Carbon and Water fluxes in a tropical lowland rainforest in Far North Queensland

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DAINTREE OZFLUX SITES

- Pristine lowland rainforest at both stations.
- Elevation: 50 - 100m

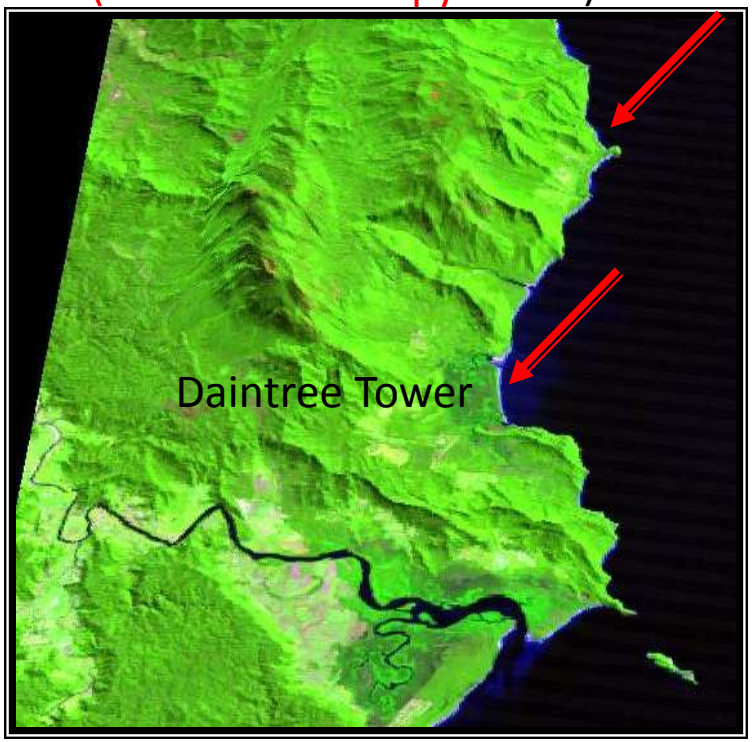
- Complex Type 1A mesophyll vine forest (cyclone scrub)
- Canopy height 25-35m
- Stems/ha ≈ 700 (10cm dbh)
- Species – 70 - 90
- Leaf area index ≈ 4

- T_{mean}: 24°C

  (daily min-max 21-29 °C)

- Rainfall: ≈ 5730mm

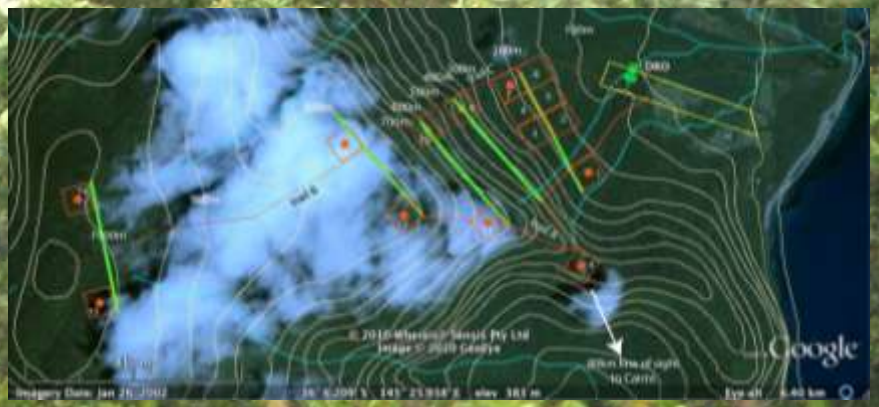
Daintree Rainforest Observatory
(Australian Canopy Crane)



DAINTREE TOWER

- TERN Ozflux Standard system.
- Running since December 2008.

DAINTREE RAINFOREST OBSERVATORY

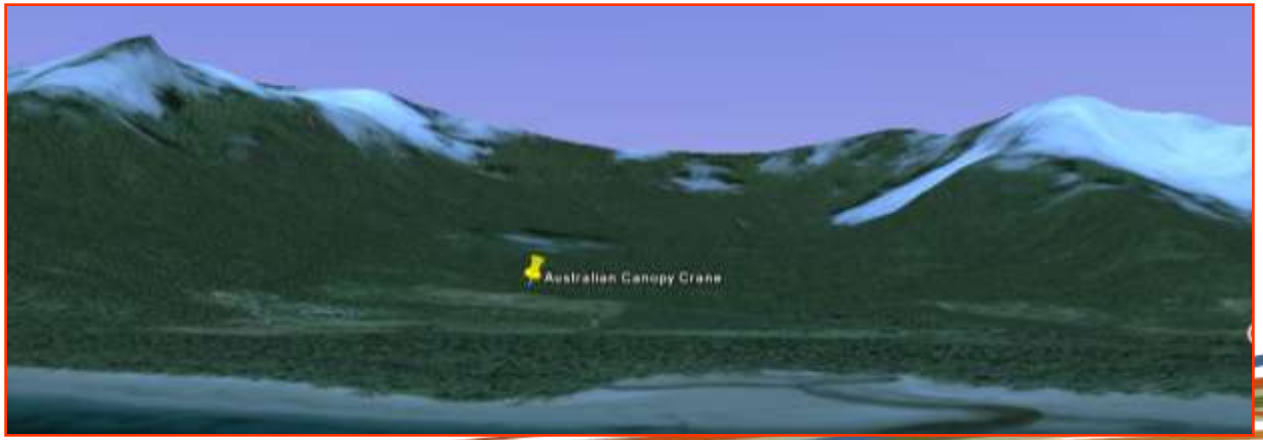


JAMES COOK UNIVERSITY
AUSTRALIA

AUSTRALIAN
CANOPY CRANE
RESEARCH STATION

DAINTREE RAINFOREST OBSERVATORY

- Cape Tribulation Ozflux station. Australian Canopy Crane
- Running since December 2001.
- TERN Ozflux Standard system since March 2012.



MONITORING OZFLUX SITES

- **Real time [monitoring](#).**

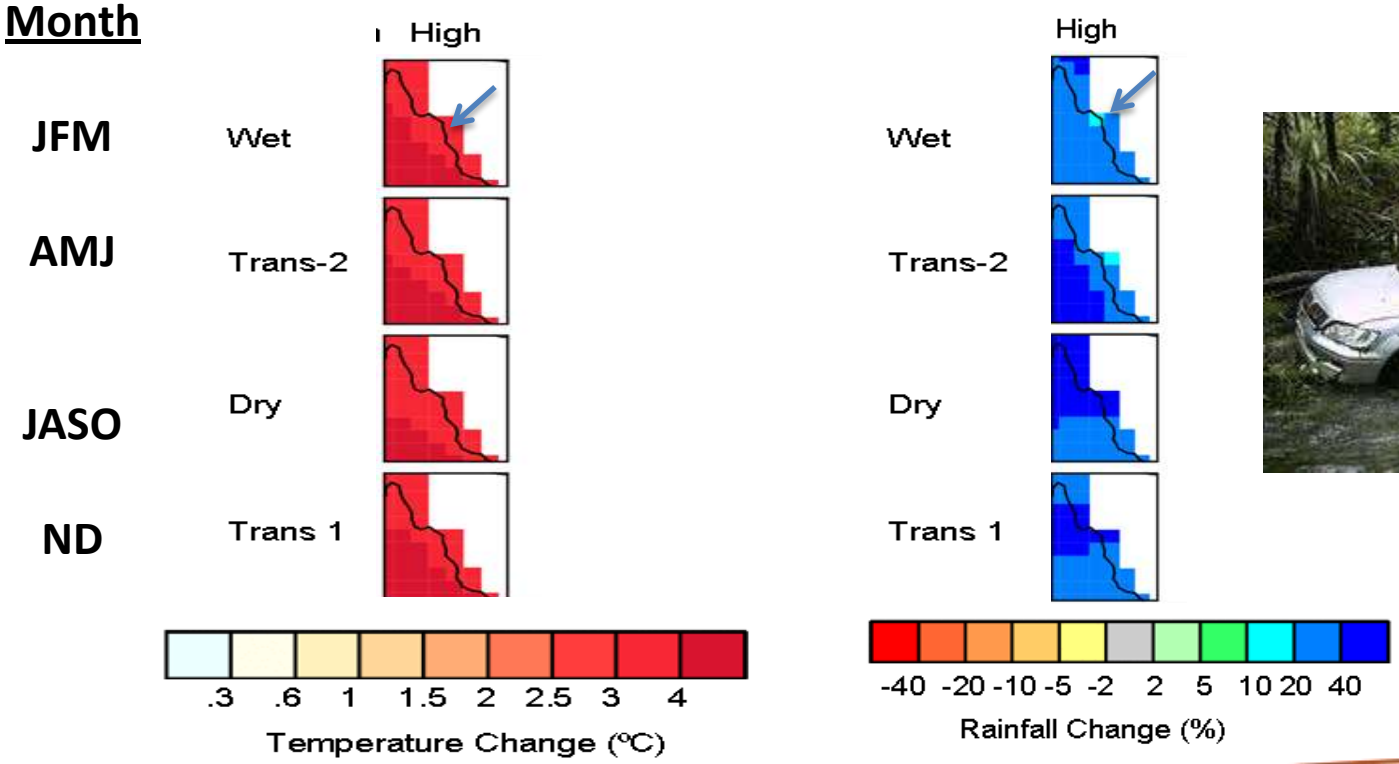
FNQ SUPERSITE OZFLUX SITES
THE RELEVANCE OF LOCATIONS

	Regional Ecosystem (1:25 000)	BVG (1:1 million)	BVG (1:2 million)	BVG (1:5 million)
Robson Creek upland	340 ha [7.3.36a]	30,000 ha [1b:CMVF-NVF on Tablelands]	60,000 ha [complex mesophyll to notophyll vine forests]	700,000 ha [type 1: rainforests, scrub]
Daintree Rainforest upland	**4,000 ha [7.3.17]**	**30,000 ha [1a: CMVF-NVF in very wet locations]**		

- **Vertebrate fauna : 28%**
- **Native flora : 10%**
- **Landmass : 0.2%**

FUTURE CLIMATE

- **High-end (90th percentile) projected increases in seasonal average T(ºC) and rainfall under high (SRES A1FI) emissions scenarios for 2070. (Source: CSIRO CMAR Suppiah 2010)**



DAINTREE OZFLUX SITES

- **Season Rainfall changes (mm/day) from downscaled simulations from the Mk 3.5 GCM to a 14km grid. (Source: Suppiah 2010)**

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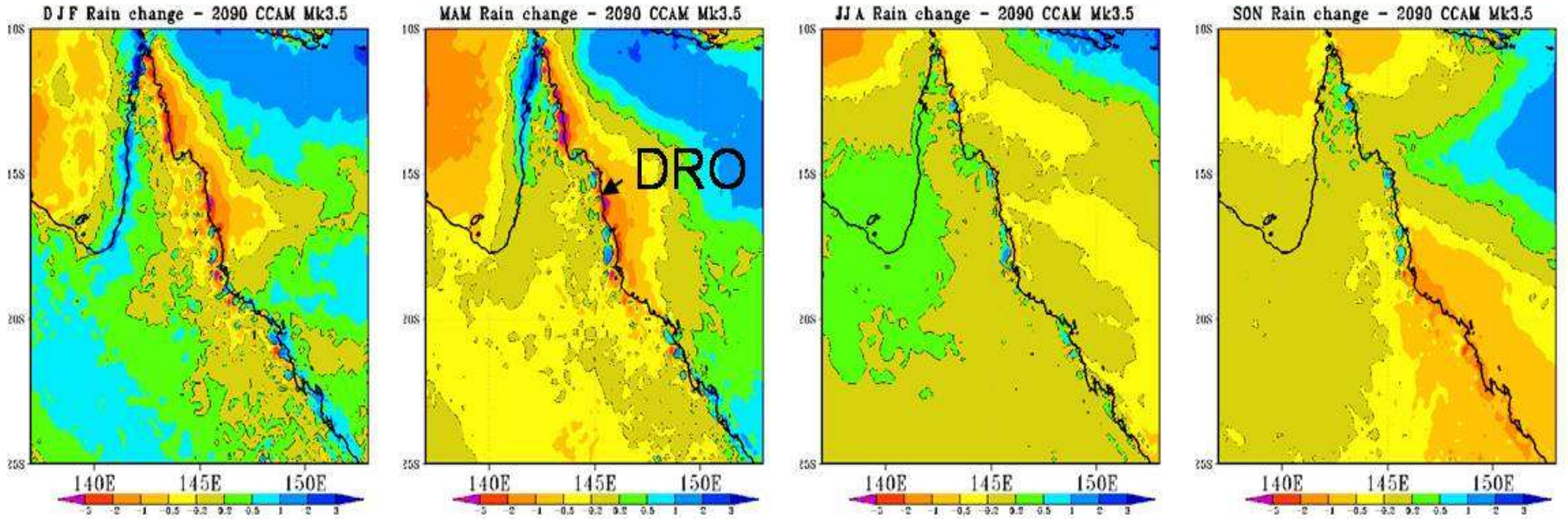
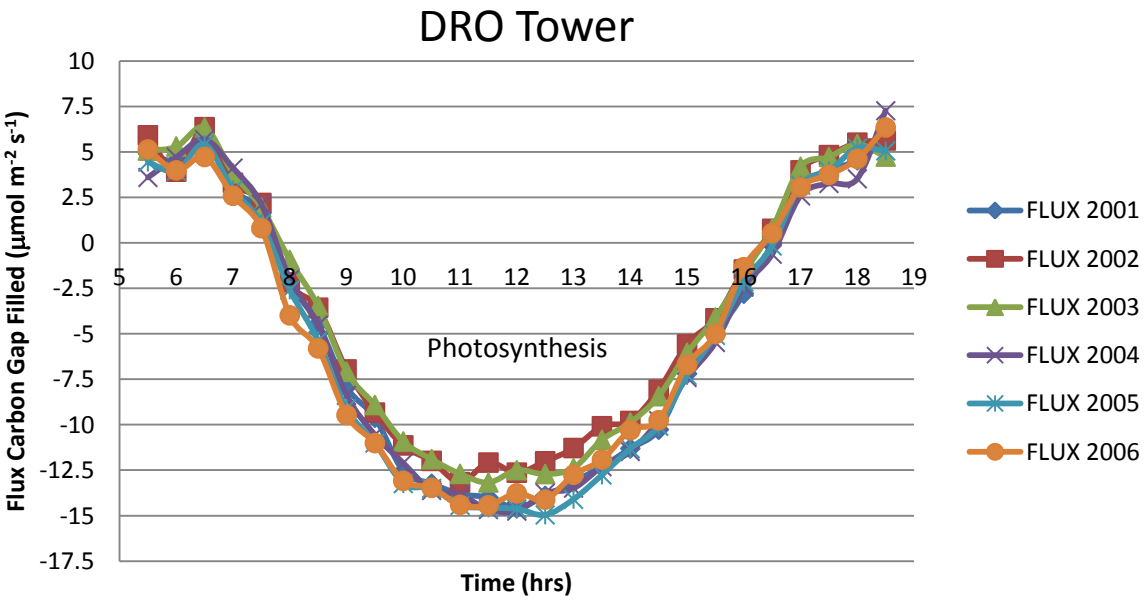
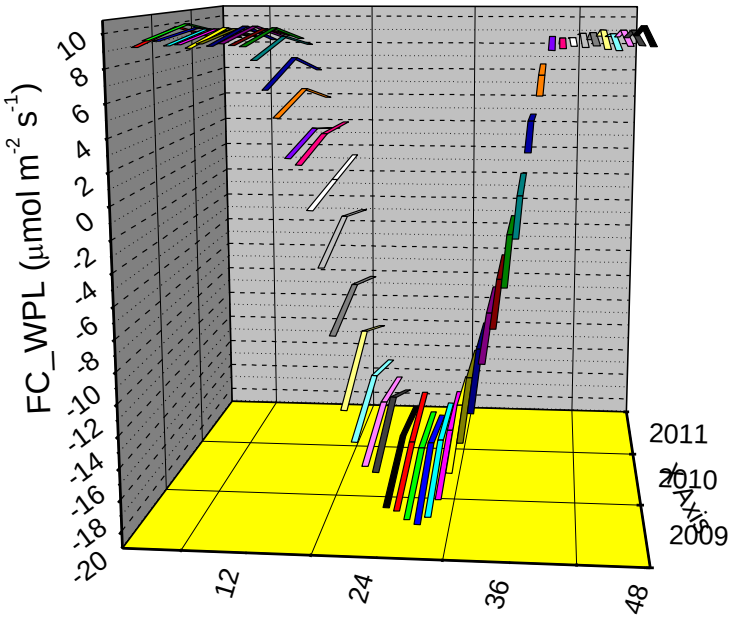


CARBON FLUXES AND DRIVERS

- Rainfall, solar radiation and temperature are the big drivers of the carbon fluxes.
- The drought of 2002, 2003 reduced the photosynthetic output of the forest.



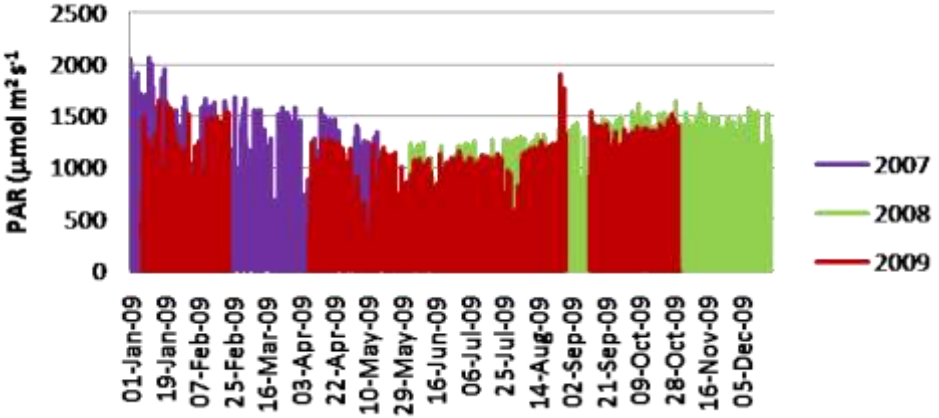
Daintree Tower

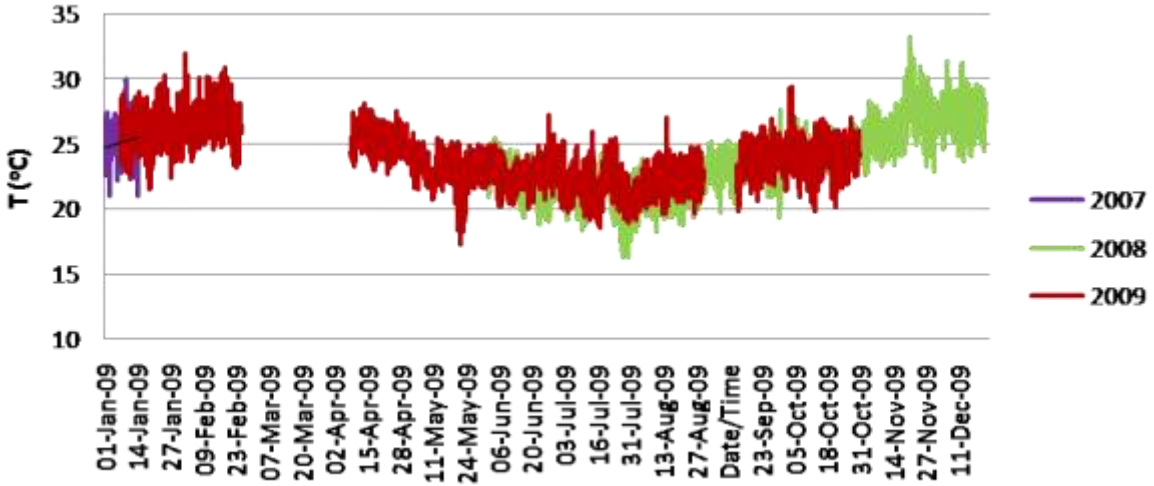


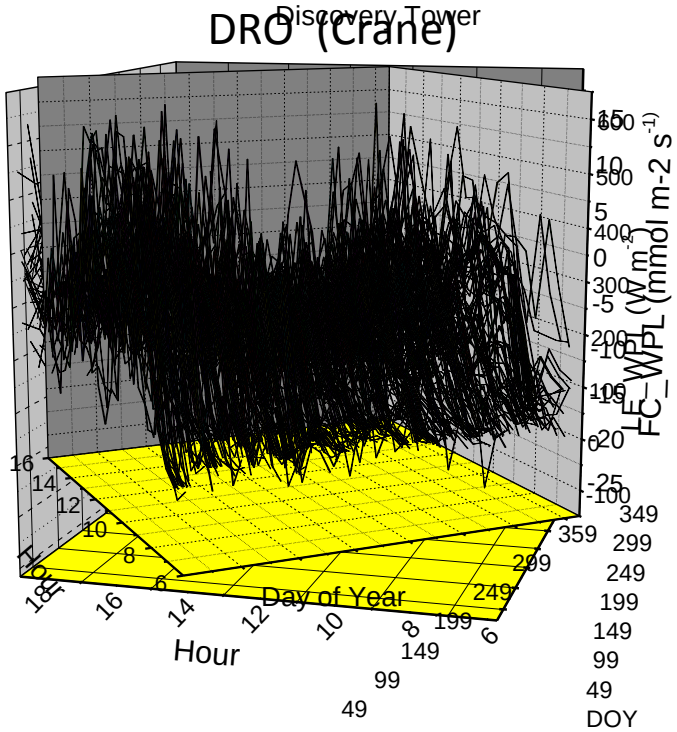
- The wet year of 2010 influenced both respiration and photosynthesis.

CARBON AND WATER FLUXES

- **PAR and temperature have strong seasonal trends.**

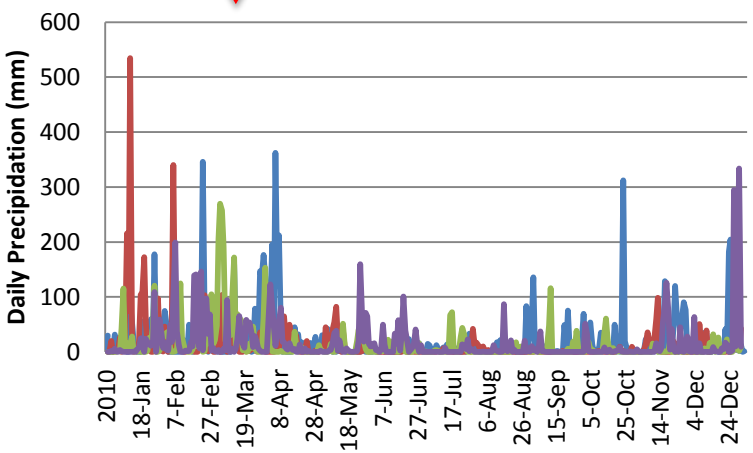


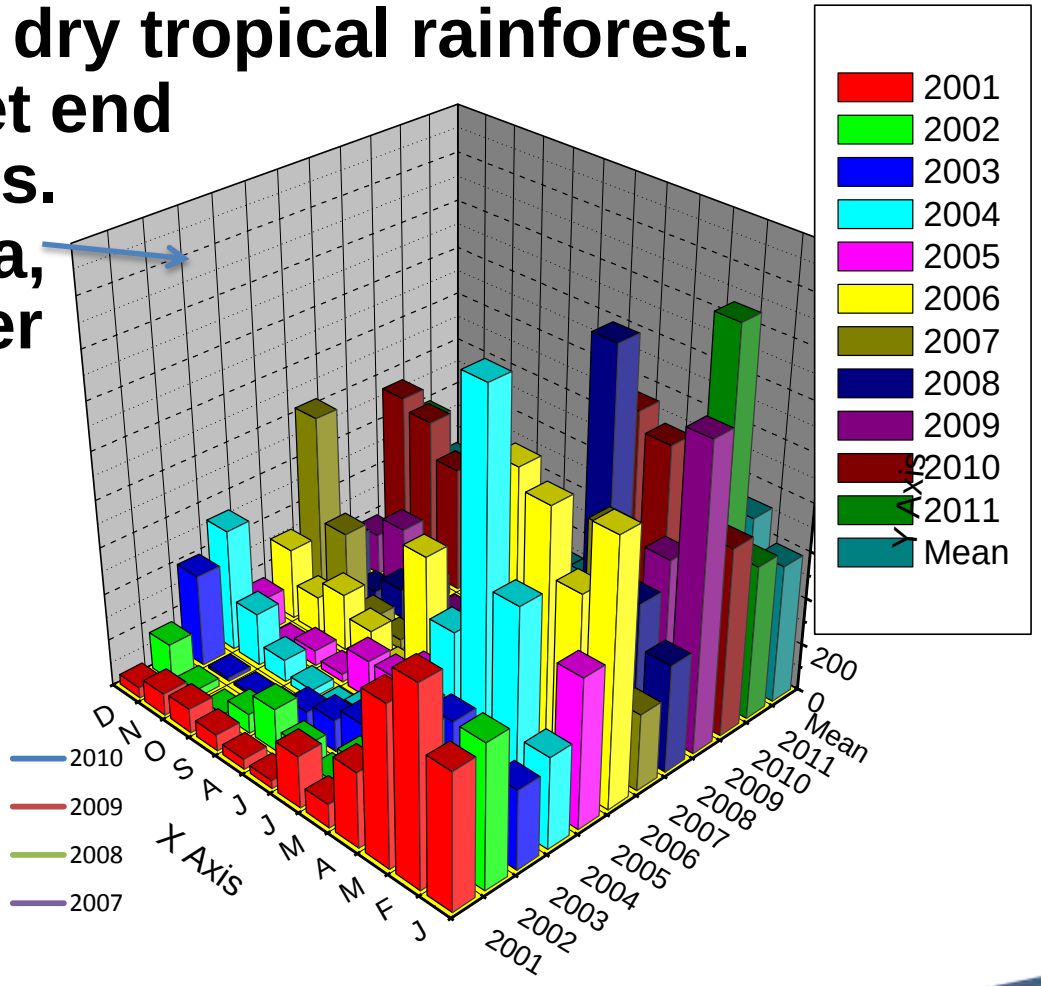




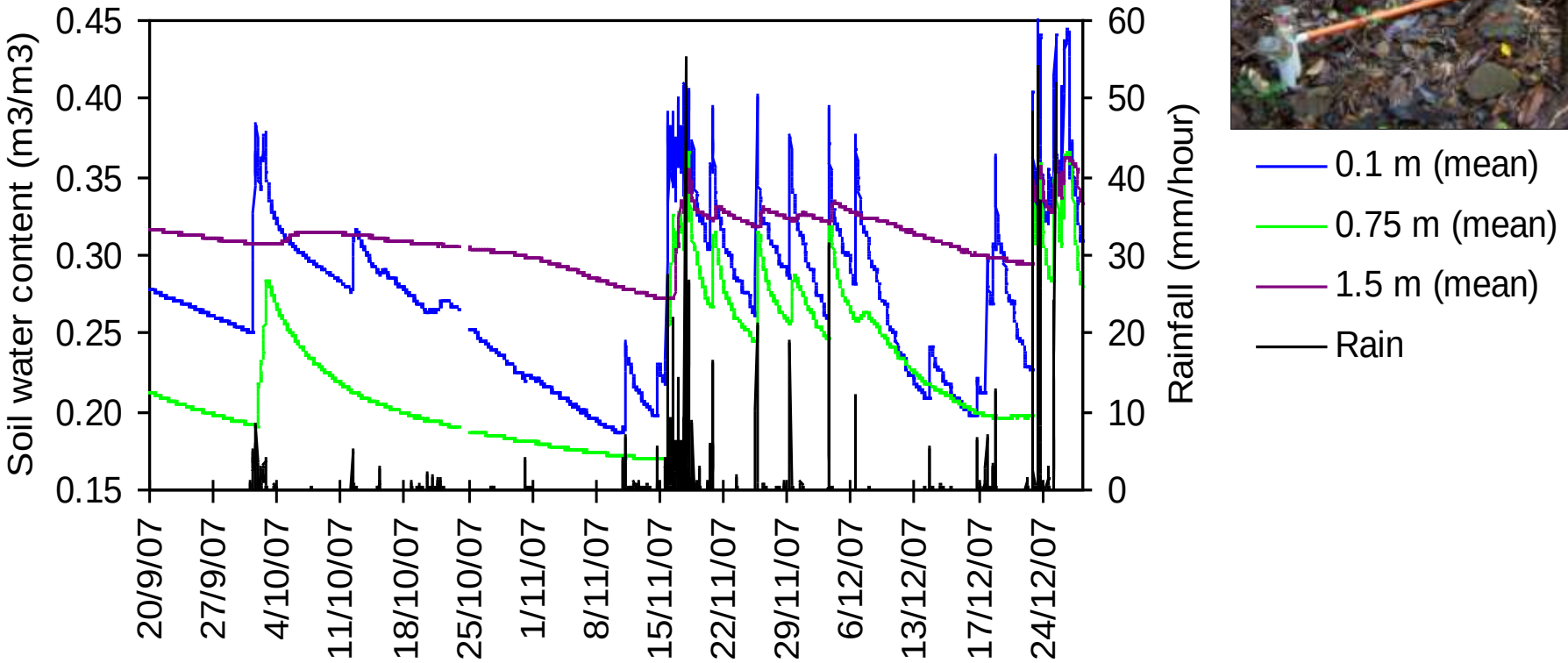
RAINFALL – THE BIG DRIVER

- This is a seasonally dry tropical rainforest.
- But .... it is at the wet end of lowland rainforests.
- This is the BOM data, the DRO is much wetter (around 1.5m) and it is 1.5km away!



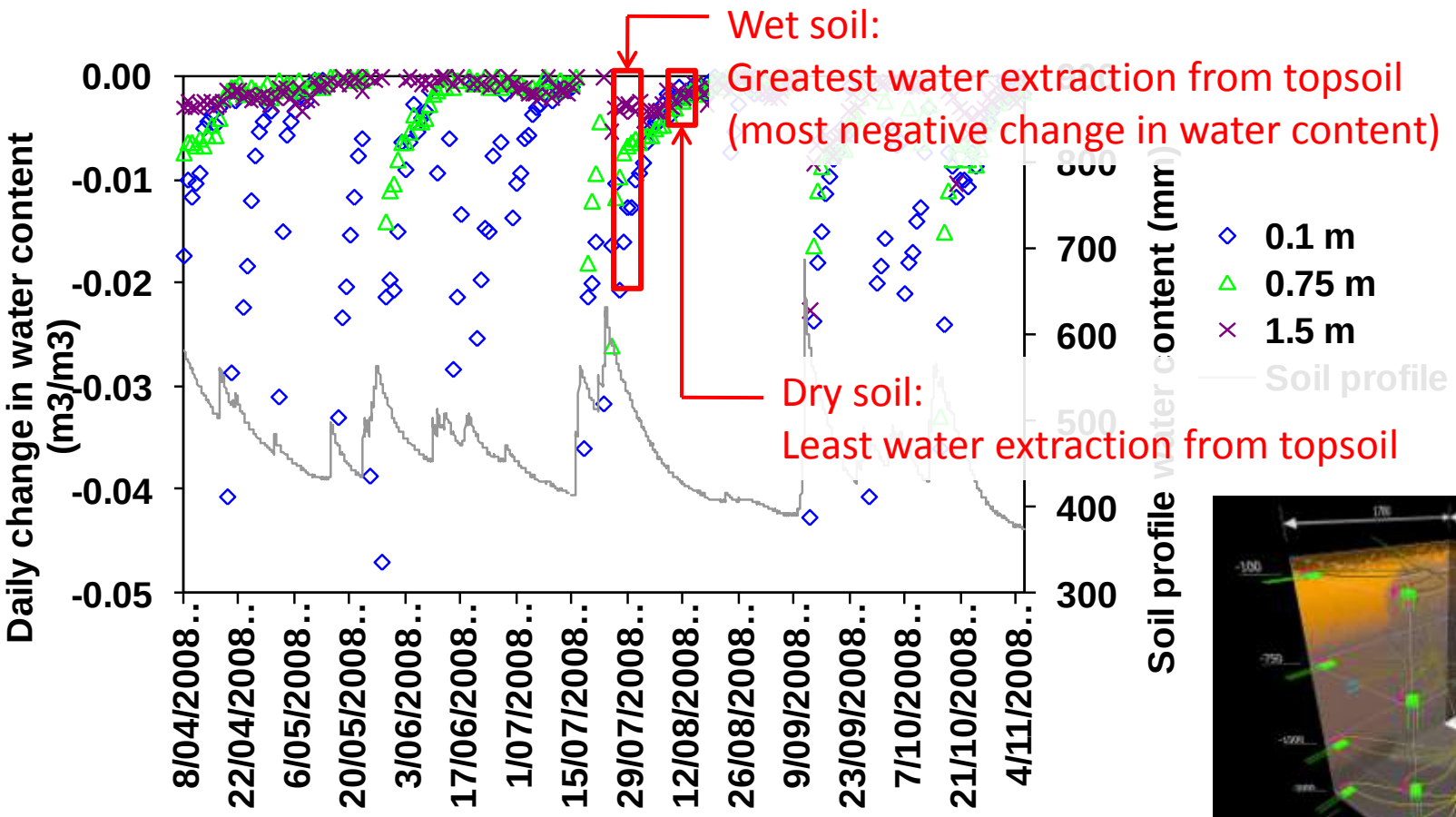


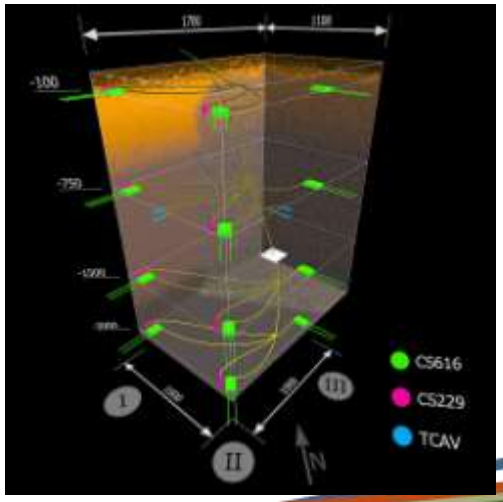
SUB-SURFACE WATER STORAGE



- **Sensors:**
  - **Temperature (thermocouple)**
  - **Water content (TDR probes)**
  - **Water potential (Gypsum blocks)**

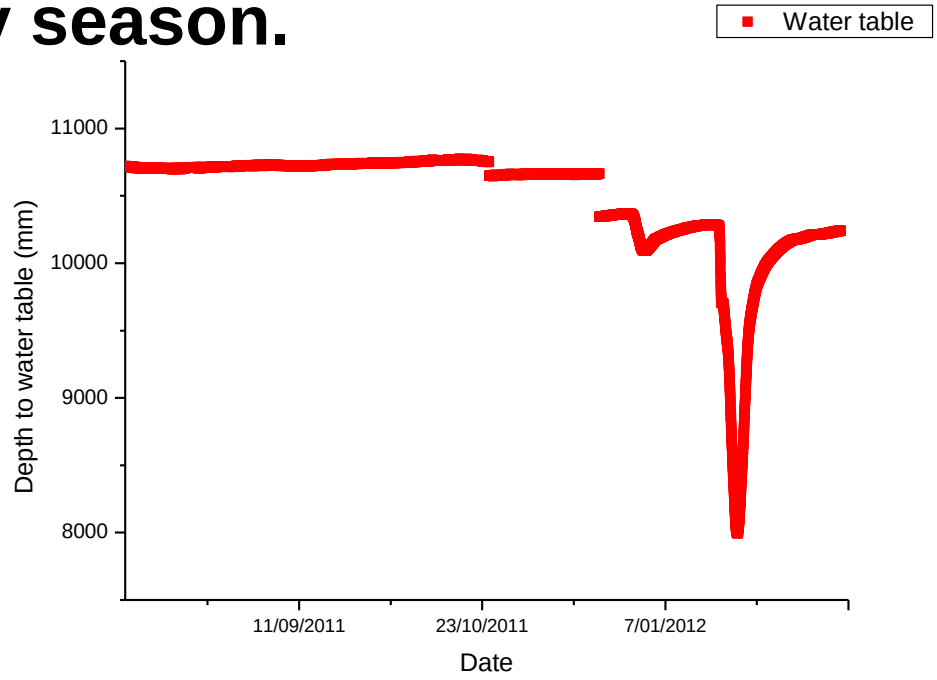
WATER UPTAKE vs DEPTH





GROUNDWATER

- Installed 3 bores to measure uptake from groundwater
- Bedrock at 12-33 m depth
- Very little variation in depth to watertable at the end of the dry season.

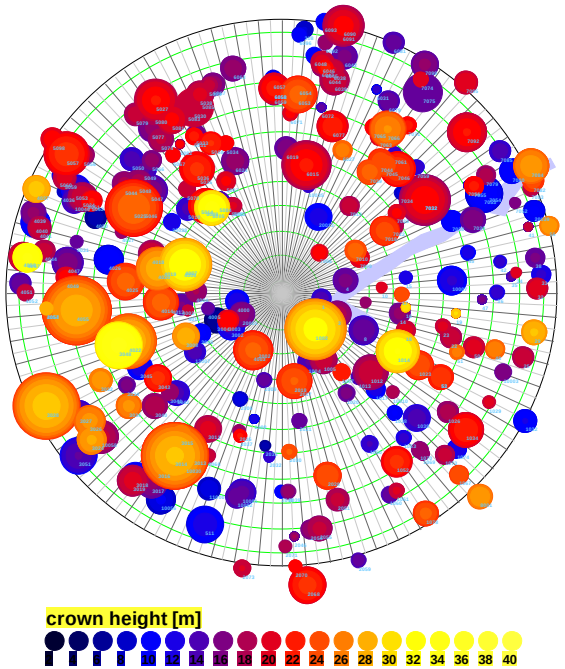


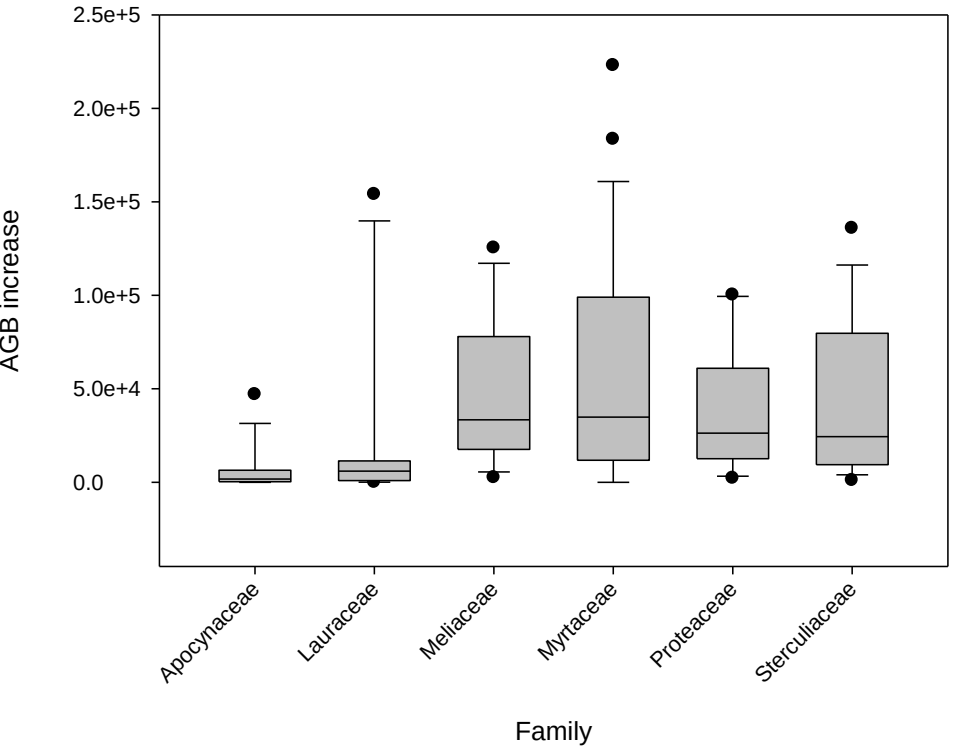
BIOMETRIC BALANCE

- We are looking at the change in the above-ground tree biomass AGB.
- There have been 3 census intervals 2000, 2005, 2010.
- In addition dendrometer bands have been placed on 270 trees.
- During the census period the forest has increased in AGB by 9.1 t/ha.

ALLOMETRY

- Species specific allometric equations have been developed along with general species equations allowing calculation of site biomass = 271 t ha^{-1}

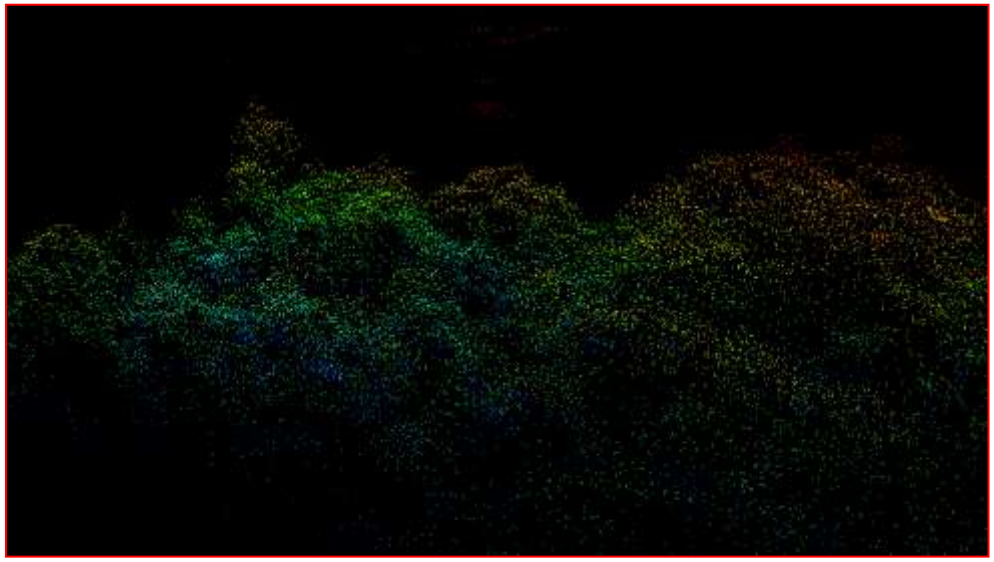


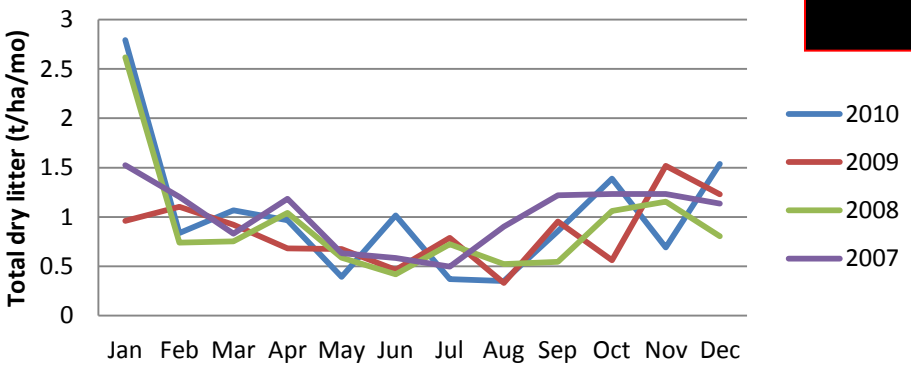


- Detailed measurements of crown dimensions allows the forest architecture to be monitored quantitatively.

CARBON IN PLOTS

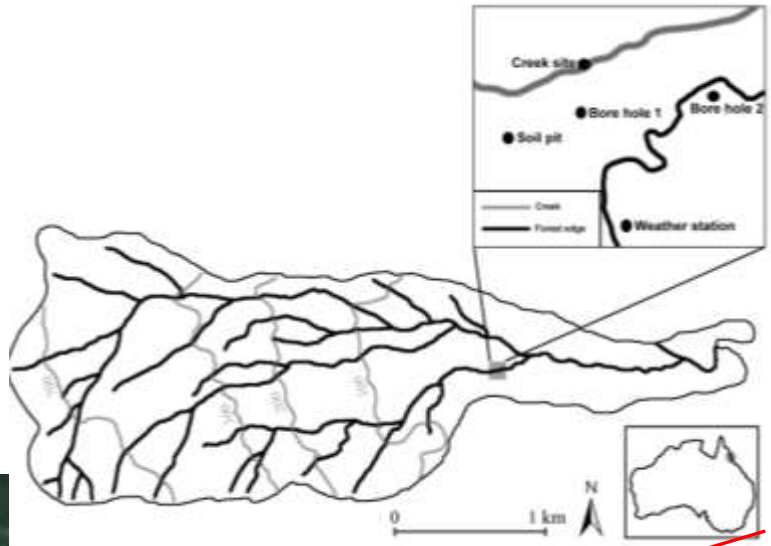
- Other components of the biomass flux are measured such as fine leaf litter. Turnover around 3%of AGB/yr.
- Water is not a major driver of changes in this flux. Unless there are drought conditions.
- Instead the main driver is wind events.



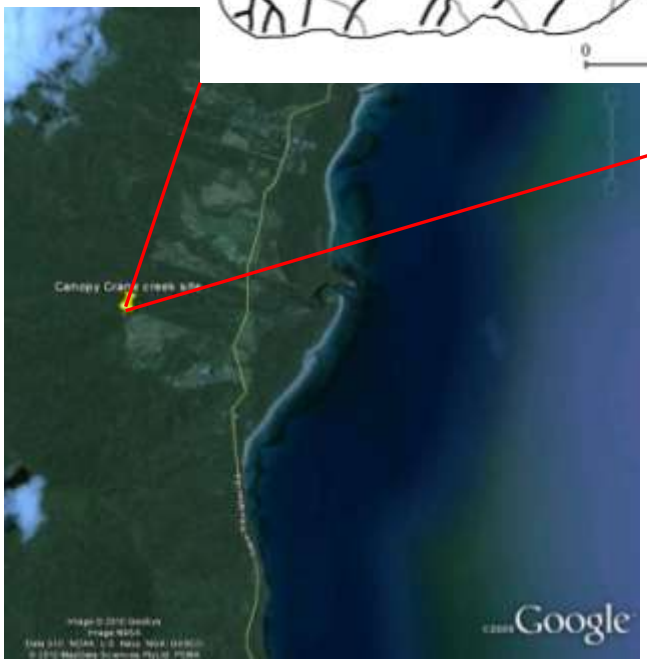


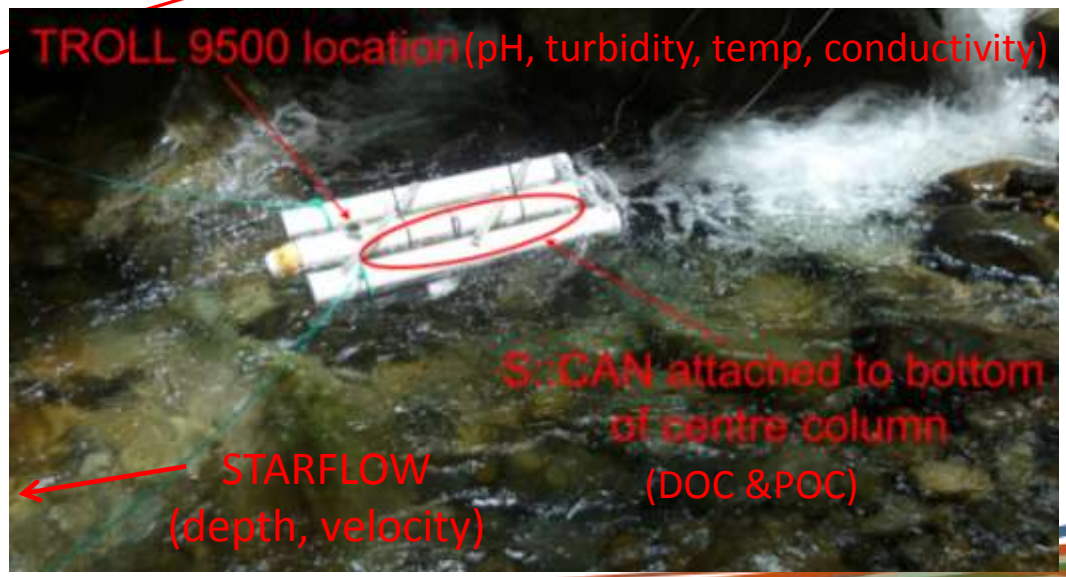
- LIDAR surveys have been carried out.

QUANTIFYING AQUATIC CARBON FLUX

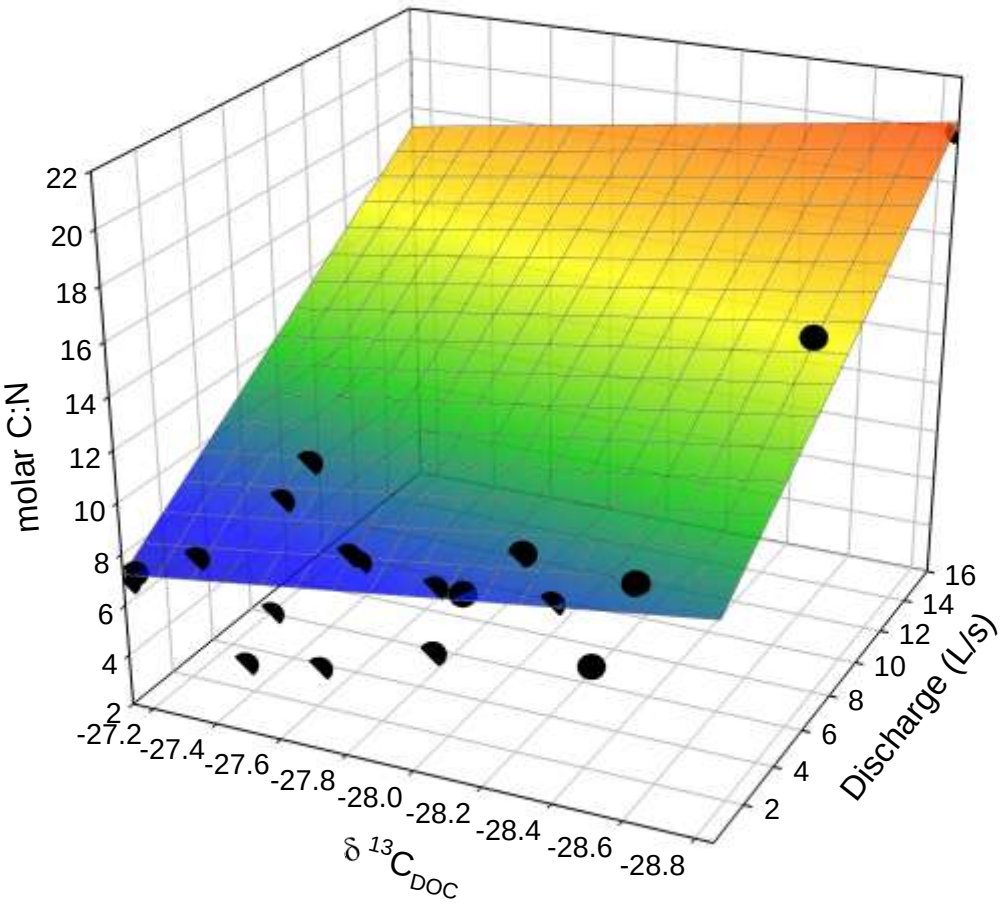


How much dissolved and particulate carbon (DOC &POC) are transported from wet-dry rainforest at the Daintree Rainforest Observatory?





DISCHARGE EFFECT ON THE SOURCE OF DOC



Preliminary data shows molar C:N and $\delta^{13}C_{DOC}$ increase with increasing discharge. This suggests during flood events organic carbon from the surface soil layers is mobilised and dominates export. During low flow groundwater export dominates.

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