Northern Australia Climate Program

Centre for Applied Climate Sciences

Climate Outlook Review – Northern Australia

July 2023

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Overview

This is a review and opinion of various seasonal and other forecast systems currently available from a range of sources, from Australia and internationally.

A key aspect to note is that this forecast review is incorporating forecast values valid from July 1st to September 30th, as well as those of later validity. We suggest that for the forecasts based on the SOI phases, commencing July 1, that the high rainfall probability values and the rainfall likely as part of this forecast has likely already fallen - in the first week of July.

Nevertheless, we continue to progress through the early stages of this new El Niño. Indeed, bursts of rainfall at the early stages of an El Niño development are not uncommon in parts of Australia (e.g., 1972, 1991, 2009).

Additionally, due to the westerly phase of the Quasi-Biennial Oscillation (QBO), (coupled with high solar activity) it is likely that the sub-tropical ridge of high pressure will be displaced a lot further north than normal this winter and spring, leading to further reduction in rainfall over southern and central Queensland during that period. This pattern would also facilitate continued passage of troughs and fronts over parts of southern Australia during winter and spring.

Note that these seasonal forecasts are for total rainfall over a total three-month period. Previous forecasts remain valid for that particular three-month period.

In terms of three-month total rainfall, the SOI phase system for the end of June was 'rapidly rising'. For the July to September 2023 total period many regions have comparatively high rainfall probability values. We would expect these values to fall again in coming months as the El Niño pattern becomes 'coupled' with the atmosphere (see Figure 1).

BoM forecast outputs are continuing to indicate very low rainfall probability values for coming periods.

The monthly average Southern Oscillation Index (SOI) value for June 2023: Minus 3.19 (-3.19) (but that still places the phase as 'rapid rise' as this system utilises/balances rate of change as well as the absolute values of the SOI).

Please note page 3, the forecast pasture growth map (Queensland Government: "DES") that utilises the integrated SOI phase system and their pasture growth model.

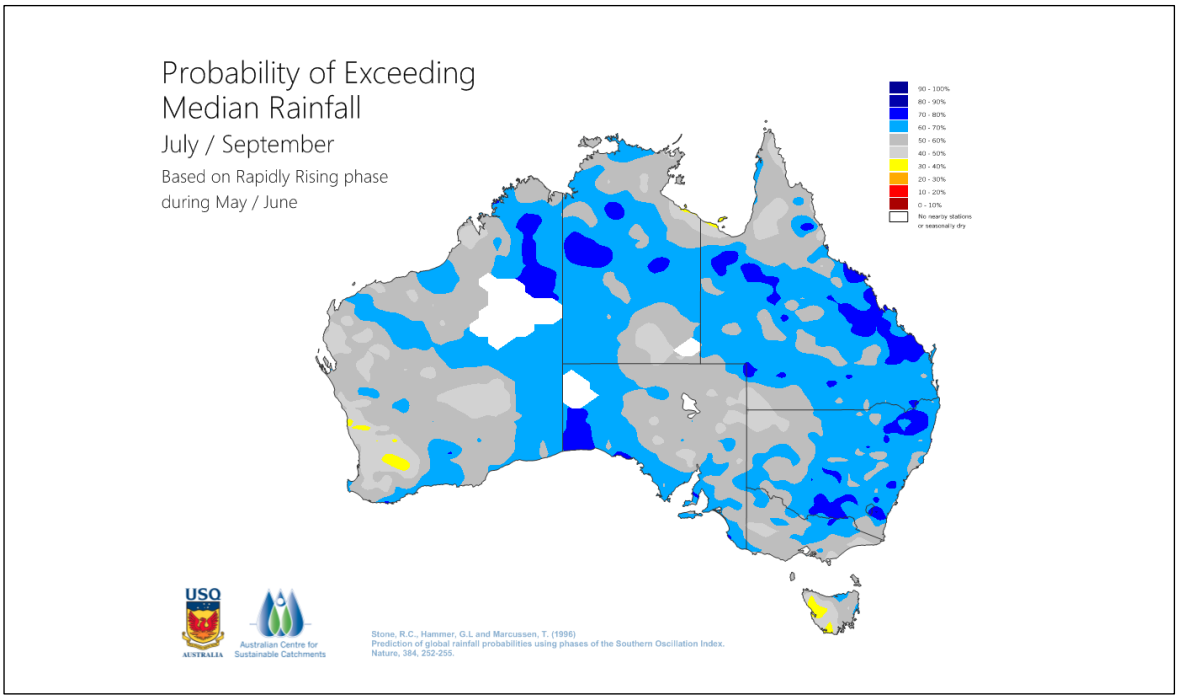


Figure 1: The SOI phase system showing the 'probability of exceeding median rainfall' values for Australia for the overall period July to September, based on a 'rapidly rising SOI Phase pattern' during May/June. Note that these probability values are relative to rainfall that occurs at this season of the year. We expect these probability values to fall again for the subsequent core winter/spring months (after Stone, et al., 1996).

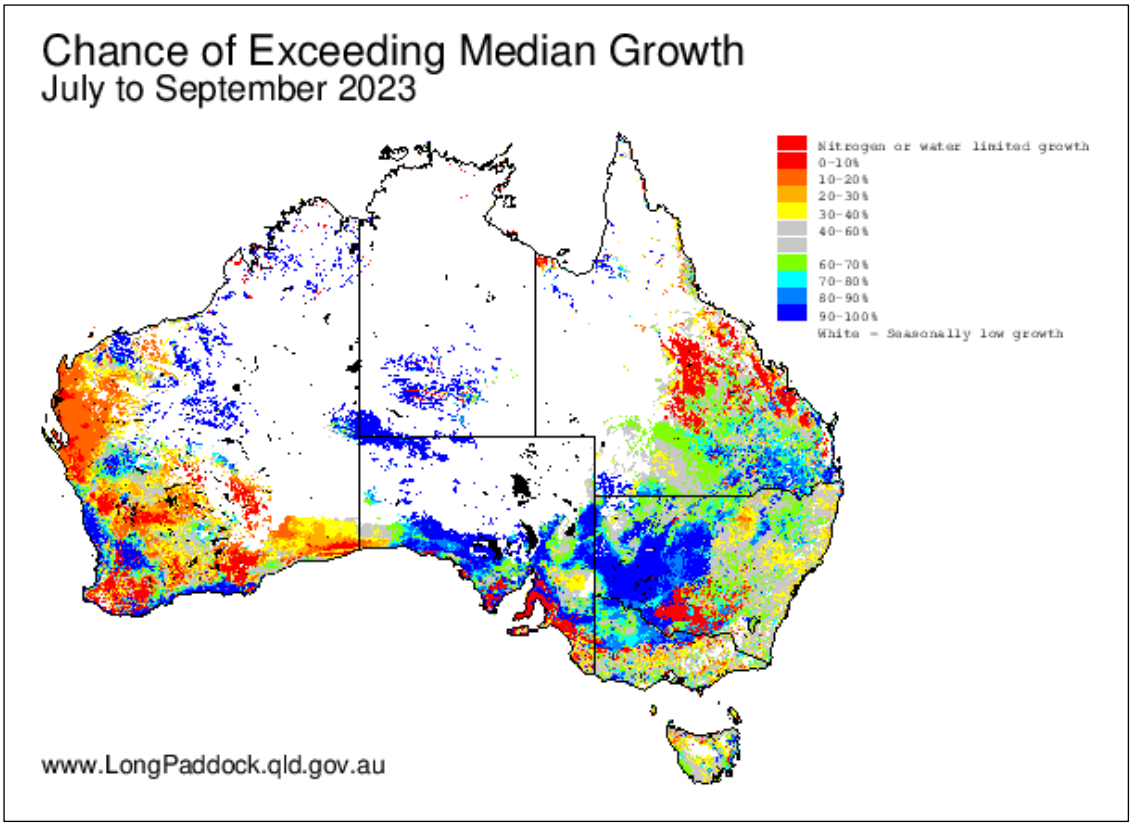


Figure 2: Chances of exceeding median pasture growth for the July to September period 2023 period (relative to this period of the year). This output integrates antecedent moisture and forecast rainfall, temperature, within a pasture growth model and the SOI phase forecast system.

The Southern Oscillation Index:

The Southern Oscillation Index (SOI) is an index based on the difference between surface pressure anomalies between Tahiti and Darwin.

The SOI phases (constructed using principal components and cluster analysis) consist of five different categories that consider both rate of change, consistency, and absolute value of the SOI.

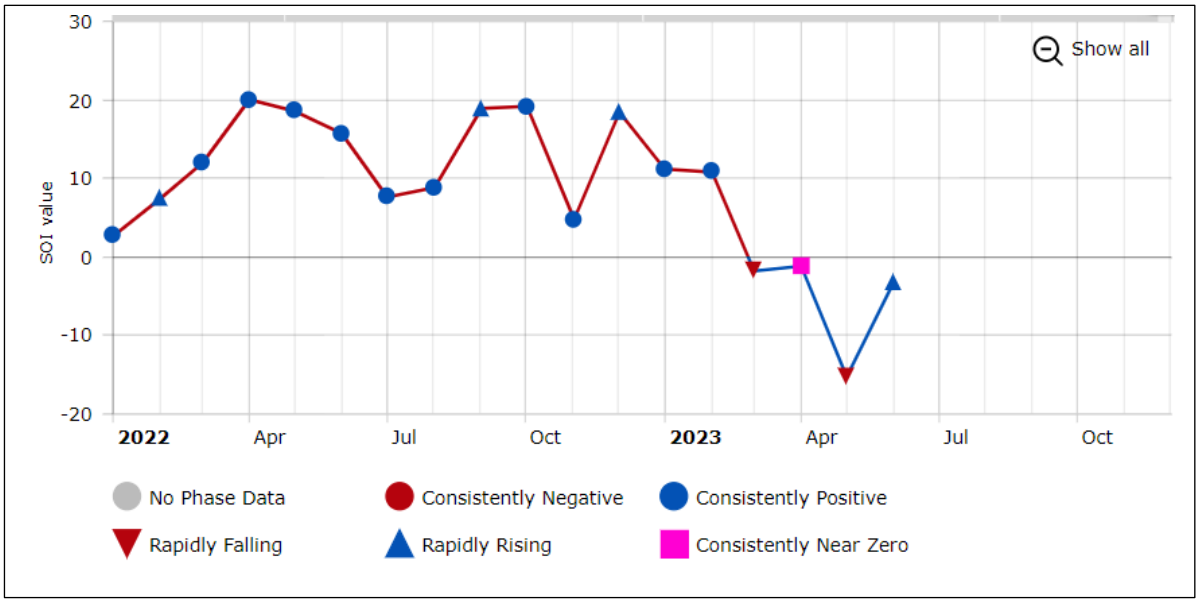


Figure 3: Recent SOI values – the most recent SOI phase was 'rapidly rising'. The monthly value for June was minus 3.19 (-3.19) (Courtesy the Longpaddock website).

Australian Bureau of Meteorology forecasts:

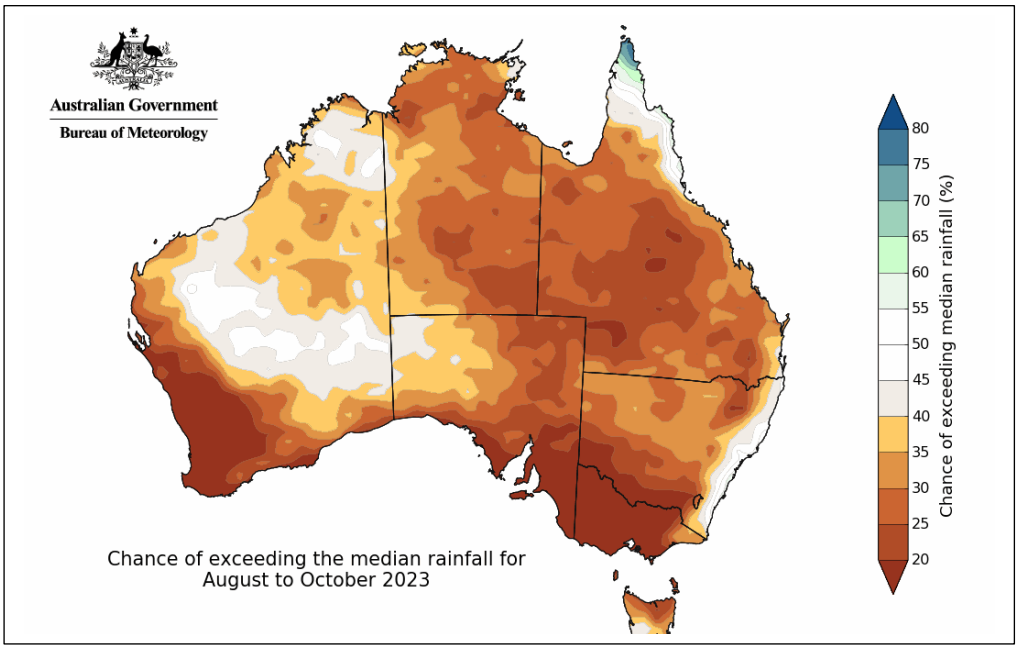


Figure 4: Bureau of Meteorology Forecast 'Chance of exceeding median rainfall' probability values for northern Australia for the overall period August to October 2023. For this coming period, rainfall probability values are shown to be much lower than normal (low probability values of exceeding the median: ~20%) in almost all regions.

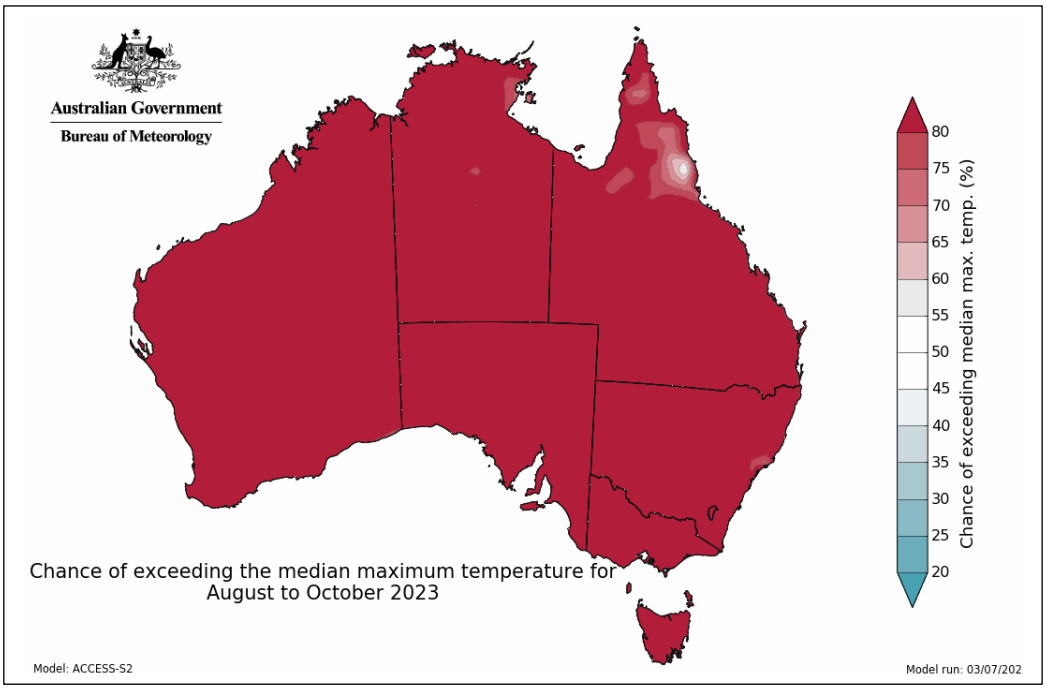


Figure 5: Bureau of Meteorology Forecast 'Chance of exceeding median maximum temperatures' for northern Australia for the overall August to October 2023 period. Almost all regions indicate a high probability of above normal maximum temperature values (possibly because of mostly clear conditions forecast).

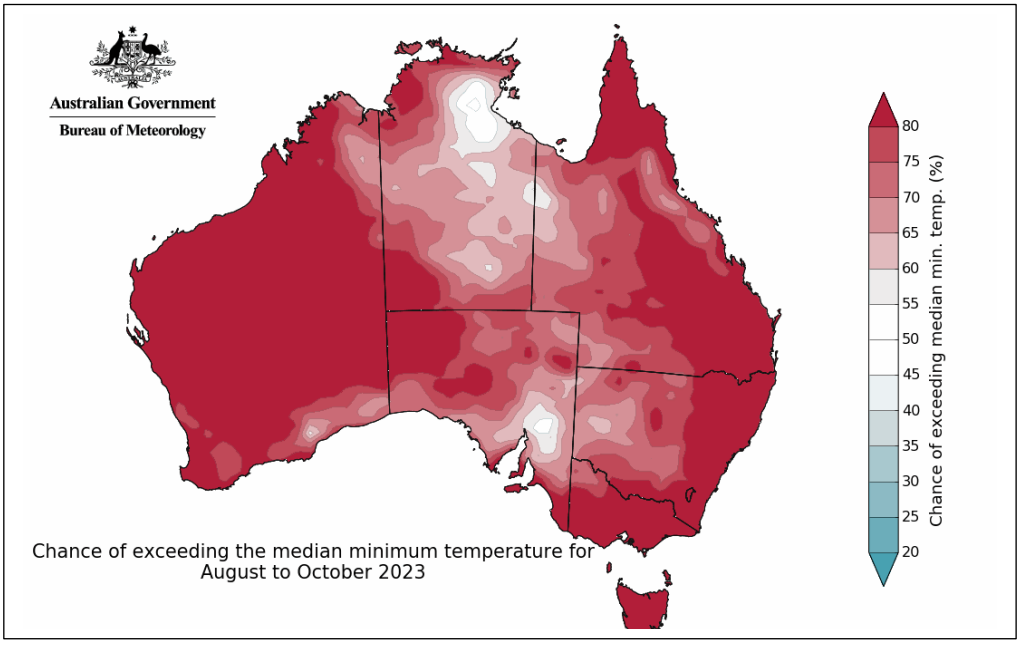


Figure 6: Bureau of Meteorology Forecast 'Chance of exceeding median minimum temperatures' for northern Australia for the overall period August to October 2023. Most regions of northern Australia except parts of inland NT, inland South Australia, southern inland Qld and inland NSW Australia are forecast by BOM to have a high probability of above median minimum temperatures (this would not include frost forecasts).

Longer-term forecasts:

The UKMO and ECMWF models provide useful assessments of longer-term rainfall probability values for northern Australia. The UKMO example below suggests about a 20 to 40% chance of above median rainfall for September to November 2023 for those regions shaded yellow.

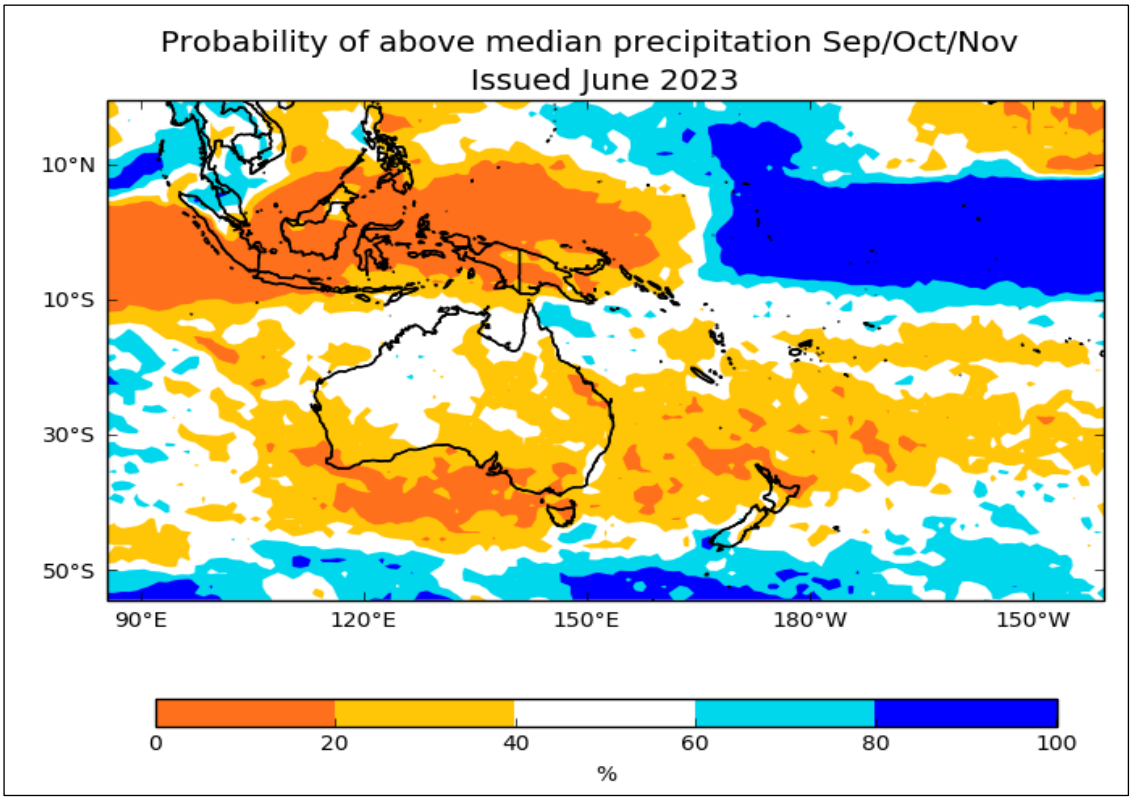


Figure 7: UK Met Office forecast map for the longer-term: Probability of getting above median precipitation for the total period September to November 2023. Regions shaded yellow or brown have less than ~20% to 40% probability of above normal spring rain. Regions shaded white have close to normal rainfall probability values (not that there are many of them).

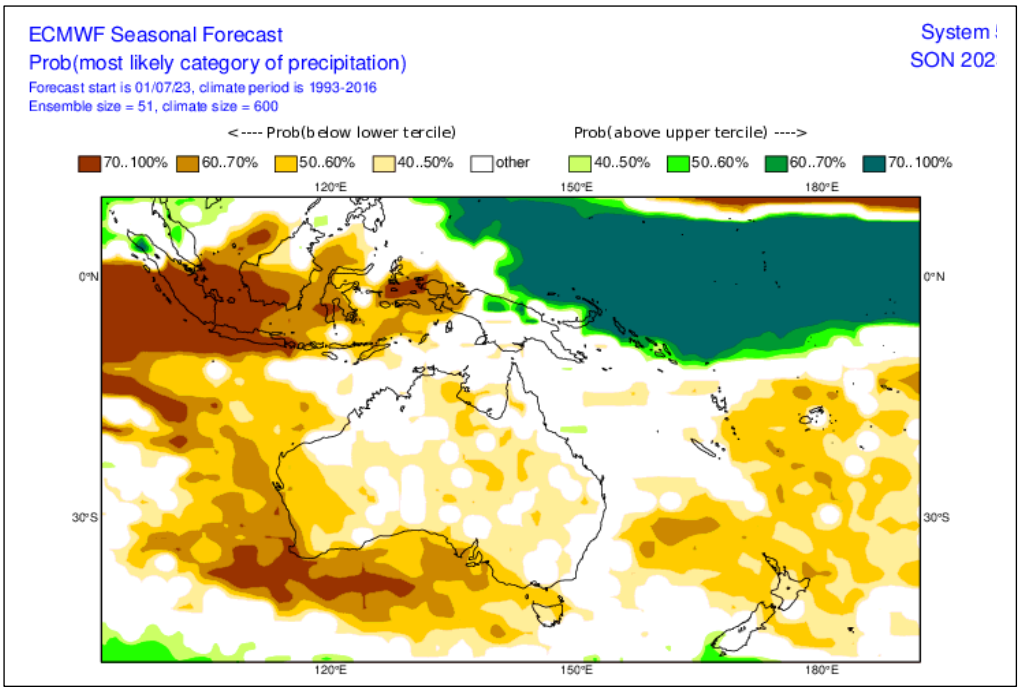


Figure 8: ECMWF forecast rainfall probability values for northern and eastern Australia – and the region generally for September to November 2023 (Courtesy ECMWF). Yellow or darker-shaded regions depict low rainfall probability values, values that will most likely continue through summer 2023/24 due to El Niño 'phase-locking'. Interestingly, this forecast system is not showing the consistency of low rainfall probability values that are being provided by other longer-term forecast systems such as BoM or UKMO.

Explaining the differences between models:

Dynamical models use the current state of the oceans and atmospheres combined with our understanding of the physical processes behind weather and climate to forecast the likelihood of future rainfall. Each dynamical model is based on certain model calibrations, which differ from model to model, providing slightly different outcomes. Statistical models use historical climate data to determine when conditions were similar in the past and what rainfall resulted from those past conditions.

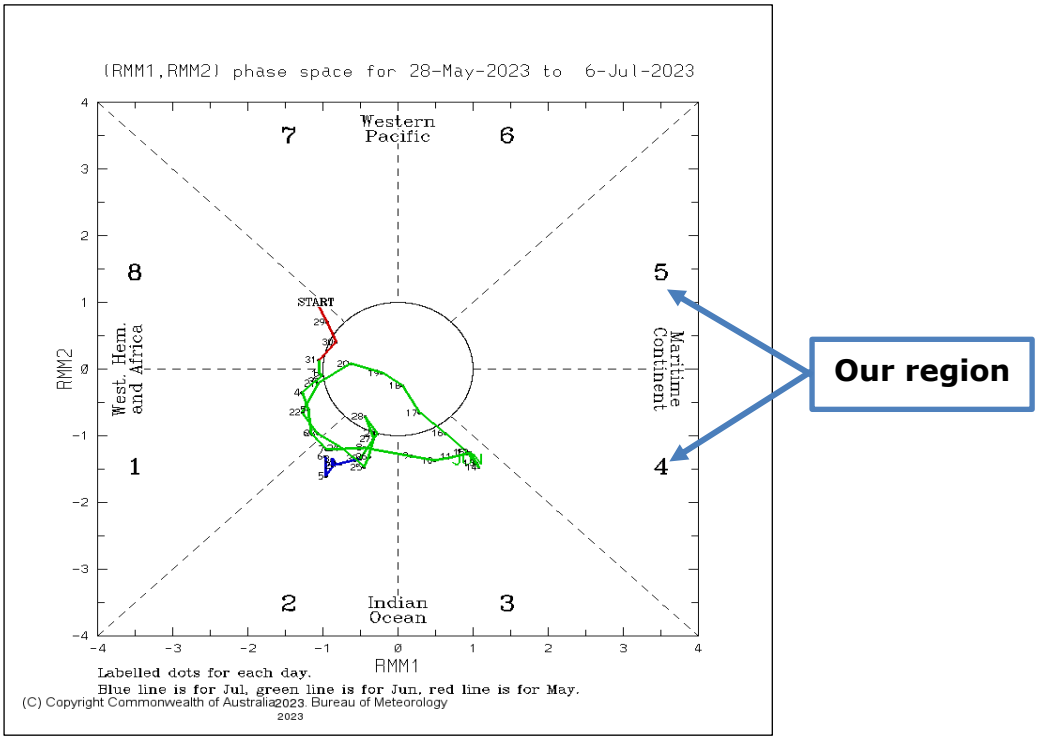
While all of the models may be slightly different, it is important to focus on the overall predicted outcomes.

El Niño-Southern Oscillation (ENSO)

ENSO events generally begin in the Southern Hemisphere winter, peak during summer, and then usually end during autumn. The El Niño phase is often associated with warmer and drier conditions while La Niña phases are often associated with cooler and wetter conditions. The main areas of Australia impacted by ENSO phases are the eastern seaboard, north-eastern Australia, and south-eastern Australia.

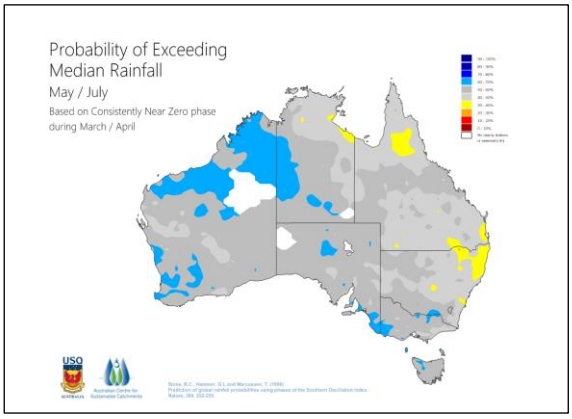
Madden Julian Oscillation (MJO)

MJO impacts weather in tropical Australia (and occasionally in higher latitude areas) on a weekly to monthly timescale. According to BoM's and NOAA's forecasting system and USQ's analysis. The Madden Julian Oscillation (MJO) will next be due at around mid-August, although it may have stalled a little over the past week or so (see the blue line on the MJO phase diagram). It takes roughly 30-40 days for the MJO to circle the earth, although this can vary considerably on occasions).

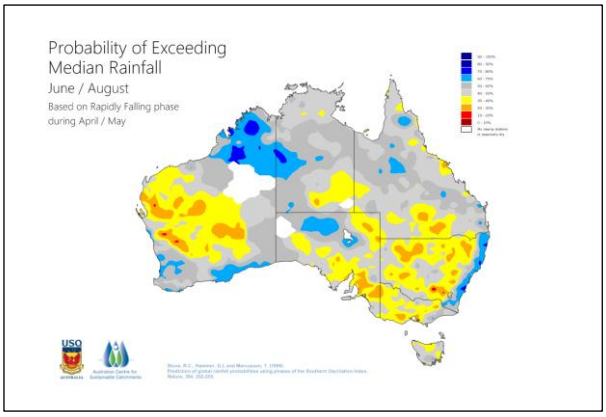


Previous SOI-phase forecast maps

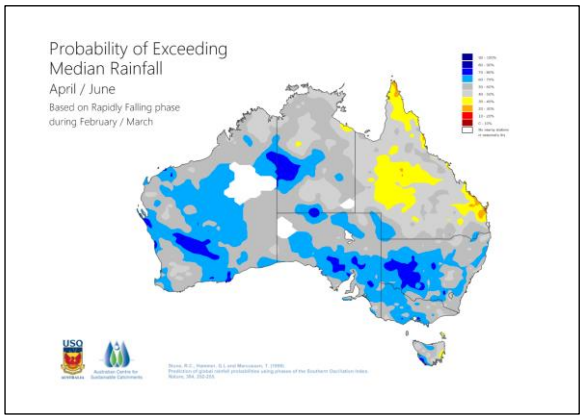
As these forecasts are issued for a three-month validity on a rolling monthly basis, it has been decided to provide a continuous reference to these forecasts, as below:



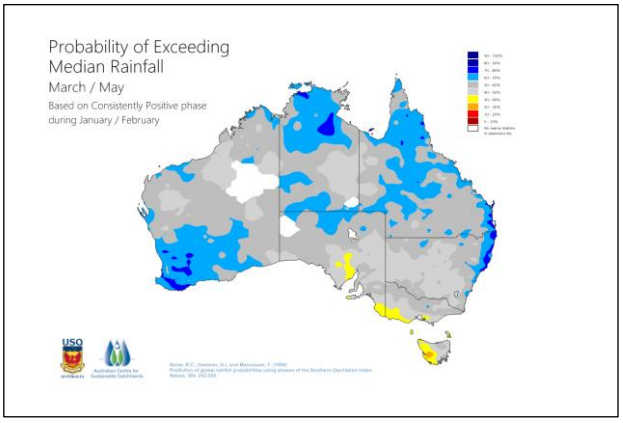
Forecast May-July 2023



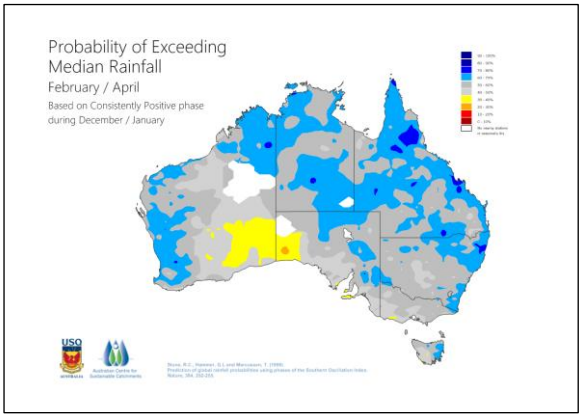
Forecast June to August 2023



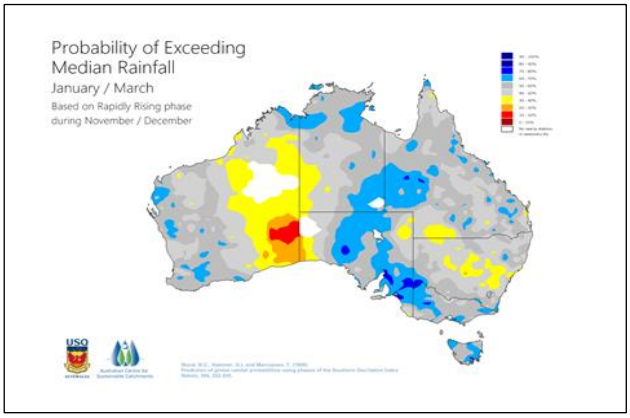
Forecast April-June 2023



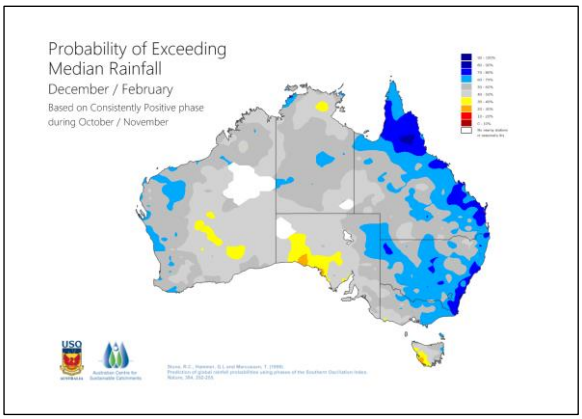
Forecast March-May 2023



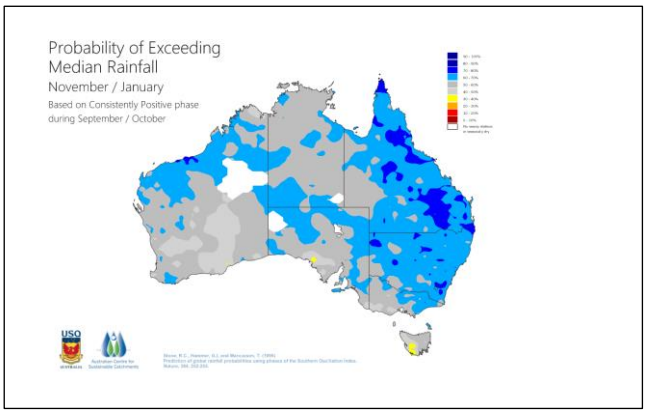
February to April 2023



January to March 2023



Seasonal climate forecast valid 1 December 2022 to 28 February (2023)



Seasonal climate forecast valid 1 November 2022 to 31 January (2023)

For further information, click on the following links:

- For the MJO
- For weekly SSTs
- For easterly (and westerly) wind anomalies across the Pacific
- For sub-surface temperatures across the Pacific
- For ECMWF forecast products
- For 'plume' forecasts of SSTs in the central Pacific
- For a complete history of the SOI
- The Long Paddock
- Additional information on ENSO

References:

Pittock, A.B. (1975). 'Climatic Change and the Patterns of Variation in Australian Rainfall' *Search*, **6**, 11-12, 498-503.

Stone, R.C., Hammer, G.L., and Marcussen, (1996). 'Prediction of Global Rainfall probabilities using phases of the Southern Oscillation Index', *Nature*, **384**, November 1996.

Williams, A.J., and Stone, R.C. (2008) 'An assessment of relationships between the Australian sub-tropical ridge, rainfall variability, and high-latitude circulation patterns' *Int J. Climatology,* **29**, 691-709.

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