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Water Forecasting Services to Manage Water Scarcity and Variability

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Bureau of Meteorology

Assistant Director

Water Forecasting Services

Hydropredict 2010

21 September 2010

The big eight water scarcity factors

Growing urban demand

Irrigation demand

Expanding plantations

Bushfire recovery impacts

The environmental flows imperative

Expanding farm dams

Uncapped groundwater extraction

Drying and warming climate

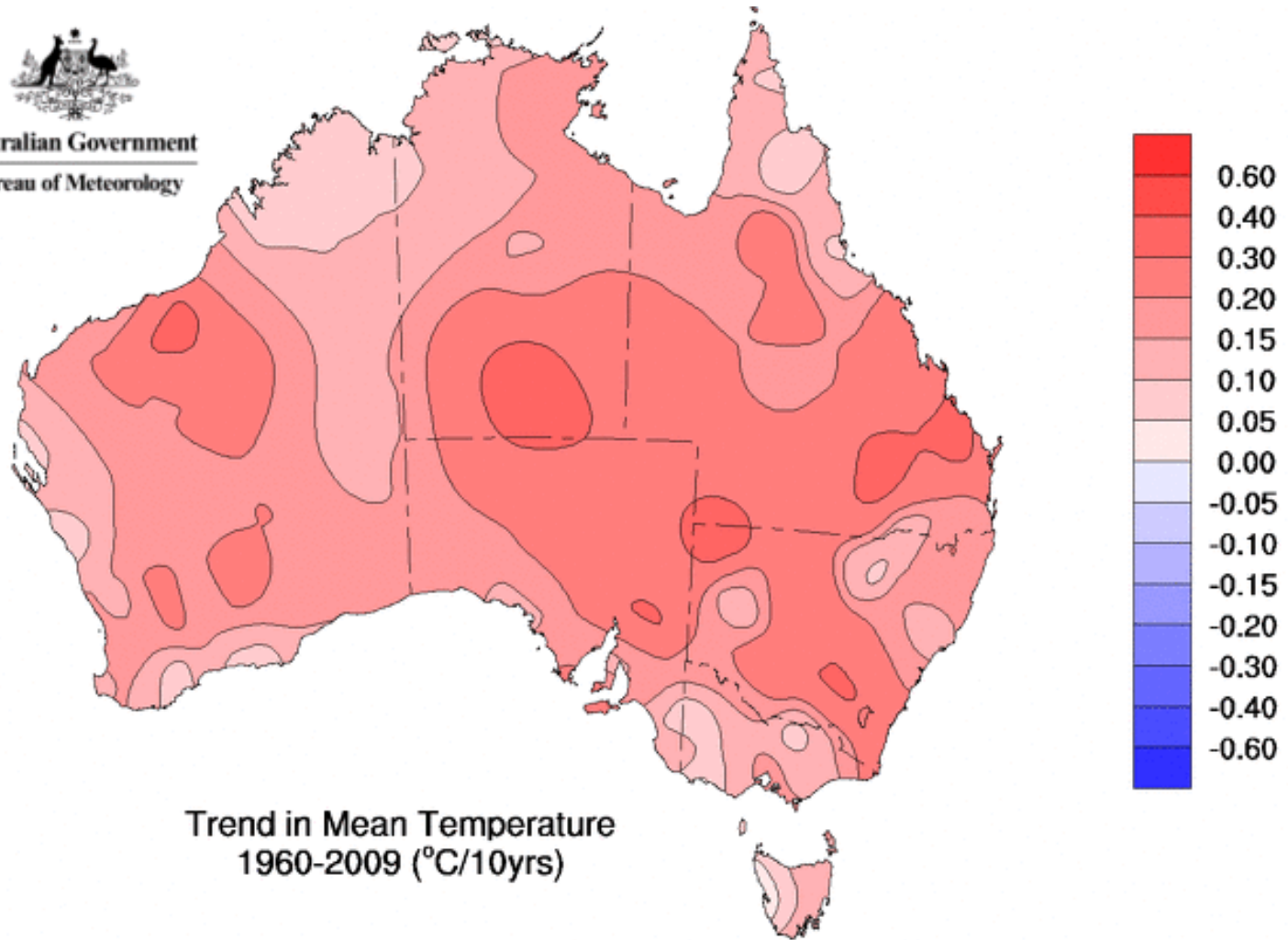
Australian Temperatures



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Issued: 28/01/2010

- All of Australia has experienced warming over the past 50 years
- Some areas, have experienced a warming of 1.5 to 2 $^{\circ}\text{C}$

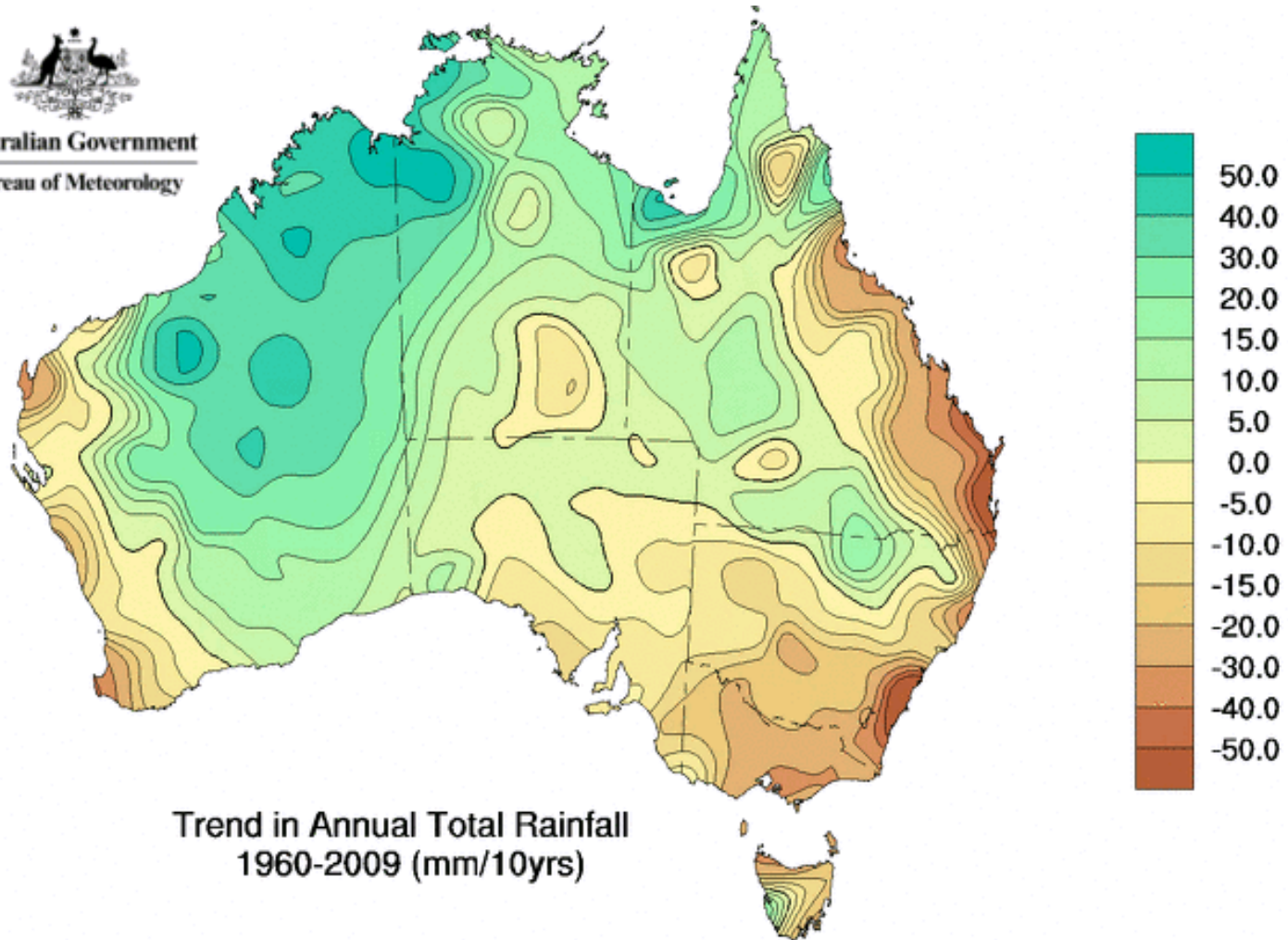
Australian Rainfall



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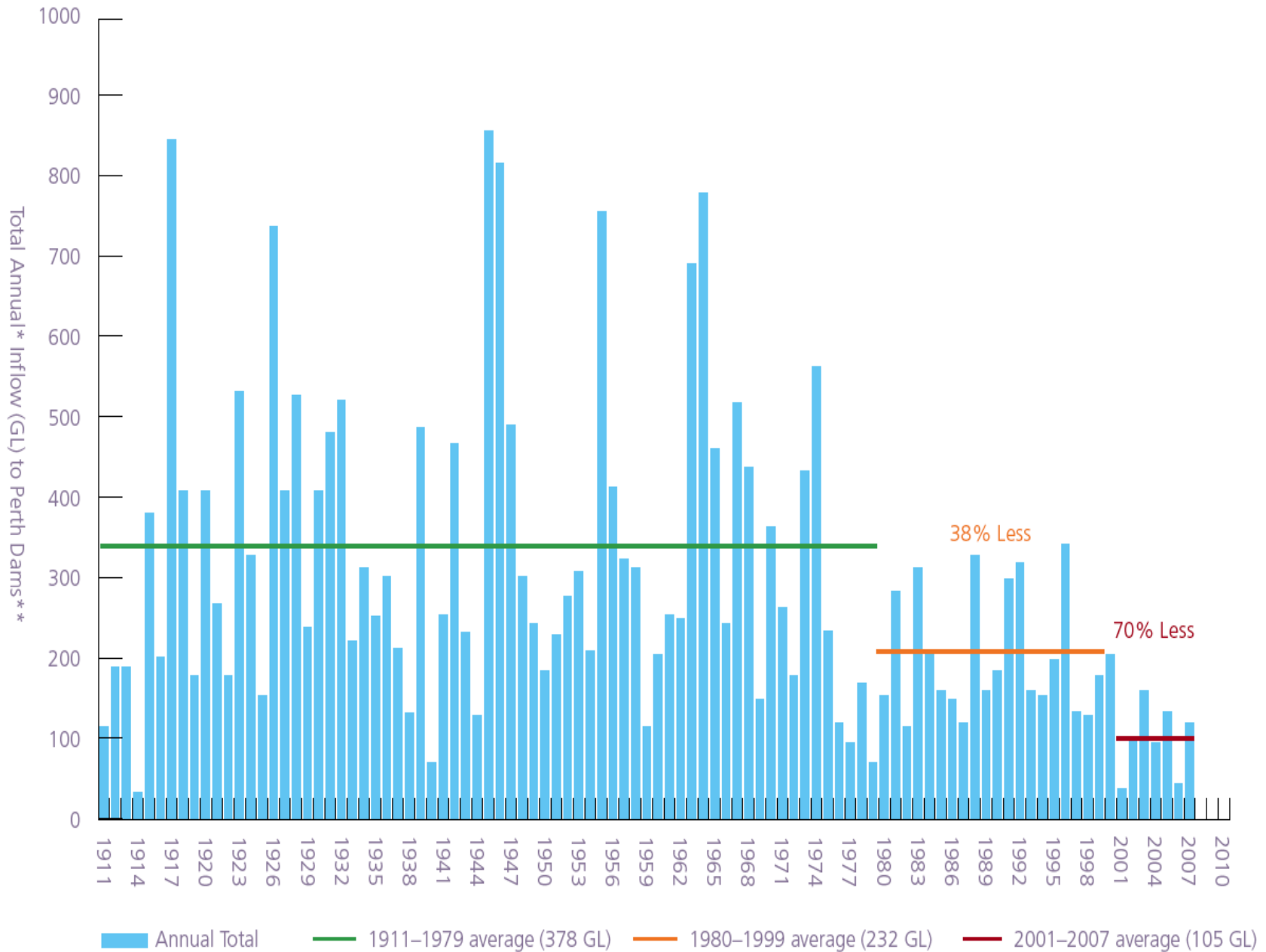


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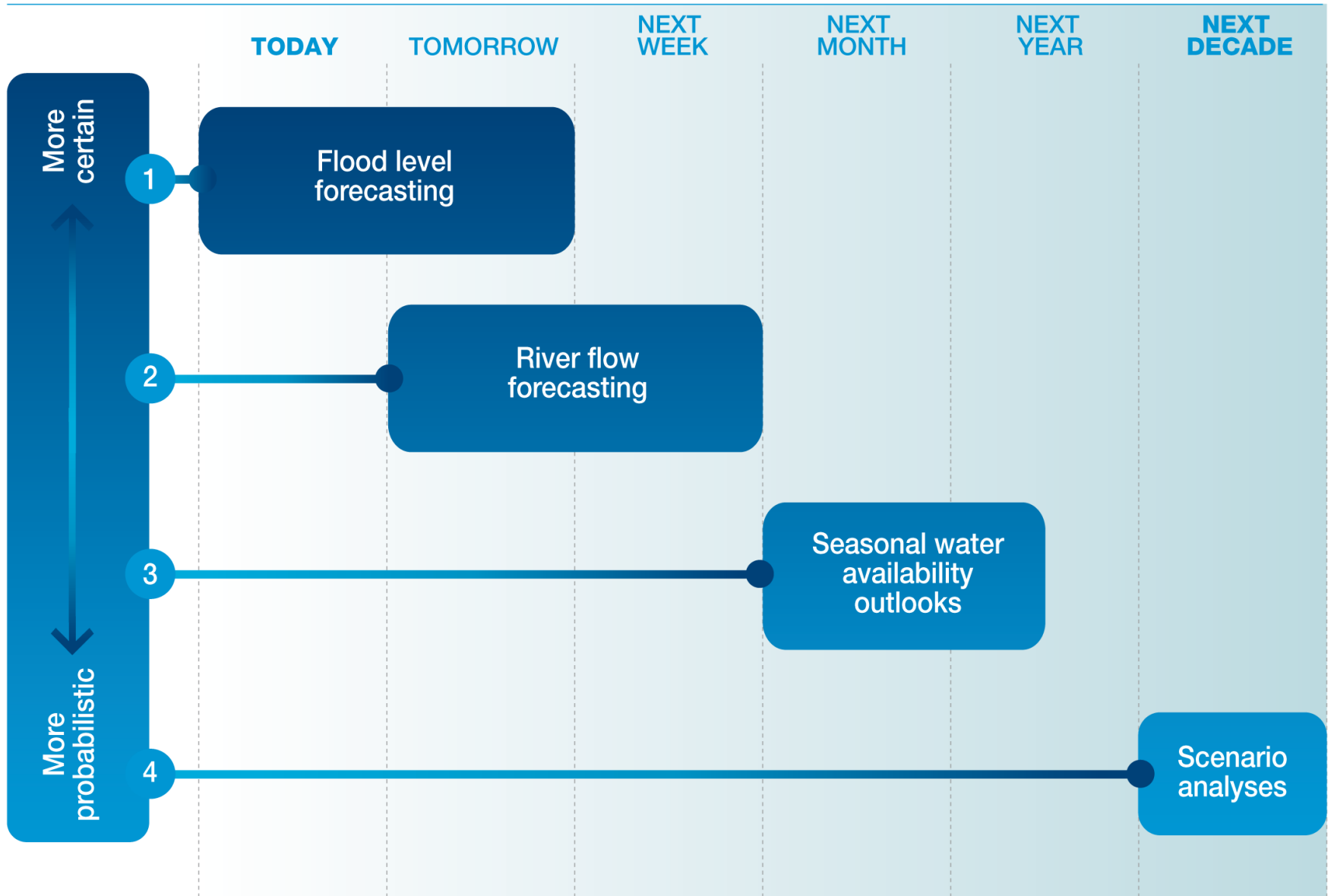
- Substantial increases in many parts of northern and central Australia
- Substantial decreases across much of southern and eastern Australia

YEARLY INFLOW TO PERTH DAMS INCLUDING SOUTHERN SOURCES



* a year is taken as May to April ** 2004/05 inflow to 31 Jan 2005

Water Forecasts from BOM





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Water forecasting services

TIME

SERVICES

DECISIONS

1-72 hours

7-10 days

3-12 months

Multi years

Flood Forecasts

Flow Forecasts

Seasonal Predictions

Scenario Projections

Emergency Response

River Operations

Water Allocations and
Supply Operations

Water Supply Planning



Flash flooding in Brisbane, February 2010



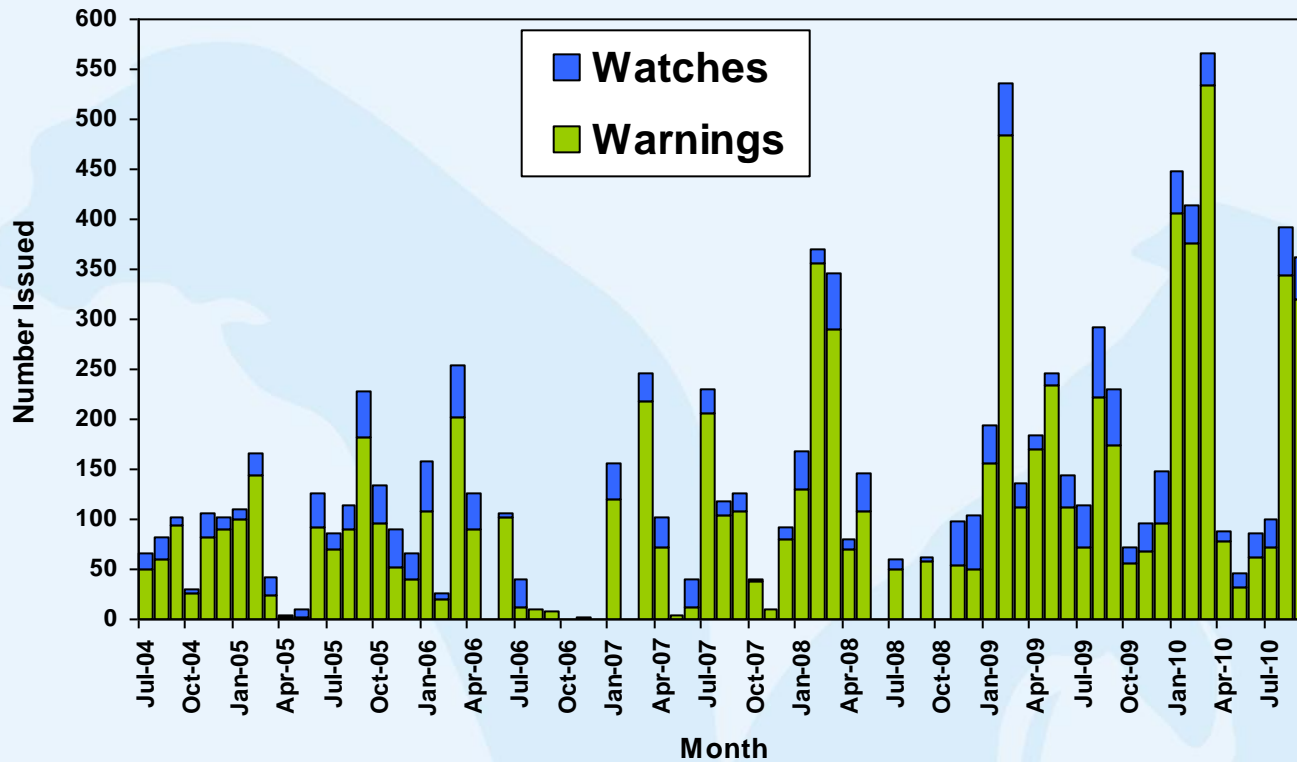
Normanton to Karumba Road cut, February 2010



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Flood warnings issued



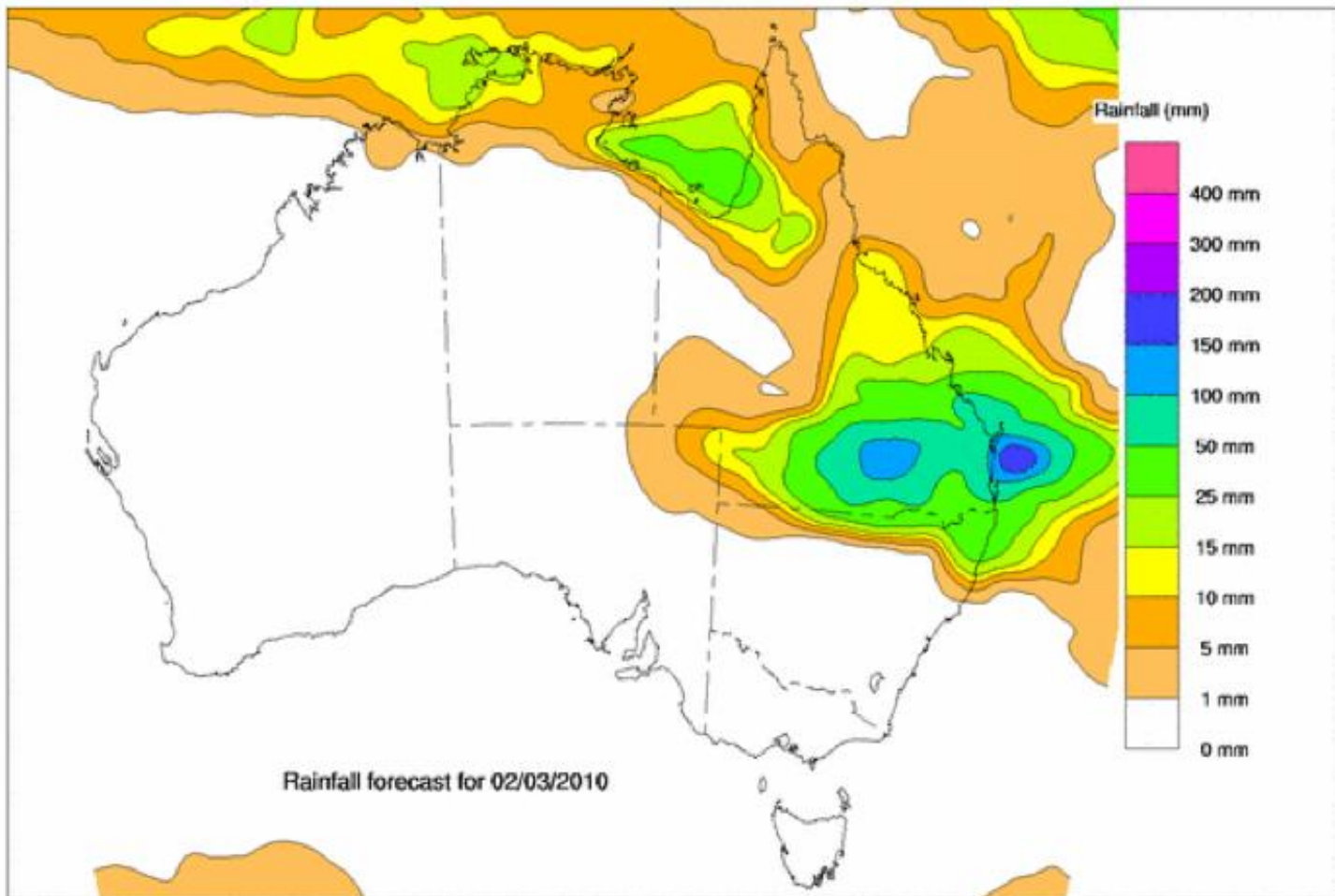
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Rainfall forecast from NWP guidance



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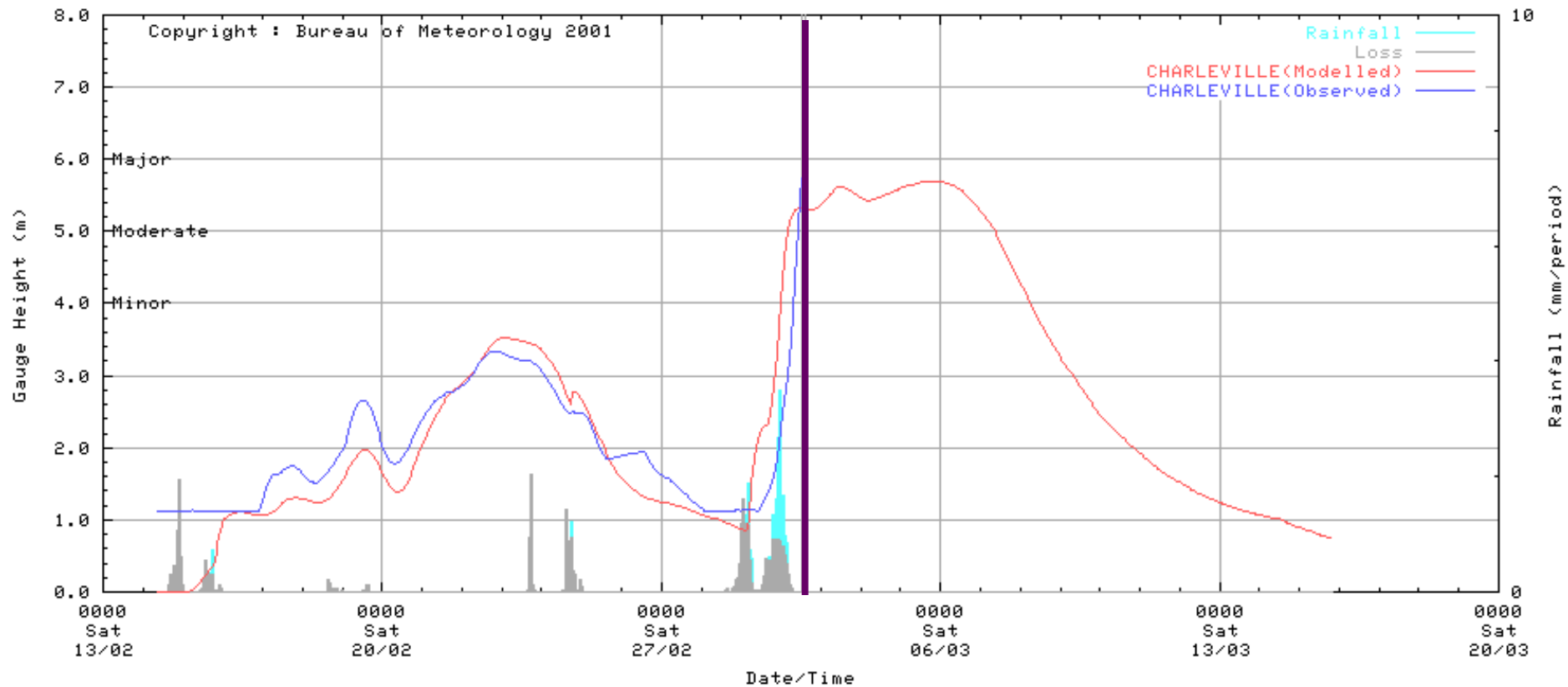


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Flood forecast for Charleville, QLD

WARREGO R TO CHARLEVILLE (no forecast rainfall)





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Water forecasting services

TIME

1-72 hours

7-10 days

3-12 months

Multi years

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Short-term flow forecasting services

- Forecast flows out to 7-10 days
- Hydrographs or flow volumes
- Probabilistic forecasts
- Will be used for storage operation, environmental flow releases, scheduling river diversions and assist water markets etc.
- Experimental pilot study on Ovens River in Vic.



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WIRADA

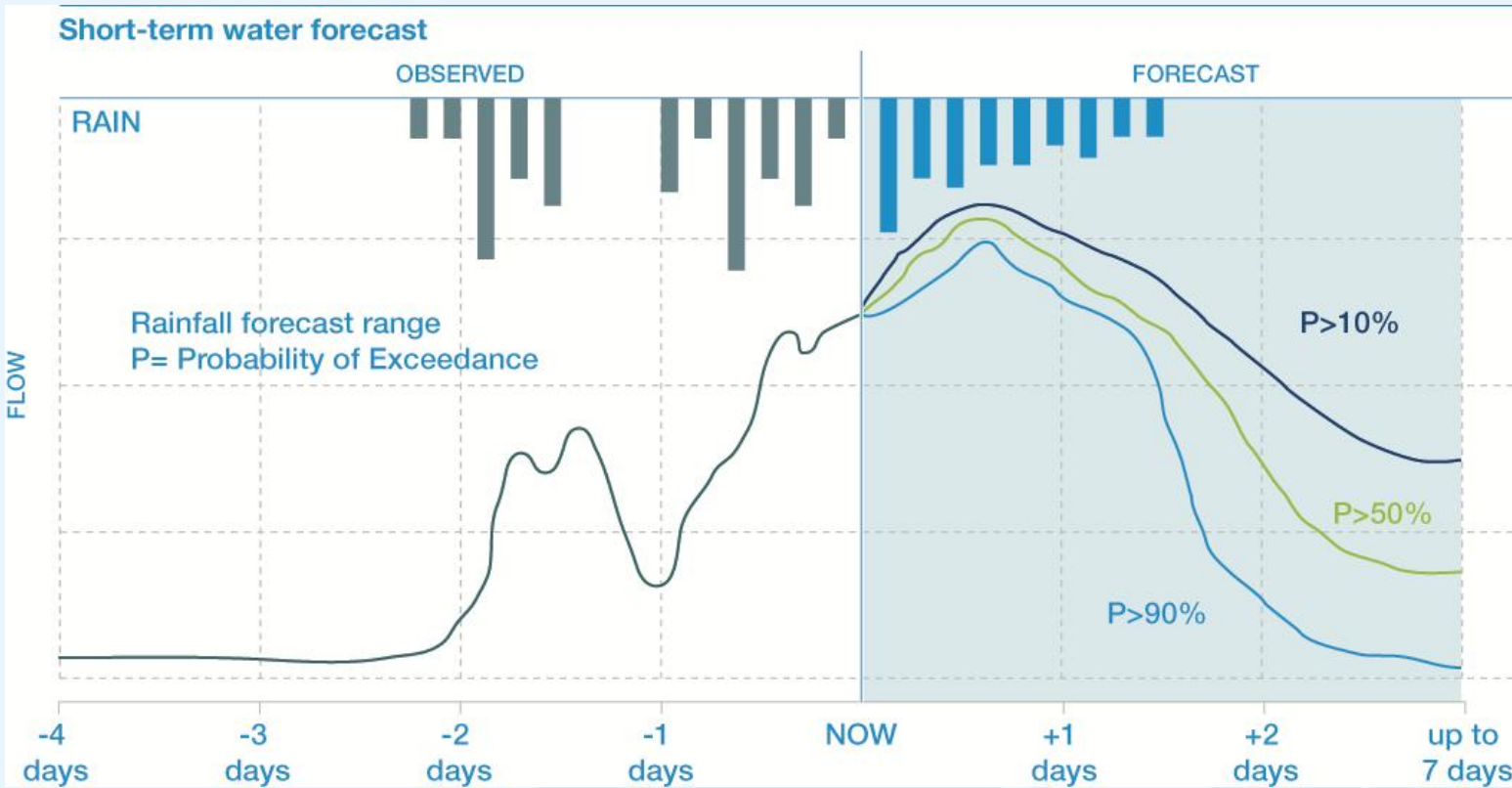
Water Information Research & Development Alliance



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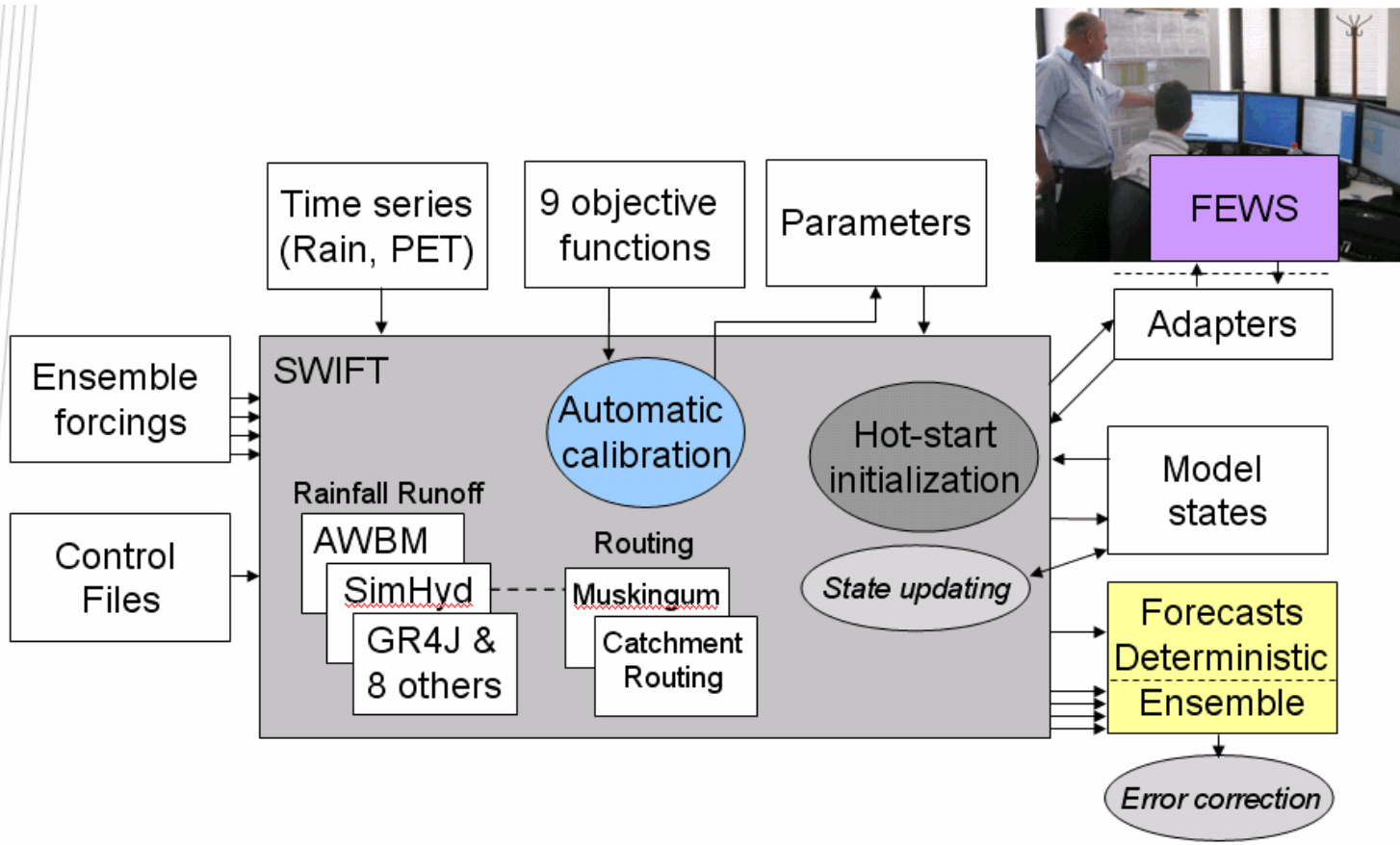
Short-term streamflow forecast product



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SWIFT – Short-term Water Information Forecasting Tools



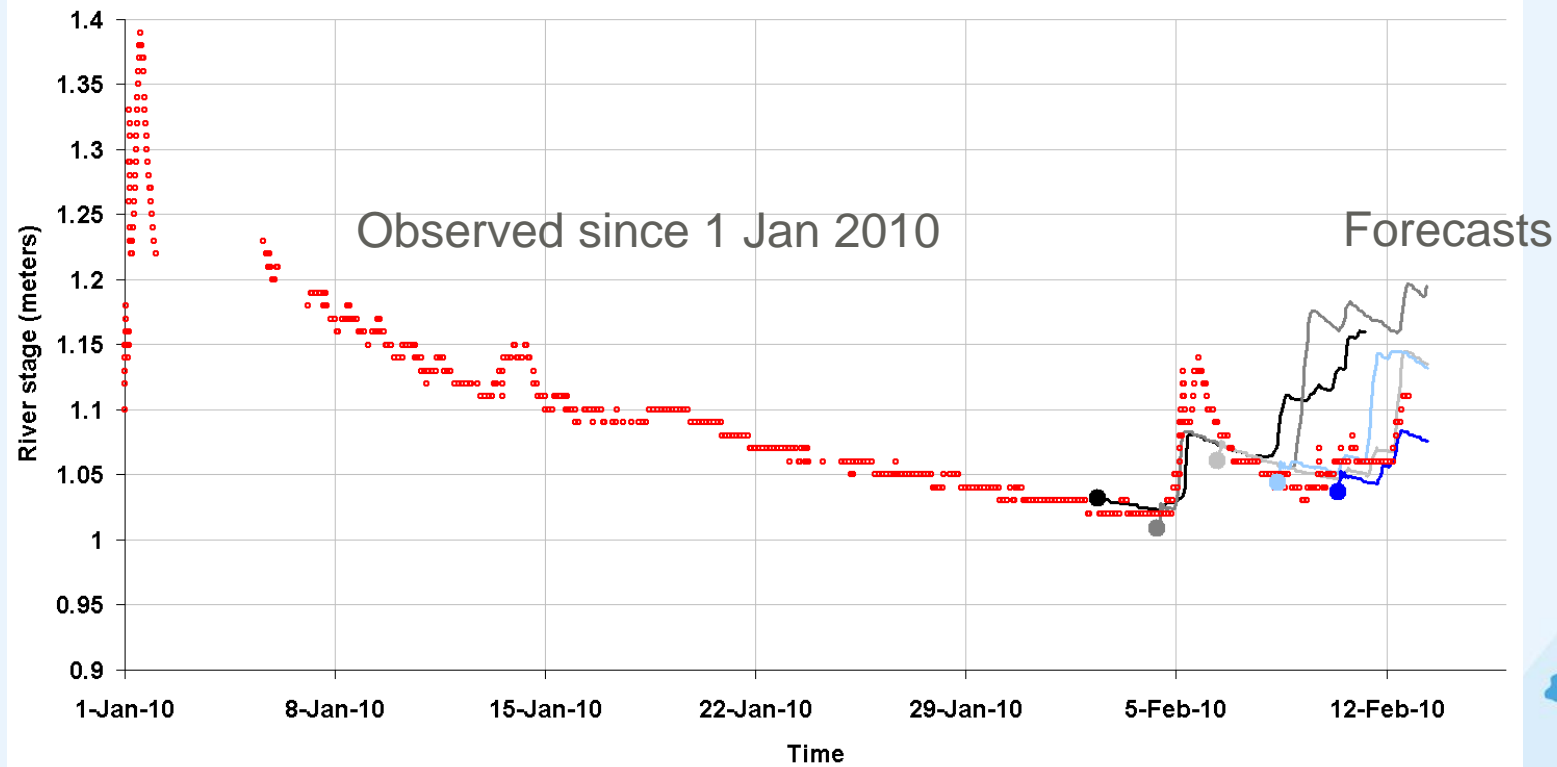


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Short Term Flow Forecasting

Ovens River at Bright Realtime Continuous Short-term Forecasting



SWIFT with FEWS

Rain forecasts: Meso-Laps, Access-R and Access-G

Rainfall-runoff: GR4J model

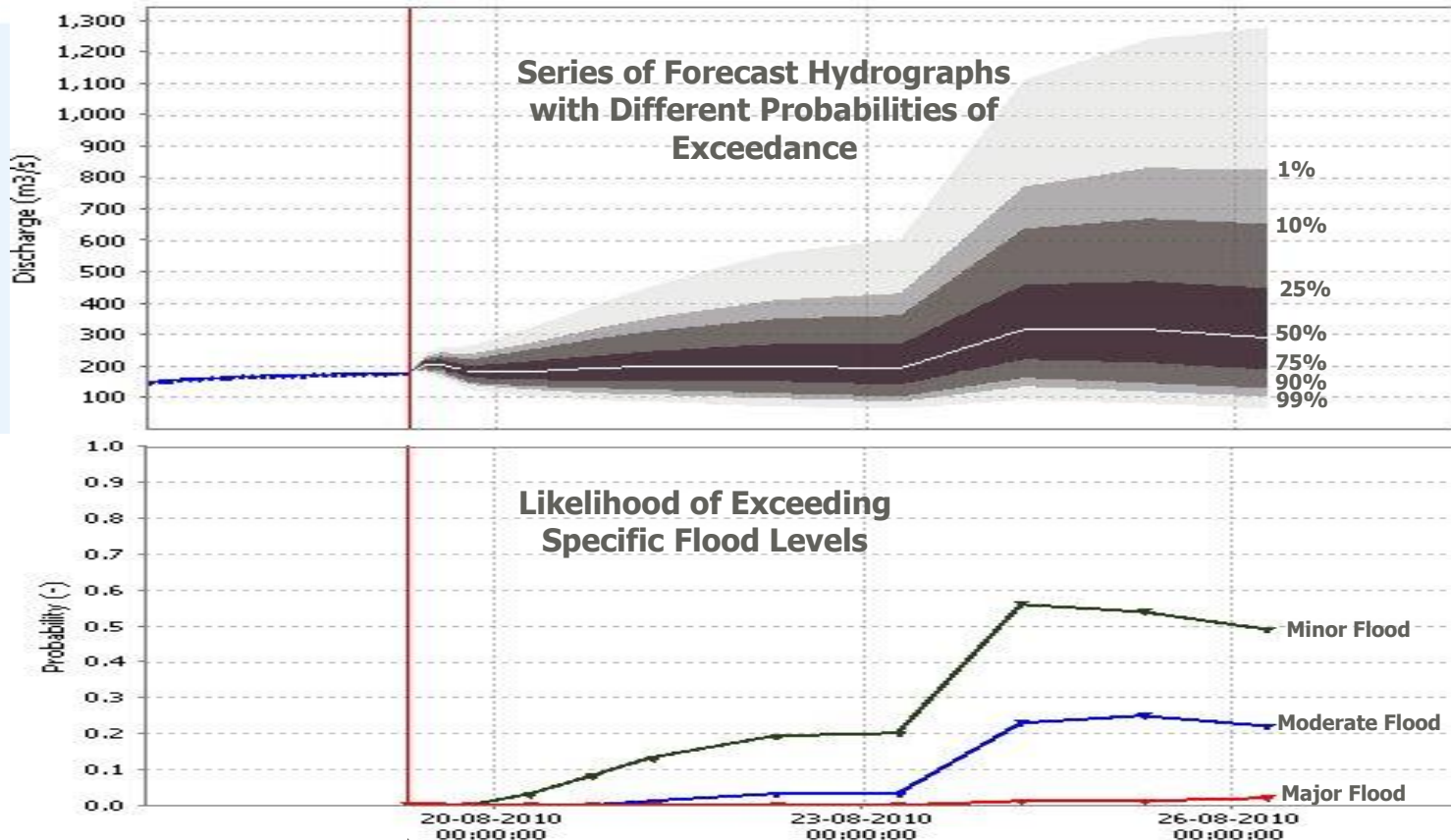


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Sample of Outputs from Ovens Pilot



Forecast Time



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Water forecasting services

TIME

1-72 hours

7-10 days

3-12 months

Multi years

SERVICES

Flood Forecasts

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River Operations

**Water Allocations
and Supply
Operations**

Water Supply Planning



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Seasonal prediction services

- Focus on 3 months cumulative stream flow (upstream of storages, non regulated systems)
- Research and development through Water Information Research and Development Alliance activities:
 - CSIRO's Statistical Bayesian Joint Probability (BJP) approach
 - Downscaling climate inputs from global climate model to hydrological model
 - Dynamic Hydrological Modelling approach
 - Combining statistical and dynamic approaches
- Early focus on user needs and engagement



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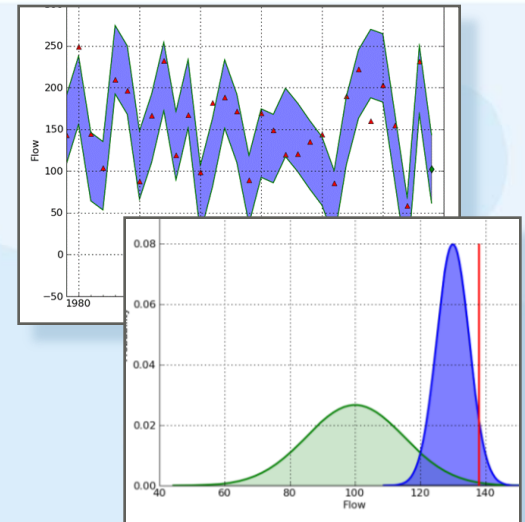
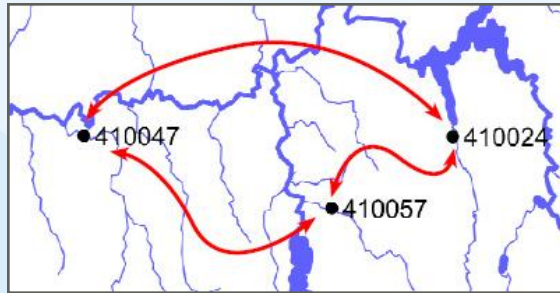
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Bayesian Joint Probability (BJP) Overview (Wang et al., CSIRO)

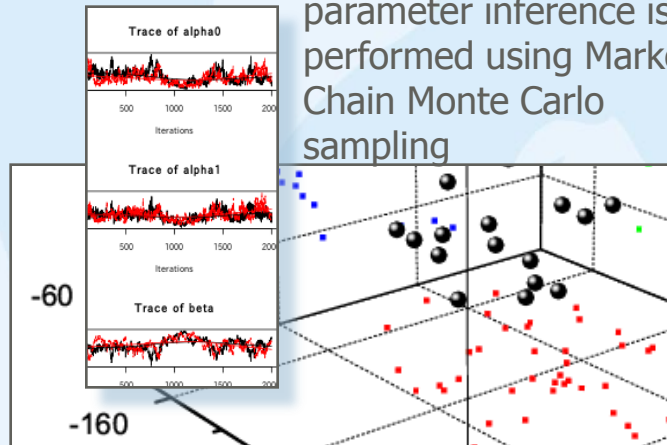
The BJP modelling approach produces simultaneous predictions for multiple sites within a catchment



Antecedent streamflow, rainfall, climate indicators and (subjective) prior knowledge are model inputs



Bayesian statistical parameter inference is performed using Markov Chain Monte Carlo sampling



Model predictions are probabilistic, providing a measure of uncertainty



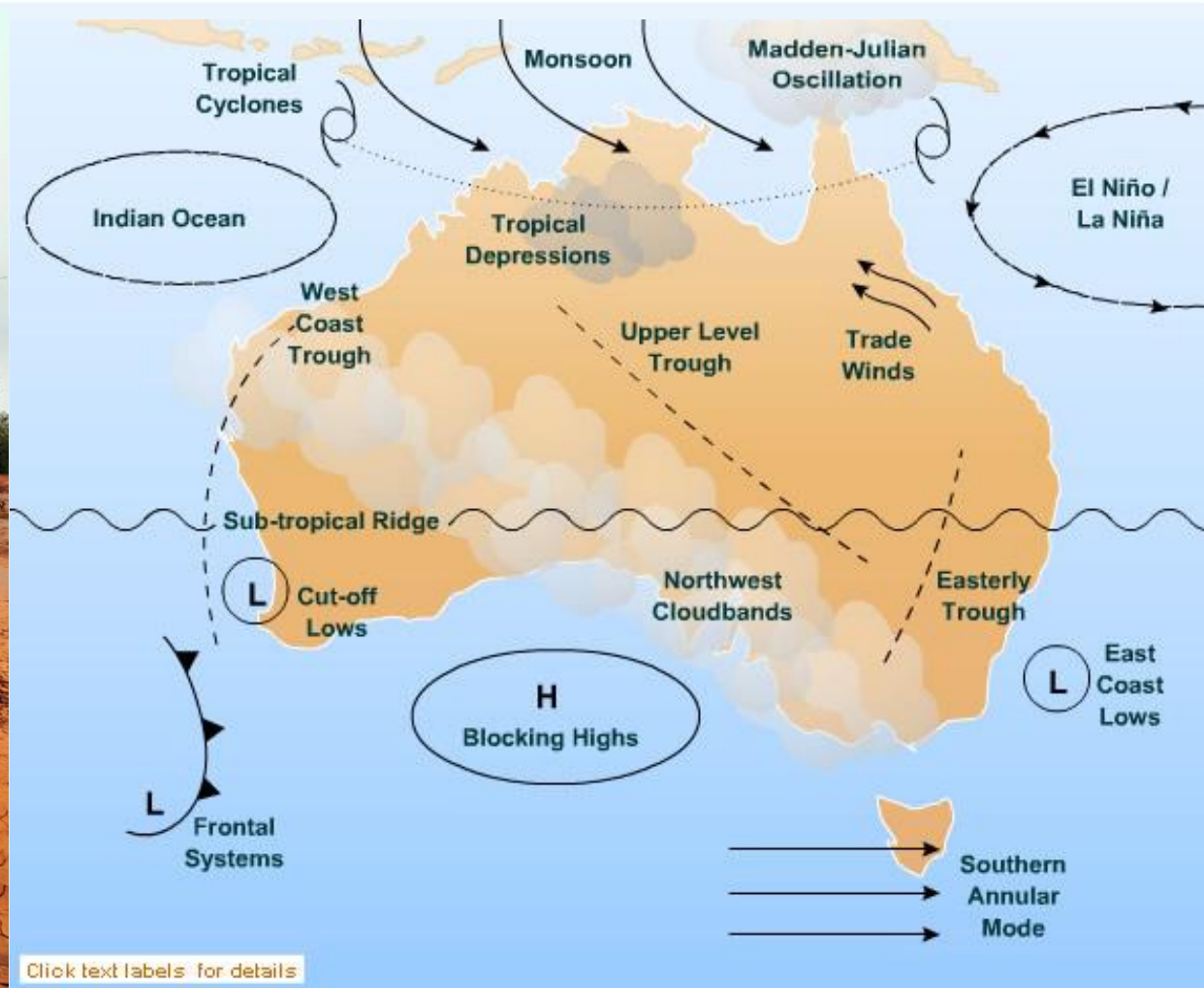
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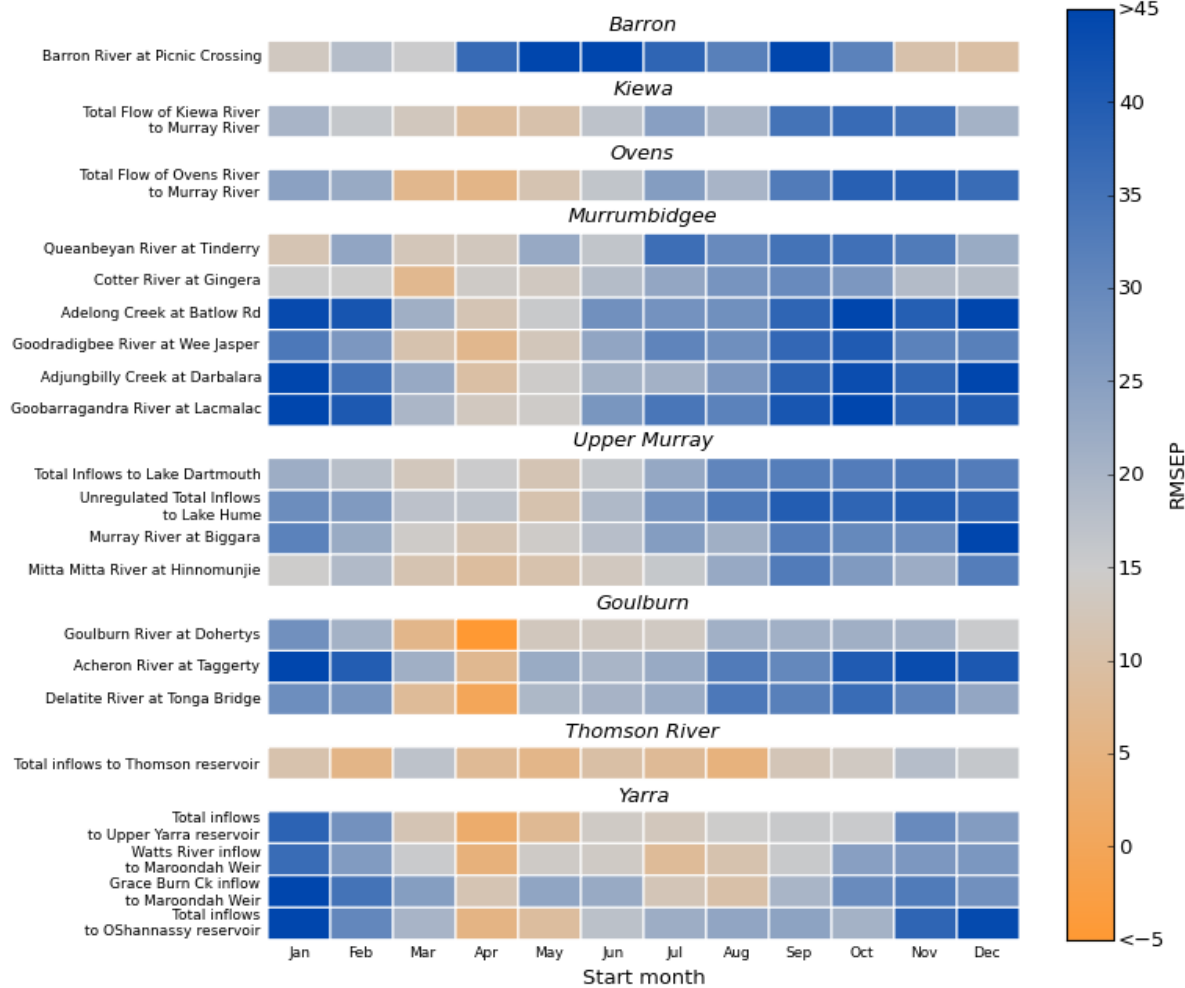
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Predicting seasonal streamflows.



Experimental forecast - Skills

Skill score summary - RMSEP

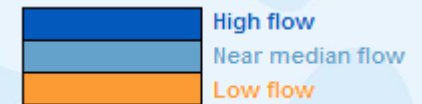
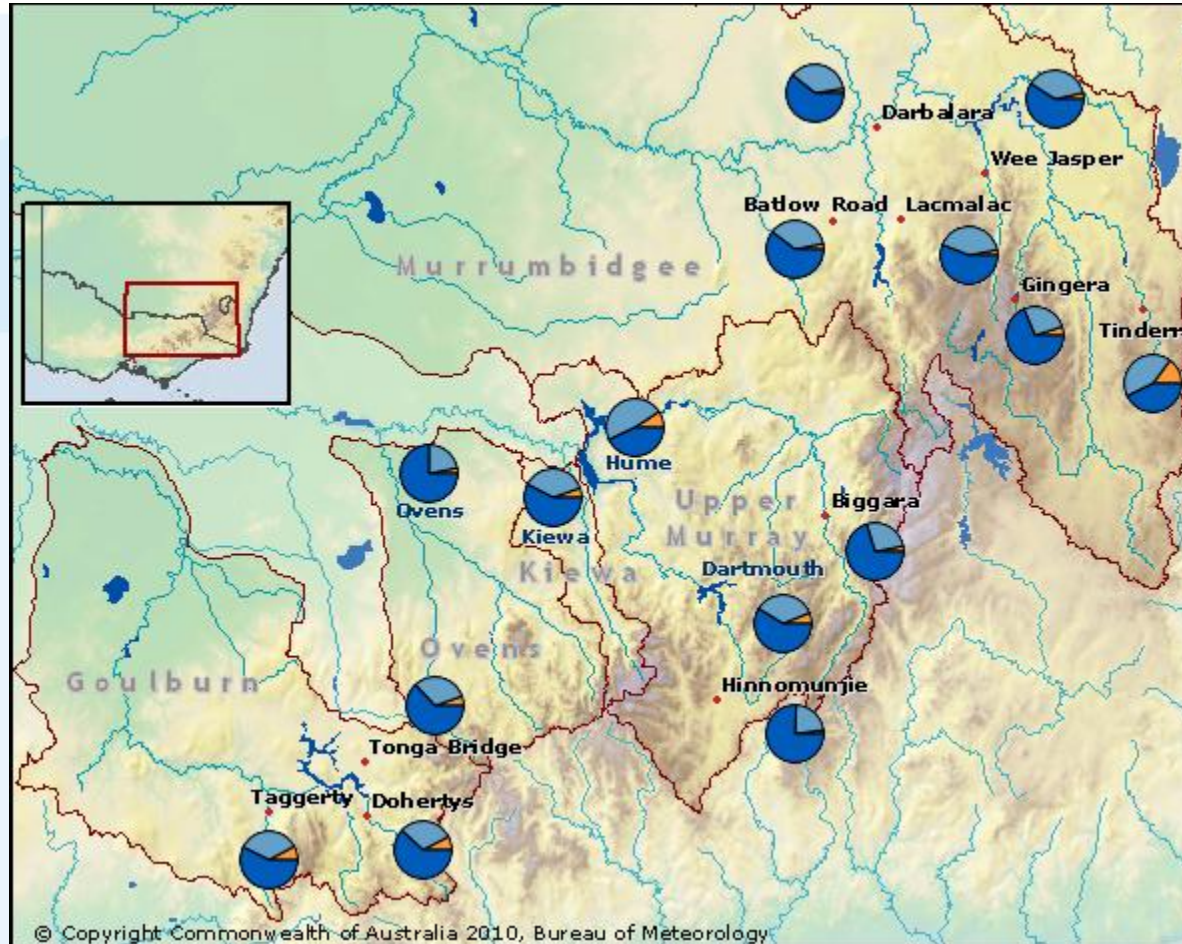




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Experimental forecast service Sep to Nov 2010 tercile summary



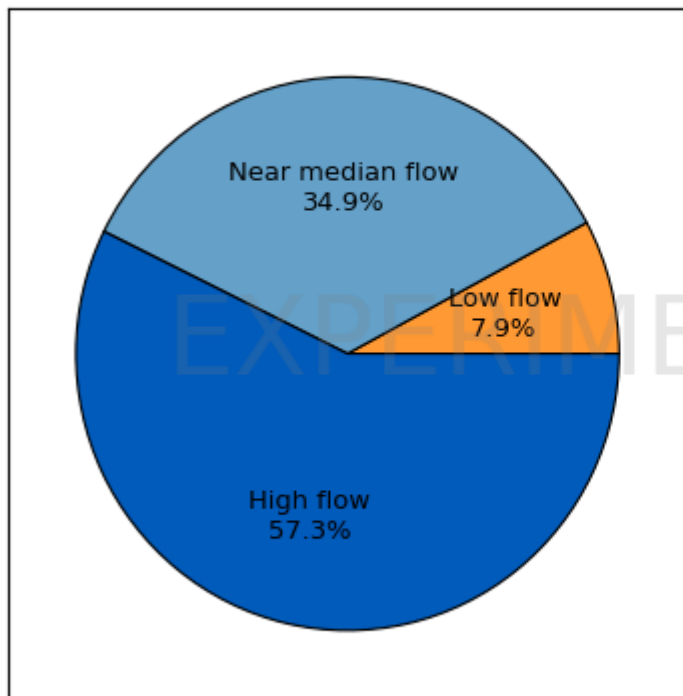
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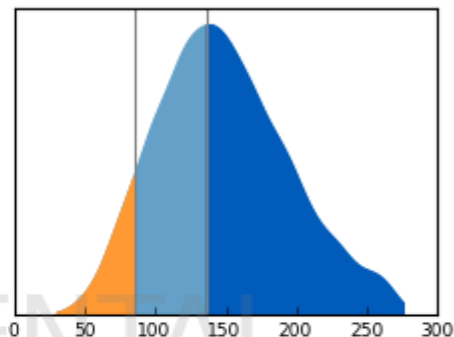
Experimental forecast Goulburn, Sep-Nov 2010 (3)

Acheron River at Taggerty (405209) Forecast period: Sep 2010 - Nov 2010

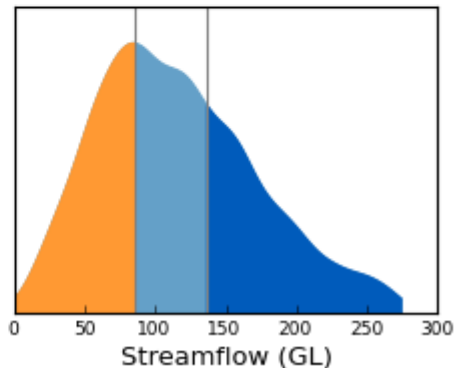
Percentage of forecast in each tercile



Terciles applied to
forecast distribution



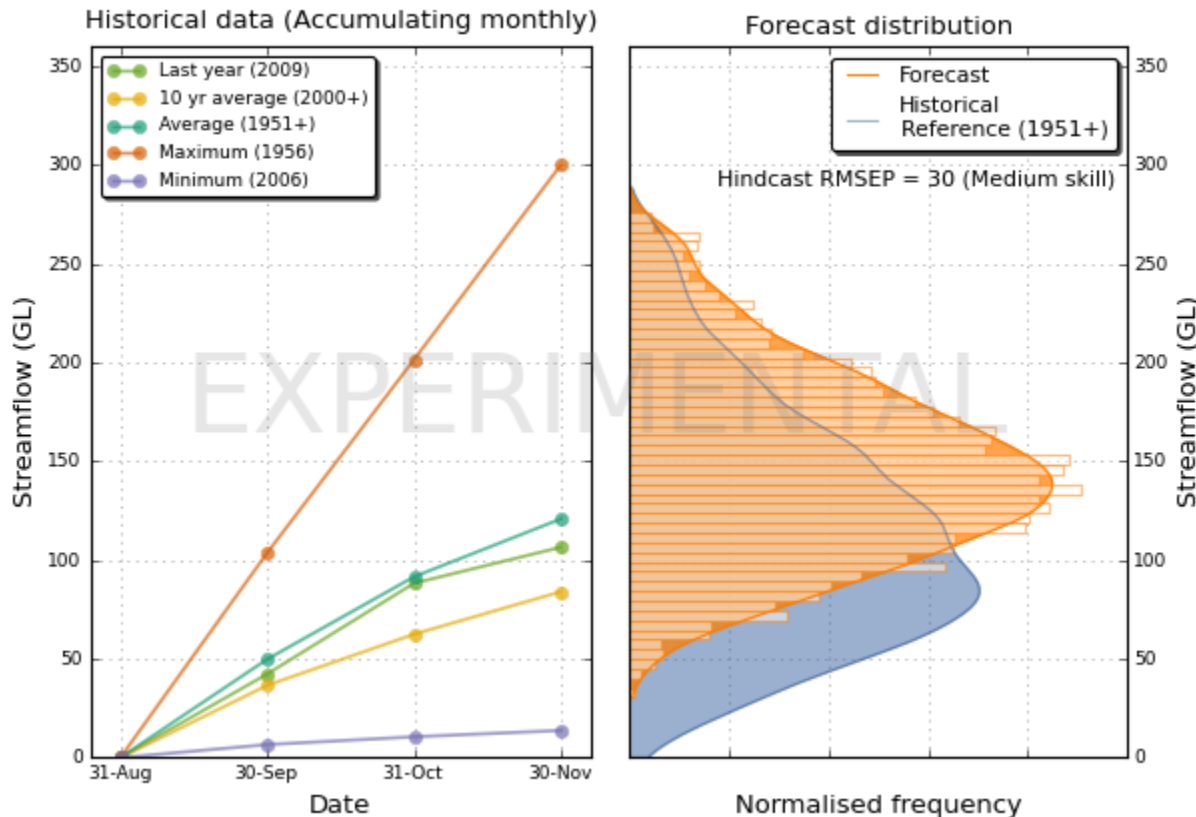
Terciles from historical data





Experimental forecast Goulburn, Sep-Nov 2010 (1)

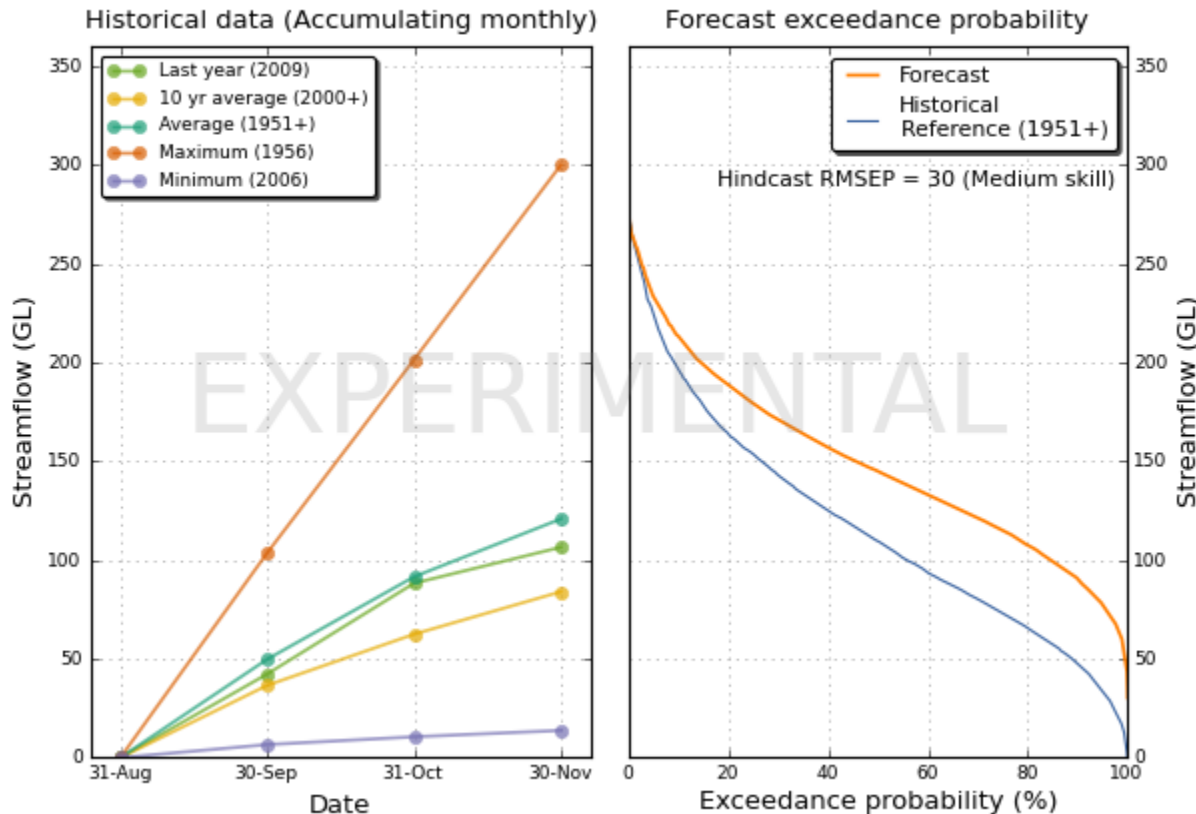
Acheron River at Taggerty (405209)
Forecast period: Sep 2010 - Nov 2010





Experimental forecast Goulburn, Sep-Nov 2010 (2)

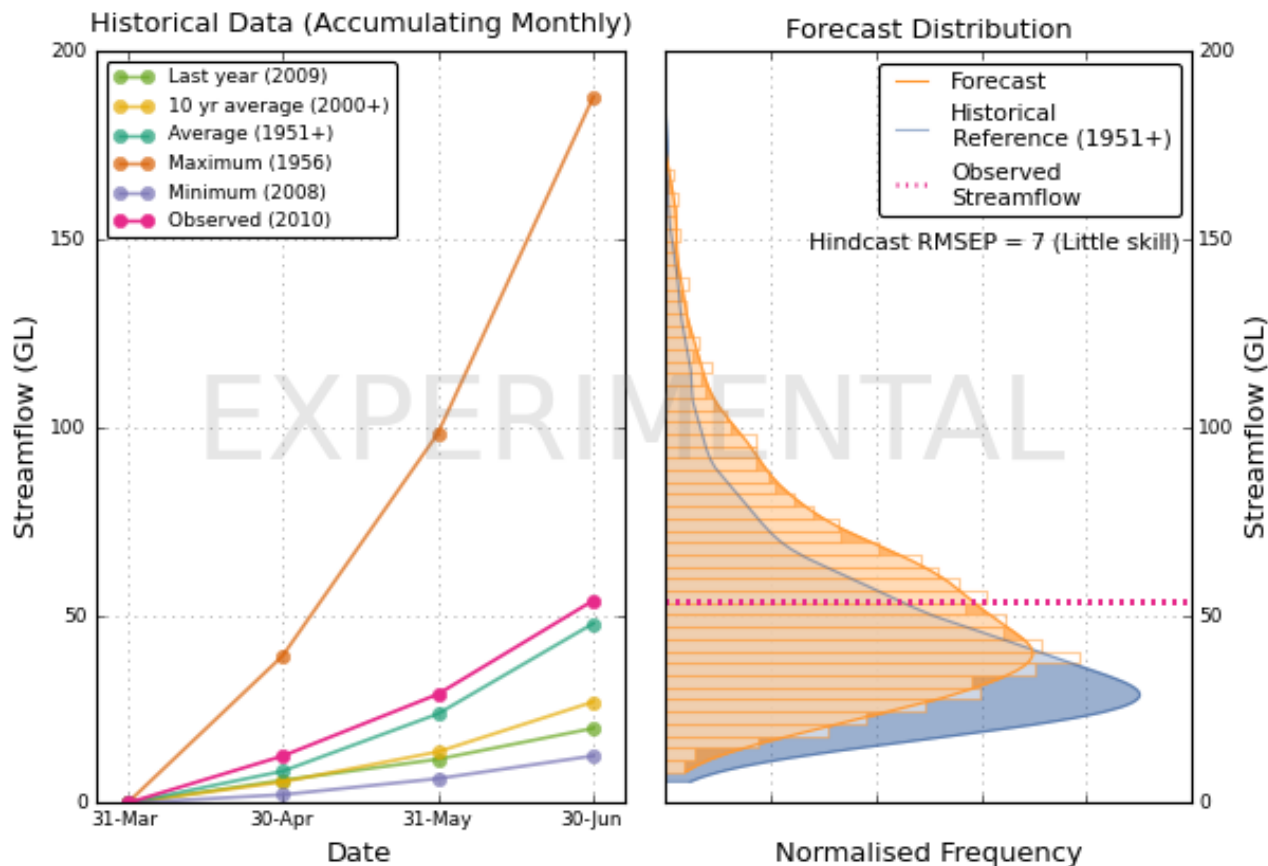
Acheron River at Taggerty (405209)
Forecast period: Sep 2010 - Nov 2010





Experimental forecast Goulburn, Apr-Jun 2010 (1)

Acheron River at Taggerty (405209) Forecast Period: Apr 2010 - Jun 2010



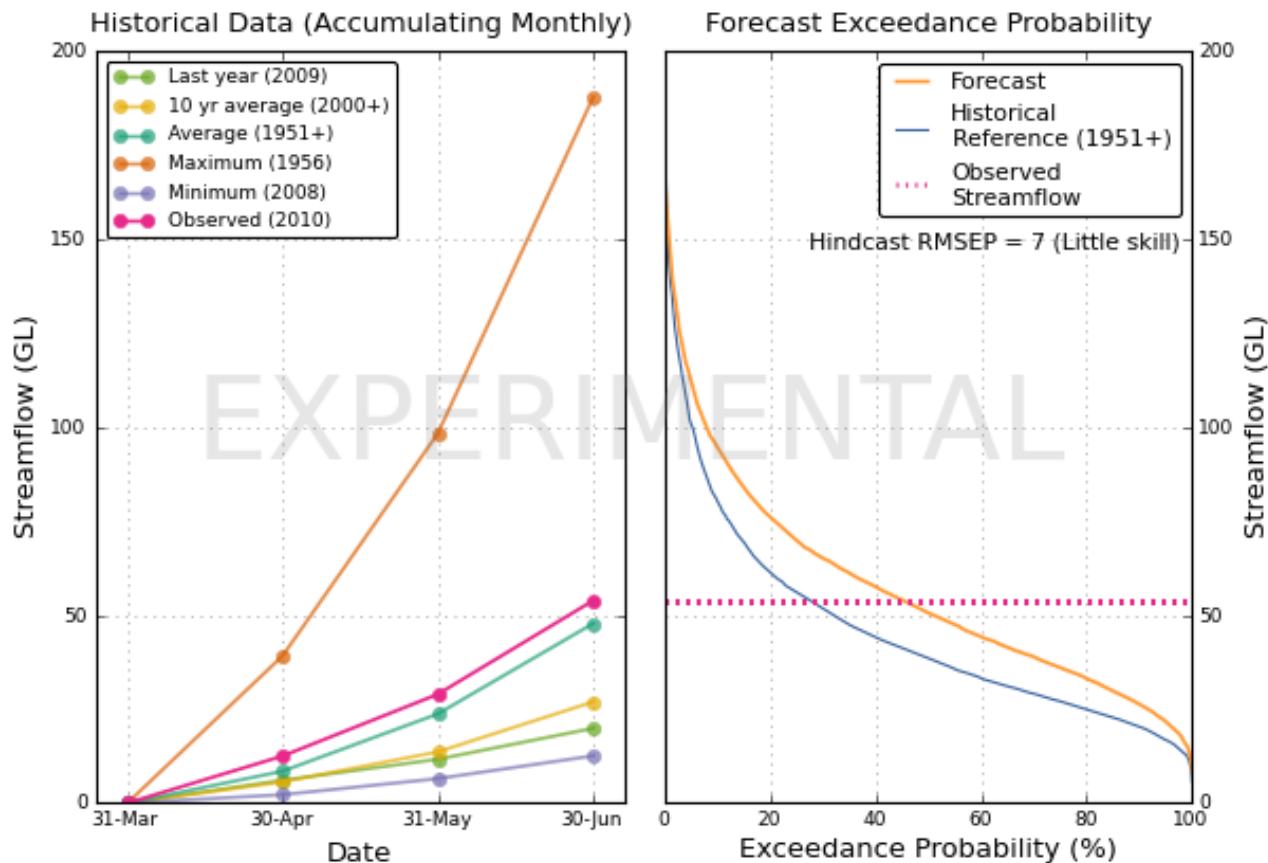
EXPERIMENTAL





Experimental forecast Goulburn, Apr-Jun 2010 (2)

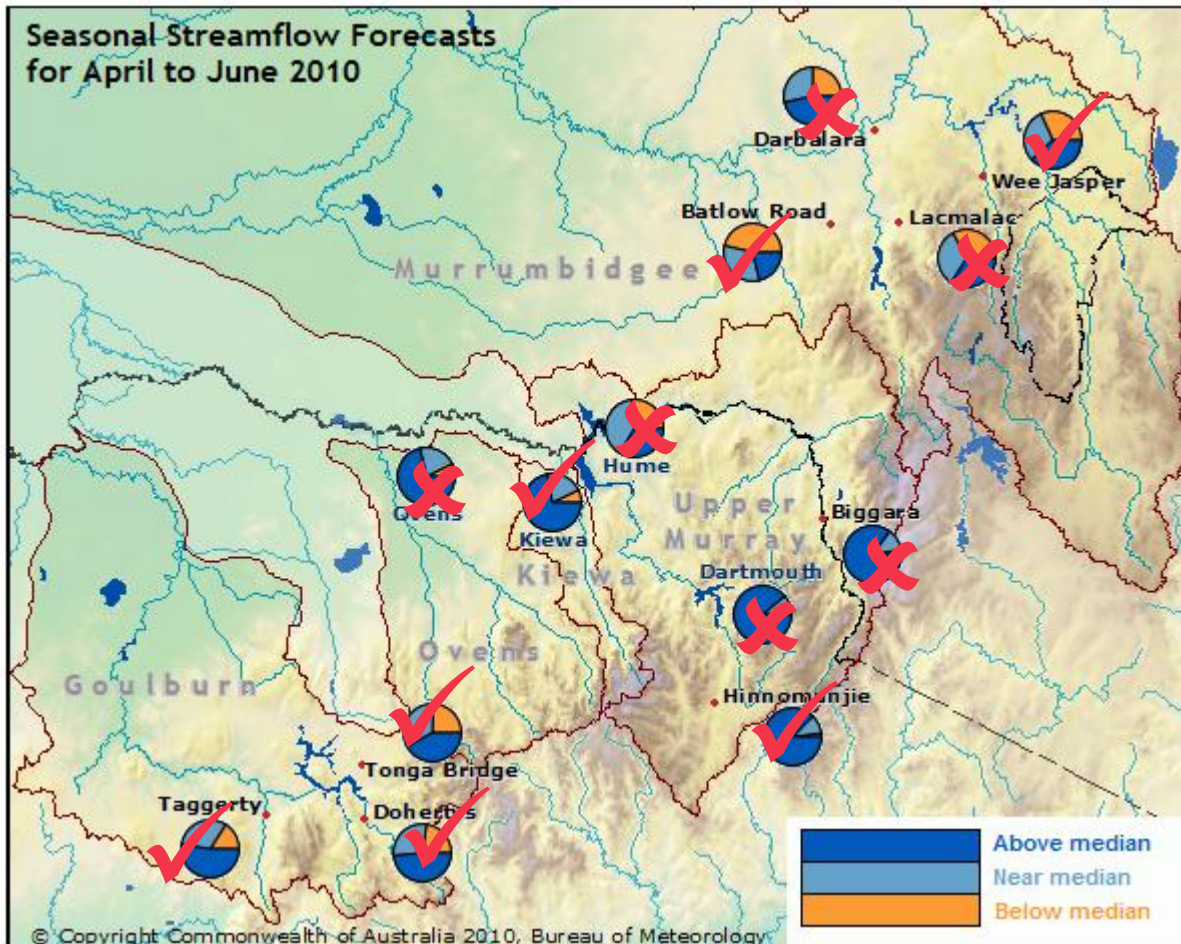
Acheron River at Taggerty (405209) Forecast Period: Apr 2010 - Jun 2010





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Experimental forecast Goulburn, Apr-Jun 2010 (4)



- 7 tercile hits and 6 tercile misses
- Low skill in Autumn

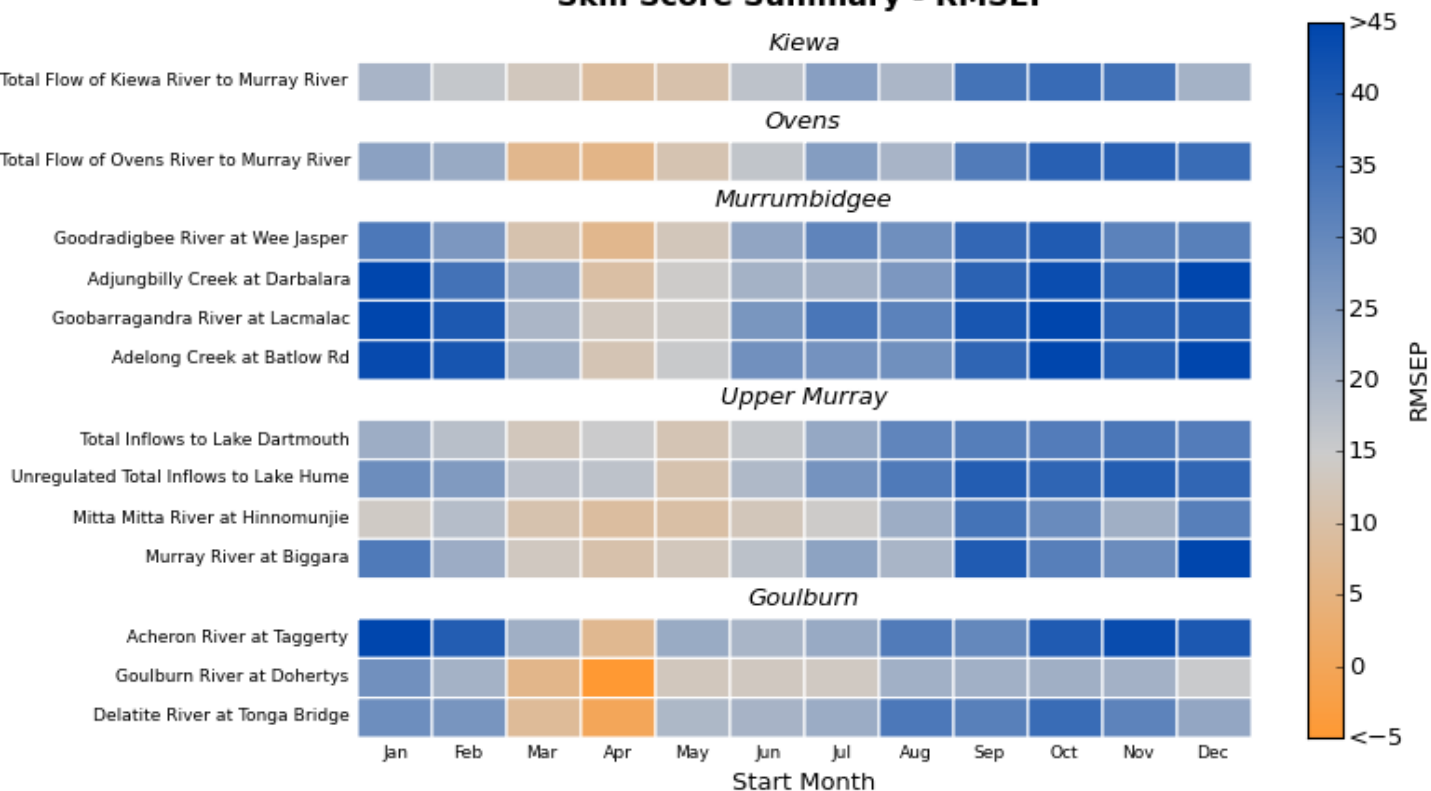


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Experimental forecast - Skills

Skill Score Summary - RMSEP





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Summary

- Short-term 7 ~ 10 day river forecast pilot showing a lot of potential
- Challenge is to convert the pilot to a full blown service
- Seasonal (3 month forecast) going operational in December 2010
- Highly applicable to areas that relate climate indicators (Soi type) with streamflow
- Dynamic modelling with downscaling work will further strengthen predictions



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Thanks for listening

Visit www.bom.gov.au/water

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