Welcome to the 2013 OzFlux Workshop

Michael Liddell (James Cook University)
Helen Cleugh and Eva van Gorsel (CSIRO)
OzFlux: the story so far and future directions
A short history of OzFlux

Australian flux monitoring in mid 1990s
(OASIS: 1994 and 1995)
A short history of OzFlux

Charles Darwin and Monash Universities
Howard Springs (ca. 2000)
A short history of OzFlux

CSIRO: Tumbarumba in 2000
By 2001, OzFlux was a vision shared across CSIRO, ANU, Monash and Charles Darwin Universities.... but really a network in search of some flux towers.
TERN - OzFlux: Achievements

1. NCRIS infrastructure investment in TERN in 2009 enabled OzFlux to grow:
   • A continental network – hardware, software
   • Nationally-consistent methods
   • OzFlux community – Workshops & training
   • Database – Monash eResearch Centre, funded by ANDS (Australian National Data Service)

with co-investment from Unis, ARC, CSIRO ...
TERN - OzFlux: Achievements

2. A network of **flux towers and supporting infrastructure**
   
   • Sensors, data acquisition and power supply
   • Telecommunications
   • Standardised across network of remote sites
From just 4 flux towers and 3 agencies in 2003 ...

... to 23 flux towers at remote sites around Australia (not all TERN funded) in 2012

Operated by 10 agencies
TERN - OzFlux: Achievements

3. A network of flux towers **plus data infrastructure**

- Technically sophisticated and complex
- Standardised approaches
- Automated processing and QC/QA
- Coordinated by OzFlux Central node – data checking, problem solving, data management

All have represented big challenges for OzFlux
TERN - OzFlux: Achievements

4. A network of flux towers and people!

- OzFlux Annual Workshops
- OzFlux Training Days: the art of flux measurements, data processing, .....
4. A network of flux towers and people!

- OzFlux and TERN websites

- OzFlux Project on ResearchGate
  - [https://www.researchgate.net/project/OzFlux/](https://www.researchgate.net/project/OzFlux/)

- FLUXNET
11 years of ecosystem breathing at Tumbarumba, NSW

A snapshot of 1-year from Howard Springs, NT
TERN - OzFlux: Relevance and impacts

OzFlux and TERN: data and process understanding needed for research addressing national research priorities:

- Ecosystem science
- Sustainable resource management: carbon, water
- Carbon – climate – water interactions
- Ecosystem health and State of the Environment assessments
… the TERN infrastructure “ecosystem”
Some climate policy questions *and* the research needed to provide the answers

What is the role of natural land and ocean sinks in sequestering greenhouse gas (GHG) emissions and what will happen to these sinks in the future?

- *Carbon cycle observations that track the uptake and release of greenhouse gases in land, air and oceans*
- *How does climate change and variability affect Australia’s carbon budget (sources and sinks; anthropogenic and biogenic)?*
- *Climate models (such as ACCESS) include coupled carbon and water cycle*
Some climate policy questions and the research needed to provide the answers

- Can natural land sinks mitigate Australia’s GHG emissions?
- What is the impact of natural disturbance regimes; how are they changing?

  • Investigate how climate and land management affect the stability of Australia’s land-based carbon sinks
  • How will carbon dioxide fertilisation affect Australian vegetation?
  • Ensuring global and regional climate simulations represent Australian terrestrial ecosystem processes
TERN - OzFlux: Relevance and impacts

A capability to determine carbon and water budgets at ecosystem to continental scales

- Uptake and release of CO2 and other GHG [fluxes]
- Carbon stocks in soil, plants and air [stores]
- Water and carbon
- Measurements and models

.... the TERN infrastructure “ecosystem”
Knowledge of ecosystem exchange of carbon, water and energy

OzFlux Network
- CO₂ and H₂O Fluxes
- Radiation
- Meteorology

AusPlots and Australian Supersites Network
- Site characteristics
- Biomass
- Soil carbon & nutrients
- Leaf-level photosynthesis

AusCover
- Vegetation type
- GPP
- Veg indices (NDVI, EVI)
- Leaf area index
- Fire
- Canopy properties .....

eMAST
- Data assimilation and integration into modelling applications

.... the TERN infrastructure “ecosystem”
TERN - OzFlux: Relevance and impacts

OzFlux and TERN

- Australian Water Resources Assessments
- Australian Climate Change Science Program
- Climate and Earth System Modelling (ACCESS)
- Regional carbon and water budgets (e.g. RECCAP)

Australian ecosystem and climate science
TERN - OzFlux: Relevance and impacts

Global ecosystem, climate and Earth system science
Future Priorities and Directions

1. Acquiring and sharing quality data
   • Measurement and analysis techniques
   • Data quality
   • Data access, sharing and curation

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Courtesy Peter Isaac
Future Priorities and Directions

2. Site and Network enhancements

- Sustainability of sites and network
- Broader suite of observations
- Enhance continental coverage

![Graph showing number of sites funded by TERN and non-TERN](image)

Courtesy Peter Isaac
Future Priorities and Directions

3. Science and policy impact

OzFlux data used to:

- Test and improve land surface models [esp. CABLE]
  - Australian ecosystems in regional and global weather and climate models
- Constrain first comprehensive carbon budget
  - Significantly reduce the uncertainty in estimated NPP for Australia
- Quantify ecosystem response to land management, disturbance and climate variability
  - Subtropical and tropical savannas, SE forests, mulga ...
Future Priorities and Directions

Insights into carbon and water budget dynamics for the Australian continent, e.g. large interannual variability in NPP

- driven by available moisture
- larger than anthropogenic greenhouse gas emissions
Haverd et al. 2013 a, b. Biogeosciences

Australian CO₂ Budget

[CO₂-TgC yr⁻¹] Atmosphere 1990-2011

- Crop Consum [+9]
- Fossil Fuel Emitter [+95]
- Fire [+104]
- Land Use Change [+18]
- Soil Respiration [+1997]
- Livestock Consum [+2]
- Wood Decay [+5]
- Wood Crops
- Wood Export [-0.3]
- Livestock Export [+1]
- Crop Export [+140]
- Riverine Transport (+2)
- Dust Export [+2]

Biosphere

Non-Territorial

Net Primary Production [-2210]

Fossil Fuels

+235

-59

+20

+155
Future Priorities and Directions

3. Science and policy impact

The challenge:

• Demonstrate importance of OzFlux data for key research questions
Thank You and Questions

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