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UNIVERSITY OF TECHNOLOGY SYDNEY

OzFlux: recent scientific contributions

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OzFlux: a network for the study of ecosystem carbon and water dynamics across Australia and New Zealand

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- Topics including:

Agriculture
Modelling

Climate
Remote sensing

Extreme events
Flux data

Carbon cycle
Phenology



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“of droughts and flooding rains”[†]

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Figure 1 | Hummock grassland during dry and wet growth seasons. Some ecosystems, such as hummock grasslands in southeastern Australia, compensate for poor growth during dry periods by increasing growth during wet periods. Ma *et al.*⁵ report that such ecosystems have until now been less vulnerable to drought than are croplands or pasture.

[Rammig and Mahecha 2015 *Nature*]



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[†] Dorothea Mackellar, *My Country*

<http://www.dorotheamackellar.com.au/archive/mycountry.htm>

Global land carbon sink anomaly of 2011

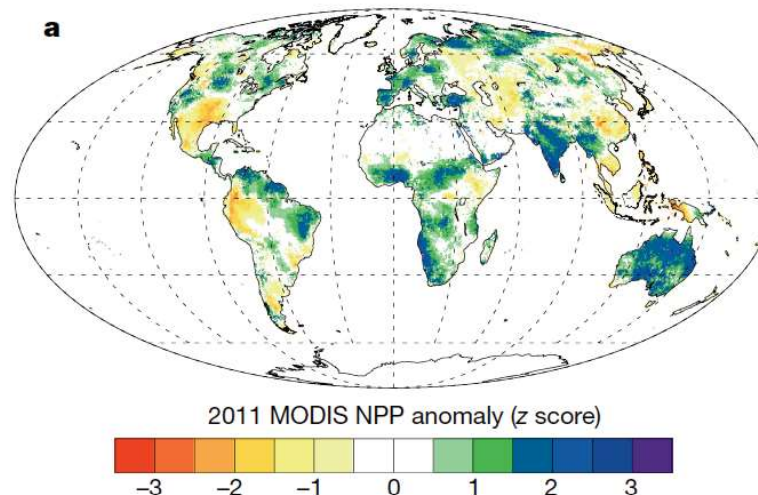
Global increase in residual land sink [Poulter et al. 2014]

- 4.1 Pg C y⁻¹ (versus 2.6 Pg C y⁻¹ average since 1958)
- Dominated by productivity in Southern Hemisphere
- Majority of contribution attributed to Australia
- Despite drought across semi-arid regions of Northern Hemisphere

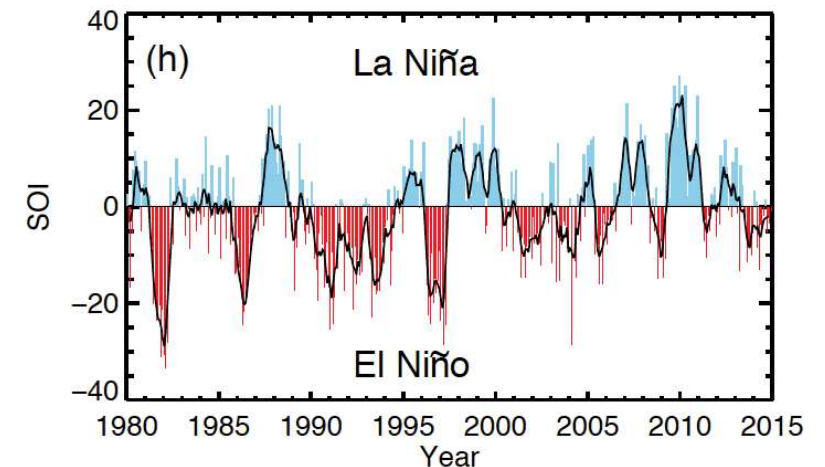
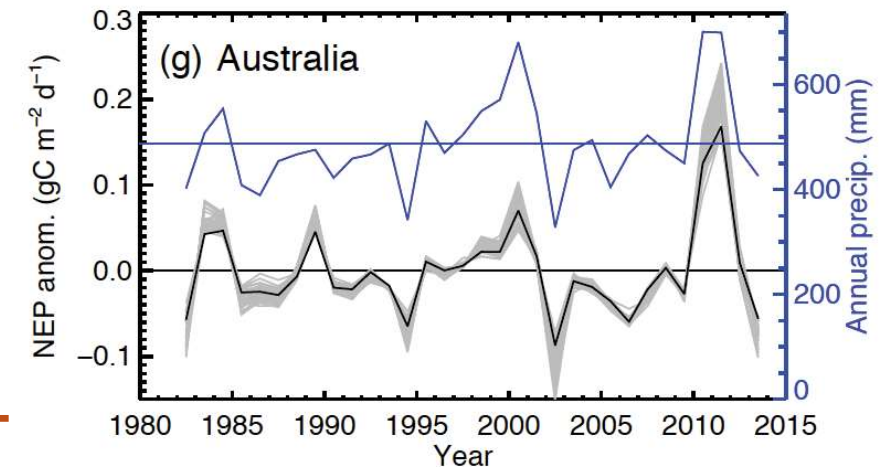
Soil moisture a key driver of large interannual variability in NEP via ENSO

[Trudinger et al. 2016]

- Followed 'Millennium Drought'
- Antecedant dry (2009) and wet (2010) years produced contrasting effects



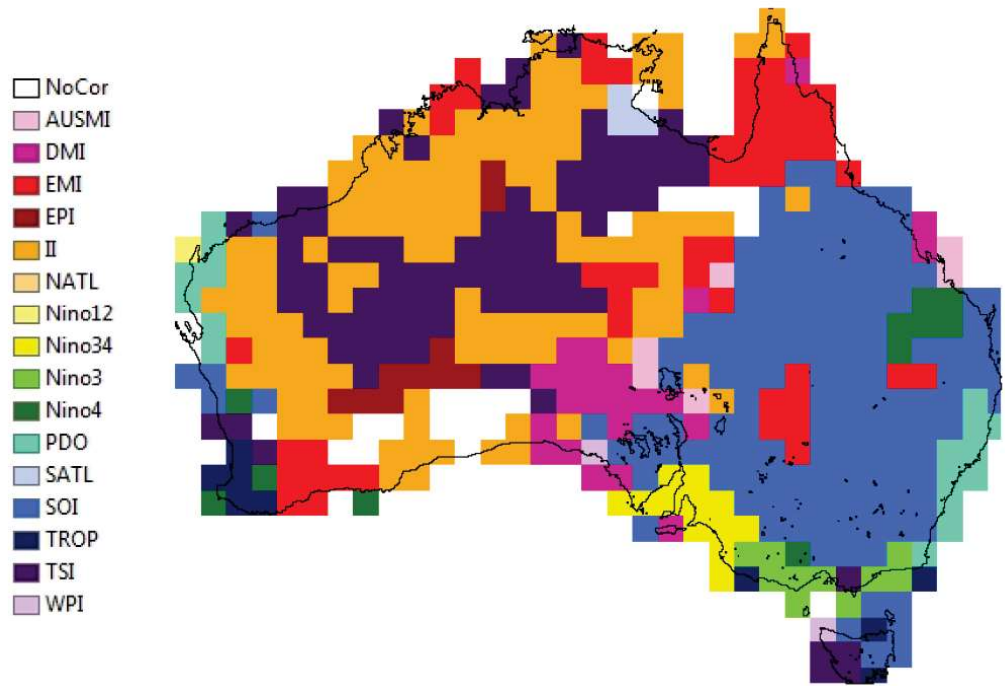
[Poulter et al. 2014 Nature]



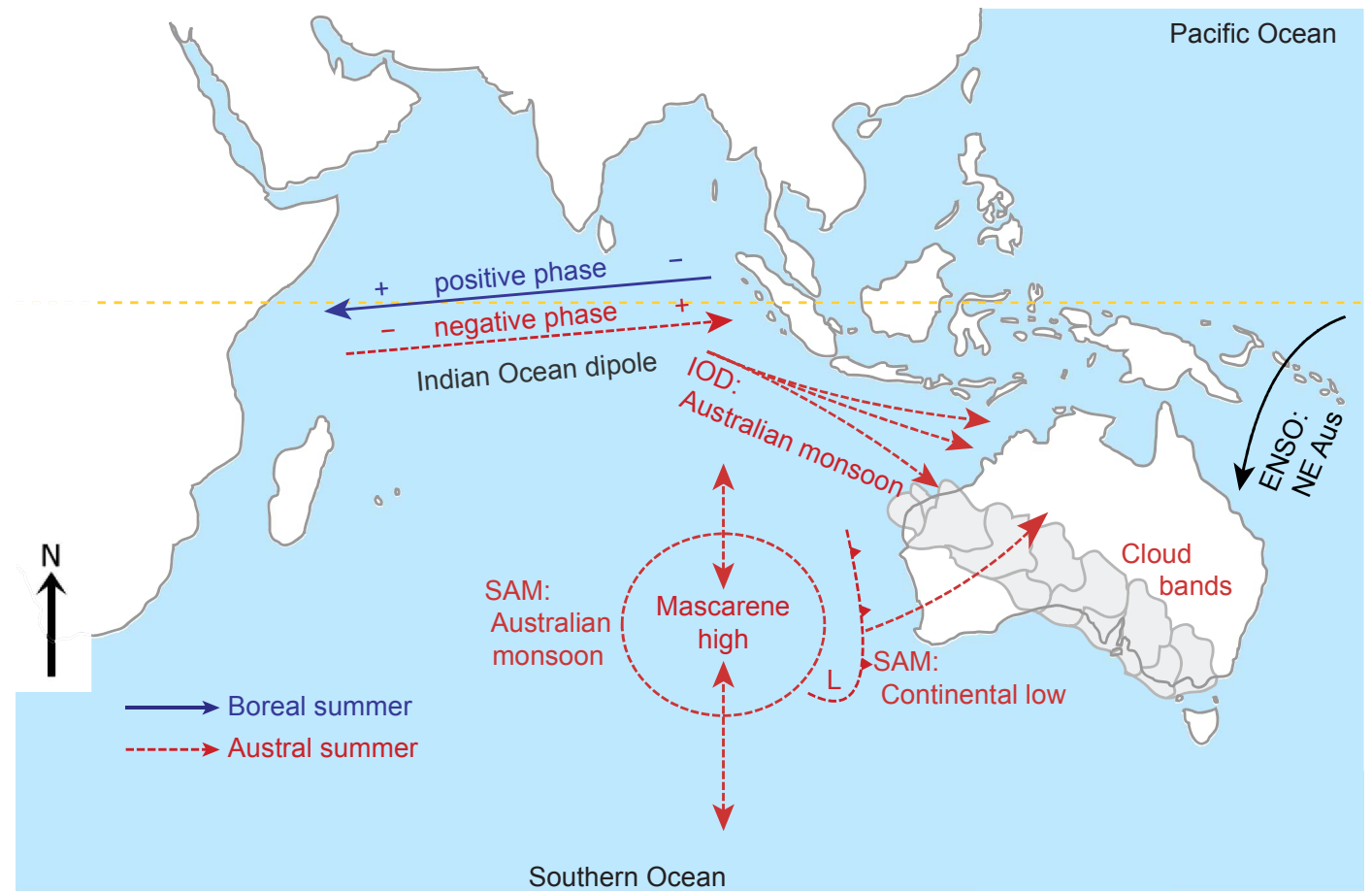
[Trudinger et al. 2016 Biogeosciences]

Enhanced climate variability

Multiple ocean effects on Australian climate and ecosystem productivity



[Rogers & Beringer 2017 *Biogeosciences*]



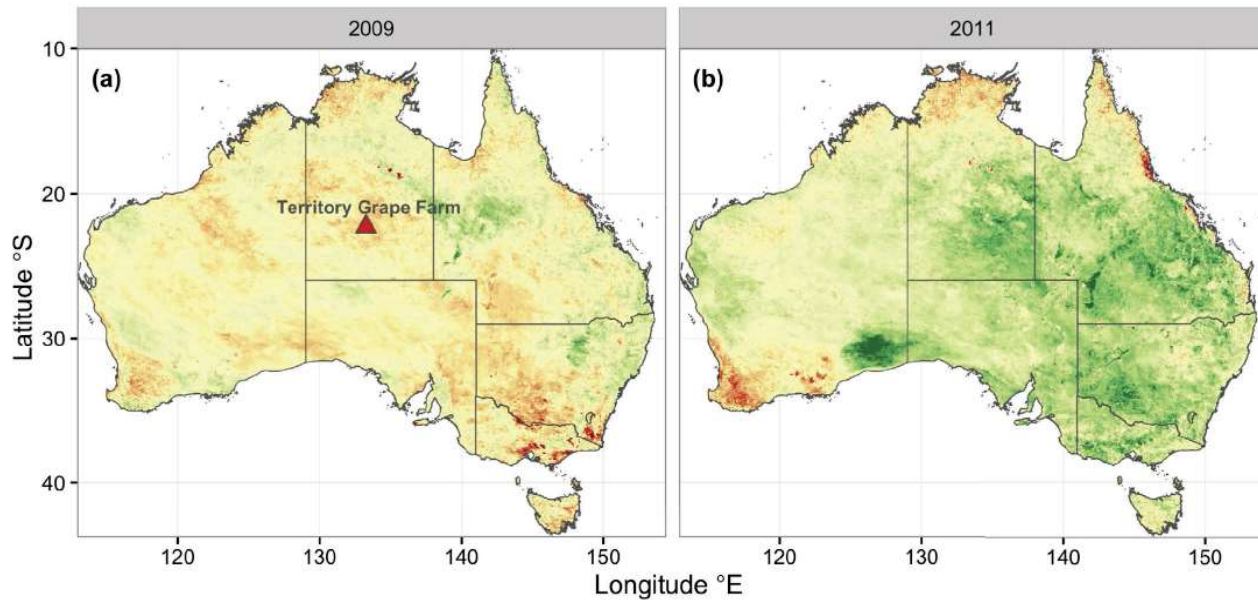
[Cleverly et al. 2016 *Scientific Reports*]



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Impacts on the ecosystem carbon cycle



[Cleverly et al. 2016 *Scientific Reports*]

Fire emissions: [Ma et al. 2016]

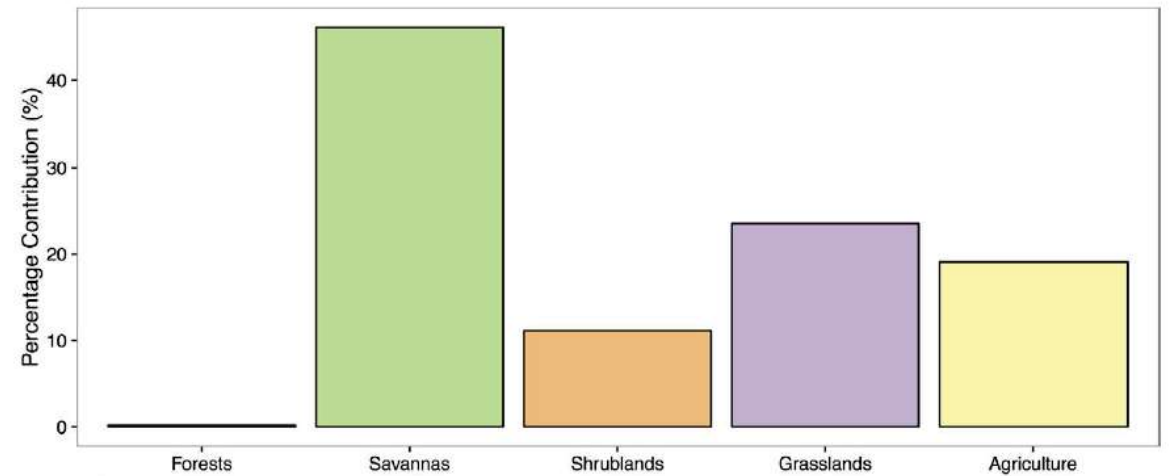
- 2010–2011: 0.07 Pg C y⁻¹
- 2011–2012: 0.17 Pg C y⁻¹



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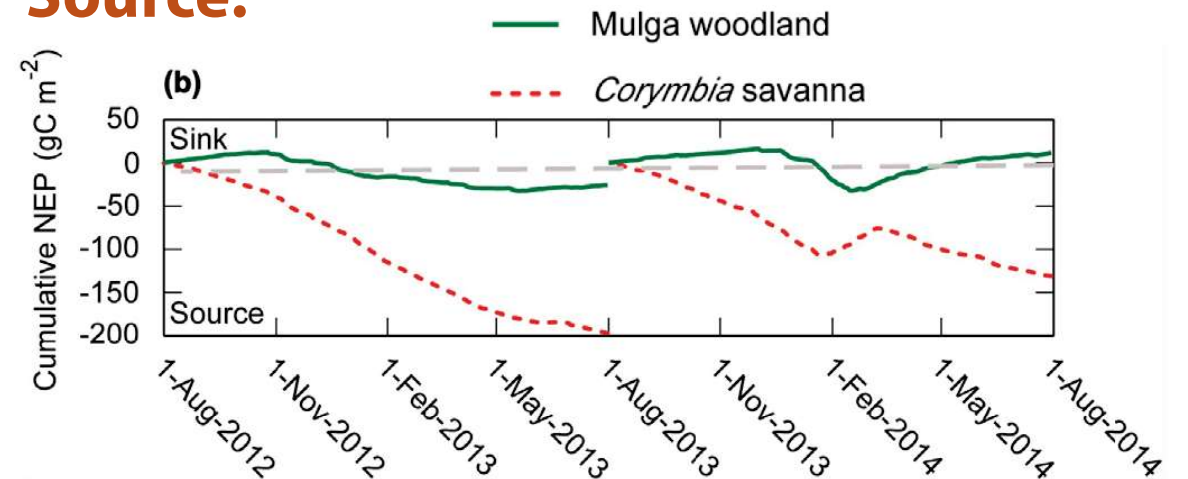
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Sink:



[Ma et al. 2016 *Scientific Reports*]

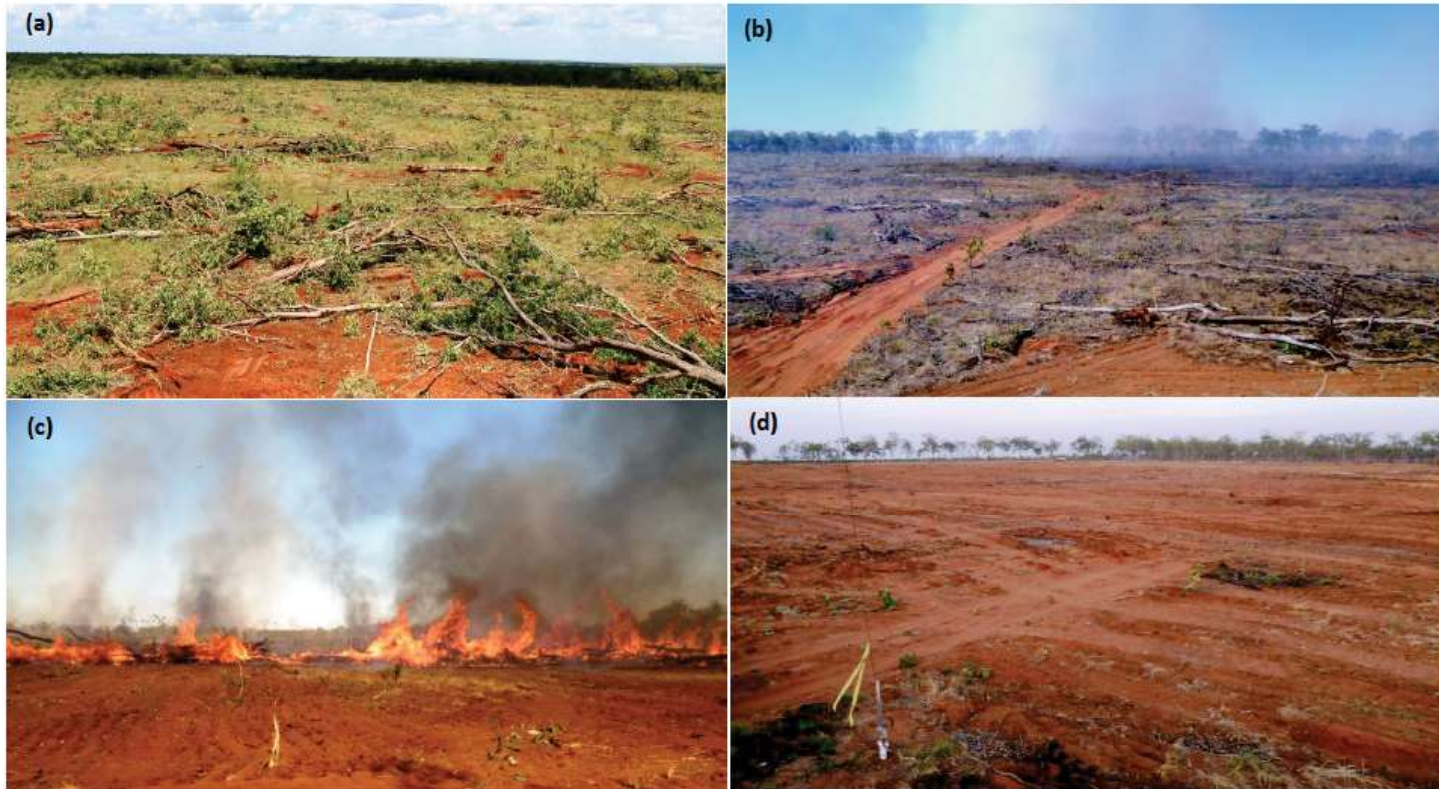
Source:



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

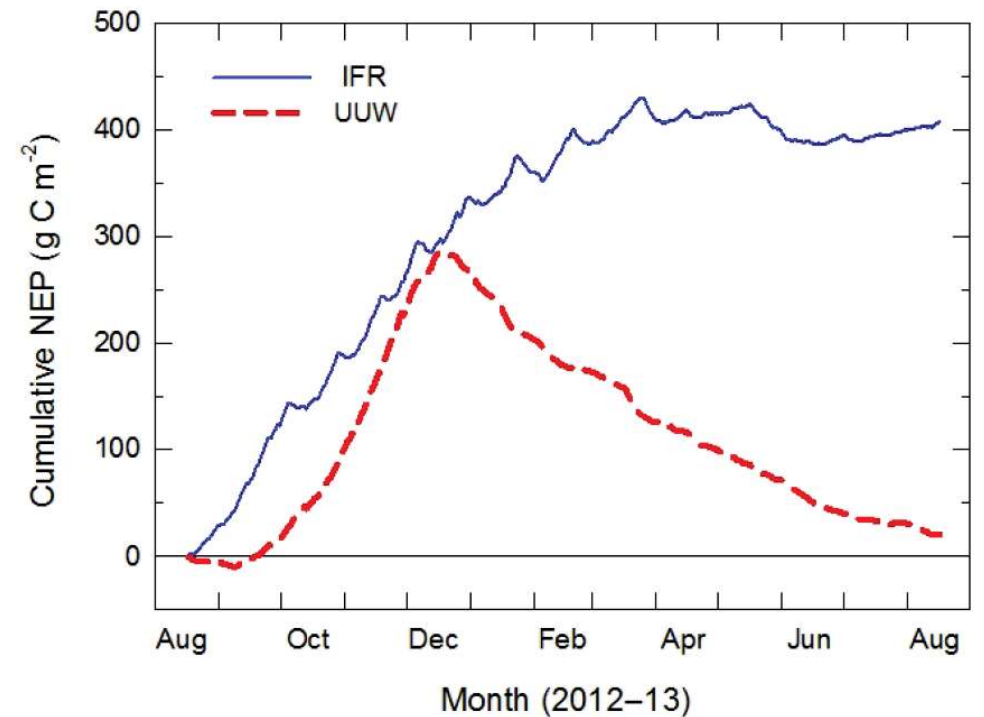
Carbon cycle and agriculture

GHG fluxes and land clearing Northern Territory



[Bristow et al. 2016 *Biogeosciences*]

Grazing, fertilisation and ecosystem productivity New Zealand



[Hunt et al. 2016 *Biogeosciences*]

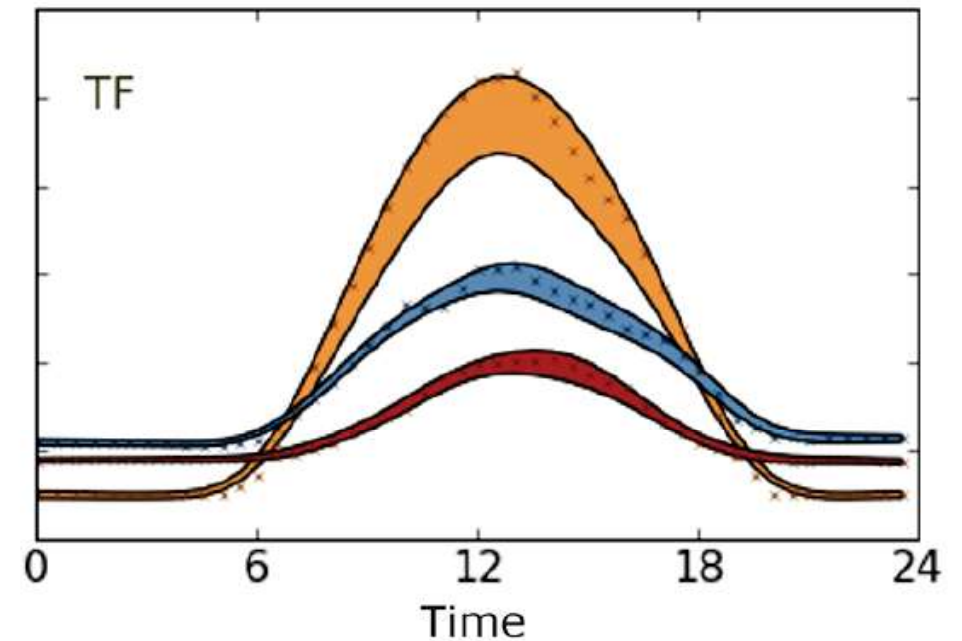
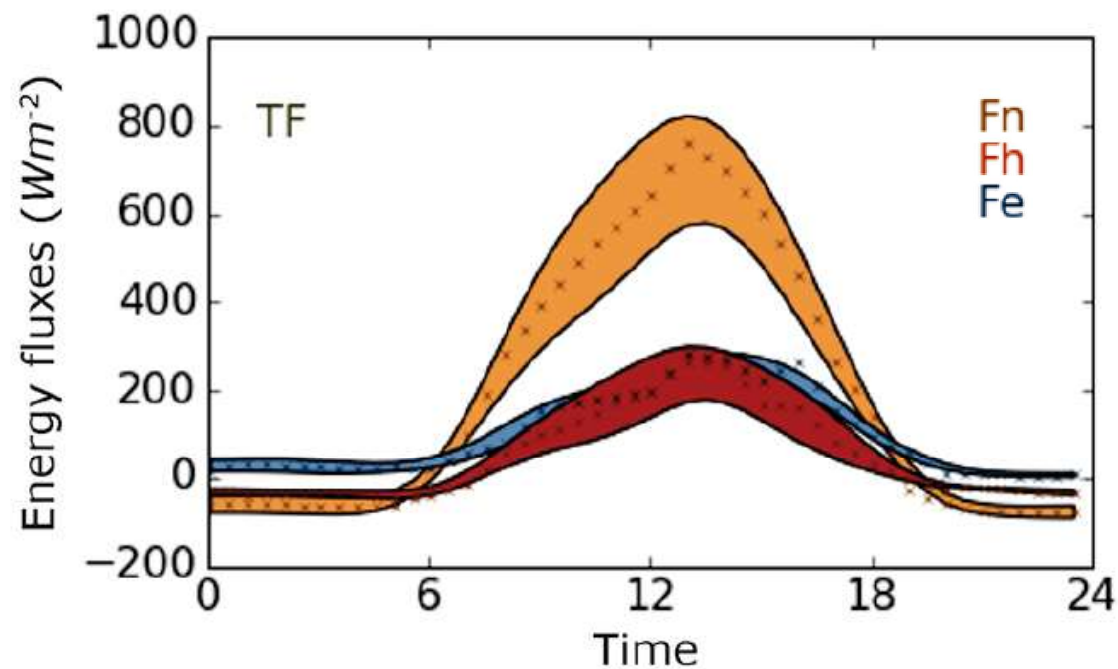


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'Angry summer' heat wave 2012/2013

Wet sclerophyll forest: evaporative cooling ameliorated the heatwave through decreased surface-atmosphere feedback, but: soil moisture reserves were nearly depleted, suggesting that a future with longer and more intense heatwaves could spell trouble



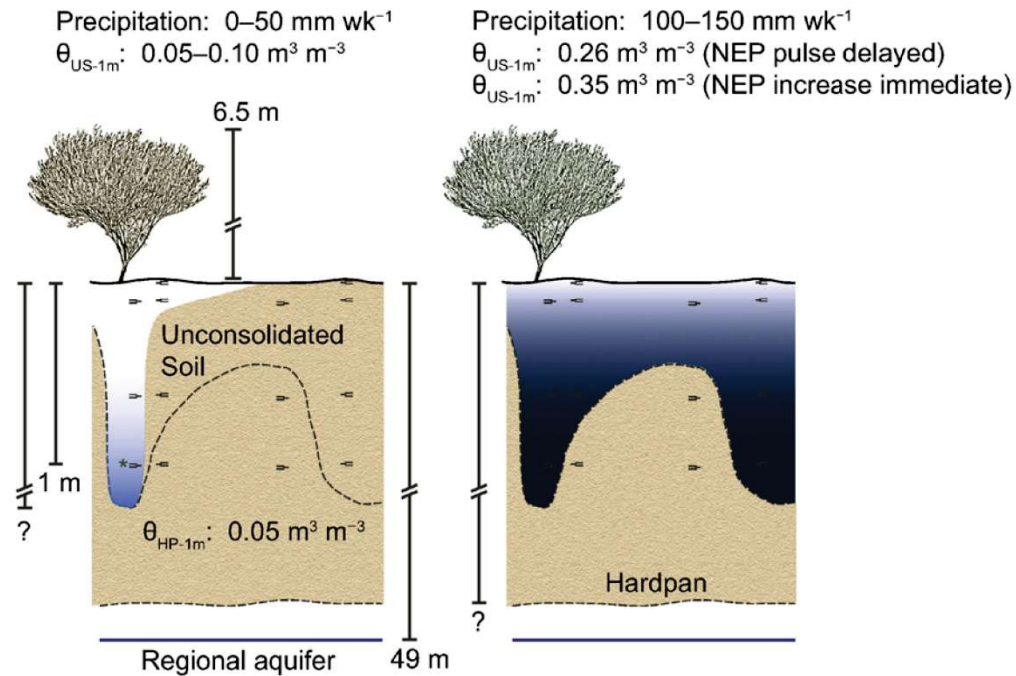
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[van Gorsel et al. 2016 *Biogeosciences*]

Spatial surface heterogeneity

Spatial correlations between regional weather patterns, topographic wetness index, leaf area index, NEP and GPP

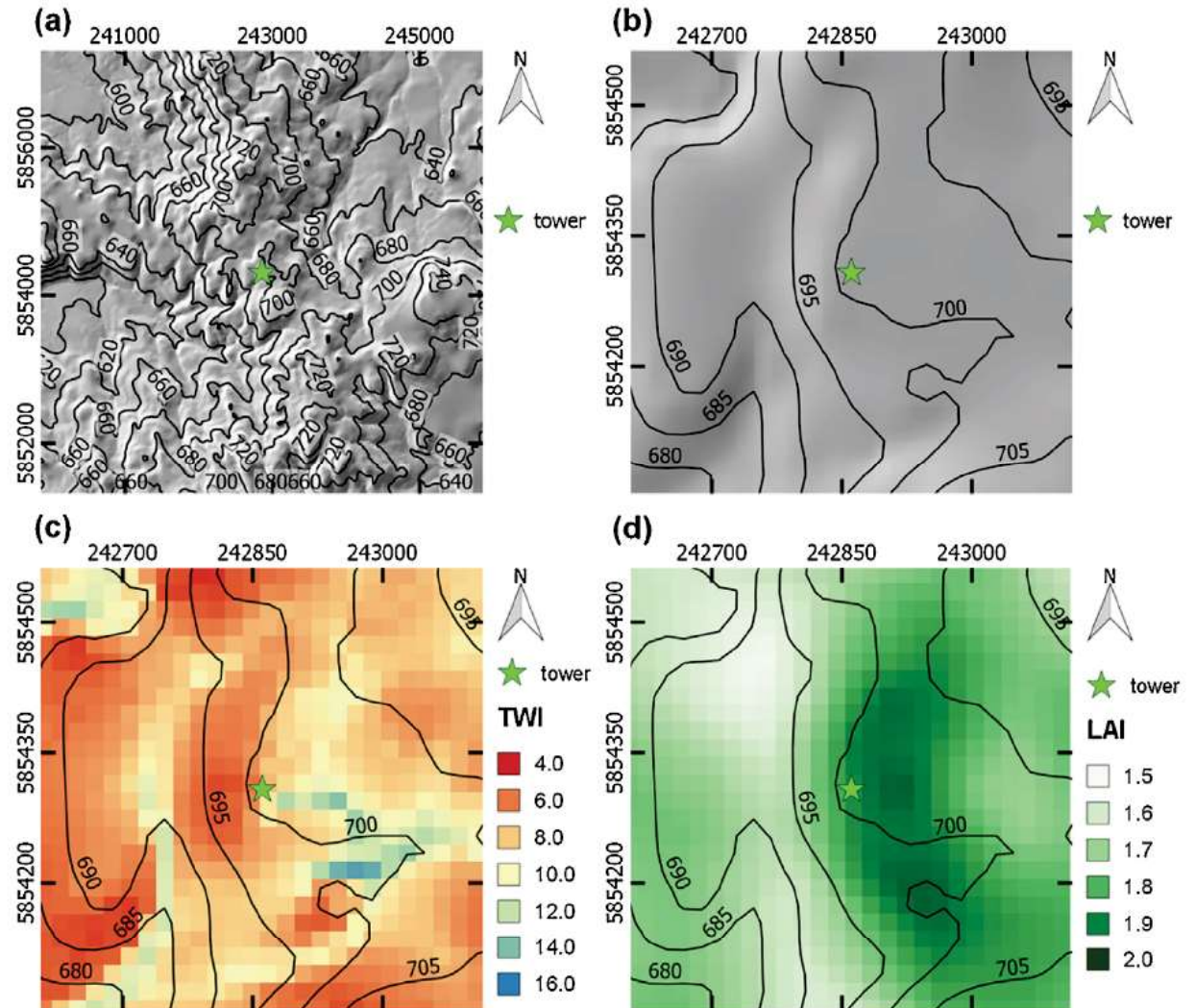


[Cleverly et al. 2016 *Science of the Total Environment*]



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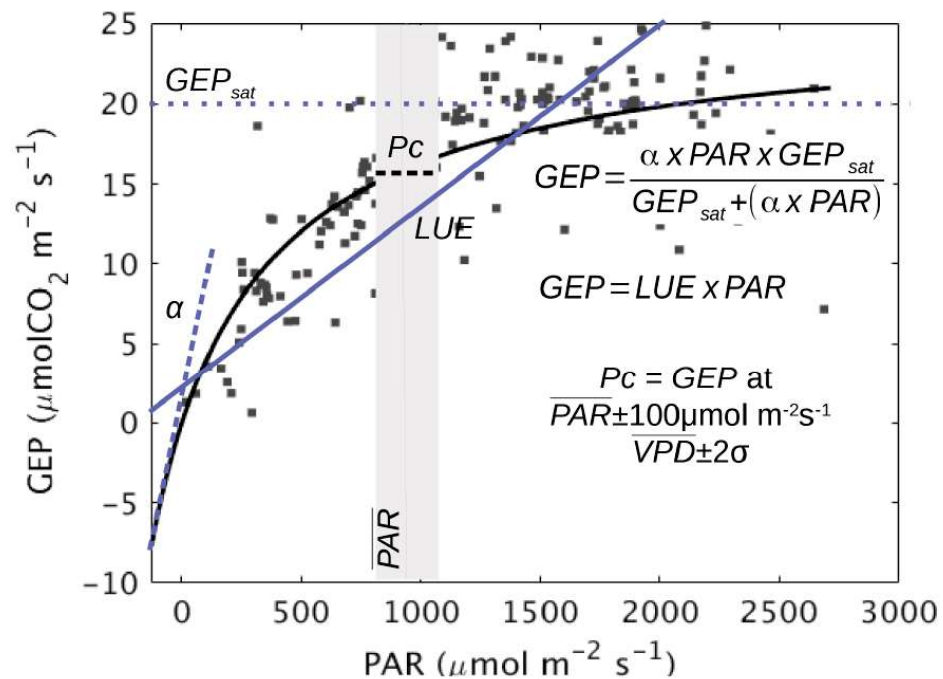


[Griebel et al. 2016 *Agricultural and Forest Meteorology*]

Photosynthesis & phenology

Photosynthesis

- Fundamental relationships of carbon uptake by ecosystems



[Restrepo Coupe et al. 2016 *Biogeosciences*]

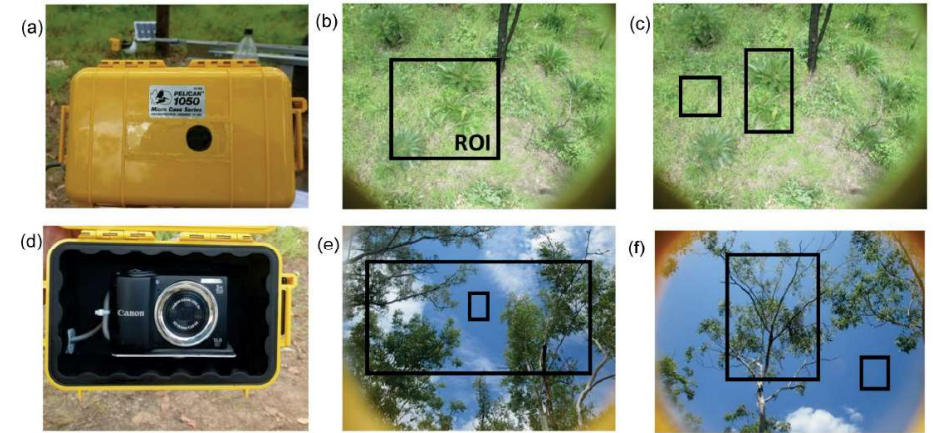


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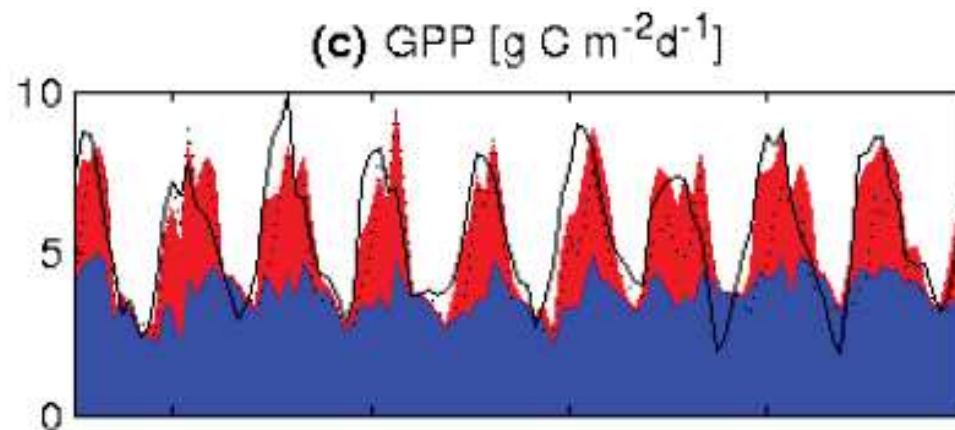
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Phenology

- Understorey and canopy attribution



[Moore et al. 2017 *Biogeosciences*]

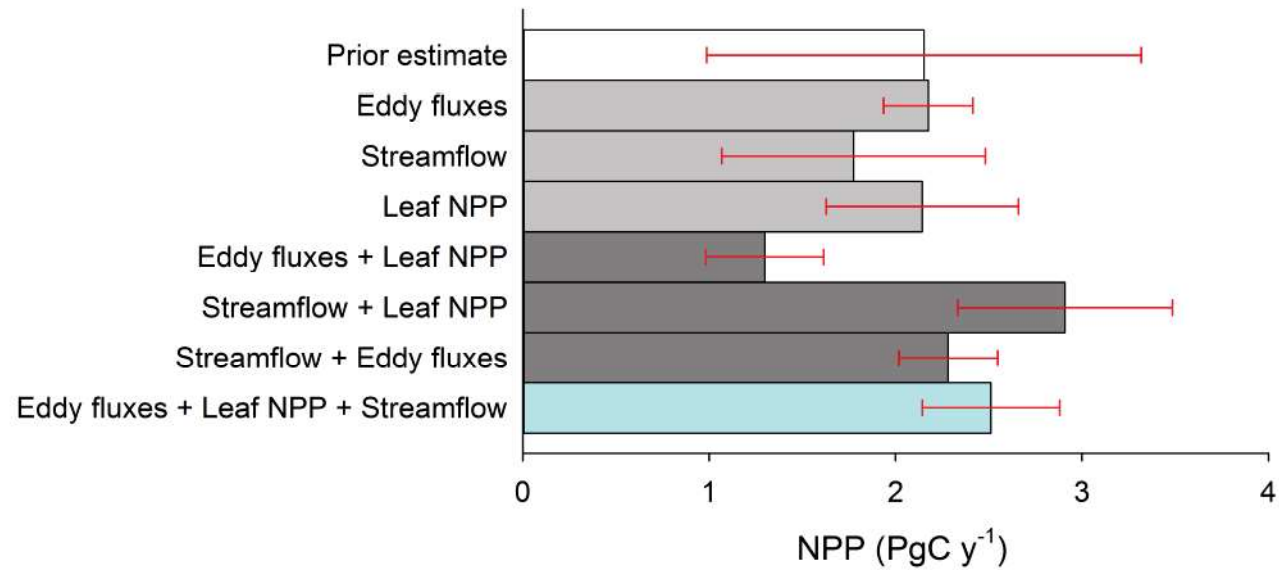


[Haverd et al. 2016 *Biogeosciences*]

Land surface modelling

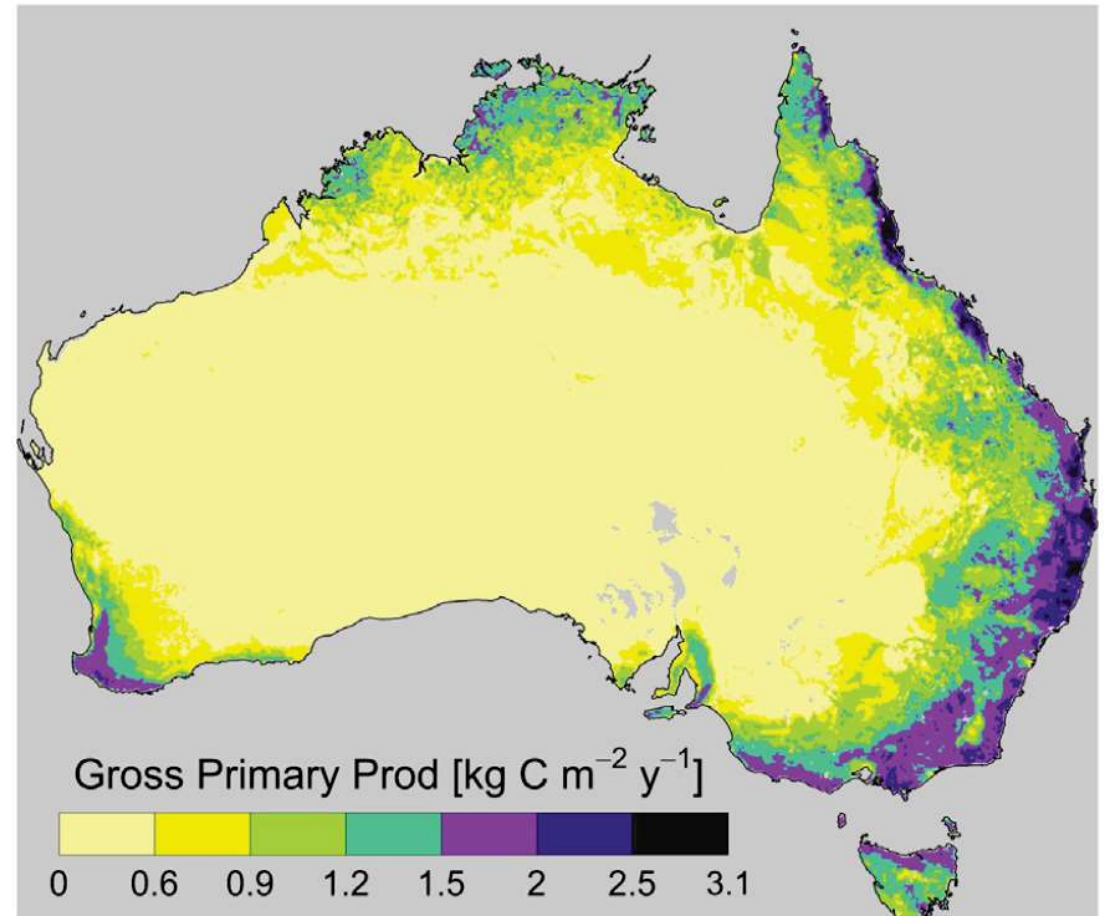
Uncertainty

- Parameterisation *via* flux data reduces uncertainty



[Haverd et al. 2013 *Biogeosciences*]

Community Atmosphere Biosphere Land Exchange (CABLE) model



[Raupach et al. 2013 *Agricultural and Forest Meteorology*]



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Thank you

Questions?



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[Photos:
Cacilia Ewenz]

