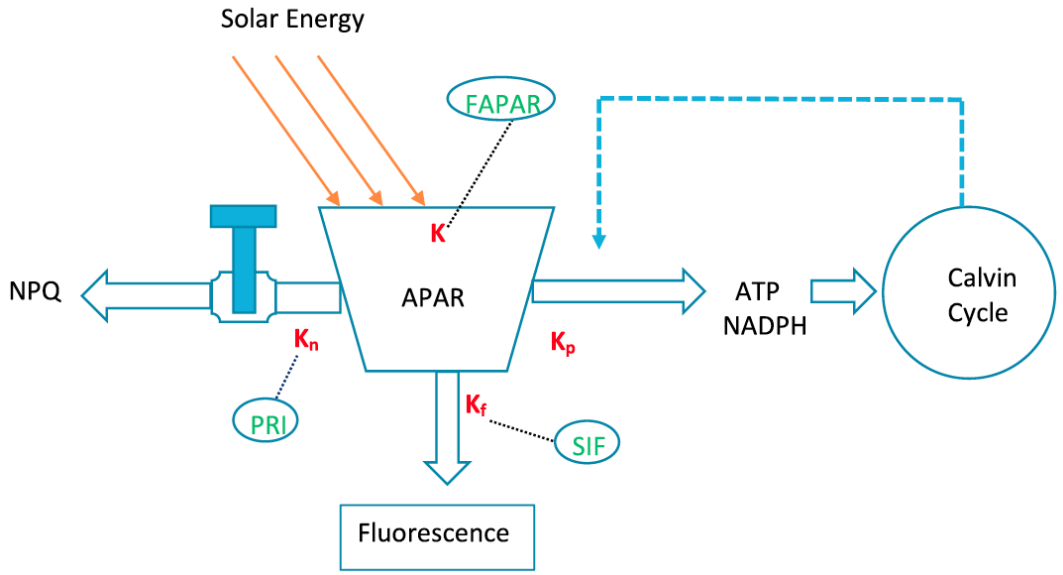
Land–atmosphere interface

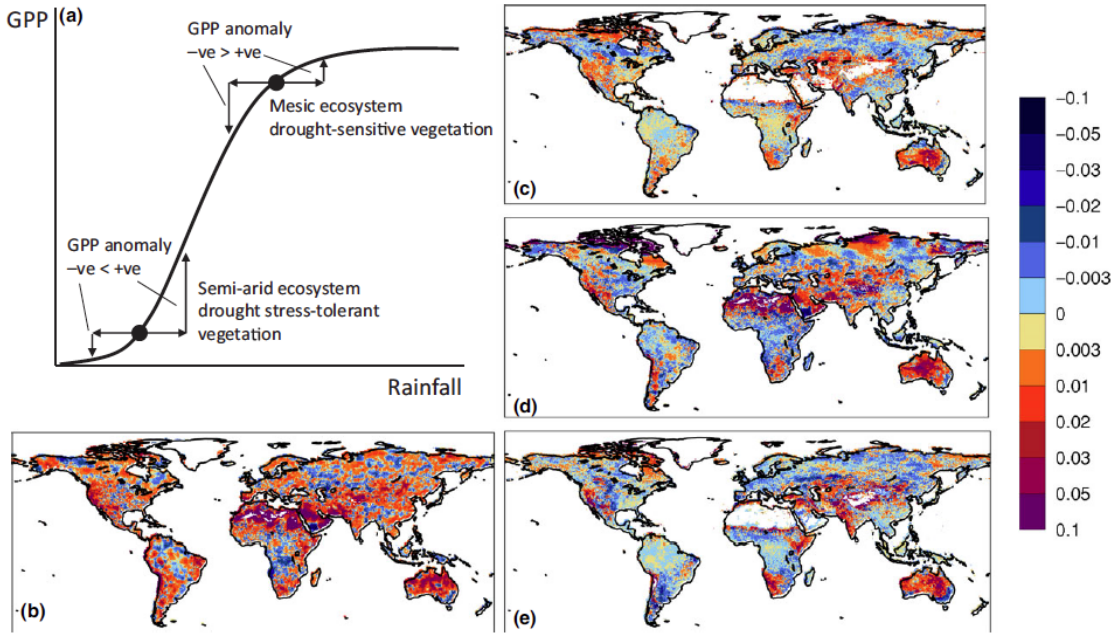
Contributions to our understanding of plant ecophysiology and morphology

- **See Santini et al. [2016 *Trees*] and Rachael Nolan's presentation [Nolan et al. 2017a *Functional Plant Biology*, Nolan et al. 2017b *Functional Plant Biology*]**

Global modelling of sensitivity of *GPP versus ER* to rainfall variability



[Verma et al. 2017 *JGR—Biogeosciences*]



[Haverd et al. 2017 *Global Change Biology*]

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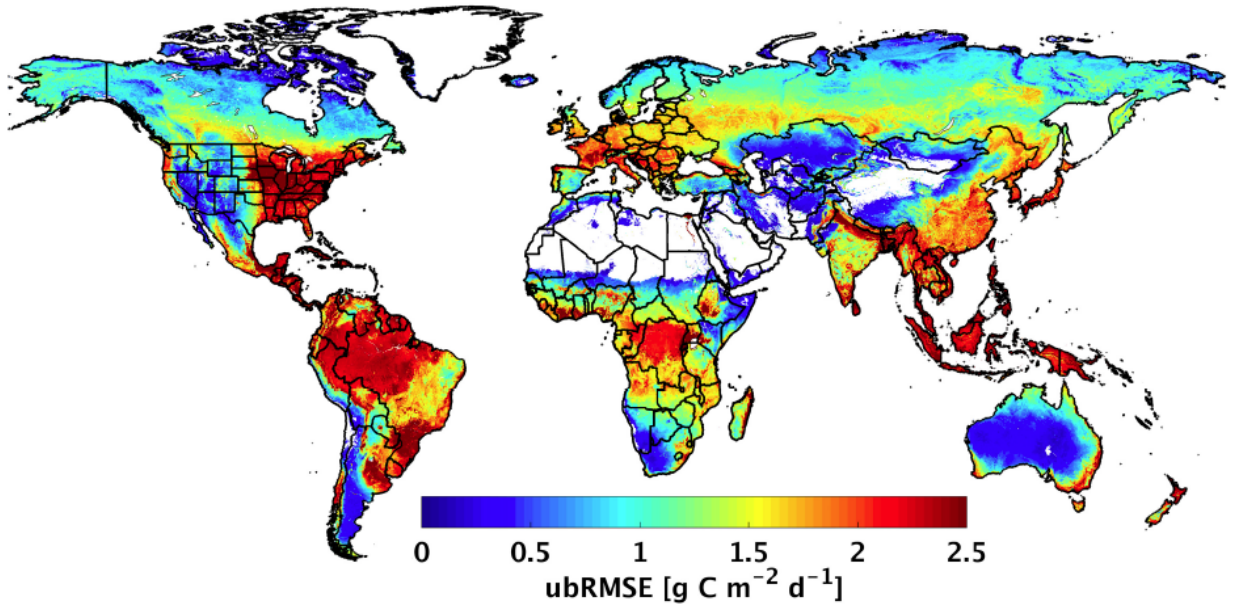
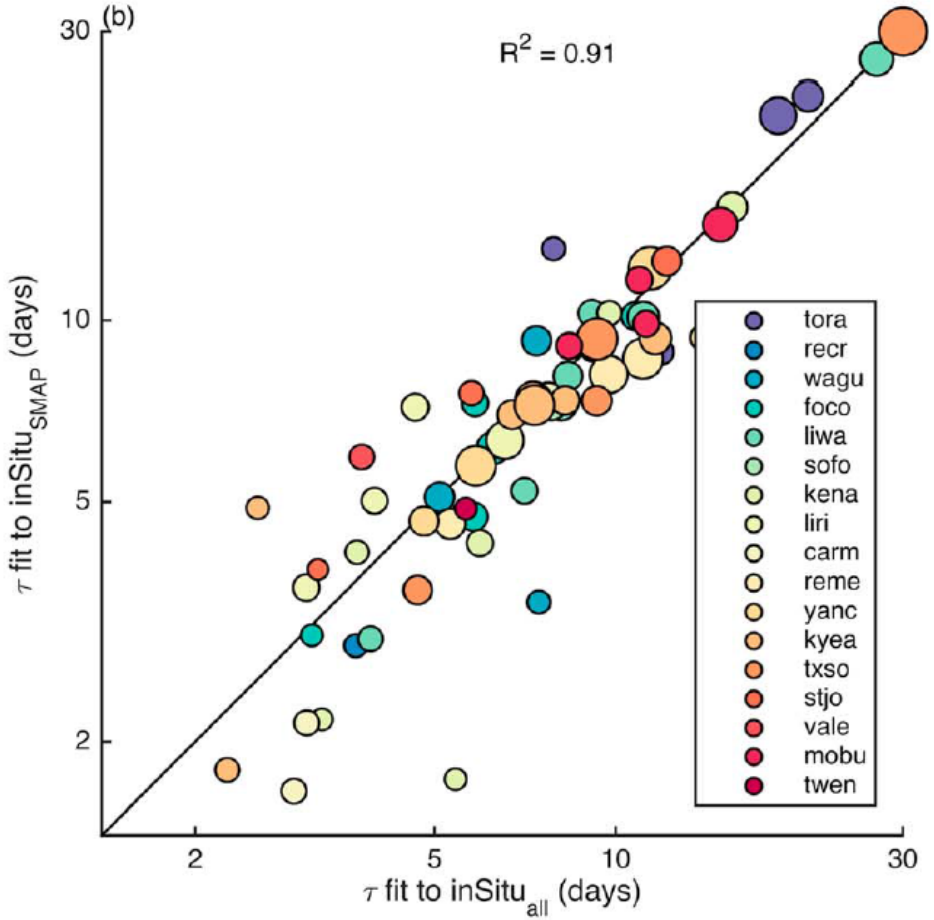
NASA SMAP

Satellite and flux measurement modelling of soil moisture and productivity



[Jones et al. 2016]



[Shellito et al. 2016]

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+ three slides which were lost...

...with my apologies for not including in the presentation

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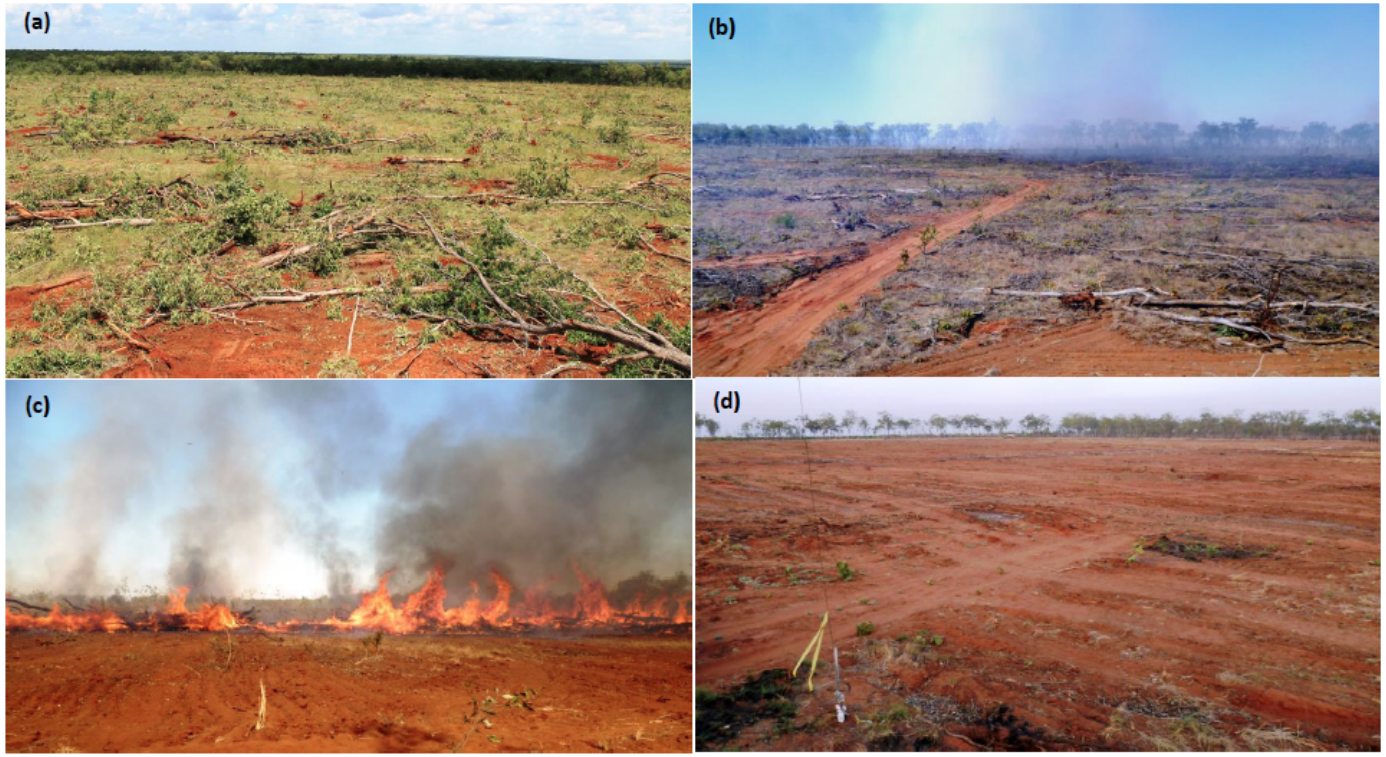
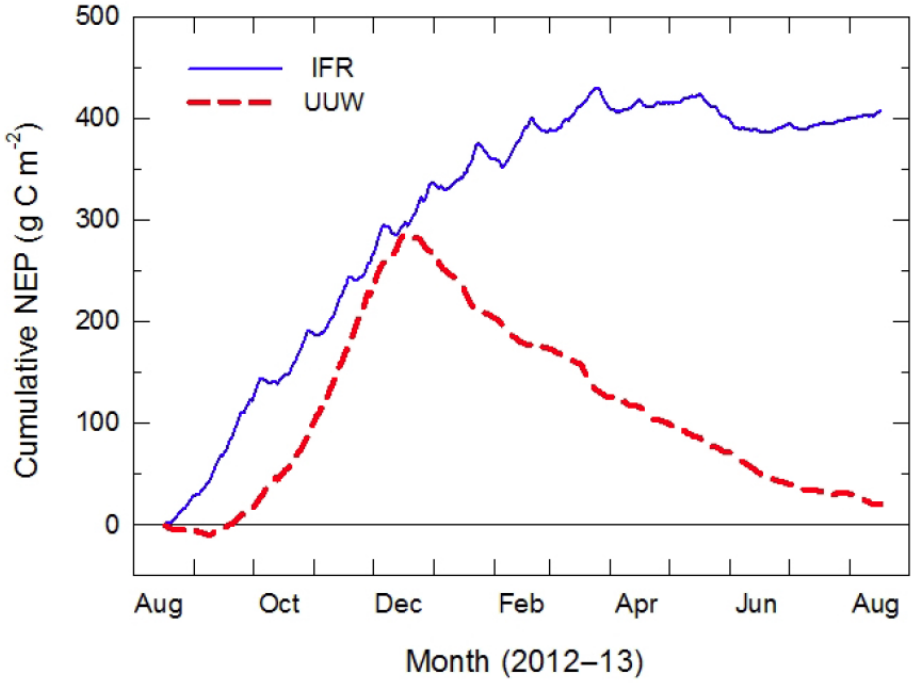
Carbon cycle and agriculture

GHG fluxes and land clearing Northern Territory



[Bristow et al. 2016 *Biogeosciences*]

Grazing, fertilisation and ecosystem productivity New Zealand



[Hunt et al. 2016 *Biogeosciences*]

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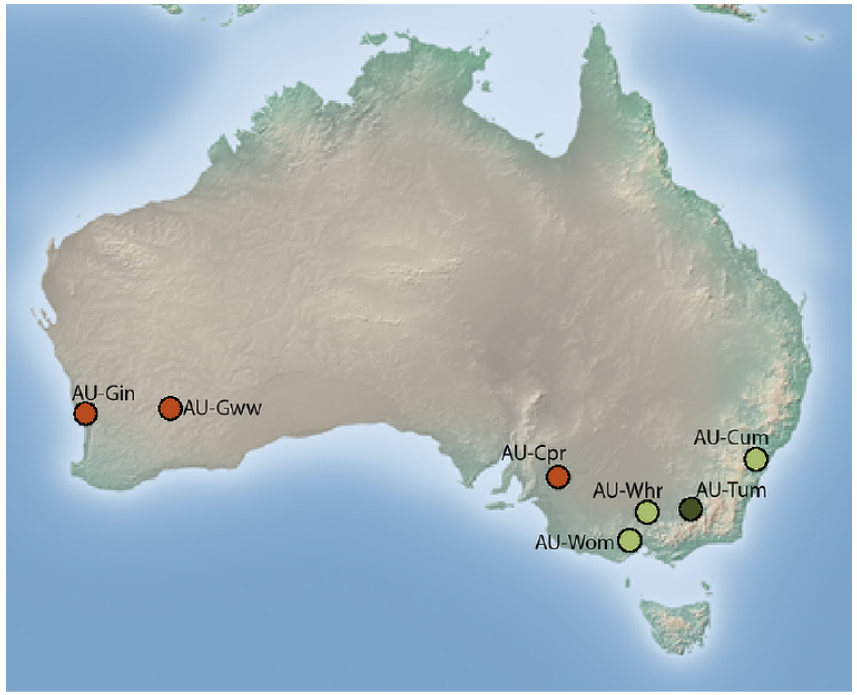
Energy and heatwave

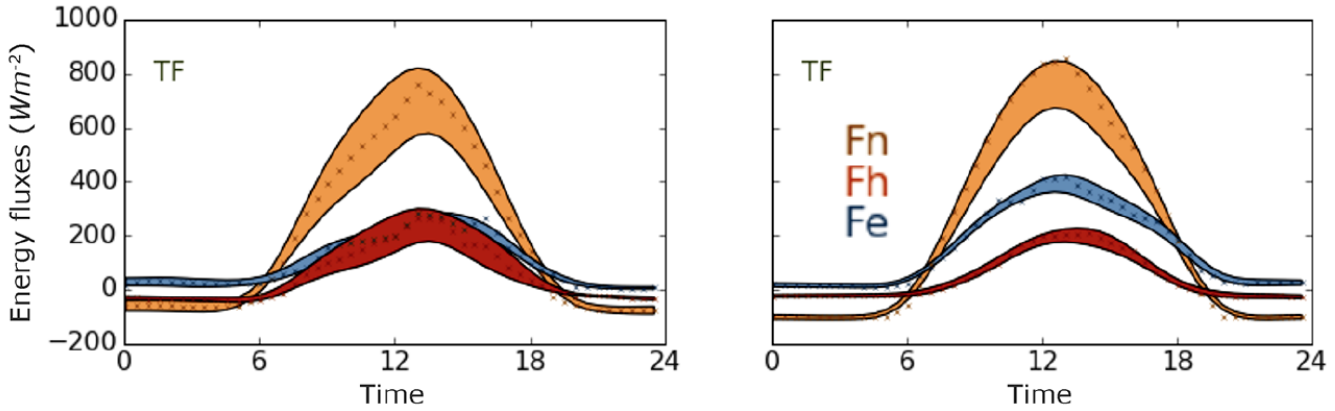
Mediterranean woodlands and dry sclerophyll forests:

- additional heat dissipated through radiative cooling (i.e., lower net radiation) and sensible heat flux,
- thus intensifying heatwave *via* land–surface feedback

AU-Tum: evaporative cooling ameliorated 'Angry Summer' heatwave, but

- soil moisture reserves were nearly depleted.
- Thus, a future with longer and more intense heatwaves could spell trouble





[van Gorsel et al. 2016 *Biogeosciences*]

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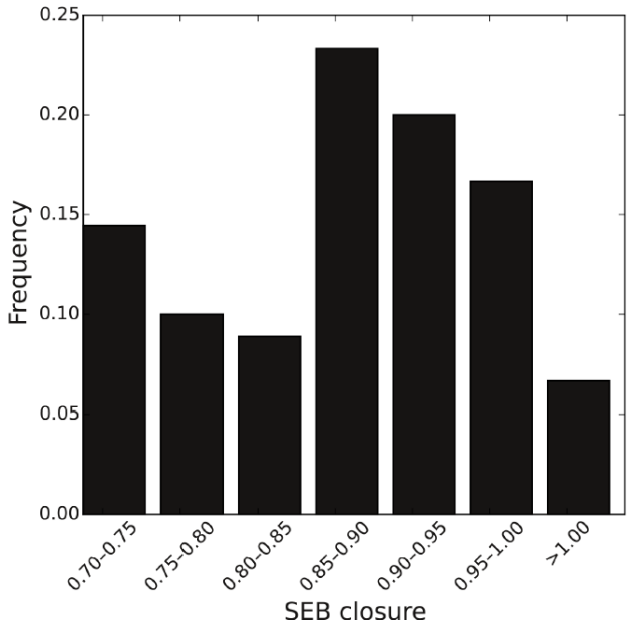
Energy balance closure

Energy balance closure comparable to or higher than global standards

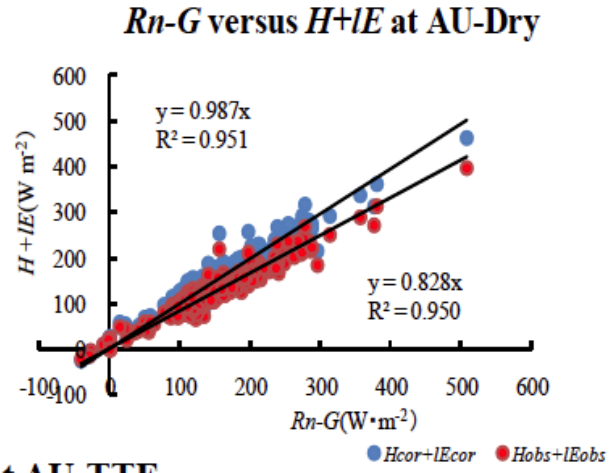
- **70 to >100% closure across all sites**

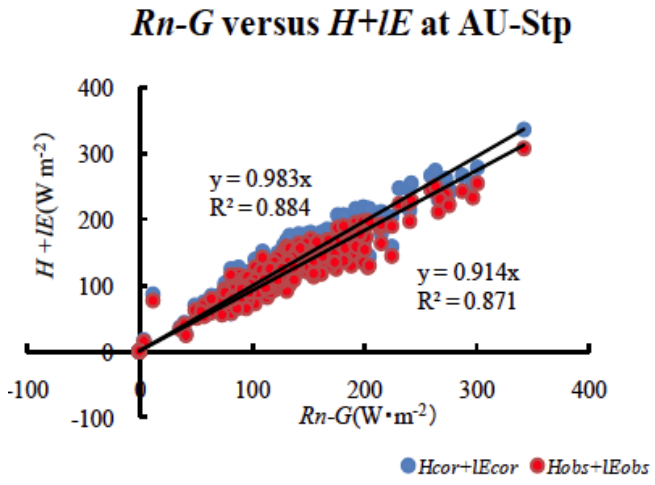


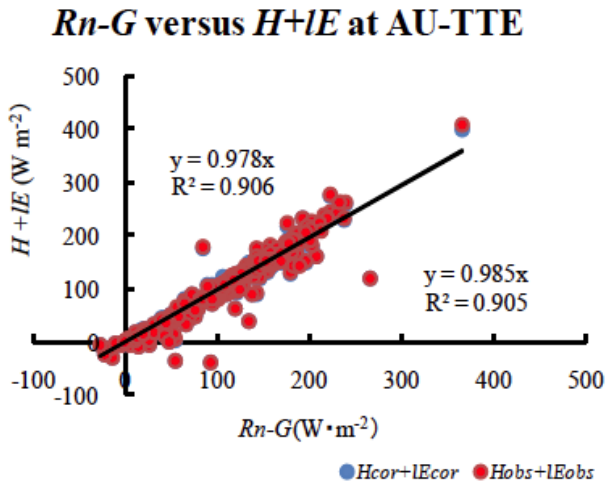
[Isaac et al. 2017 *Biogeosciences*]

Energy balance across three sites (AU-Dry, AU-Stp, AU-TTE):

- **closure *ca*. 83–99%**







[Maruyama et al. 2017 *Open Journal of Modern Hydrology*]

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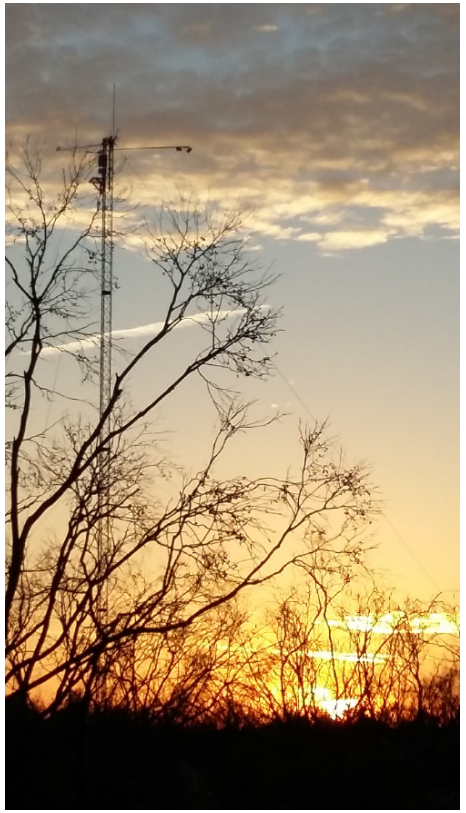
Congratulations

Questions? Corrections?



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[Photos:
Cacilia Ewenz]