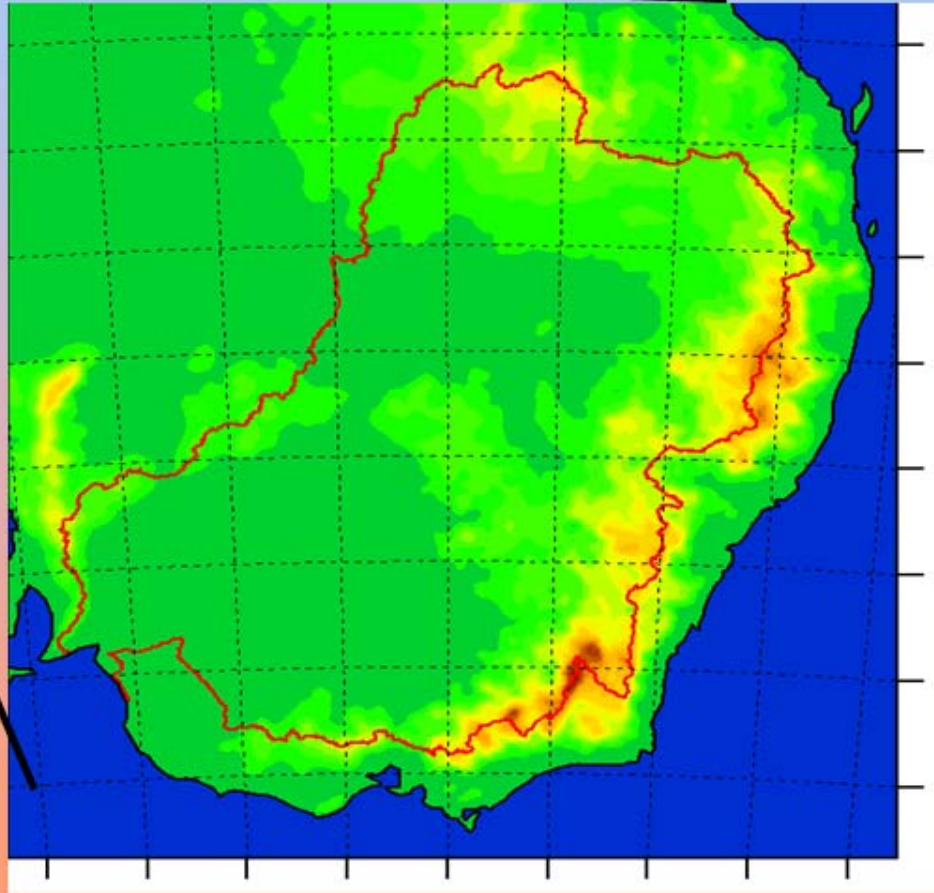


# Murray-Darling Basin Regional Hydroclimate Project

**Scientific Steering Committee:**

**Jason Evans, Helen Cleugh, Michael Manton, Jeff Walker, Andy Pitman,  
Francis Chiew**

# Murray-Darling Basin



# Murray-Darling Basin

- ~1,000,000 km<sup>2</sup> in area – 14% of Australia
- Murray & Darling rivers are longer than 2,500km long
- ~40% of Australia's agricultural production
- ~1,500,000 hectares under irrigation
- > 80% of divertible surface water is consumed in basin
- ~2 million people live in the basin



# RHP Objectives

- Produce and compile research quality datasets of the energy and water budgets in the MDB.
- Improve the understanding and modelling of the dynamics of the coupled water, energy and carbon cycles in the MDB, a developed semi-arid zone basin.
- Improve predictive tools for water management, including real-time forecasting products for use by water agencies in the MDB.
- Strengthen interaction between the climate research community and decision-makers.



# Assessment in relation to RHP criteria

## Technical Criteria

- Cooperation of an NWP centre for provision of atmospheric and land surface data assimilation. ✓
- Atmospheric-hydrologic models for studying transferability and climate variability. ✓
- Mechanism for collecting and managing adequate hydrometeorological data sets. ✓
- Participation in the open international exchange of scientific information and data. ✓
- Interactions with hydrologic services and related groups. ✓
- Commitment of adequate resources and personnel. ✓
- Evaluation of GEWEX global data products. ?
- Contributions to CEOP in situ, remote sensing and model output databases. ✓



# Assessment in relation to RHP criteria

## Scientific Criteria

- Observe, simulate and predict diurnal, seasonal, annual and interannual variability. ✓
- Determine climate system variability and critical feedbacks. ✓
- Demonstrate improvements in predictions of water-related climate parameters. ✓
- Demonstrate the applicability of techniques and models for other regions. ?
- Assess the human impact on hydroclimate variations, including vulnerability to climate change ✓



# Recent Progress

A number of projects have contributed to the MDB RHP objectives. Some examples are

- Murray-Darling Basin Sustainable Yields Project
- South Eastern Australian Climate Initiative
- Australian Water Availability Project
- National Airborne Field Experiment
- Stable environmental isotopes studies
- Regional climate modelling studies



# Murray-Darling Basin Sustainable Yields Project

<http://www.csiro.au/partnerships/MDBSY.html>

Work was performed through the CSIRO water for a healthy country flagship. Some key findings include:

- Development has caused major changes in flood regimes that support important lakes and wetlands.
- Southern MDB has been in severe drought this century, some places experiencing a 1 in 300 year event.
- Under median 2030 climate water availability would fall by 9-11% in the north and 13% in the south.
- Range of possible climate outcomes is wide due to uncertainty in current climate model projections.





# South Eastern Australian Climate Initiative

<http://www.mdbc.gov.au/subs/seaci/index.html>

Research led by CSIRO and Bureau of Meteorology. Some key findings:

- Rainfall reduction of the on-going drought is linked to Mean Sea level Pressure and Sub-Tropical Ridge (STR) Intensity increases.
- STR intensity has increased with global warming.
- Seasonal climate predictions were improved though upper limit of predictability may be ~30% of variance.
- Developed Bayesian joint probability modelling approach for probabilistic predictions of seasonal streamflows.

The new phase of SEACI, while maintaining a climate focus, aims to develop improved short-term predictions for hydrological and agricultural applications.

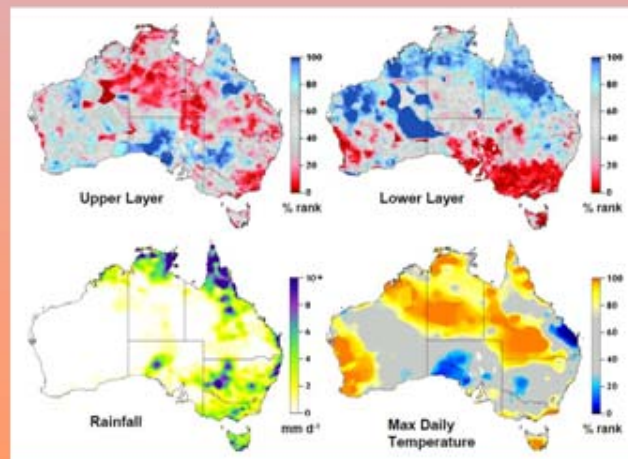


# Australian Water Availability Project

<http://www.daffa.gov.au/brs/climate-impact/awap>

Research led by CSIRO and Bureau of Meteorology. Some key outputs:

- A range of improved meteorological analyses over Australia for precipitation, temperature, vapour pressure and solar exposure, at 5km spatial scale and time periods from daily upwards.
- A hydrological model driven by the above meteorological forcing provides estimates of the water balance components in near real time, and makes them available through a web interface.



Example output for  
9 – 15 March 2009

# National Airborne Field Experiment

<http://www.nafe.unimelb.edu.au/>

Research led by the University of Melbourne. Focus is on the estimation of soil moisture from remotely sensed data. Some key outputs:

- Ground level in-situ data
- Multiple airborne campaigns collecting data from multiple sensors including the microwave sensor to be launched on the SMOS satellite.
- Testing and improvement of remotely sensed soil moisture retrieval algorithms under the often dry conditions present in the MDB.



# Stable Environmental Isotope Studies

[http://www.ansto.gov.au/research/institute\\_of\\_environmental\\_research/science/isotopes\\_for\\_water](http://www.ansto.gov.au/research/institute_of_environmental_research/science/isotopes_for_water)

Research led by the Australian Nuclear Science and Technology Organisation. Some key outputs:

- Investigated the connectivity between surface and groundwater in the Macquarie Marshes.
- Identified groundwater ages and sustainable yields.
- Local paleo-climate records from speleothems.
- Increased monitoring of isotopic composition of precipitation and river flow within the MDB.



# Regional Climate Modelling Studies

Some of this research led by University of New South Wales.

In one study they explored the impact of CO<sub>2</sub> on the terrestrial surface energy balance via down-regulation of stomatal conductance.

- Multiple realisations show the clear impact of increasing leaf level CO<sub>2</sub> on the transpiration and temperature, particularly when sufficient moisture is available.
- At high CO<sub>2</sub> concentrations rainfall feedbacks are also evident.



# Challenges

- Coordination/Integration of various contributing projects
- Development and adoption of ACCESS (Australian Community Climate and Earth System Simulator) and CABLE (LSM) for
  - Operational NWP
  - Climate related research
- Combine climate modelling & hydrology modelling



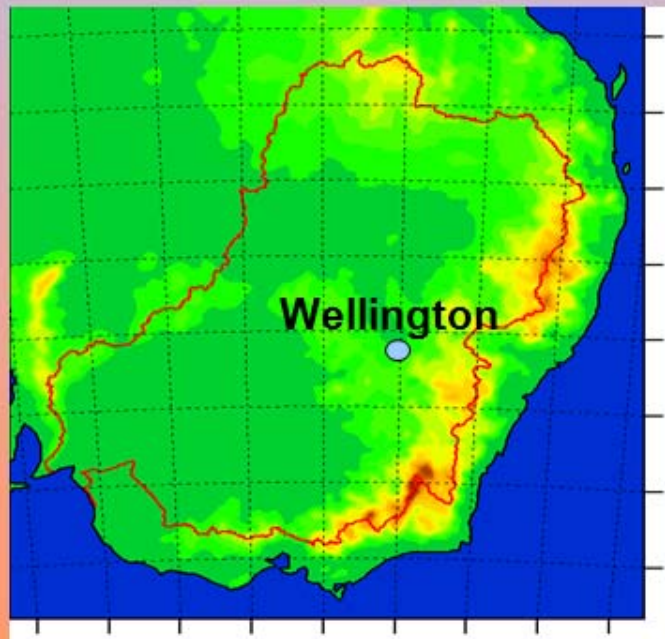
# Plans – new data collection

Terrestrial Ecosystem Research Network (TERN)



# Plans – new data collection

National Centre for Groundwater Research & Training  
Wellington observational super-site  
Groundwater – surface water - atmosphere





# Plans - projects

- Bureau of Meteorology Water Division
  - Australian Water Resources Information System (AWRIS)
    - Online information system that will collate and disseminate water related information from across Australia (including the MDB)
  - Water Information Research and Development Alliance (WIRADA) - with CSIRO
- SEACI-2 – aims to improve short-term predictions for hydrological and agricultural applications.
- Regional climate modelling
  - Land-atmosphere interactions
  - Impacts of land-use and climate change



# Timetable

2009 – AWRIS phase 1 operational

2010 – Identify regions of strong land-atmosphere coupling within the MDB using high resolution regional climate models

2011 – Wellington site instrumented and operational

2011 – TERN sites in place and operational

2009-2012 – SEACI 2

2009-2013 – WIRADA



# and.....

What is your RHP's opinion on its role within WCRP and GEWEX?

- Bridges scales: global – regional – local
- Brings research to applications for operations/management
- MDB is mostly semi-arid basin facing similar issues to many parts of the developing world

What is your RHP's opinion on its role within CEOP in terms of e.g. mutual benefit?

- Potentially beneficial interactions with other CEOP elements: other RHPs; semi-arid studies; modelling and observations.

What are practical means to improve cooperation among RHPs and other CEOP elements?

- ????

