Applying seasonal and multi-year forecasting systems in dam management for drought and flood in Queensland, Australia.

Prof Roger Stone

Wivenhoe Dam

World Meteorological Organization
Weather • Climate • Water

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UNIVERSITY OF SOUTHERN QUEENSLAND

Rookwood Weir construction project - Fitzroy River, Queensland, Australia

Research into Dam management for drought and flood in south-east Queensland.

Key issues:

How to manage dam storage for a major Brisbane water reservoir through flood - then drought?

Most of our droughts ‘start and finish with a flood’ (ENSO cycle, MJO influences).

Dam management systems have trouble coping: how much storage to release during flood events if potential for drought then follows?

Largest political issue with drought rather than flood events: massive loss of votes when using recycled drinking water during drought..

Use of Multi-year forecasting project for Seqwater.

- Enhanced modelling to include all climate models contributing to World Climate Research Program (WCRP via UKMO) (WMO, Geneva)

- Key aspect on the provision of the data we need so that we can downscale and focus on key time periods of interest for seqwater.

- All models have now been uploaded forecasts for Australia and Queensland produced for coming years.

- Hindcasts (previous forecasts from these models) also negotiated and obtained.

Ocean-atmosphere models:

FGOALS (China) ('The Flexible Global Ocean-Atmosphere-Land System')

CCCMA (Canada) ('Canadian Centre for Climate Modelling and Analysis').

DePreSys (UK Met Office) ('Decadal Prediction System').

EC-Earth-3 (European Union).

GFDL (United States of America) (Geophysical Fluid Dynamics Laboratory)

MIROC5 (Japan) ('Model for Interdisciplinary Research on Climate').

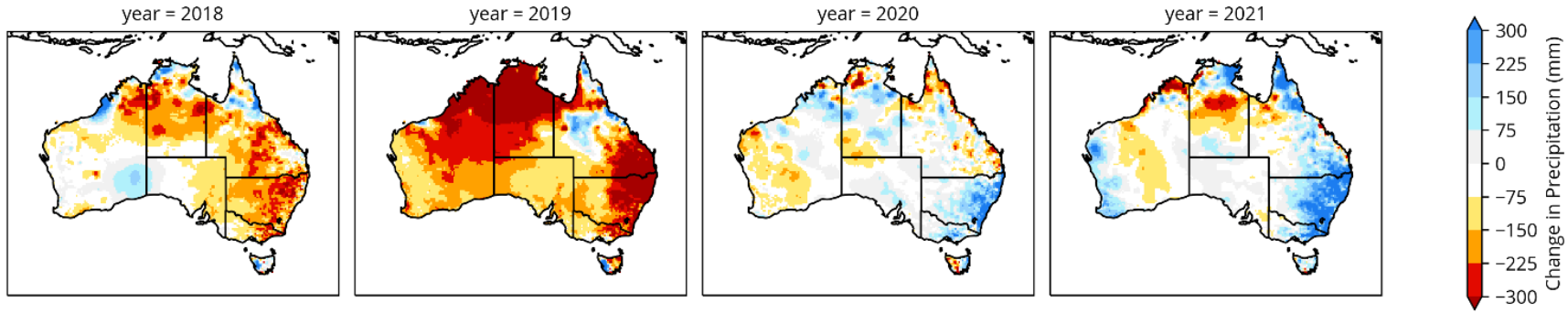
MPI (Germany) ('Max-Planck Institute').

MRI (Japan) ('Meteorological Research Institute').

NorCPM (Norway)('Norway Climate Prediction Model').

Precipitation Hindcast Skill

Observed precipitation anomaly for the past 4 years:



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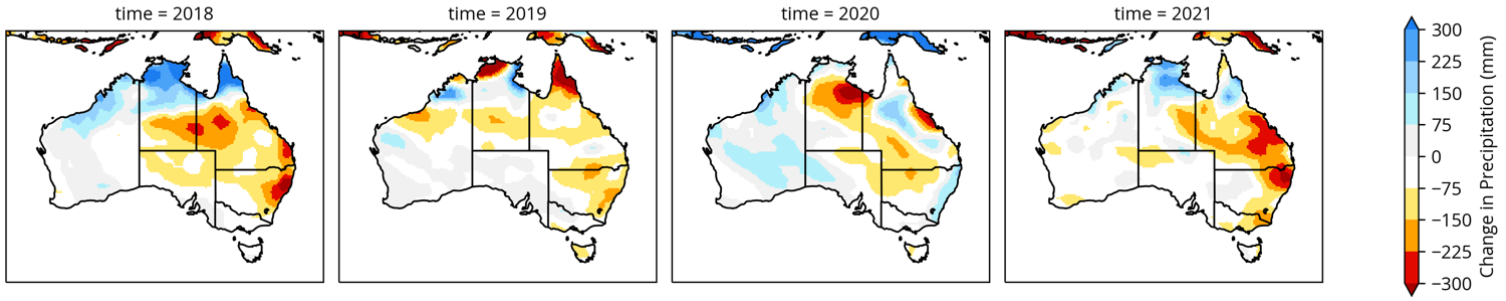
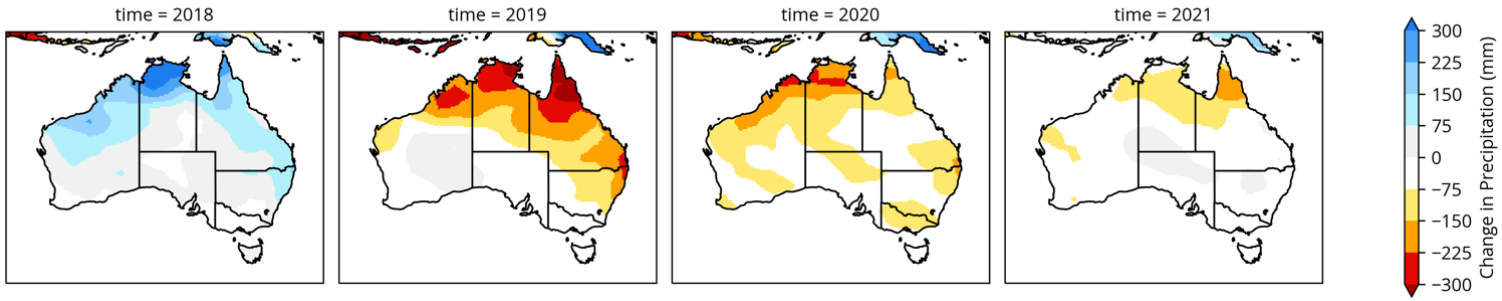
Hindcasts examples

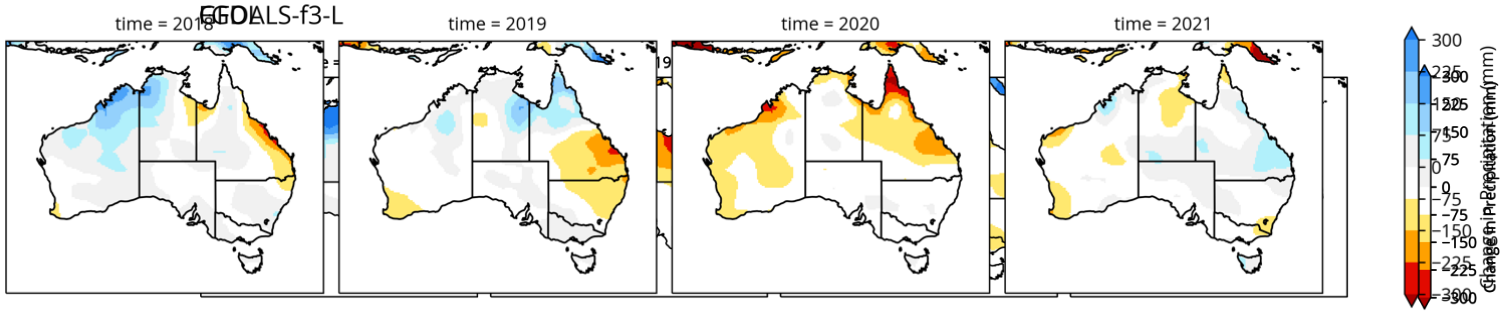
FGOALS-f3-L

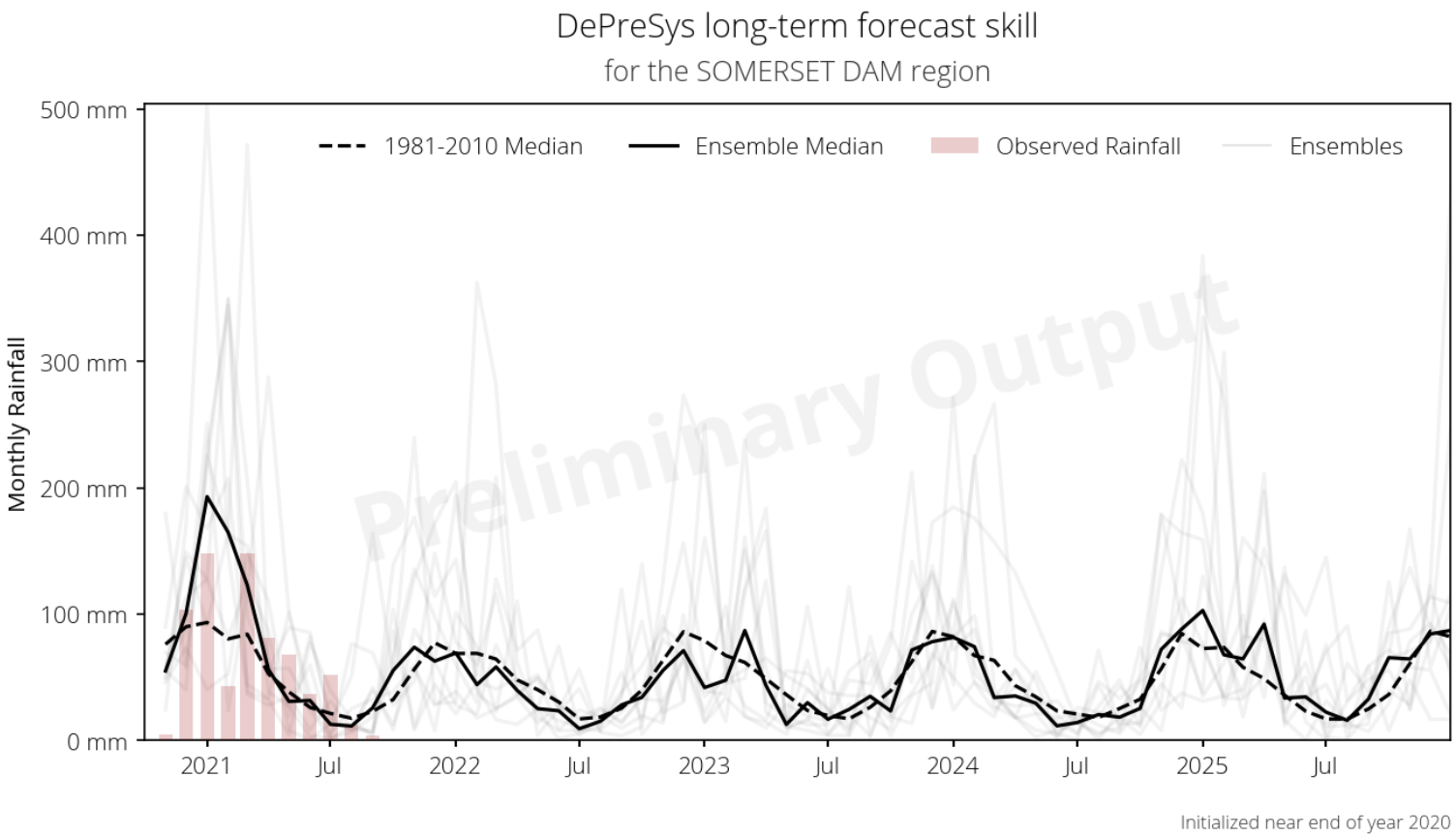


GFDL



MIROC5





Skill assessment – downscaled model

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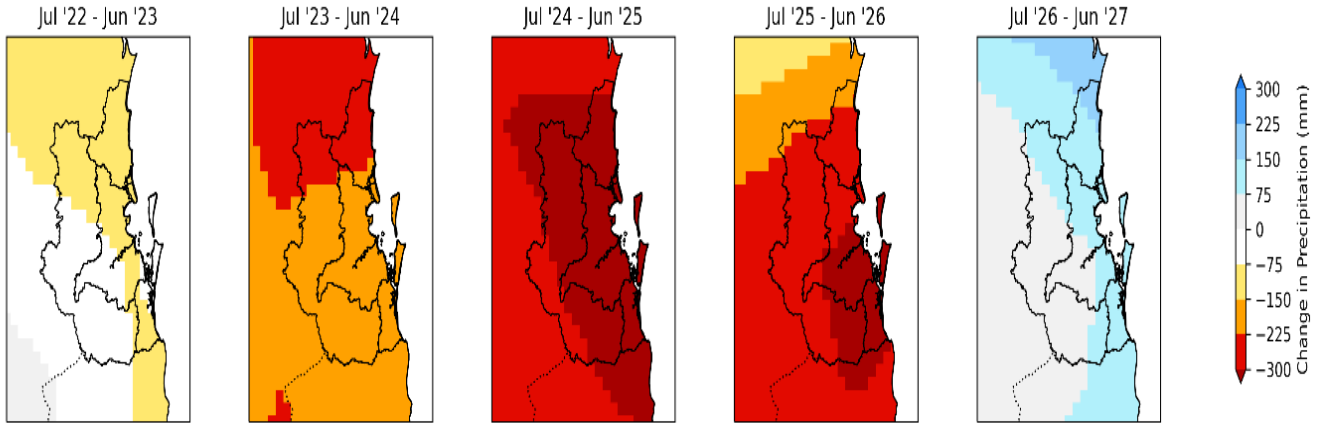
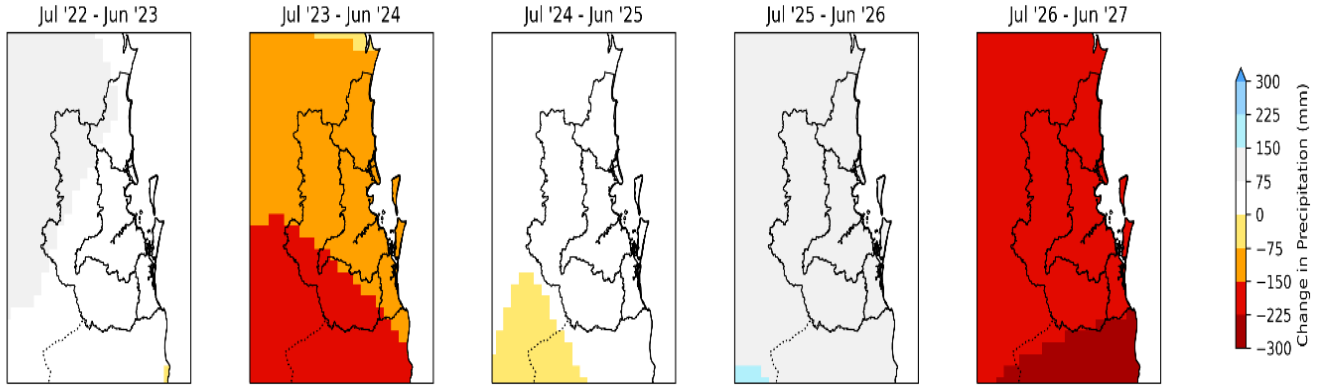
Research activity multi-year forecasting - downscaled for south-east Queensland region and catchment area (derived from multi-model **WCRP/UKMO** data)

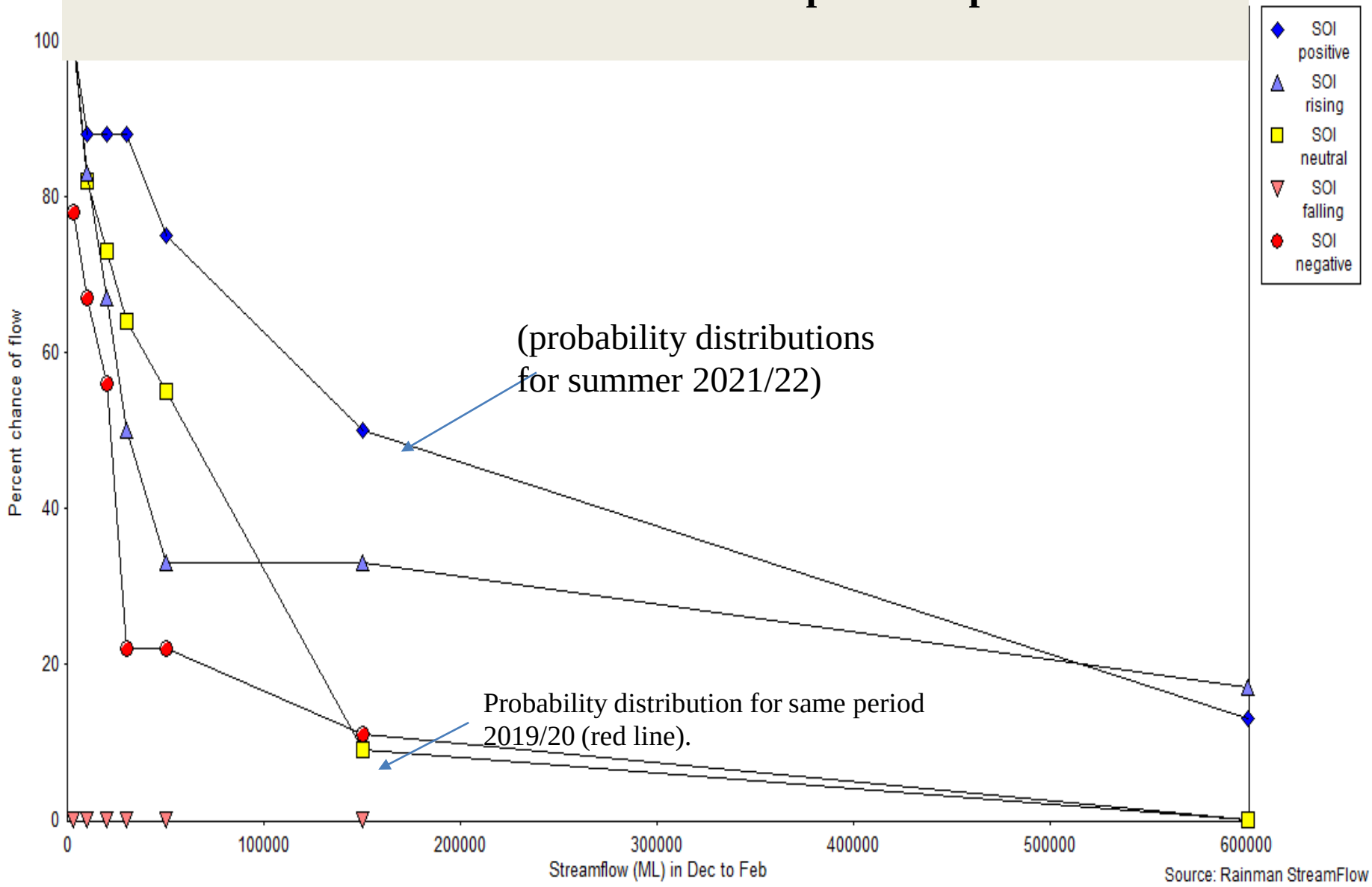
FGOALS



CCCMA



Streamflow probability distributions: Gregor's Creek. Dec-Feb associated with antecedent SOI phases Sept/Oct



Seasonal Forecasting Sunwater Rookwood Weir Project, Riverslea, Fitzroy River

1 March 2022

Percent Chance of Flow	Rising SOI Phase (relevant to this year) Flow in ML	All Year's combined Flow in ML
5%	12,000,000	8,500,000
10%	8,500,000	5,400,000
20%	4,400,000	2,700,000
30%	2,900,000	1,450,000
40%	1,750,000	920,000
50% (median)	1,026,017	538,775
60%	910,000	330,000
70%	380,000	192,000
80%	135,000	134,000
90%	55,000	54,000
100%	39,296	2,677

Table 2: Percent chance of streamflow probability values for Fitzroy River at Riverslea/Rookwood for the total March to May 2022 period.

Conclusions:

Seasonal to multi-year rainfall and streamflow forecast research seems to provide valuable opportunity for dam management – especially strategic water release management.

Seasonal forecasts for streamflow providing significant value for dam and reservoir construction and maintenance management. Key is to work closely with water and dam engineers.

Need further assessment of multiyear forecasting capability.

Beware of political issues associated with management of floods followed by droughts in water resource issues.

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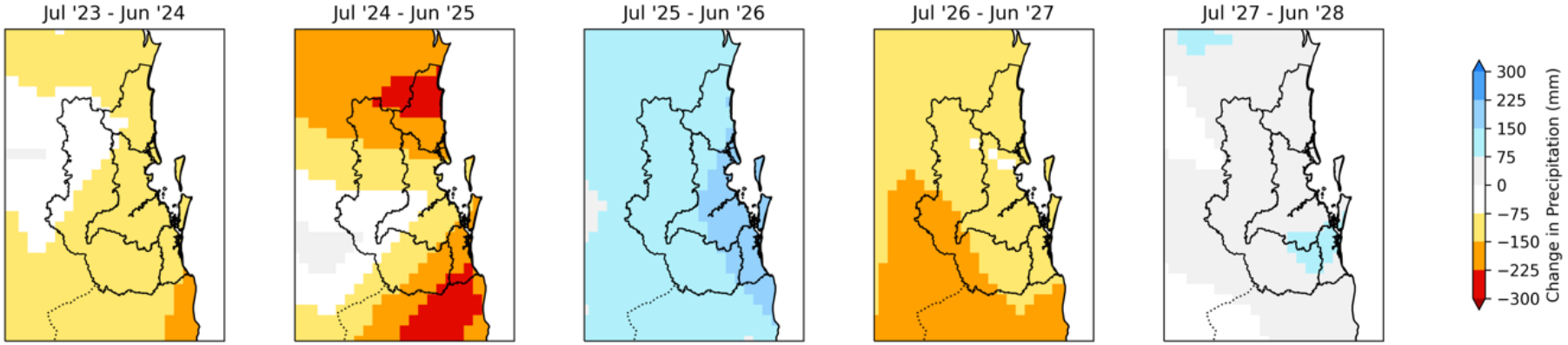
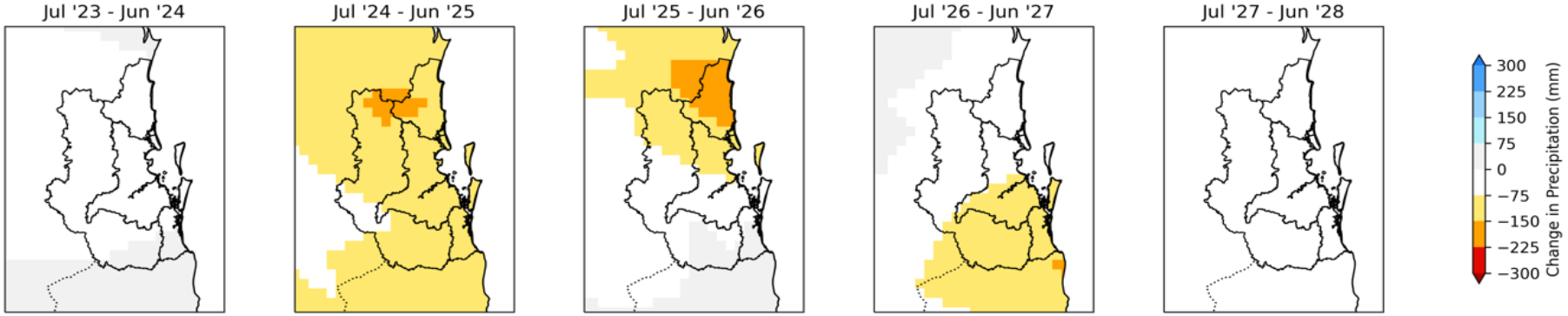
Thank you

Updated May 2023

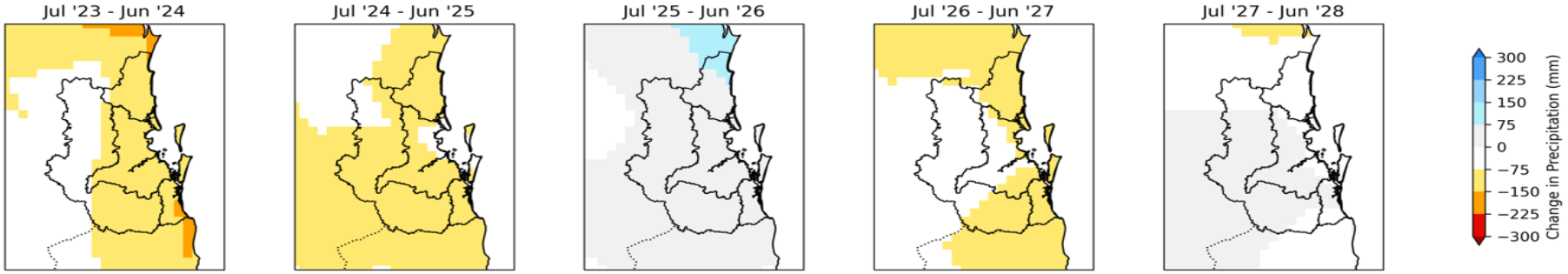
FGOALS



IPSL

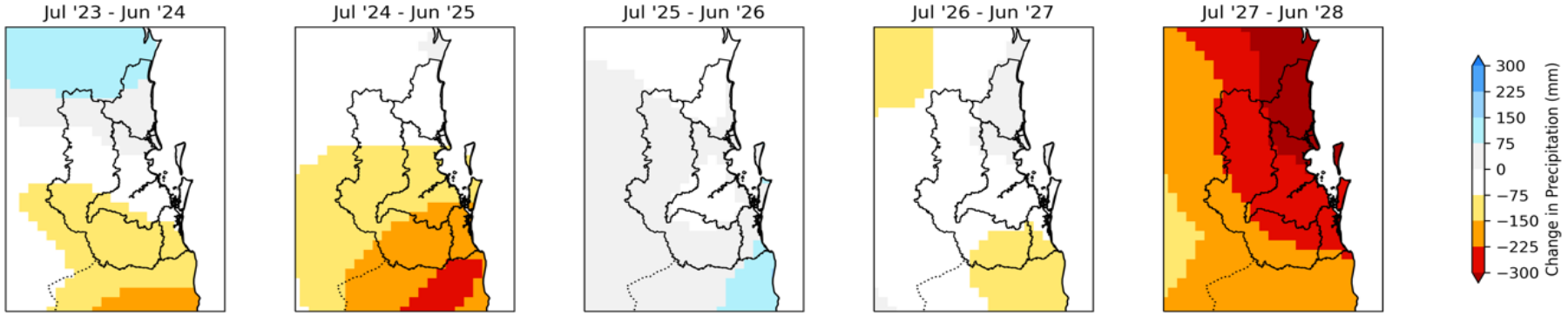


GFDL

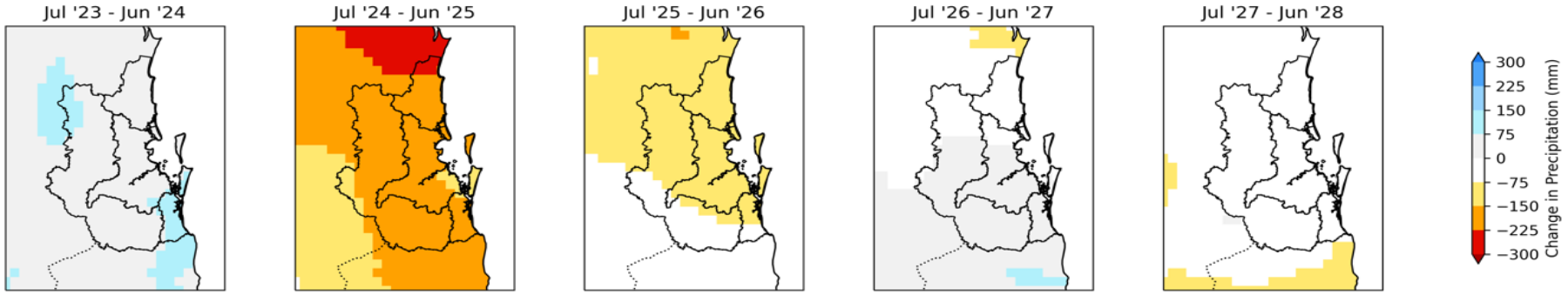


Updated May 2023

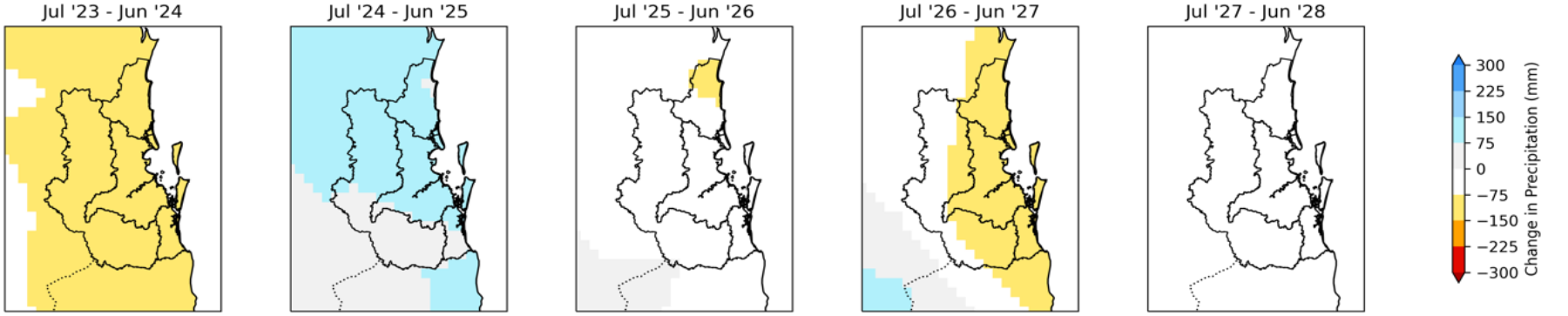
EC-EARTH



CMCC



MRI



The Wivenhoe Dam is a rock and earth-fill embankment dam with a concrete spillway across the Brisbane River in South-East Queensland, Australia. The dam wall is located about 80 kilometres by road from the centre of Brisbane.
Opened: 1984
Area: 109.4 km²
Installed capacity: 500 MW (670,000 hp)
Total capacity: 1,165,238 ML (256,317×10^6 imp gal; 307,823×10^6 US gal)
Construction: March 1973; **Coordinates:** 27°23′38″S 152°36′28″E / 27.39389°S 152.60778°E
Dam volume: 4,140×10^3 m³ (146×10^6 cu ft)