Alice Springs and Ti Tree: Expansion in Central Australia

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Alice Springs Mulga and Ti Tree East

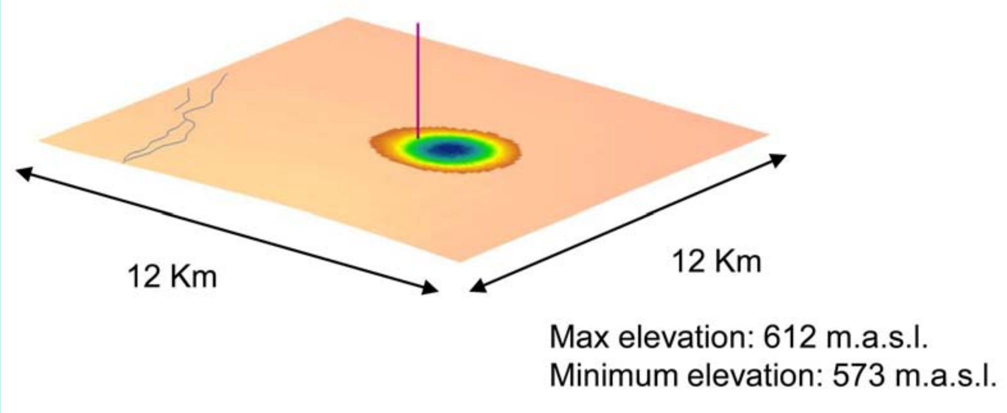
Central Australia

Status of Alice Springs Mulga
and
Ecohydrologic and metabolic responses to deluge and drought

Network expansion: 2nd tower, AusCover, TERN Supersite and NCGRT Superscience Site

Site Characteristics
Alice Springs Mulga

- *Canopy height 6.5 m*
- *606 m above sea level*
- *200 km north of Alice Springs*
- *Near Ti Tree NT*
- *Pine Hill Cattle Station*
- *Red compacted sandy loam (79:20 sand:silt)*
- *Water table: 49 m deep*
- *Average precipitation: 305.9 mm per year*



System maintenance and data delivery

CSAT3:

- Bird damage to 4 of 6 sonic transducers
- Wicks removed after sensor repair

LI7500:

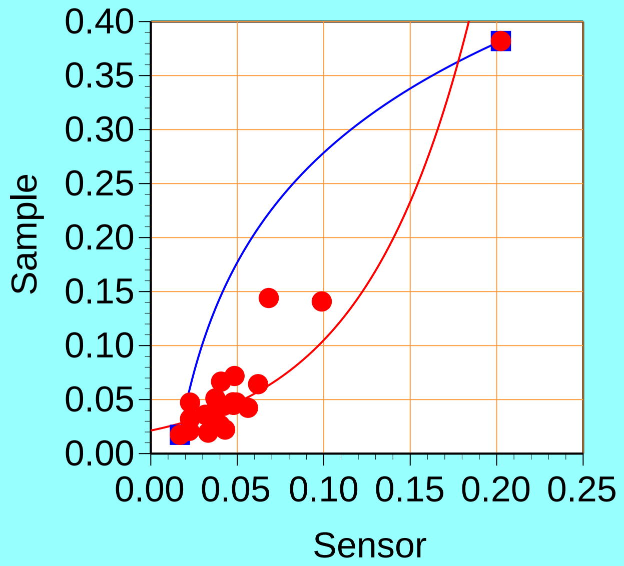
- New sensor: [CO_2] = 220 ppm
- Post-calibration drift toward lower density
- Bad circuit board
- [CO_2] constrained by approximate global atmospheric observations

Soil moisture:

- completed calibration against in situ samples (repeated samples in top 10 cm and single samples collected during installation of deep sensors)

OzFlux data portal:

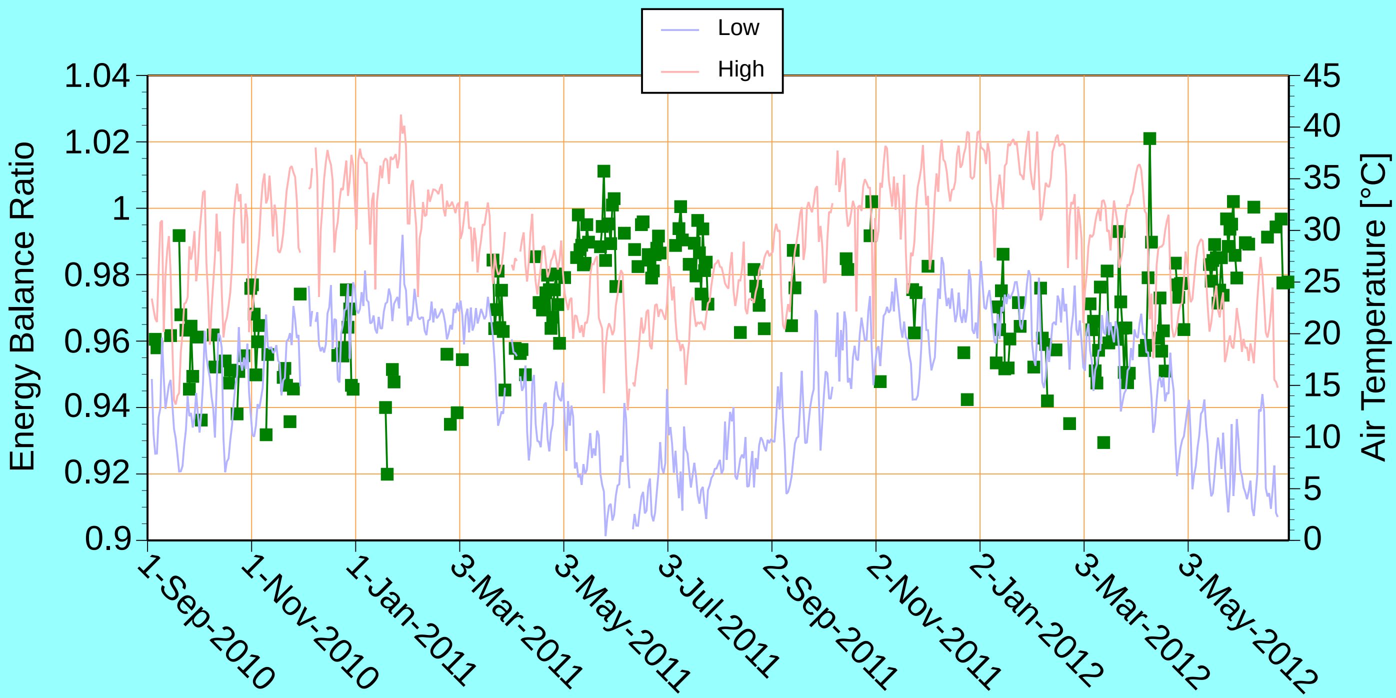
- September 2010 – June 2012
- L3 & L4
- CF meta-data convention (thank you P. Isaac)
- OzFluxQCv2.0

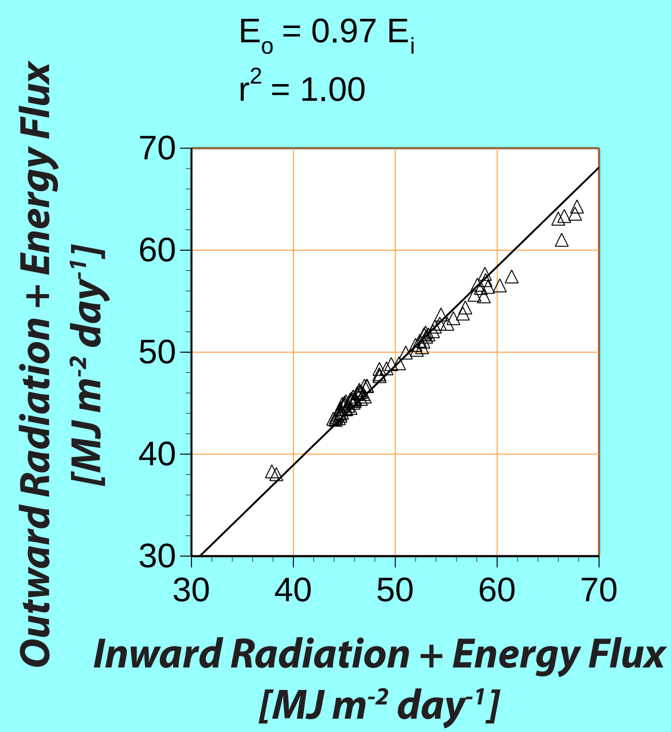


Surface Energy Balance

Near steady-state (24-hr total flux)

- L3 corrected but not gap-filled fluxes
- Ratio of outward radiation and energy fluxes to inward radiation and energy fluxes: 0.97
- Energy balance ratio = 0.95 on L4 gap-filled fluxes
- Summer EBR: 0.95; Winter EBR: 0.99



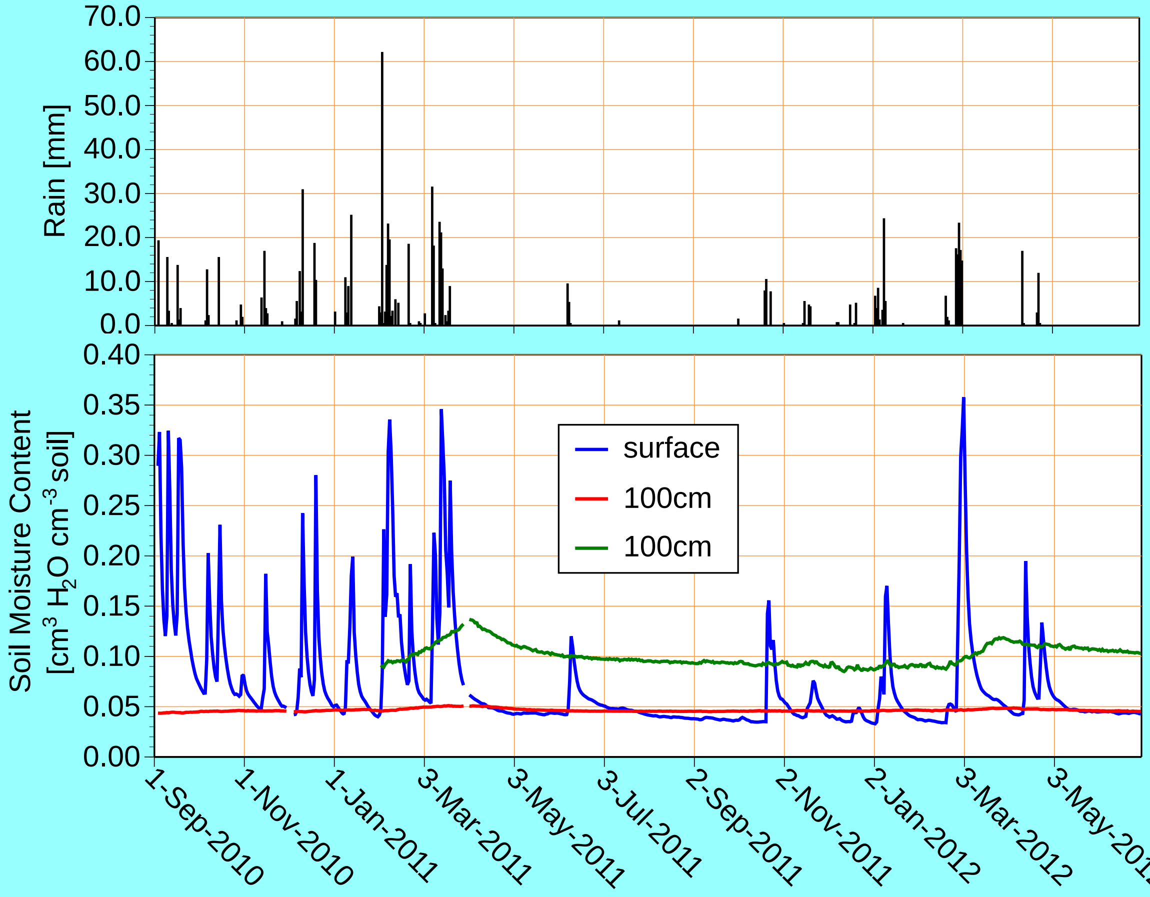


Hydrology

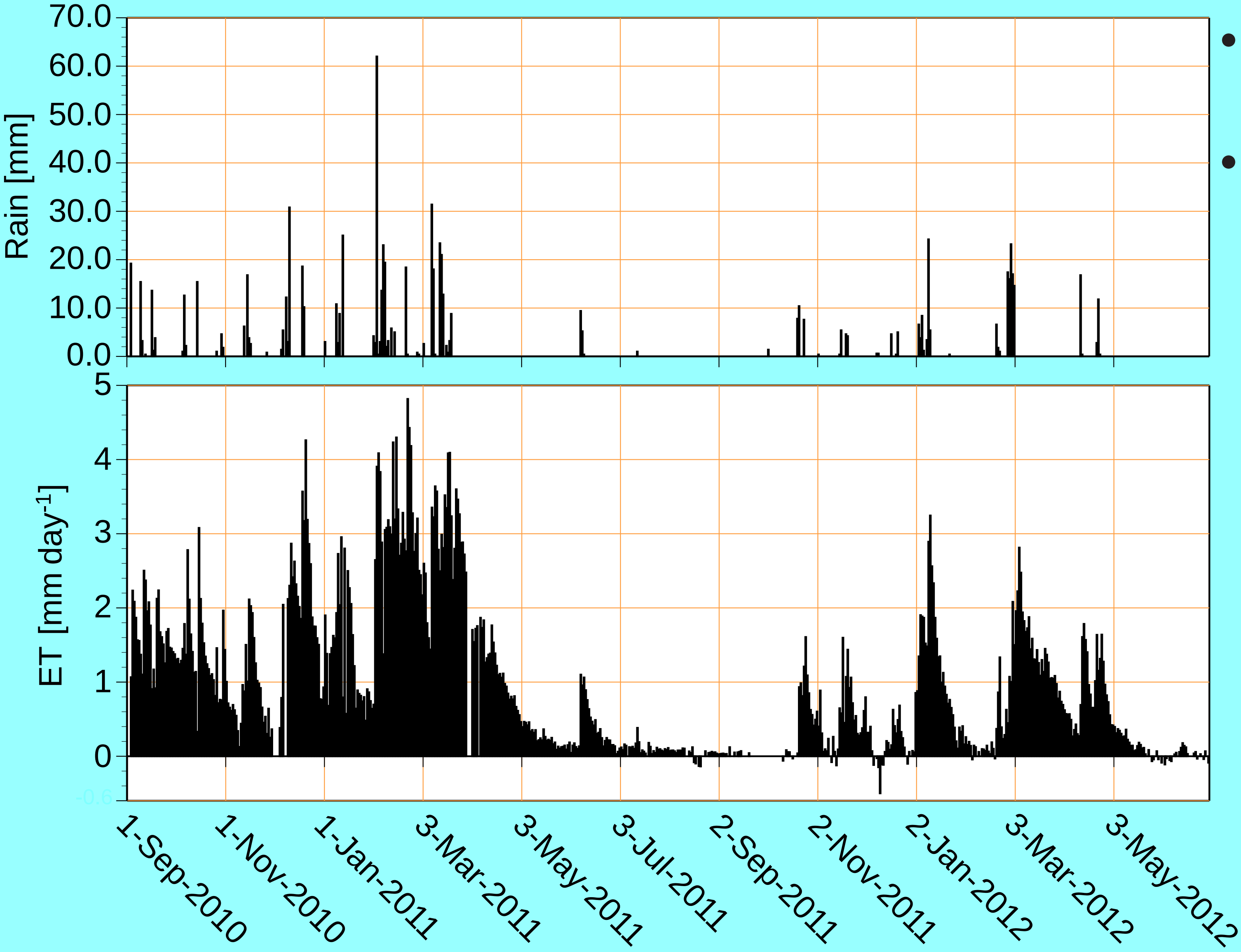
Rainfall and Soil Moisture

Hypotheses:

- ***Deep soil moisture variably-responsive to precipitation regime***
- ***ET during the wet higher than other global semi-arid ecosystems but negligible after sustained drought (High precipitation variability)***
- ***Bulk ecosystem conductance responds more readily to vapour pressure deficit during wet conditions***



Hydrology
Evapotranspiration



- ***Peak ET rates > 4 mm/day***
- ***ET < 0 during dry conditions***
- ***Exponential de-cline***

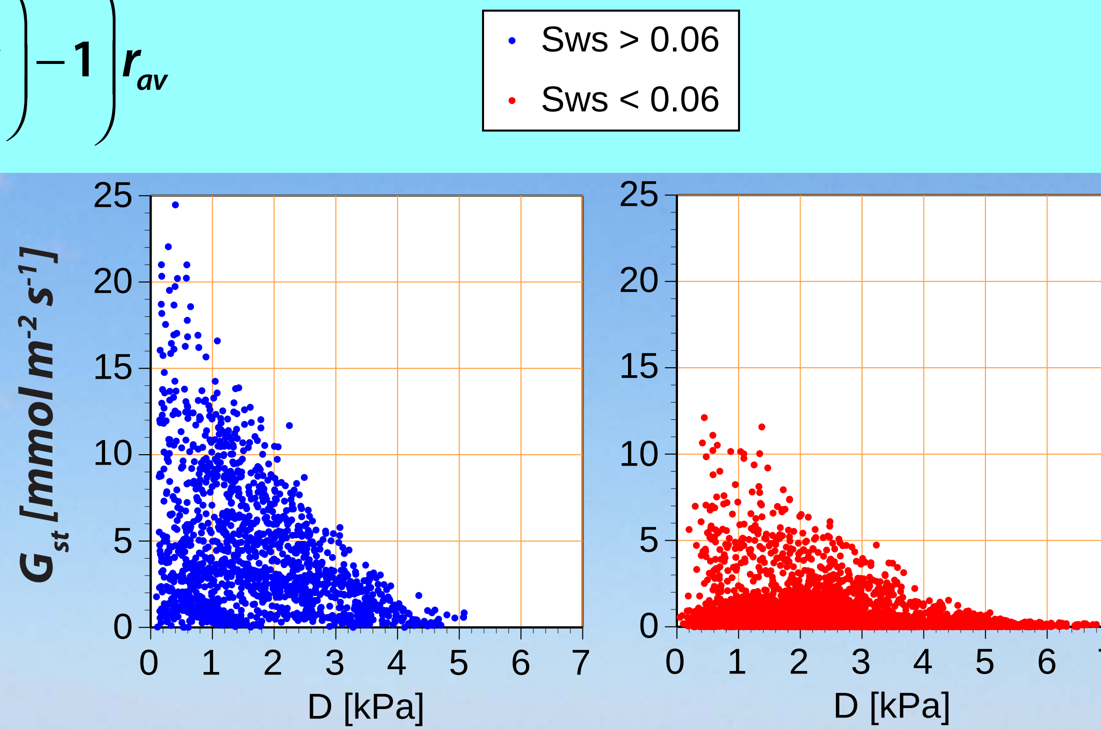
Hydrology
Bulk stomatal conductance

$$r_{st} = \left(\left(\left(\frac{\Delta \left(E_A / \lambda \right) + \rho c_P \left(VPD / \lambda r_{av} \right)}{\overline{w'q'}} - \Delta \right) \Big/ \gamma \right) - 1 \right) r_{av}$$

$$r_{av} = \frac{1}{U C_E}$$

$$C_E = \frac{\overline{w'q'}}{U \left(q_a - q_s \right)}$$

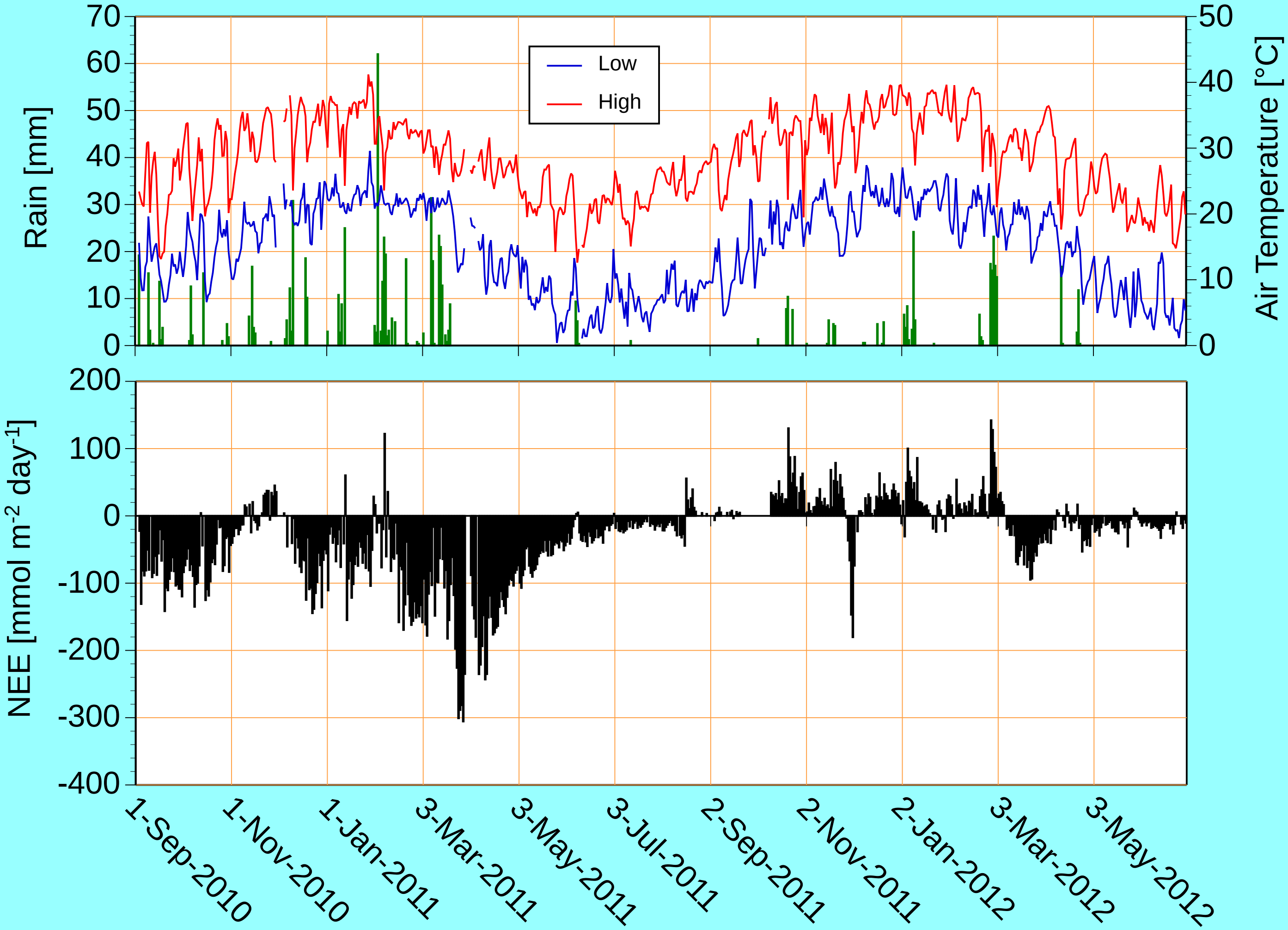
(Brutsaert 1982, Stull 1988)



Carbon
NEE

Hypotheses:

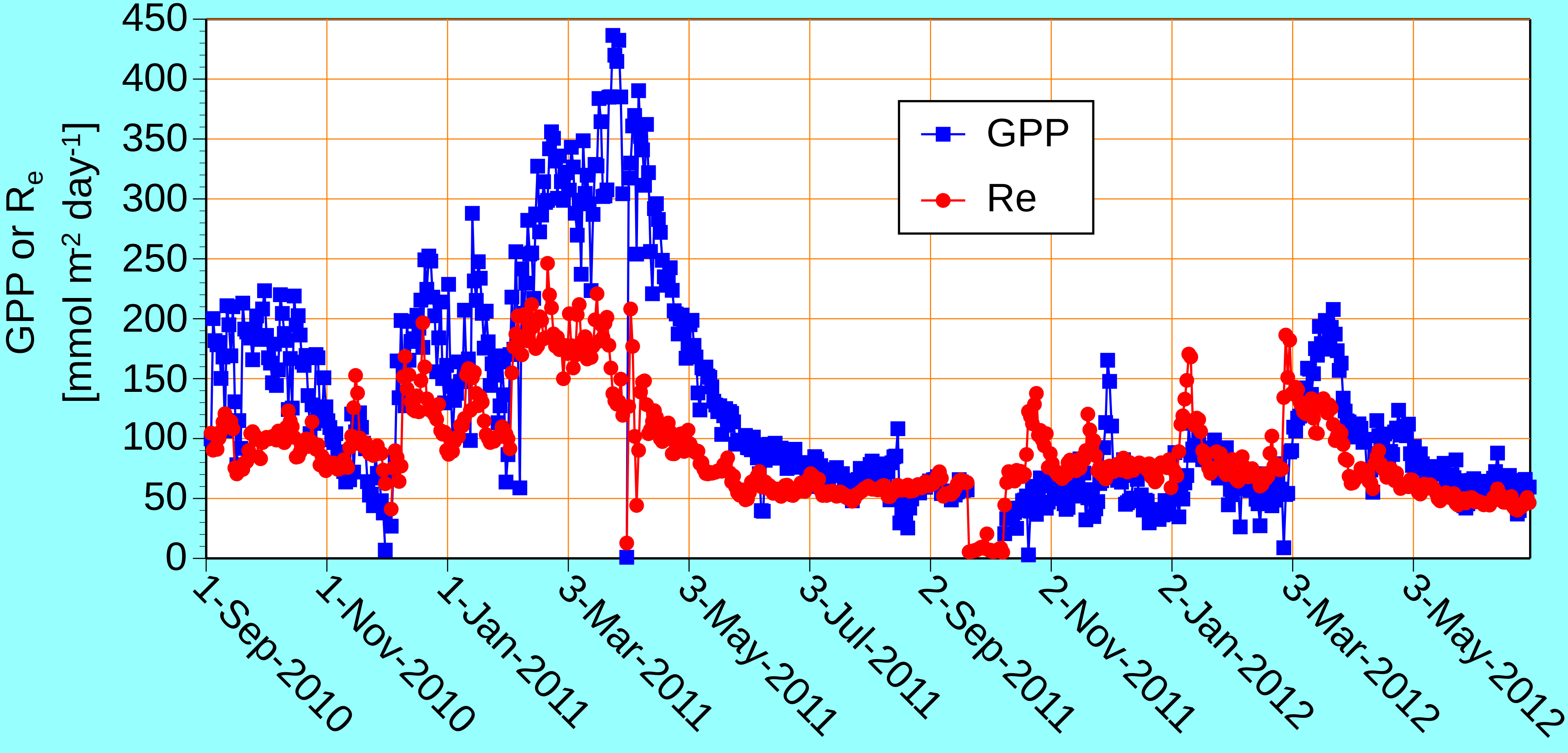
- ***Stronger carbon sink strength when wet than source strength when dry***
- ***R_e and GPP dictated by temperature, soil moisture and seasonal phenology (substrate)***



- ***November $F_c > 0$***

Carbon
R_e and GPP

- ***GPP declines during drought, but R_e also declines such that GPP tends to exceed R_e***
- ***R_e responds rapidly and consistently to rainfall during drought***
- ***GPP responses to rainfall during drought are slower and do not follow all events***

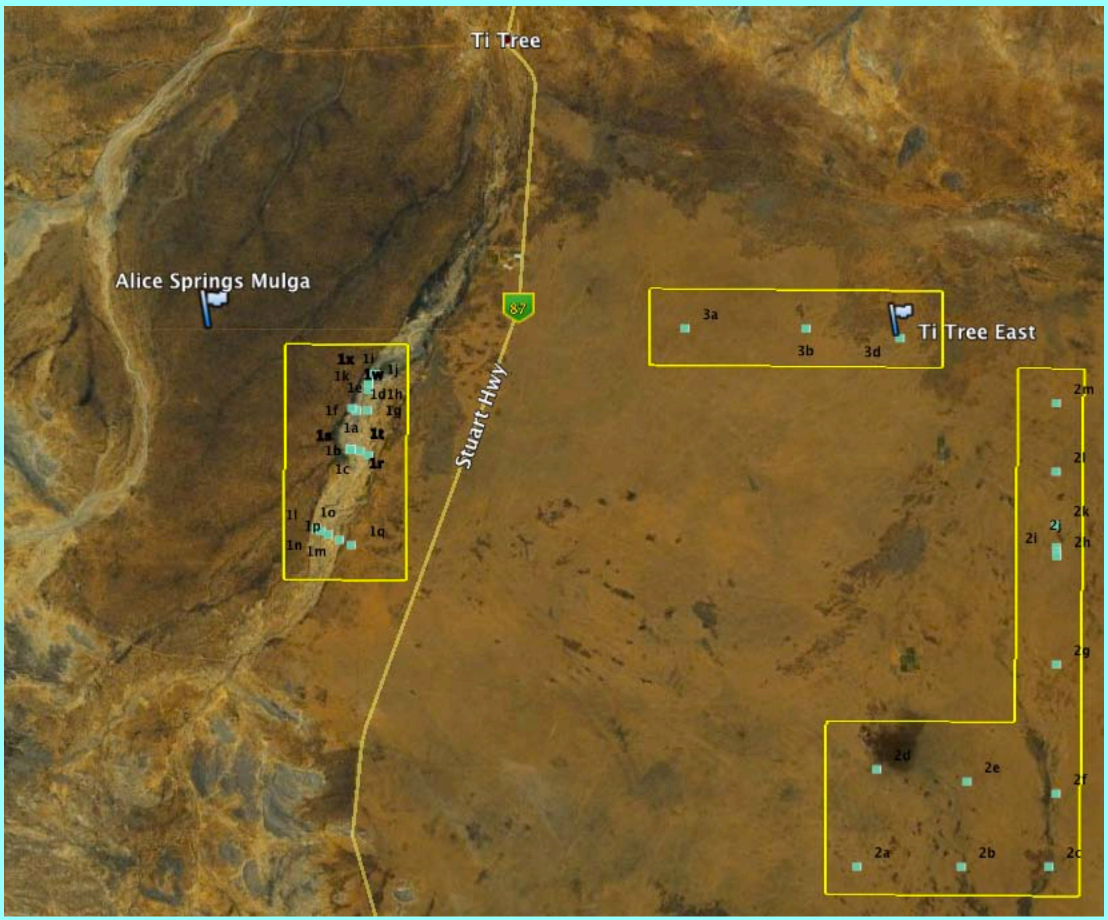


Alice Mulga TERN Supersite
Ti Tree NCGRT Superscience Site

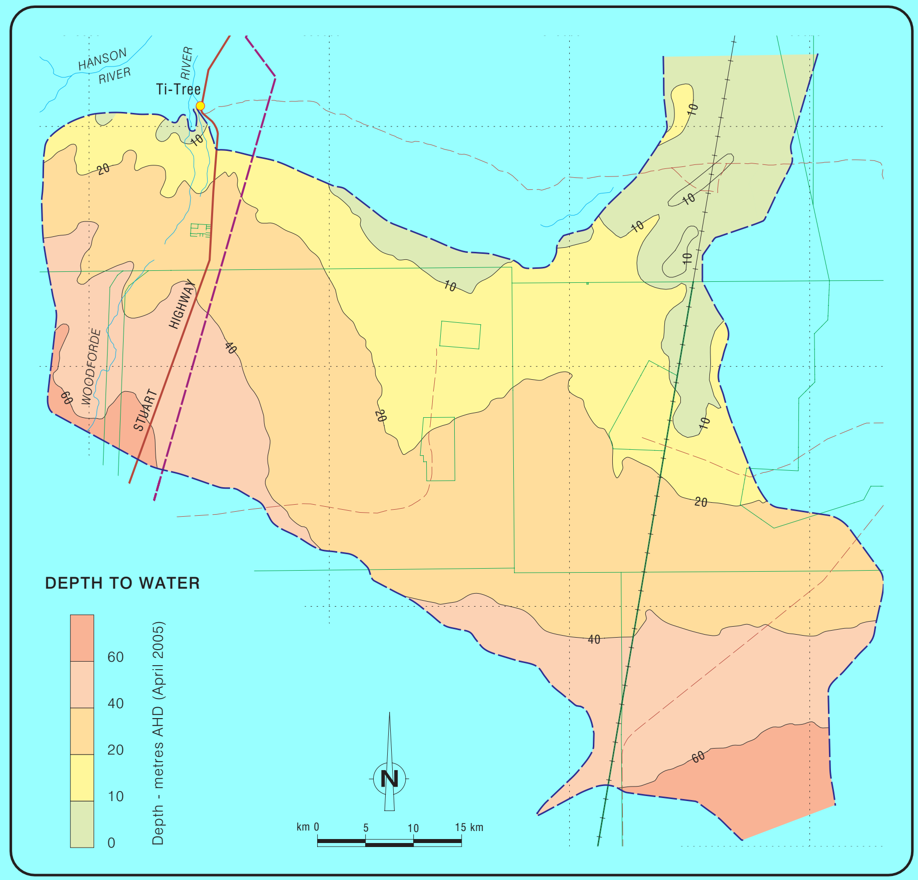
Australian Government
National Water Commission
Australian Research Council

NATIONAL CENTRE FOR
GROUNDWATER RESEARCH AND TRAINING
sustaining a vital water resource

- ***Horizontally heterogeneous***
- ***Clumped mulga in semi-arid savanna***
- ***Depth to water: estimated between 7 and 10 metres belowground***



DEPTH TO WATER



Ti Tree East
EC tower

April – May 2012:

- **Footings dug and concrete poured**
- **Underground conduit run through trenches**
- **10 m tower erected**

July 2012:

- **System to be brought on-line**

Ti Tree East
Ecosystem characteristics

- **3 ground habitats for soil sensor arrays:**
  mulga, spinifex-mulga ecotone, inter-mulga and understory grasses

AusCover

Vegetation plots established

- ***Three plots associated with each tower***
- ***One plot within the footprint of the Alice Springs Mulga tower (200 m)***
- ***Plots in representative ecosystems at Ti Tree East***


Thank you
Questions?