

Summer Cropping Climate workshop 2017

Goondiwindi Royal Hotel



Darren Ray

Senior Climatologist

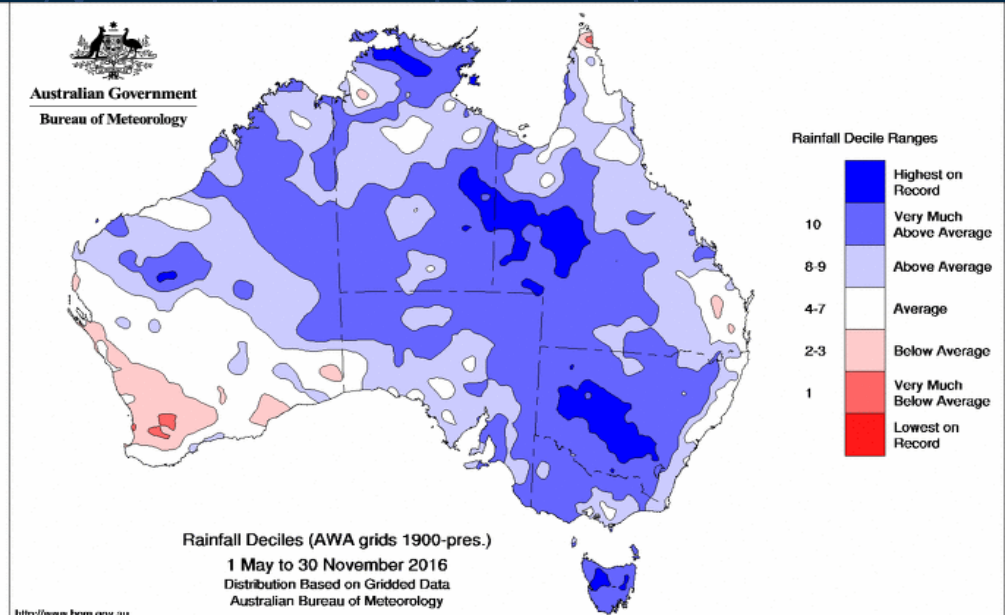
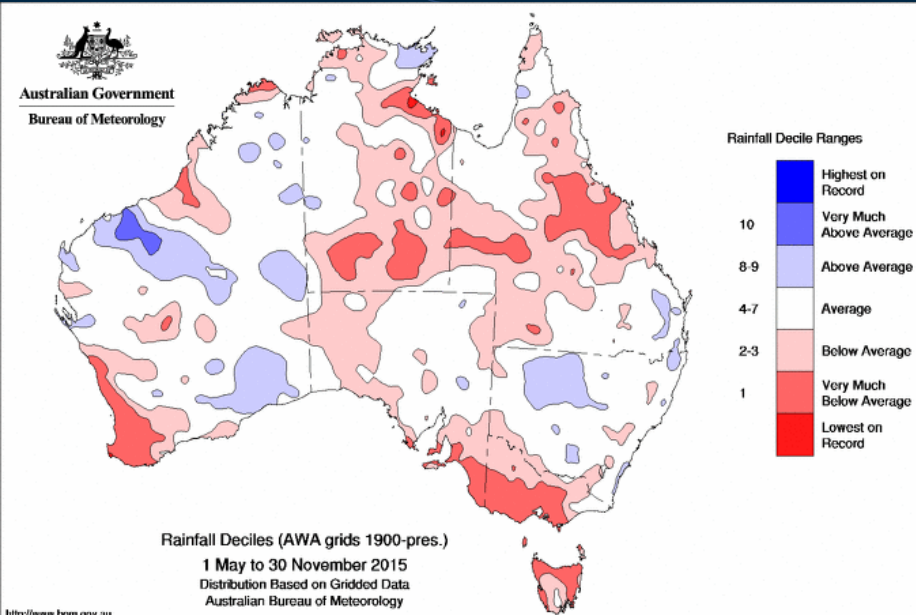
Bureau of Meteorology – Agriculture Program

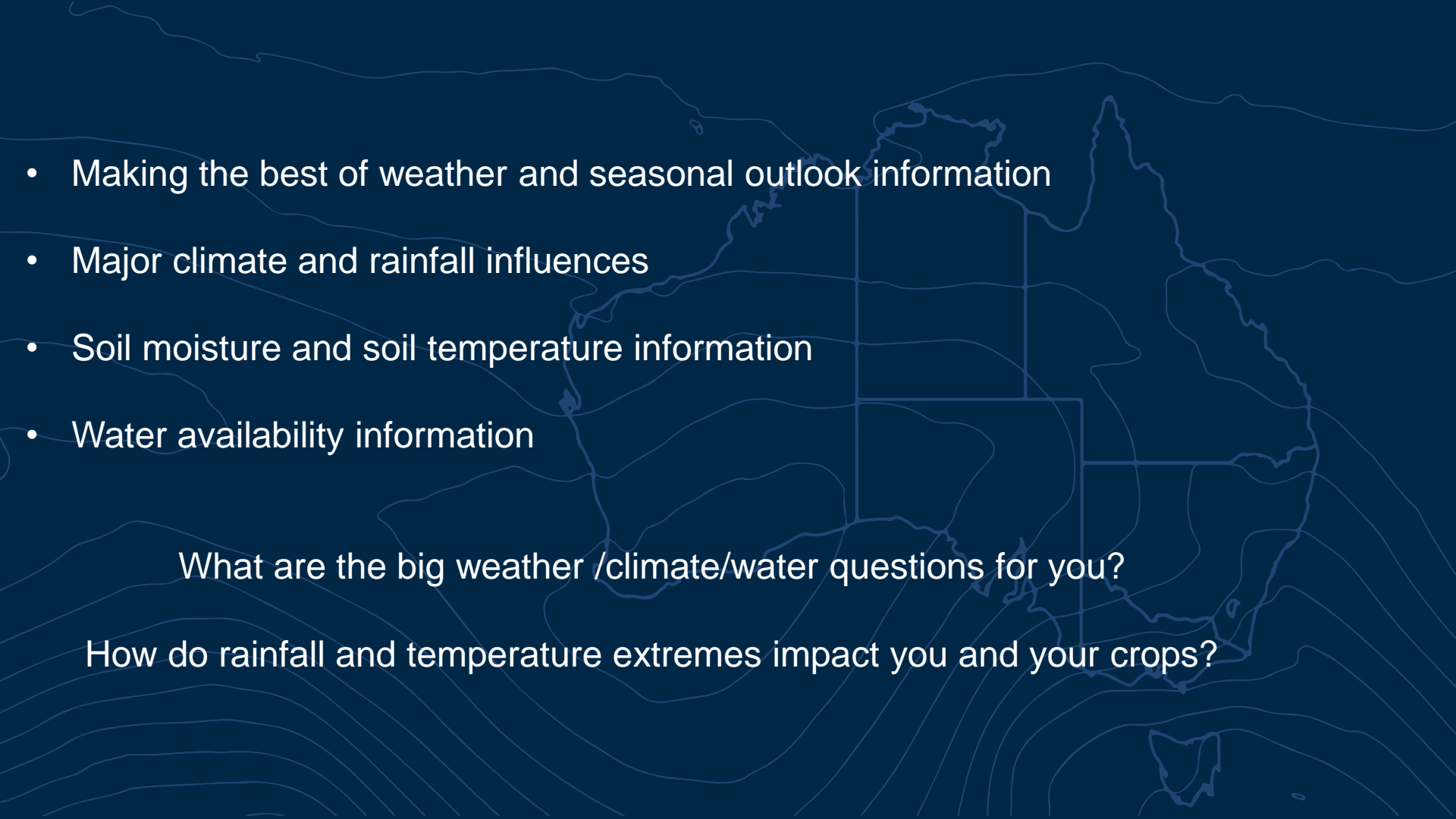


Australia's significantly variable climate

2015

2016



- 
- Making the best of weather and seasonal outlook information
 - Major climate and rainfall influences
 - Soil moisture and soil temperature information
 - Water availability information

What are the big weather /climate/water questions for you?

How do rainfall and temperature extremes impact you and your crops?



Australian Government
Bureau of Meteorology

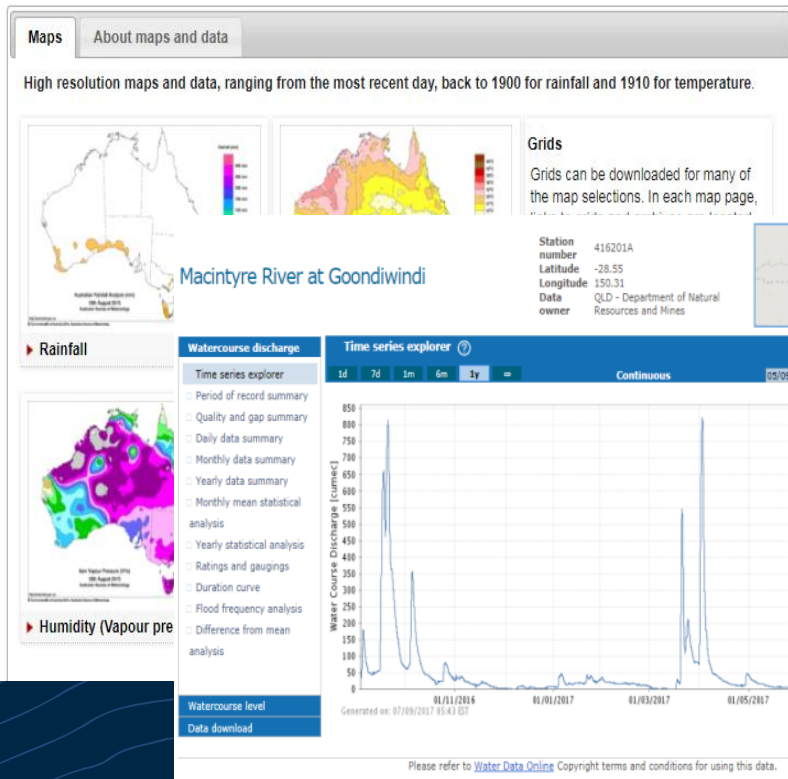
What's been happening?



Climate and Water information

Bureau Home > Climate > Maps of recent and past conditions

Maps of recent and past conditions



Climate Data Online

<http://www.bom.gov.au/climate/data/>

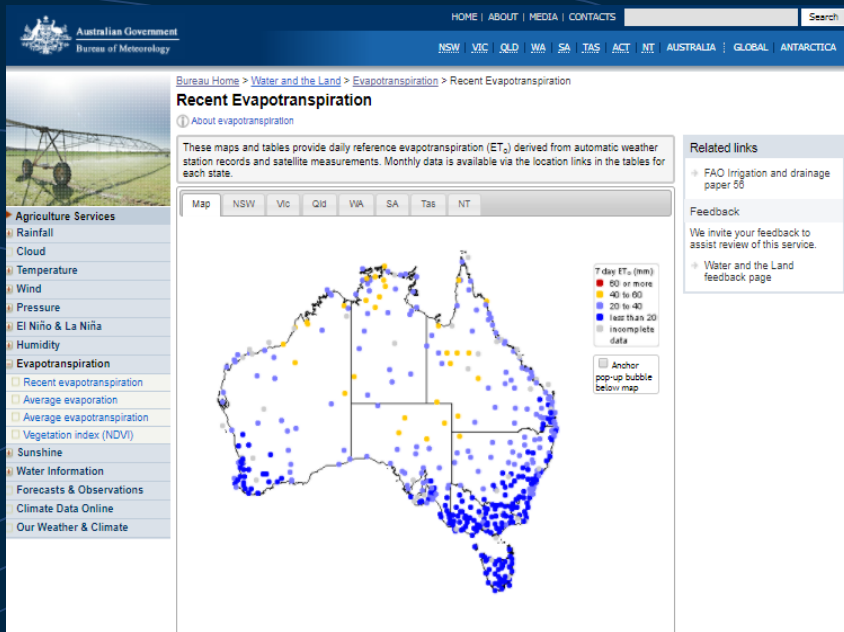
Water Data Online

Rainfall, temperature, solar radiation, vegetation mapping

<http://www.bom.gov.au/climate/maps/>

Evapotranspiration information

Daily recent evapotranspiration from Bureau weather stations: <http://www.bom.gov.au/watl/eto/>



Evapotranspiration Calculations

Narrabri Airport - September 2017 daily calculations

Date	Evapotranspiration (mm) 0000- 2400	Rain (mm) 0900- 0900	Pan Evaporation (mm) 0900- 0900	Max Temp	Min Temp	Max Rel Hum (%)	Min Rel Hum (%)	Average 10m Wind Speed (m/sec)	Solar Radiation (MJ/sq m)
30/08/2017	3.4	0.0		20.1	-0.3	78	17	2.41	18.57
31/08/2017	4.2	0.0		20.4	-0.1	74	19	3.88	18.77
01/09/2017	4.8	0.0		21.1	4.7	65	14	4.36	18.89
02/09/2017	3.7	0.0		24.4	1.2	64	12	1.88	19.01
03/09/2017	6.7	0.0		30.0	4.6	56	16	4.90	16.23
04/09/2017	4.3	0.0		22.2	0.8	85	16	3.33	19.25
05/09/2017	4.3	0.0		20.1	1.5	69	20	4.04	19.36
Totals:	31.4	0.0							

Monthly Archive

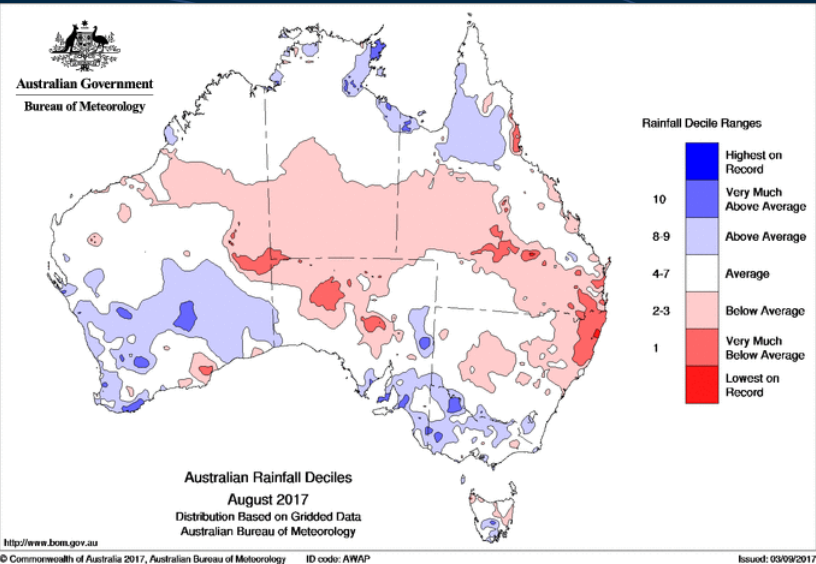
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			

Product Code: IDCKWCDEA0

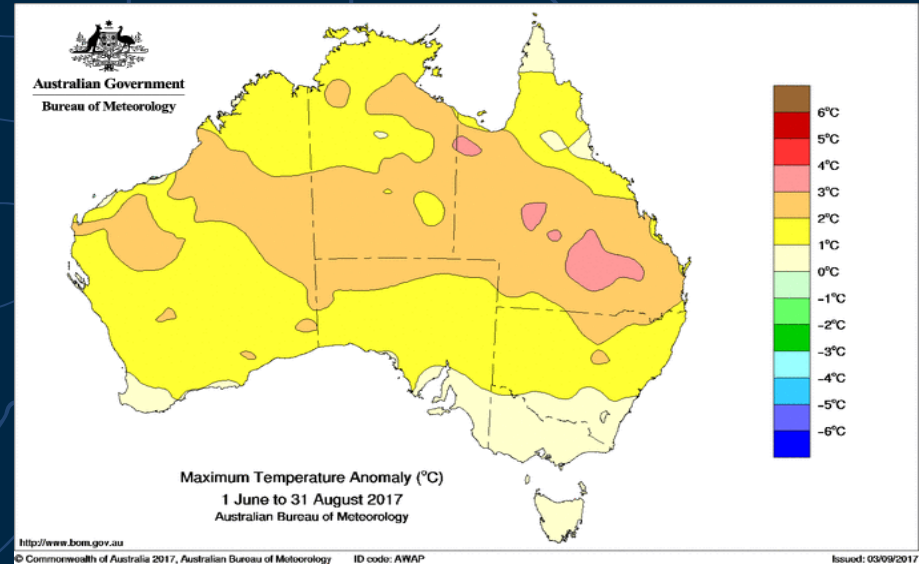
Have been trialling 7 day forecast daily Eto for irrigated cropping

2017 so far

Rainfall



Temperatures

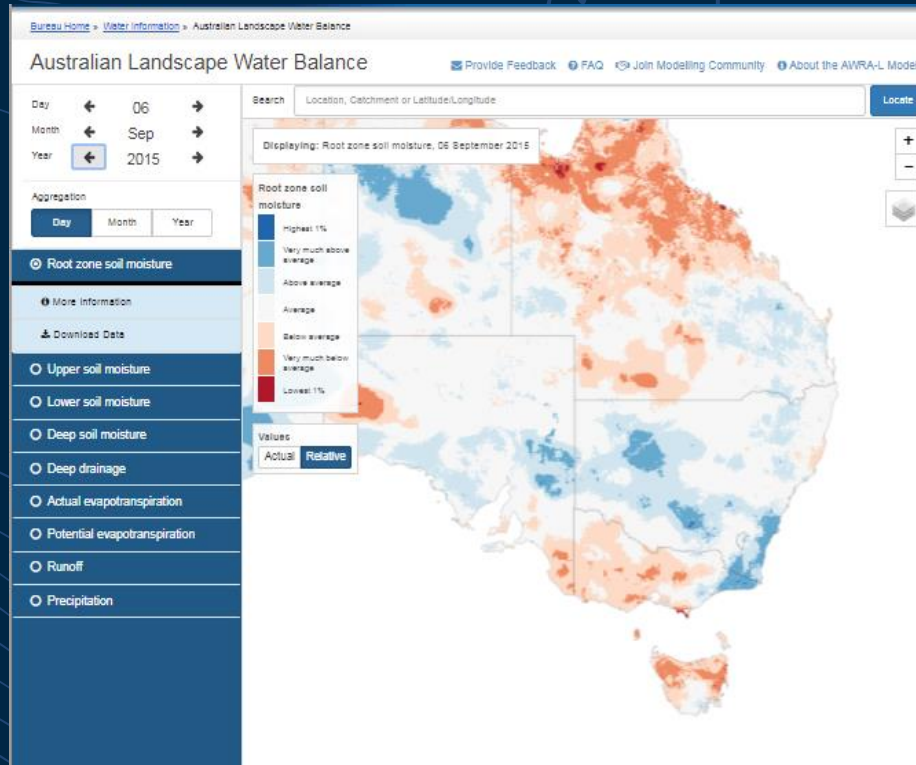


Drier than average, and much warmer than average temperatures

Modelled soil moisture levels

<http://www.bom.gov.au/water/landscape/>

5km resolution
updated daily





Australian Government
Bureau of Meteorology

Forecasts for the week ahead

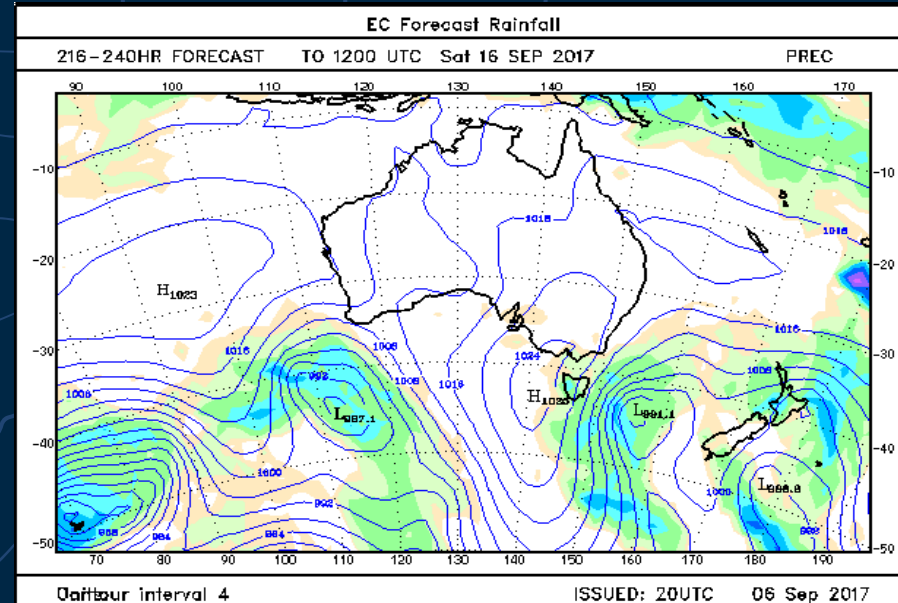
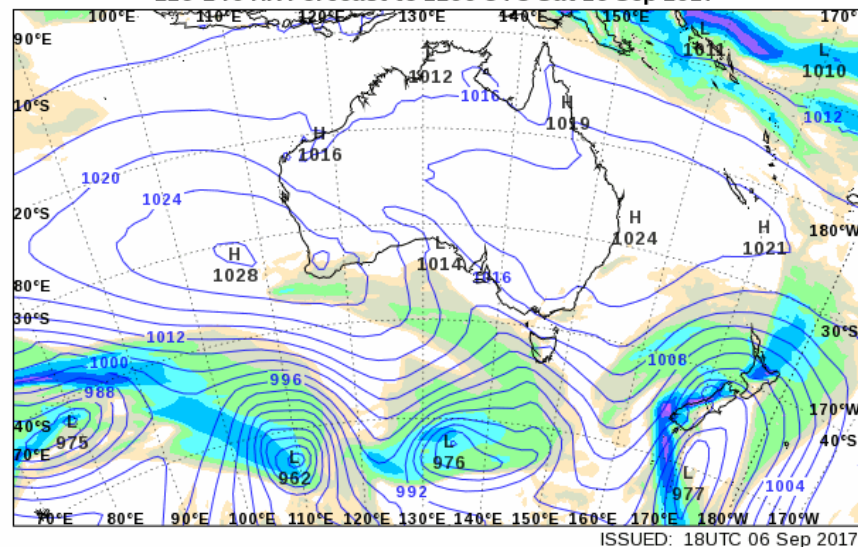


Forecasting for high impact

Bureau ACCESS model

European Centre Weather model

ACCESS-G Forecast 24 Hour Rainfall
216-240 HR Forecast to 1200 UTC Sat 16 Sep 2017



Be wary of forecasts from one model, and looking past 7 days

MetEye

Bureau of Meteorology forecast system incorporates a range of models, and gives more weight to the better performing ones

The forecasts from this system are available through MetEye on the Bureau home page:

www.bom.gov.au

The screenshot shows the Bureau of Meteorology website. At the top, there's a navigation bar with links to HOME, ABOUT, MEDIA, and CONTACTS, along with a search bar. Below this, there's a section for 'Warnings current' with a yellow background and a warning icon. To the right of this section is a 'Warning services' dropdown menu. The main content area features a map of Australia with state abbreviations (NT, QLD, WA, SA, NSW, ACT, VIC, TAS). To the right of the map is a vertical list of links: 'Rain radars', 'Satellite images', 'Weather maps', and 'MetEye'. The 'MetEye' link is highlighted with a red rectangular box. To the right of the map and links is an 'eBay' advertisement with the text 'Check Out ebay' and a 'Shop Now' button. Below the map and links is a section titled 'Forecast for Wednesday 7 June' with a 'City observations' dropdown menu. This section contains a table of weather forecasts for eight cities: Sydney, Melbourne, Brisbane, Perth, Adelaide, Hobart, Canberra, and Darwin. Each city's forecast includes the current temperature, wind speed and direction, and a range of temperatures for the day.

Sydney	Melbourne	Brisbane	Perth	Adelaide	Hobart	Canberra	Darwin
Now	Now	Now	Now	Now	Now	Now	Now
13.3°	11.8°	18.4°	22.4°	12.9°	9.2°	8.3°	30.6°
SW 28km/h	SSE 11km/h	W 7km/h	WNW 7km/h	SSE 9km/h	SSW 11km/h	S 10km/h	ESE 17km/h
10° 18°	7° 15°	8° 20°	7° 23°	3° 16°	4° 14°	1° 13°	20° 31°
Showers. Windy.	Cloud clearing.	Sunny.	Sunny.	Morning frost or fog. Sunny day.	Sunny.	Possible shower. Windy.	Sunny.

MetEye BoM weather forecasts

6km resolution (coming down to 1.5 km)

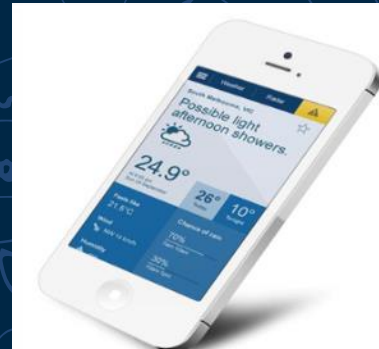
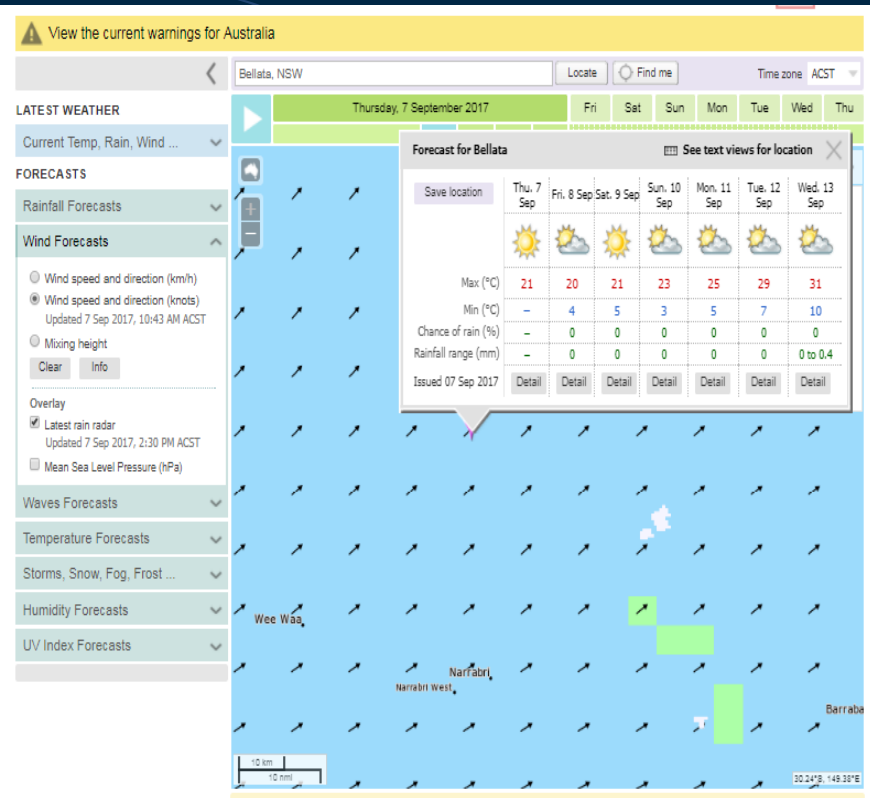
7 day ahead

Available on website, or via free app on

Google Play or Apple iStore, or via

m.bom.gov.au in your web browser

on your phone or tablet



Accessing weather information on the go

m.bom.gov.au or BOM Weather app

Weather Radar

Narrabri, NSW

Sunny.

19.7°

At 3:00 pm
Thu 7 September

21°
Today

Feels like
13.7°C

Wind
WSW 20 km/h
WSW 11 knots

Rain since 9 am
0 mm

Humidity
24%

Station: Narrabri
Approx. 2.3 km away.

Past 24 hours

Tomorrow
Partly cloudy.

Possible rainfall:
0 mm

Chance of any rain:

Using 'Launch Full Site'

Narrabri Detailed Forecast (beta)

View the current warnings for New South Wales

Change location Start typing, then select from list (town, city, postcode or lat/lon) Locate Find Me

Thursday 7 September

Friday 8 September

Rainfall

From	1:00 AM	4:00 AM	7:00 AM	10:00 AM	1:00 PM	4:00 PM	7:00 PM	10:00 PM
50% chance of more than (mm)	0	0	0	0	0	0	0	0
25% chance of more than (mm)	0	0	0	0	0	0	0	0
10% chance of more than (mm)	0	0	0	0	0	0	0	0
Chance of any rain	0%	0%	0%	0%	0%	0%	0%	0%

Temperatures

At	1:00 AM	4:00 AM	7:00 AM	10:00 AM	1:00 PM	4:00 PM	7:00 PM	10:00 PM
Air temperature (°C)	9	4	5	16	20	16	10	5
Feels like (°C)	6	1	2	9	12	10	5	1
Dew point temperature (°C)	2	0	1	0	-1	-1	0	-2

UV

At	1:00 AM	4:00 AM	7:00 AM	10:00 AM	1:00 PM	4:00 PM	7:00 PM	10:00 PM
UV index	0	0	1	4	6	1	0	0

Significant Weather

From	1:00 AM	4:00 AM	7:00 AM	10:00 AM	1:00 PM	4:00 PM	7:00 PM	10:00 PM
Thunderstorms	0	0	0	0	0	0	0	0
Snow	0	0	0	0	0	0	0	0
Rain	0	0	0	0	0	0	0	0
Fog	0	0	0	0	0	0	0	0
Frost	0	0	0	0	0	0	0	0

Humidity & Wind

At	1:00 AM	4:00 AM	7:00 AM	10:00 AM	1:00 PM	4:00 PM	7:00 PM	10:00 PM
Wind speed km/h	4	6	6	26	26	31	13	11
Wind speed knots	2	3	3	15	15	17	7	6
Wind direction	S	WSW	W	SW	SW	SW	WSW	S
Relative humidity (%)	62	77	80	32	25	28	49	62
Forest fuel dryness factor	8.4	8.4	8.4	8.5	8.5	8.5	8.5	8.5
Mixing height (m)	229	229	229	2149	2622	2284	229	229

THE AUSTRALIAN

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RADAR

MAP VIEW

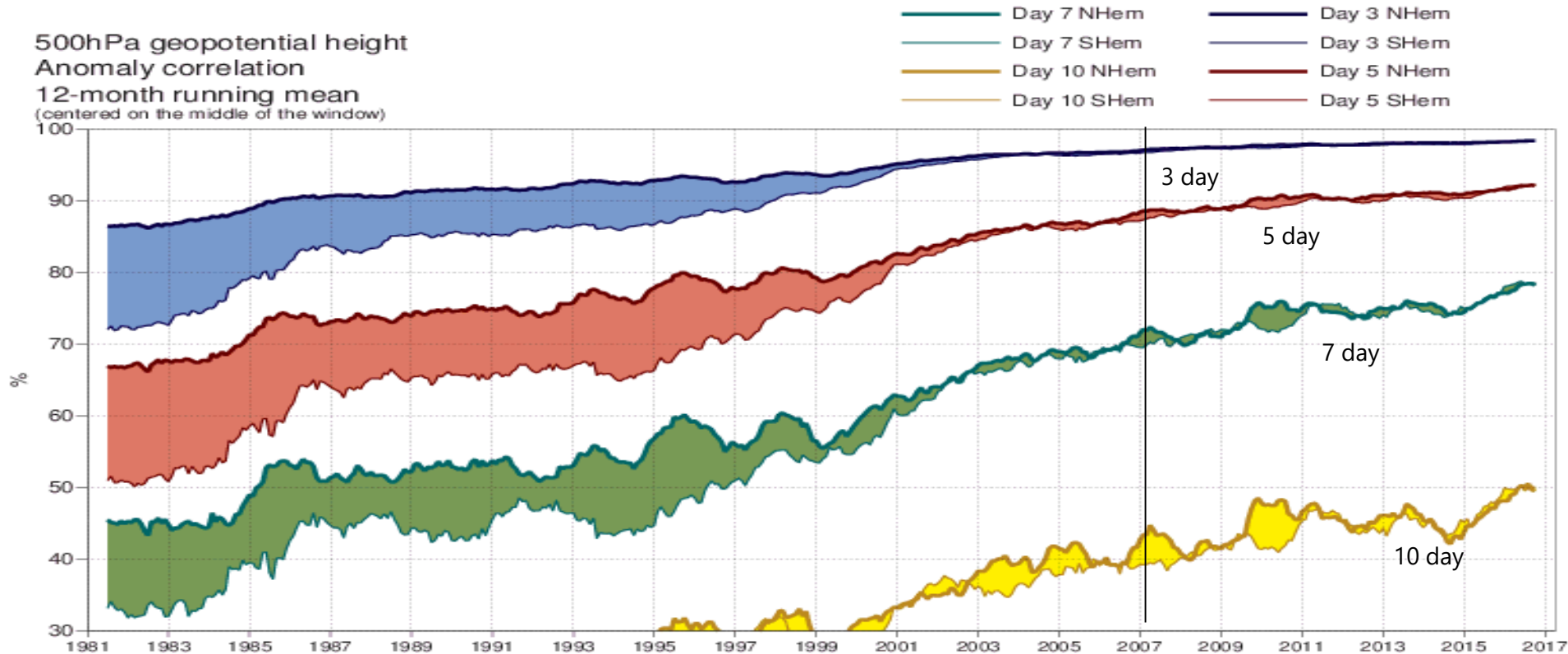
MeiEye

MILDURA WAGGA WAGGA YARRAWONGA SYDNEY WOLLONGONG GRAFTON NAMOI MOREE (NORF ISLAND) NEWCASTLE

From m.bom.gov.au or the app, with a location selected, scroll down the page and use 'Launch Full Site'

How accurate are weather models?

500hPa geopotential height
Anomaly correlation
12-month running mean
(centered on the middle of the window)



Forecast accuracy – Moree Airport

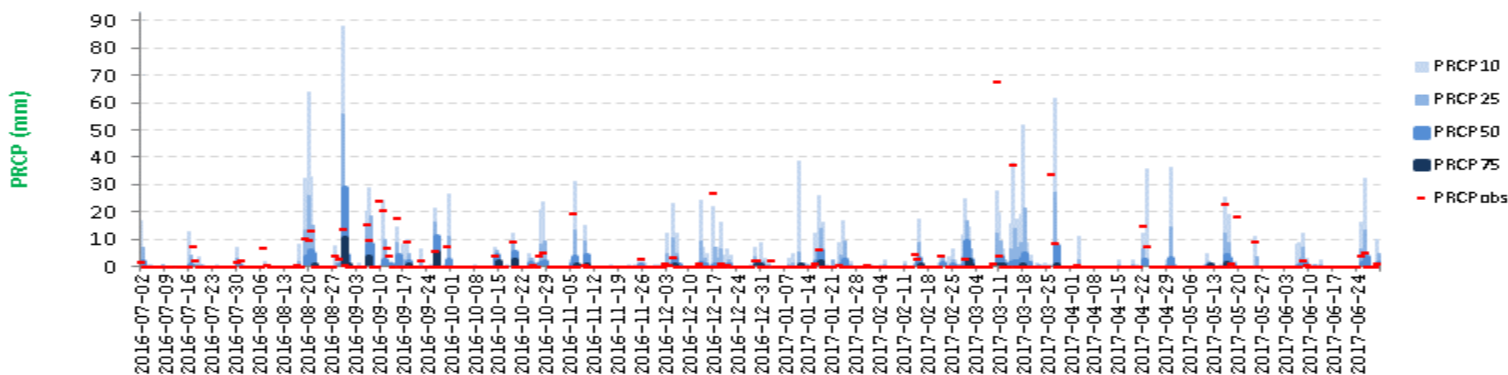
Rainfall 2015/16

Lead	PRCP10% calib(F<st>0)	PRCP25% calib(F<st>0)	PRCP50% calib(F<st>0)	PRCP75% calib(F<st>0)
D+0	5%	18%	48%	78%
D+1	2%	12%	39%	77%
D+2	6%	14%	42%	91%
D+3	7%	18%	54%	71%
D+4	8%	15%	43%	86%
D+5	8%	17%	47%	67%
D+6	6%	18%	47%	80%
Bias Colour Legend				
Forecast too dry				
Forecast on target				
Forecast too wet				

Rainfall 2016/17

Lead	PRCP10% calib(F<st>0)	PRCP25% calib(F<st>0)	PRCP50% calib(F<st>0)	PRCP75% calib(F<st>0)
D+0	6%	18%	40%	63%
D+1	7%	17%	38%	63%
D+2	8%	20%	41%	82%
D+3	8%	21%	54%	77%
D+4	12%	19%	49%	45%
D+5	10%	23%	30%	35%
D+6	11%	22%	31%	25%
Bias Colour Legend				
Forecast too dry				
Forecast on target				
Forecast too wet				

Days 5 and 3 forecasts





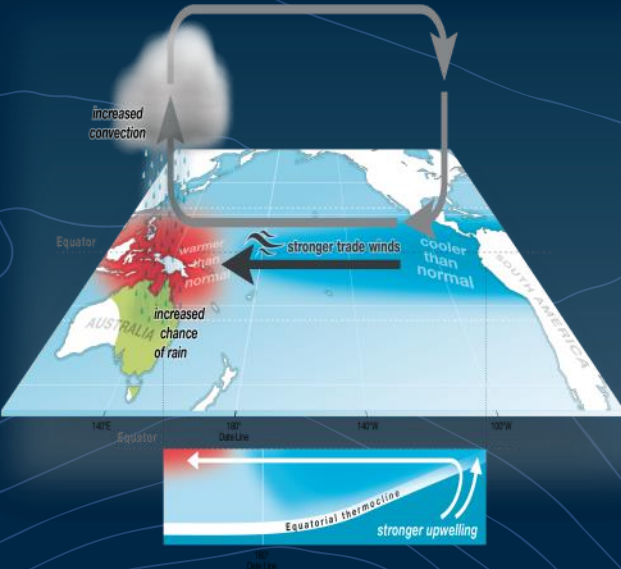
Australian Government
Bureau of Meteorology

Climate influences on eastern Australia

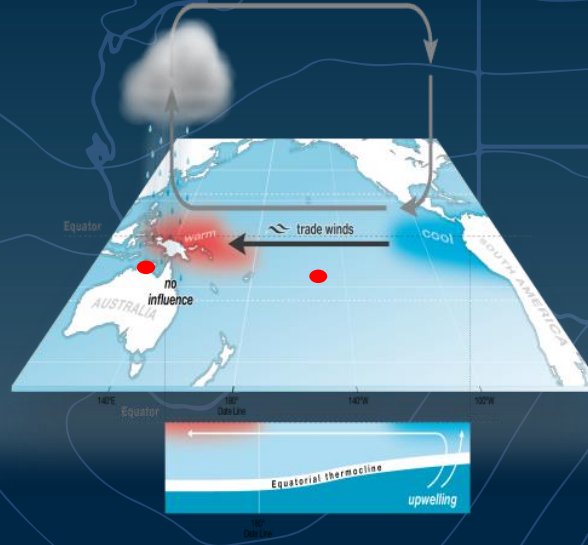


El Niño – Southern Oscillation (ENSO)

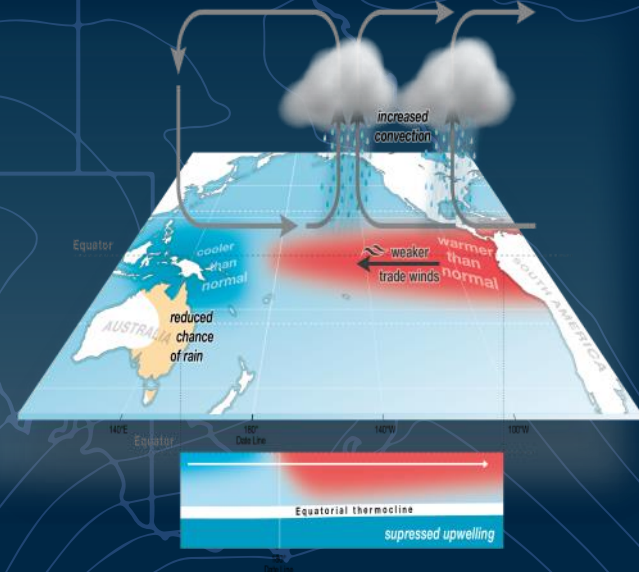
La Niña



Neutral phase



El Niño



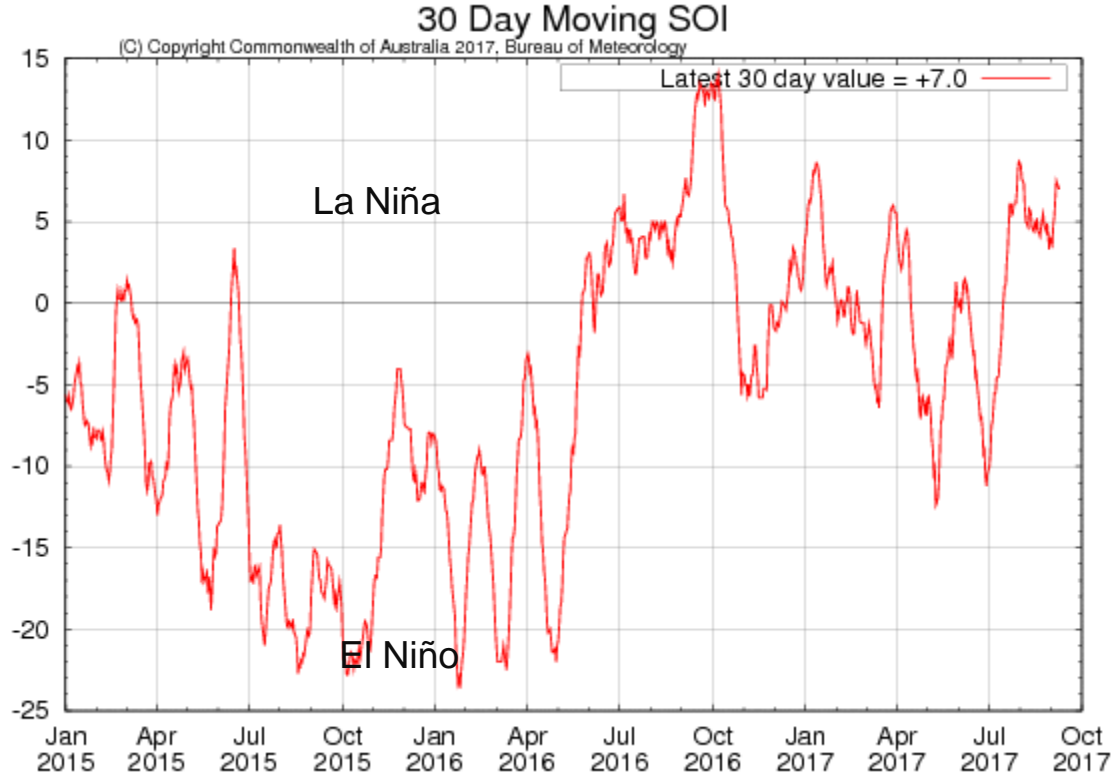
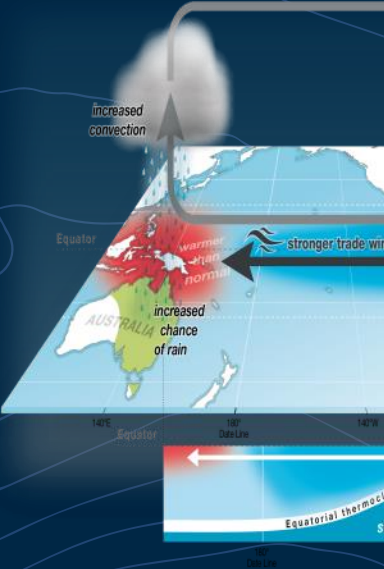
<http://www.bom.gov.au/climate/enso/>



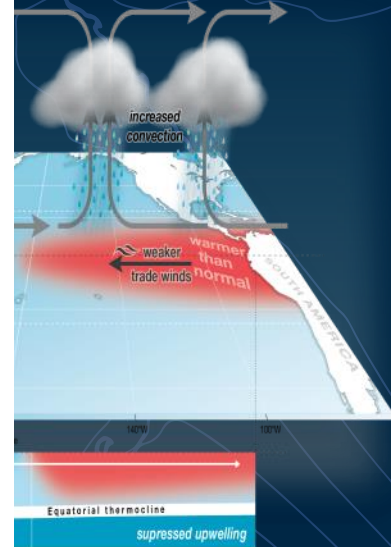
Australian Government
Bureau of Meteorology

El Niño Southern Oscillation (ENSO)

La Niña



El Niño

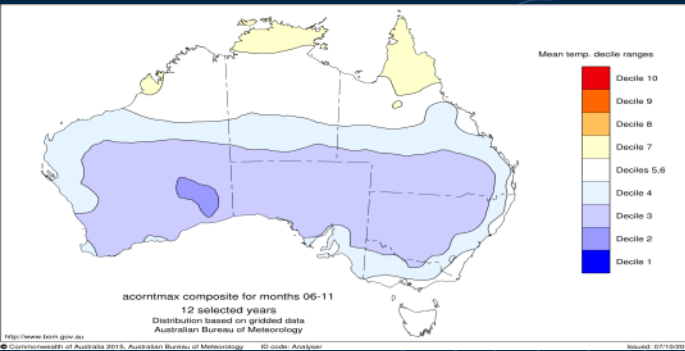
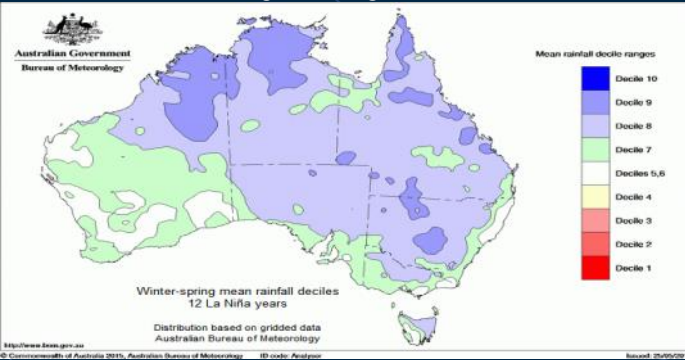


<http://www.bom.gov.au/climate/enso/>

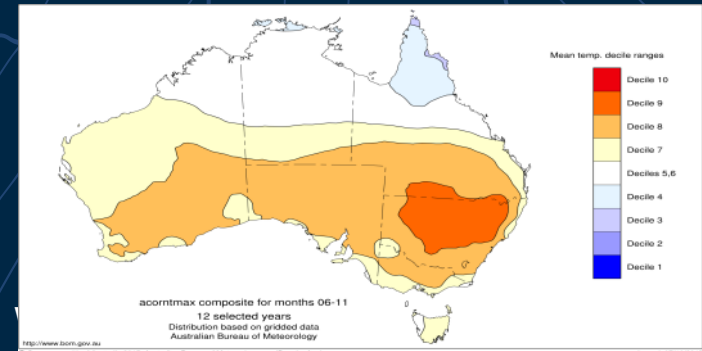
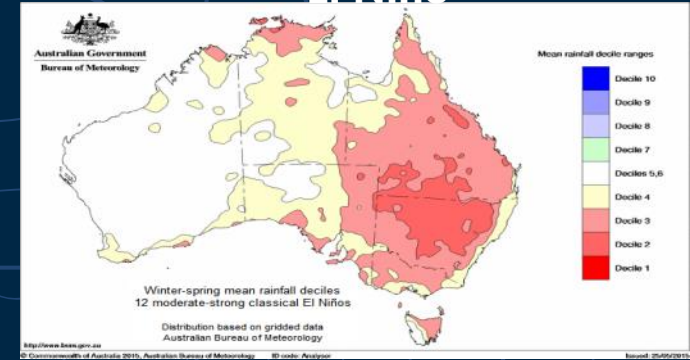


ENSO impacts

La Niña



El Niño



Each occur every 4-7 years
on average, starting during
winter and going for ~9
months

Can be predicted 3-6
months ahead by ocean
modelling

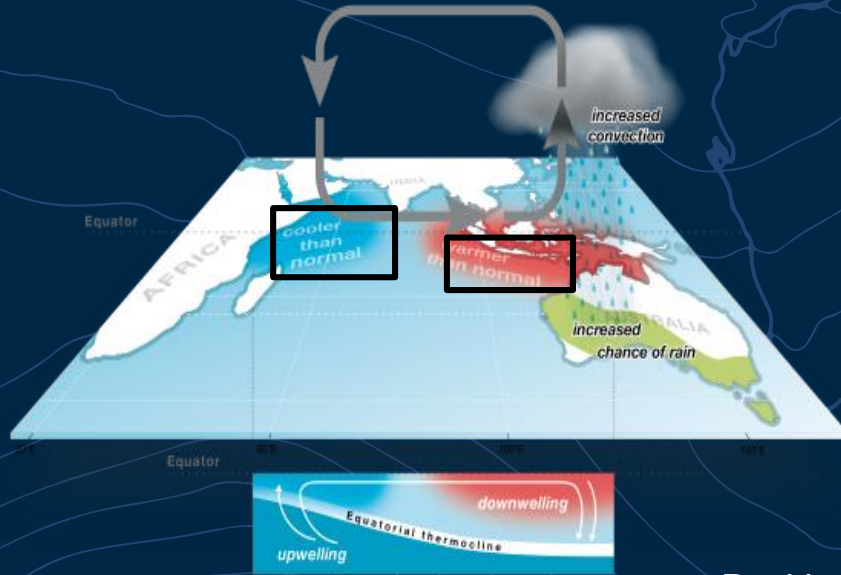


Australian Government
Bureau of Meteorology

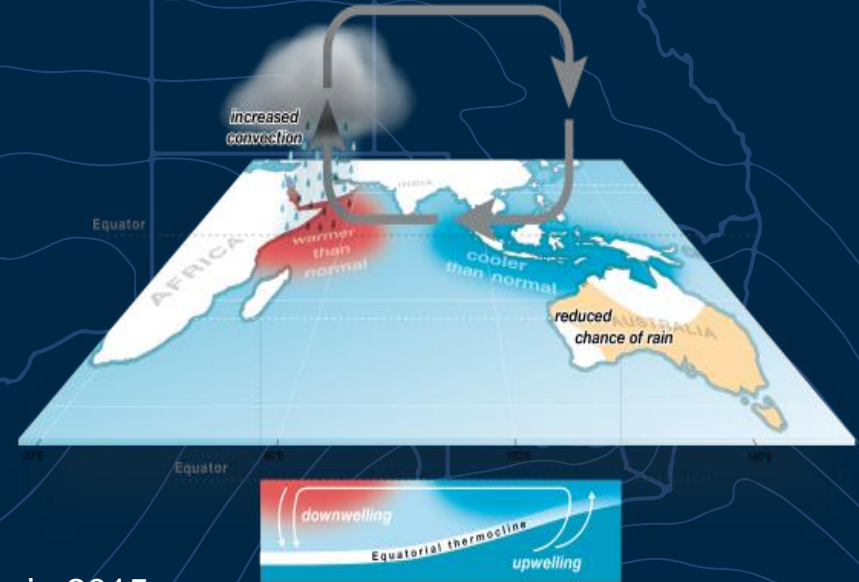
Indian Ocean Dipole (IOD)

Mainly a June to October influence

<http://www.bom.gov.au/climate/enso/>



Negative phase

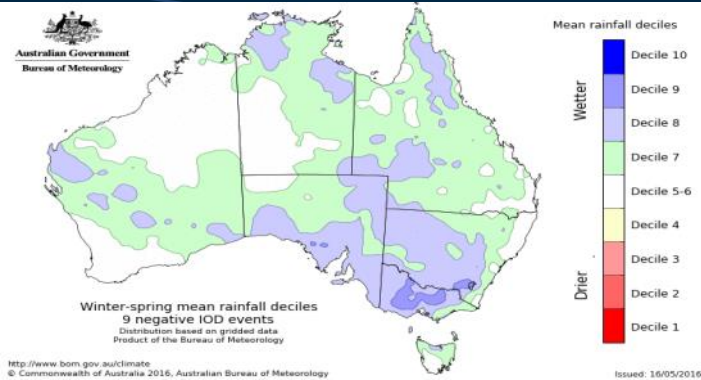


Positive phase in 2015
Negative phase in 2016

Positive phase

Indian Ocean Dipole impacts

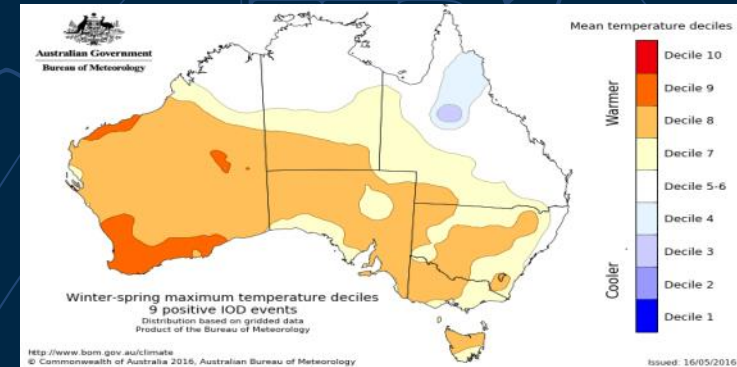
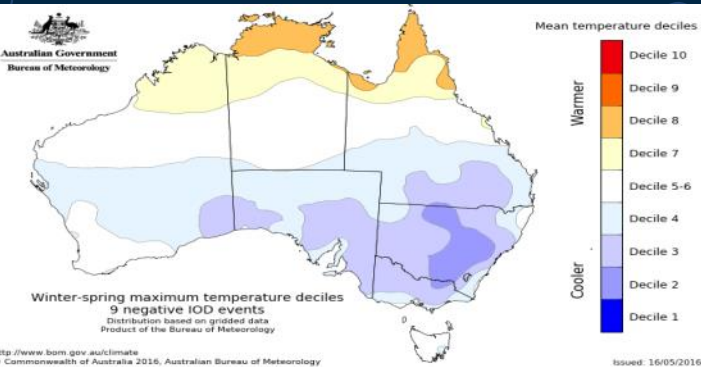
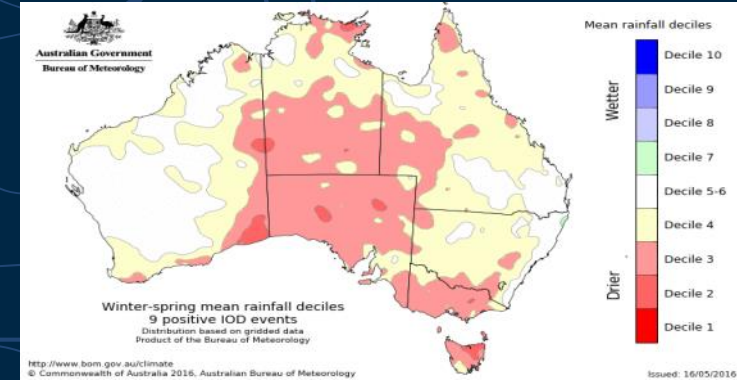
Negative IOD



Also occurs every 4-7 years on average, starting during winter and ending in November

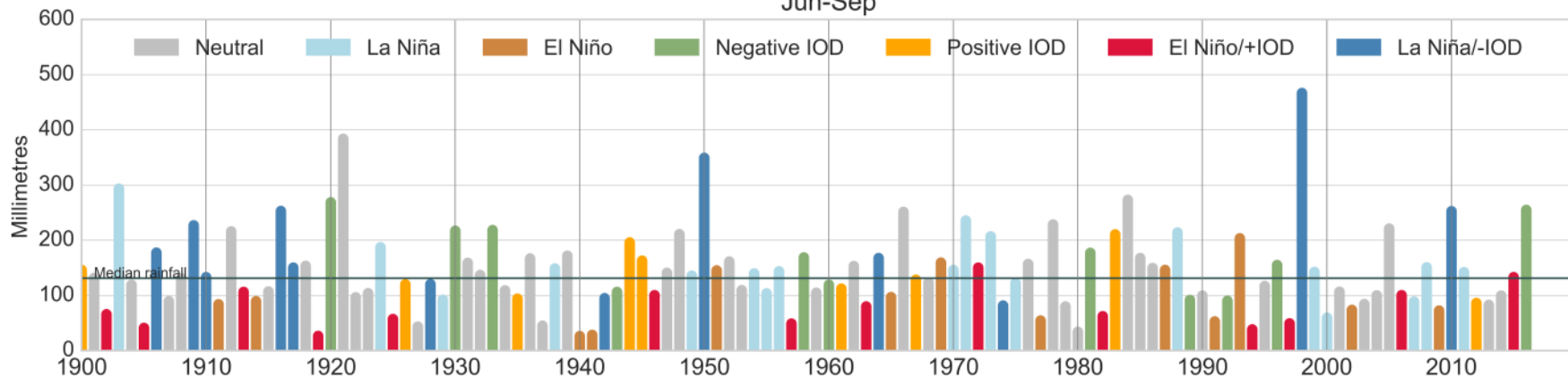
Can be predicted 3-4 months ahead by ocean modelling

Positive IOD

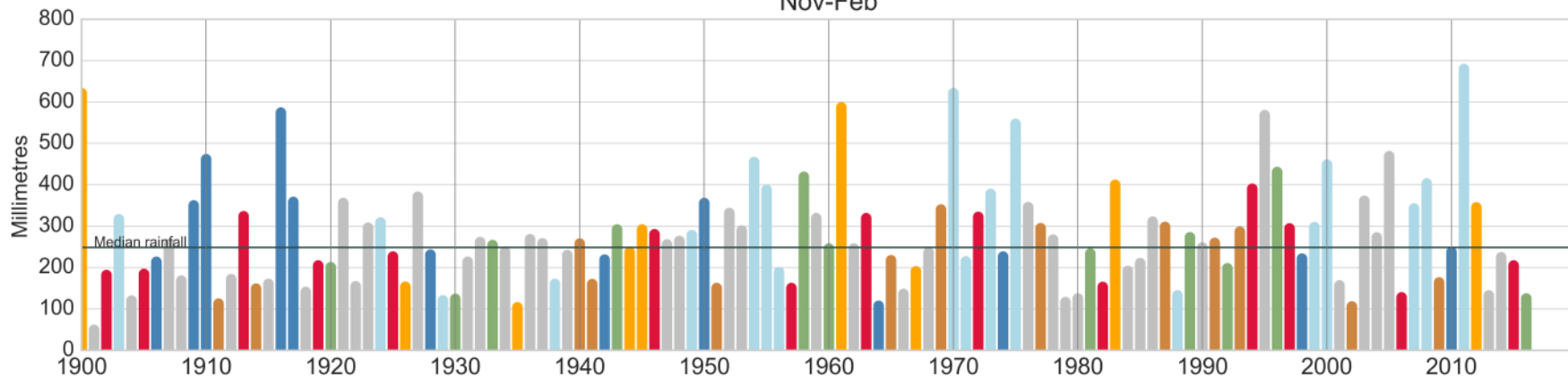


Tulloona rainfall

Jun-Sep



Nov-Feb

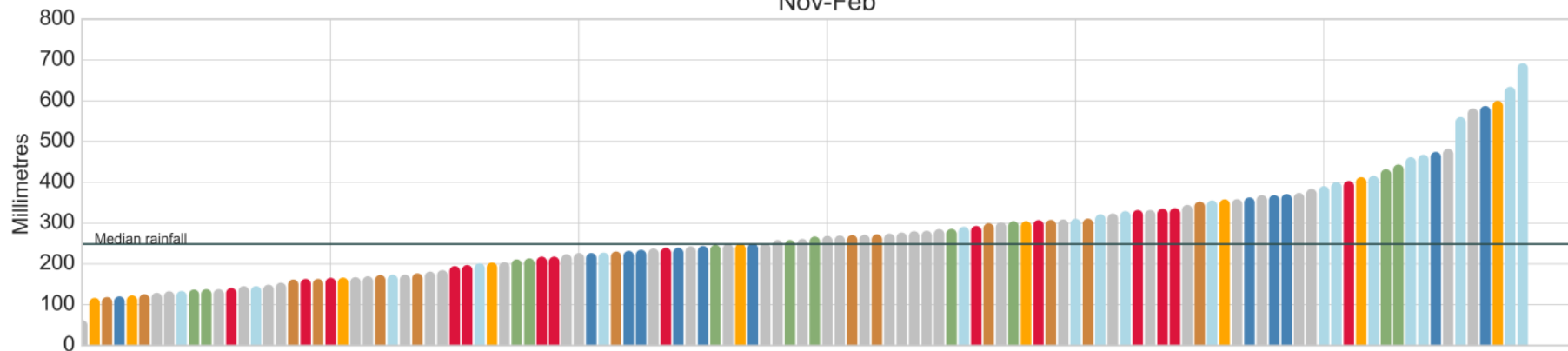


Tulloona rainfall (sorted by amount)

Jun-Sep



Nov-Feb

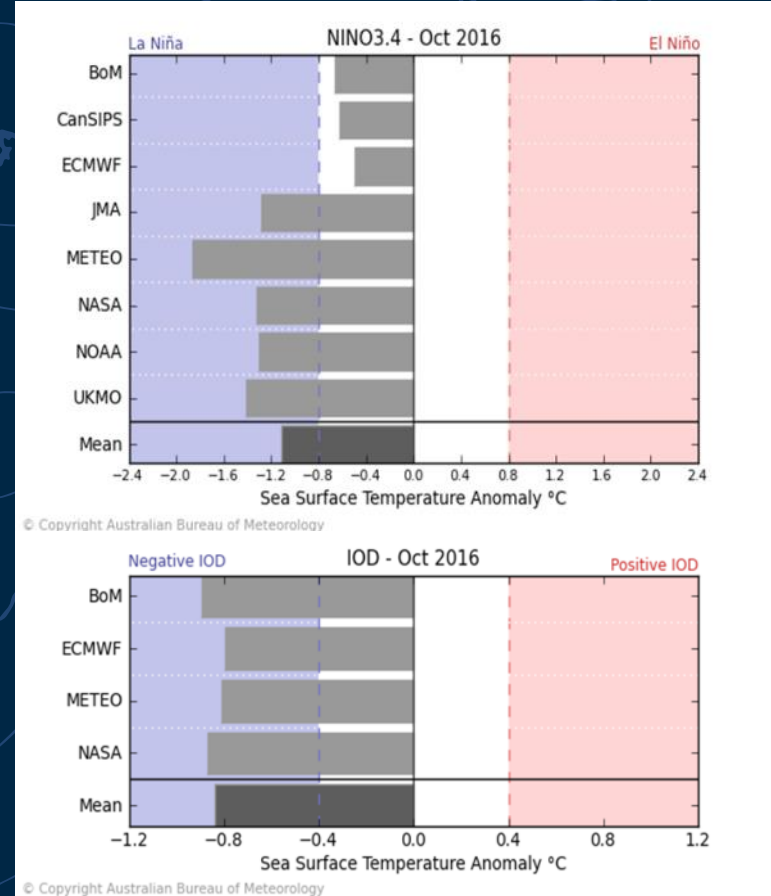


ENSO and IOD Outlook for 2017

El Niño+Positive IOD in 2015
Negative IOD in 2016

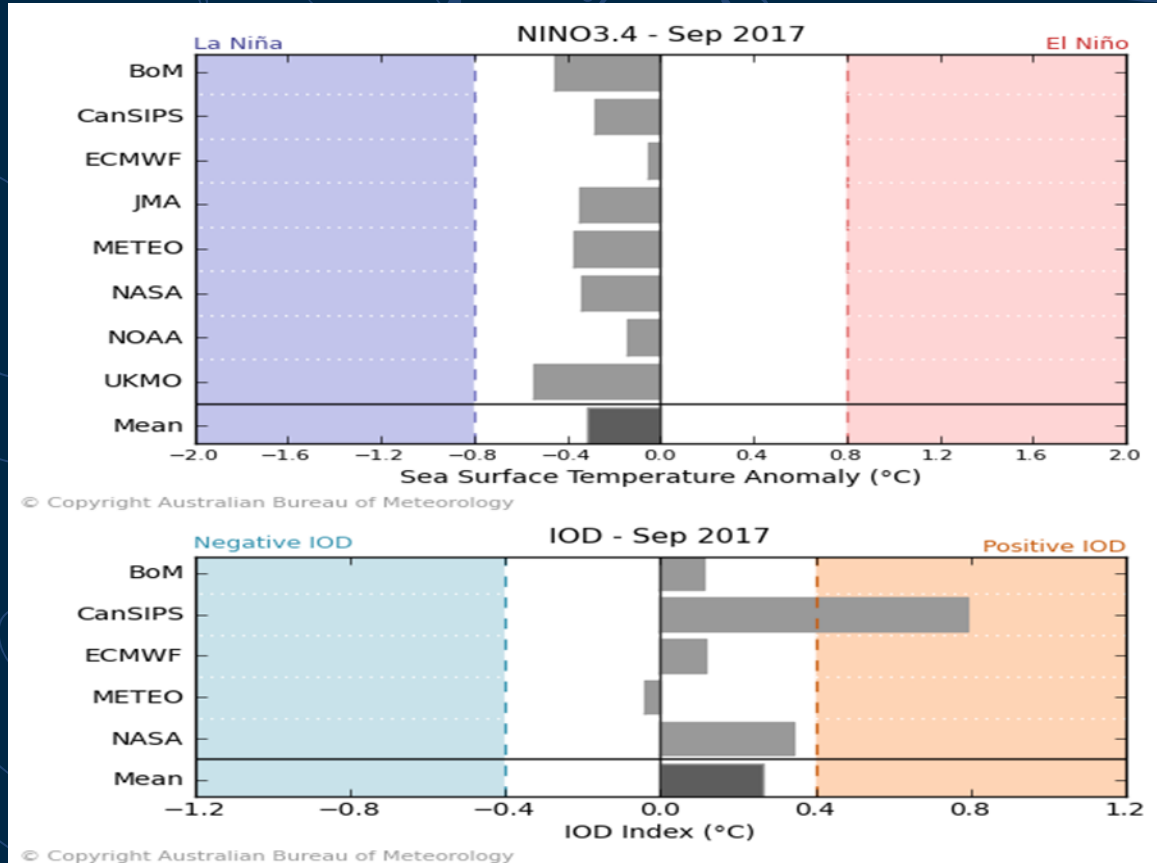
See:

<http://www.bom.gov.au/climate/model-summary/>



ENSO and IOD Outlook for 2017

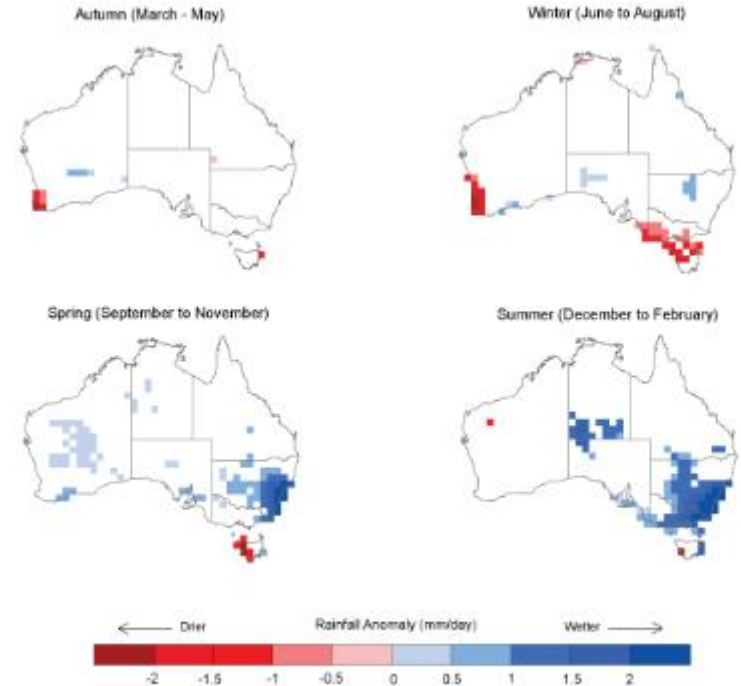
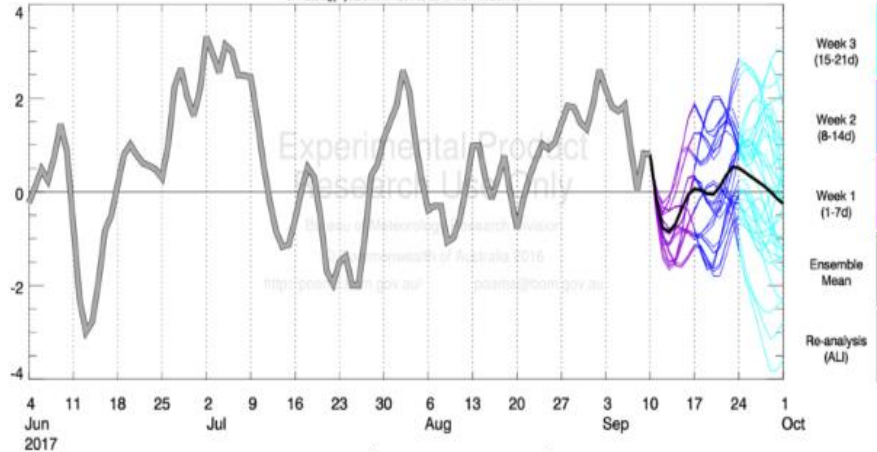
From the range of Bureau and international model outlooks, neutral conditions are expected for the rest of 2017 and early 2018



Southern Annular Mode

SAM Index Forecast initialised 10Sep2017 (mw2rt)

Climatology: years from 1981 to 2010 with mmd2=0911



Average impact of the Southern Annular Mode ("positive" phase) on rainfall in Australia
(Composite over multiple events based on data from 1979-2005)



Australian Government
Bureau of Meteorology

The outlook for the remainder of 2017

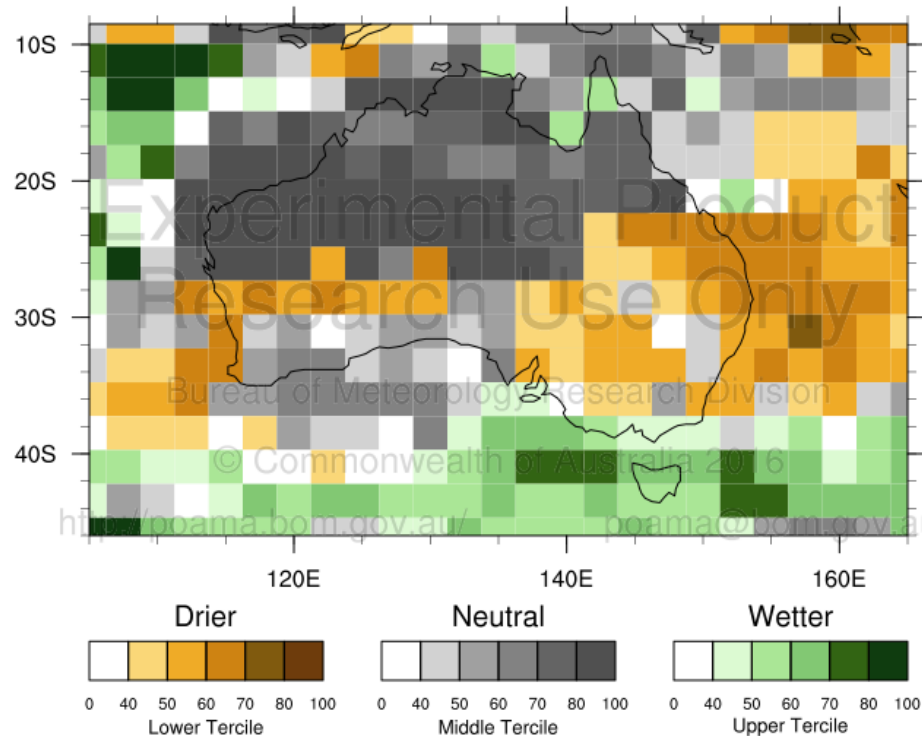


Precipitation / Rainfall Tercile Probabilities

Region: Australia

Start Date: 2017-09-10

Period: (2 Weeks) 10/09/2017 to 23/09/2017



Climatology: years from 1981 to 2010 with mmd = 0911

Created: 2017-09-11 14:12:19 +0000

Start Dates (MM/DD): Start Date List

Resource: w2act_ / fortnight

Bureau of Meteorology Seasonal Outlook

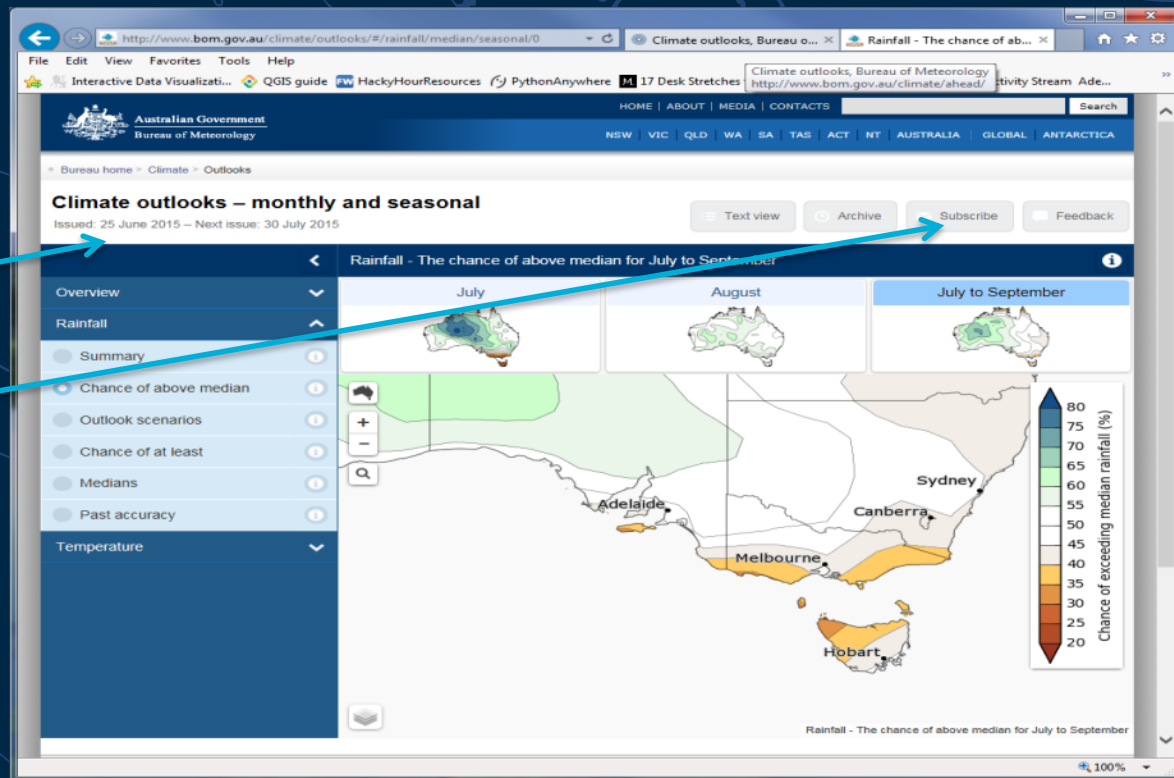
Produced from dynamic ocean atmosphere modelling

Updates each month for the following 1-3 month period

Has free email subscription

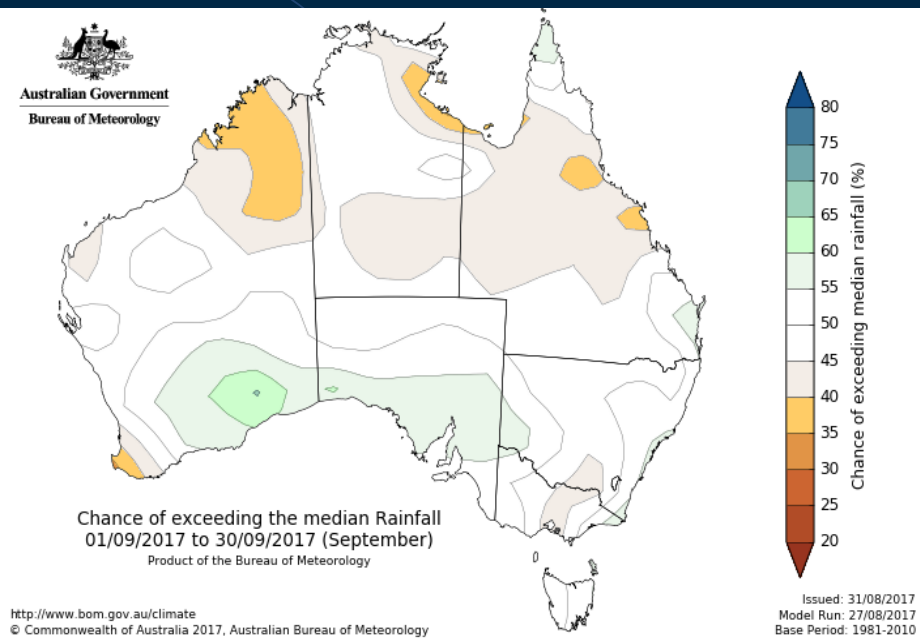
Look at the 3-4 minute video summary

<http://www.bom.gov.au/climate/outlooks/>

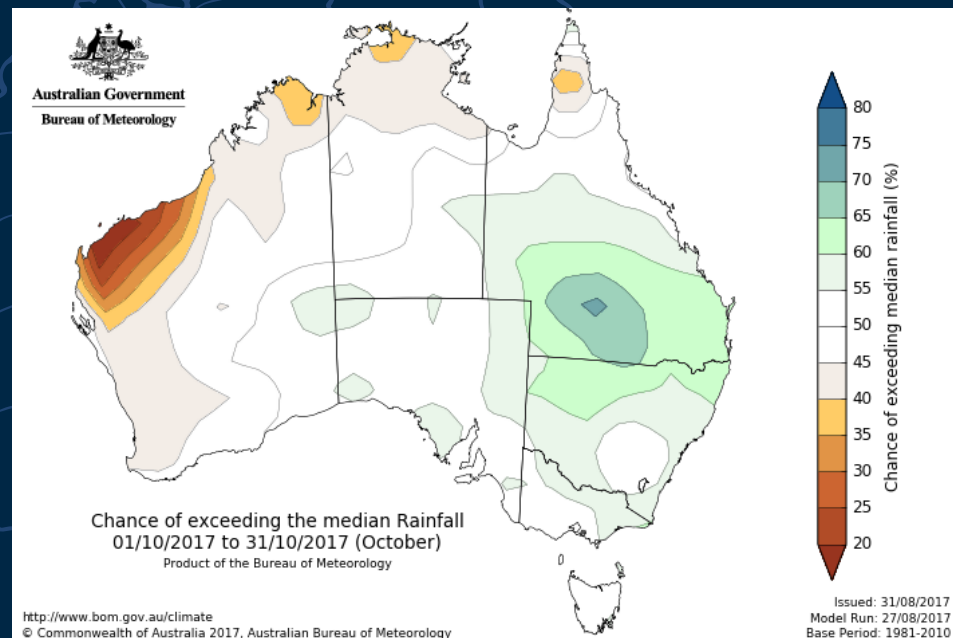


Now being updated mid-month

Rainfall Outlook



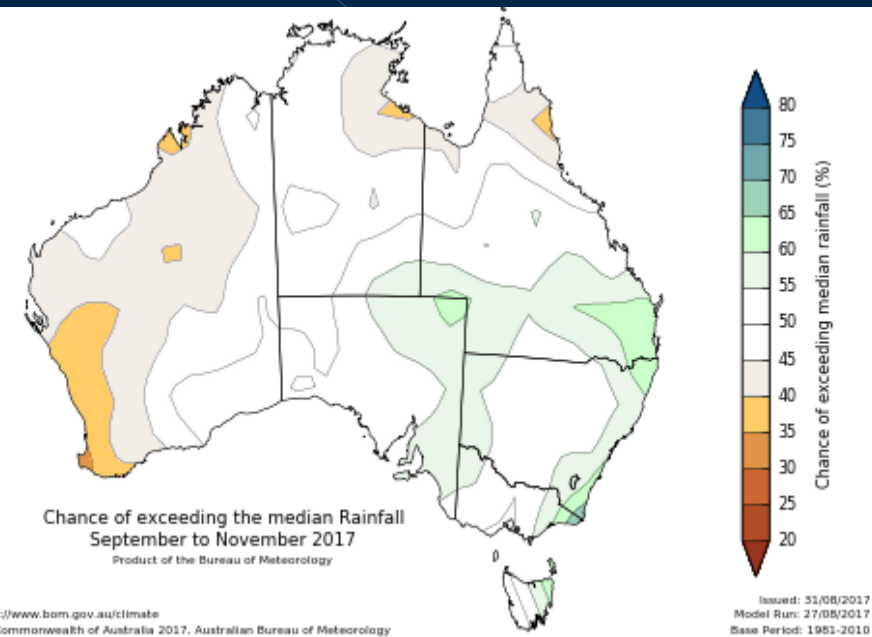
September 2017



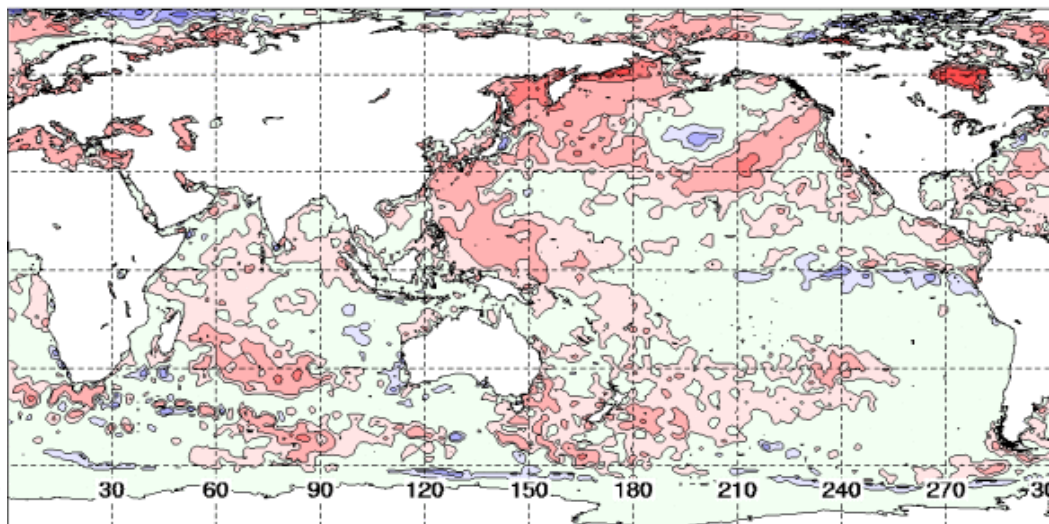
October 2017

See <http://www.bom.gov.au/climate/outlooks/> for the latest

Rainfall Outlook



SSTA 1.0X1.0 NMOC OCEAN ANOMALIES (C) 20

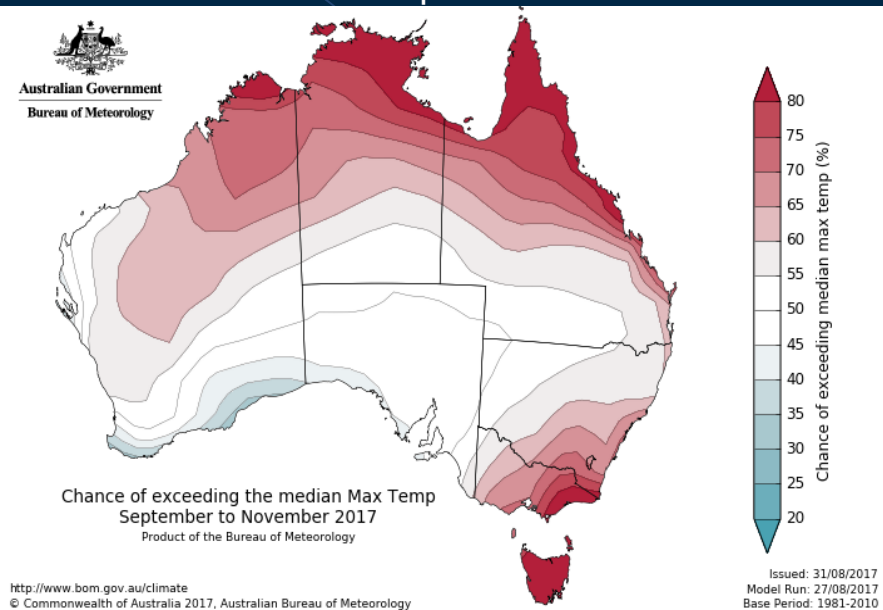


August to October 2017

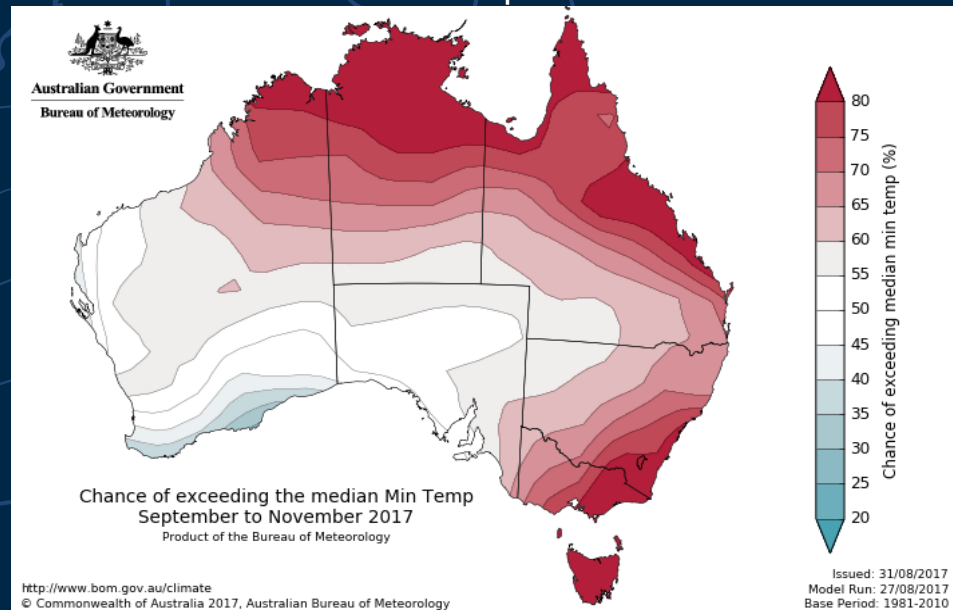
Difference from average of ocean surface temperature

Temperature Outlook

Maximum temperature

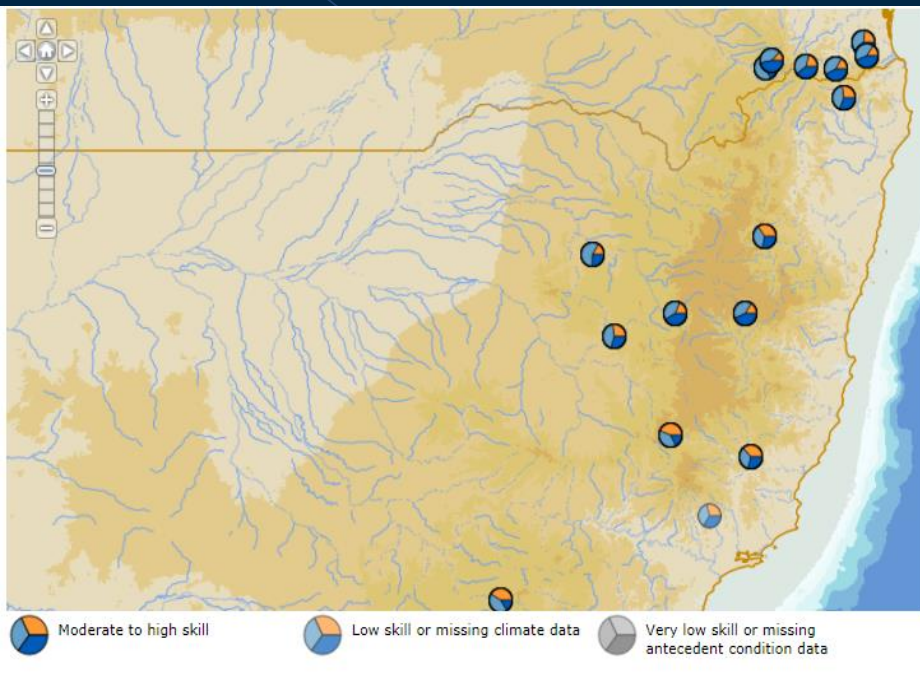


Minimum temperature



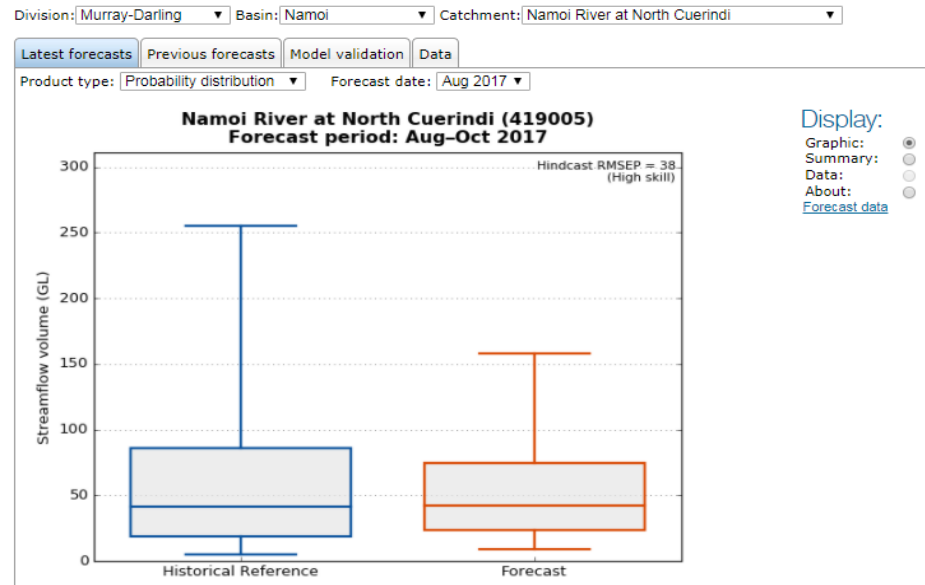
Warmer days and nights , particularly for the south-east

Seasonal Streamflow Outlook



<http://www.bom.gov.au/water/ssf/>

Seasonal Streamflow Forecasts



	Statistics	
	Streamflow Forecast (3 month total flow in GL)	Historical Reference (3 month total flow in GL)
5th percentile	8.532	4.881
25th percentile	23.622	18.953
Median	42.513	41.181
75th percentile	74.682	85.747
95th percentile	157.588	255.003



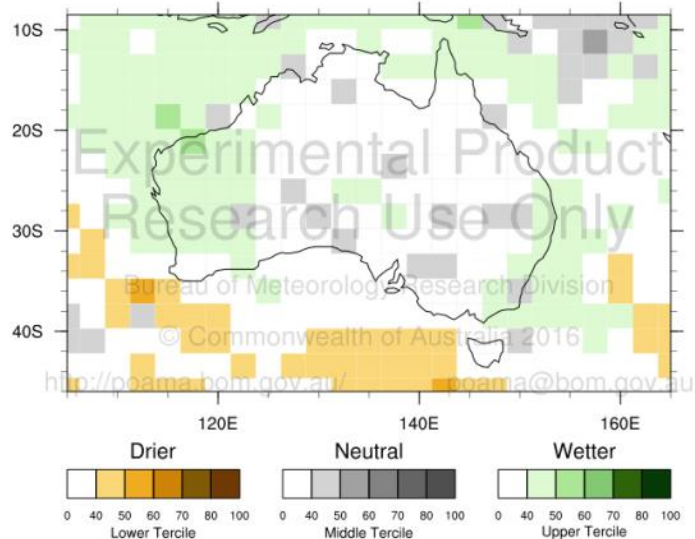
Summer 2017/2018

Precipitation / Rainfall Tercile Probabilities

Region: Australia

Start Date: 2017-09-03

Period: (DJF) 01/12/2017 to 28/02/2018



Climatology: years from 1981 to 2010 with mmdd = 0901

Created: 2017-09-04 15:15:28 +0000

Start Dates (MM/DD): 03/09, 31/08, 27/08, 24/08, 20/08

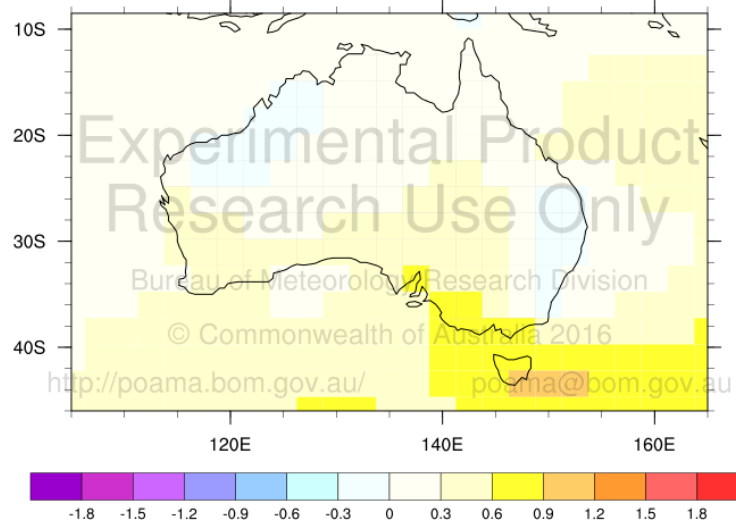
Resource: m3acts_ / season

Maximum Temperature Anomaly - Degrees C

Region: Australia

Start Date: 2017-09-03

Period: (DJF) 01/12/2017 to 28/02/2018



Climatology: years from 1981 to 2010 with mmdd = 0901

Created: 2017-09-04 14:57:48 +0000

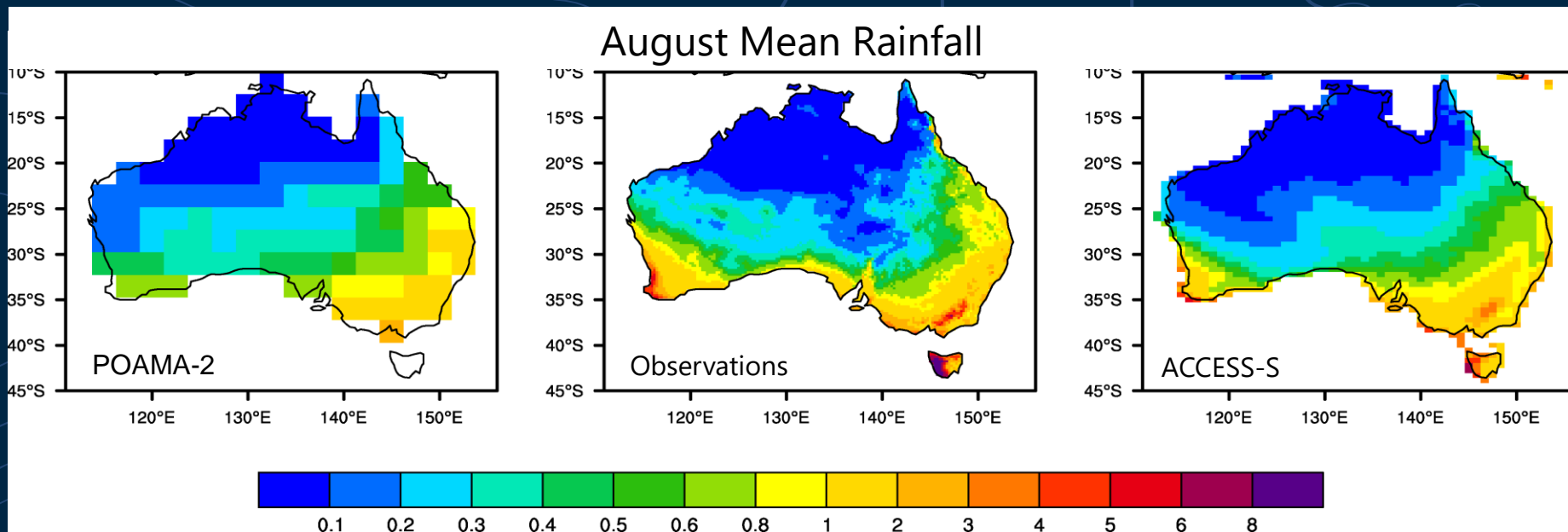
Resource: m3acas_ / season

Near average rainfall and tending warmer than average, particularly across SE Australia

ACCESS improved seasonal forecasts

Produces a more realistic climate

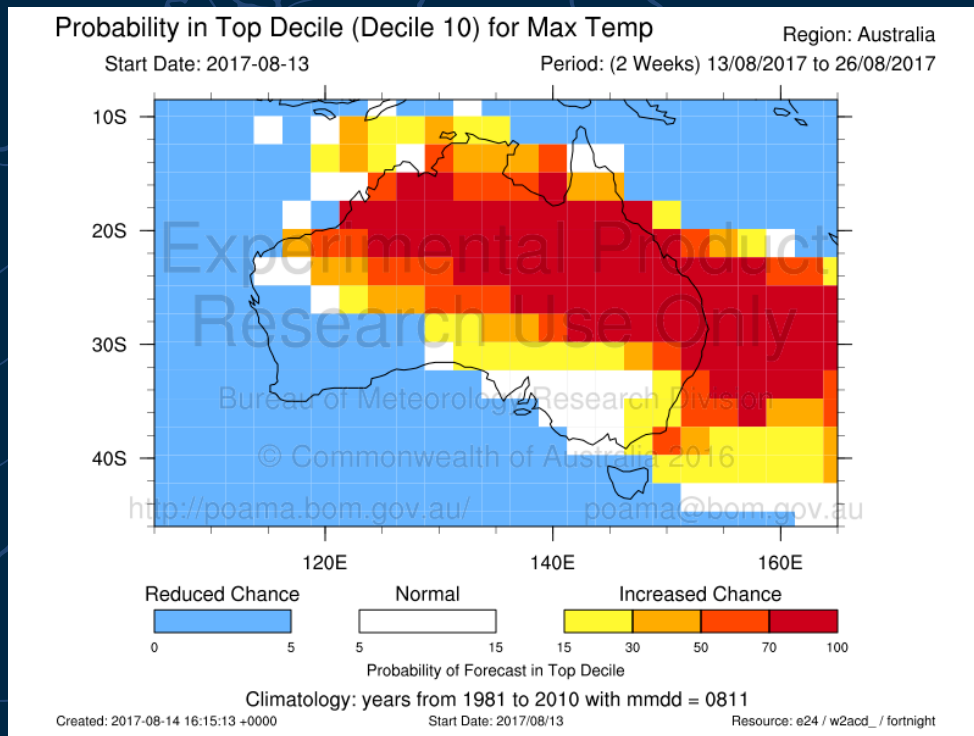
- Better captures Australian climate with much higher resolution
- Output easily links to decision models (e.g., water models, crop models)



The Bureau is in the process of updating our seasonal outlook system to ACCESS-S
Will switch to this in the first half of 2018

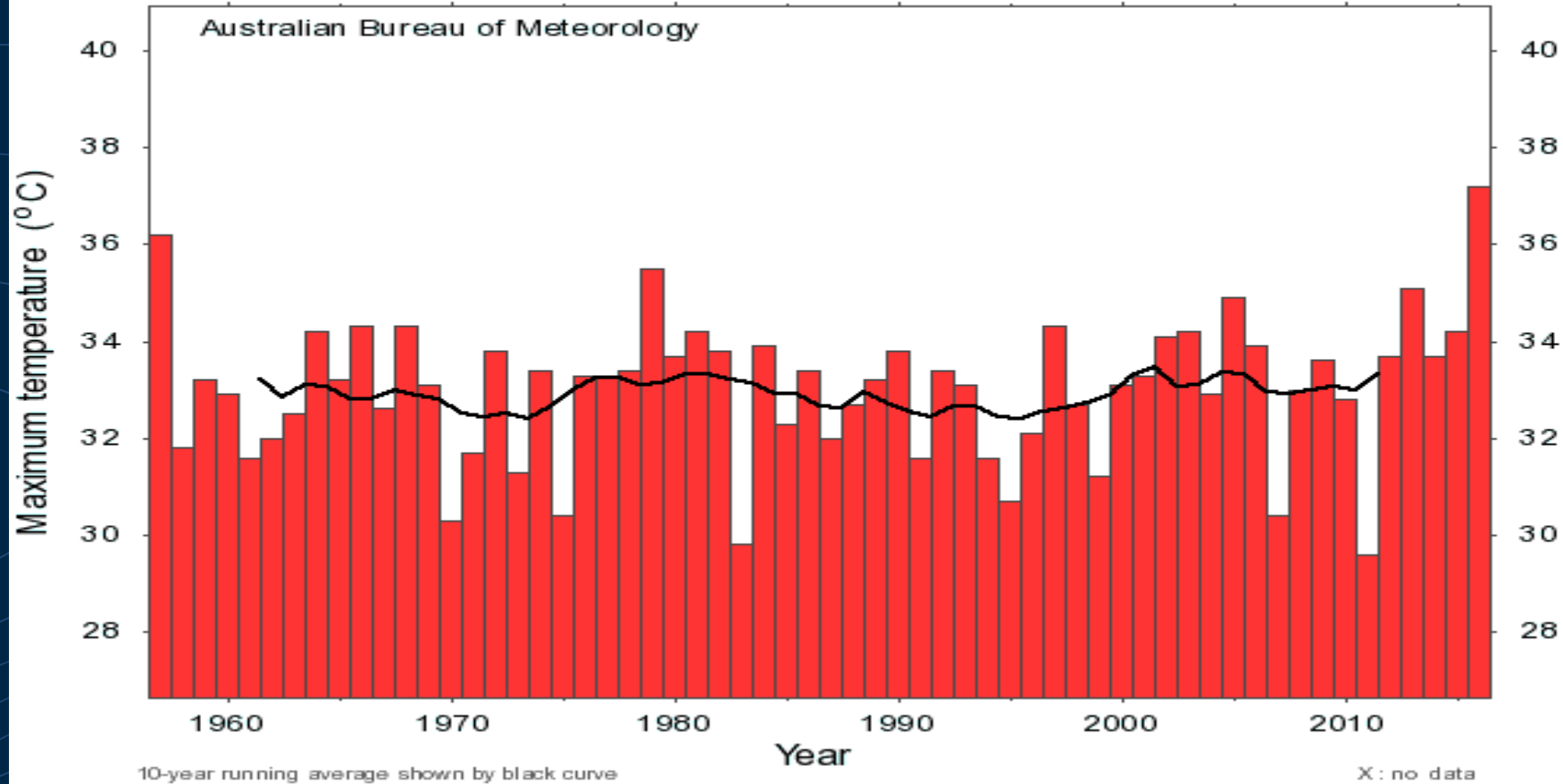
Rural Research and Development for Profit Climate Extremes project

- 5 year project just starting funded through Dept. Agriculture and Water Resources, and industry bodies
- Assess extreme heat, frost, rainfall and drought events impacting partner industries, and the ability of ACCESS-S to forecast these
- Focus on multi-week to seasonal scales
- Livestock, grains, grapes, dairy, sugar, cotton, rice, horticulture, pork
- Linking with applied ag research to develop tools and management guidelines

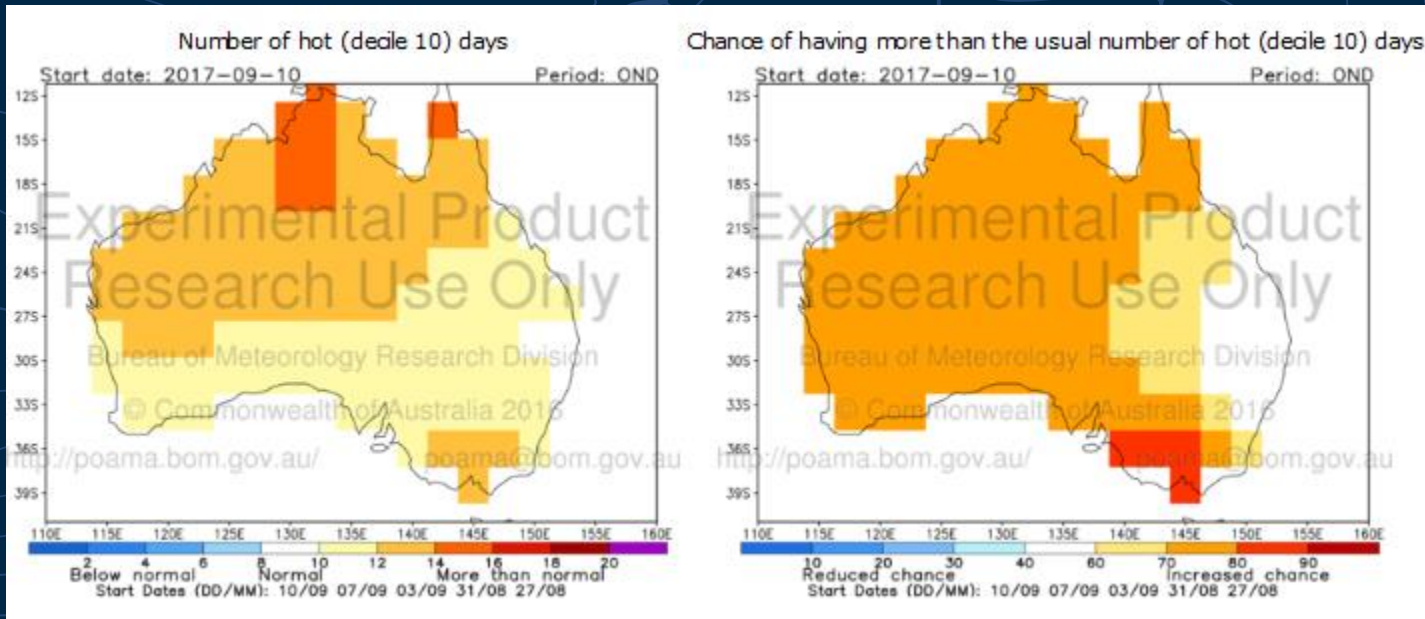


- 
- How do rainfall and temperature extremes impact you and your crops?
 - What are the standout events over the last 30 years?

Summer maximum temperature at site 053115 (1957-2016)



Current chance of hot days and expected number for OND 2016
What would be the threshold you might look to?



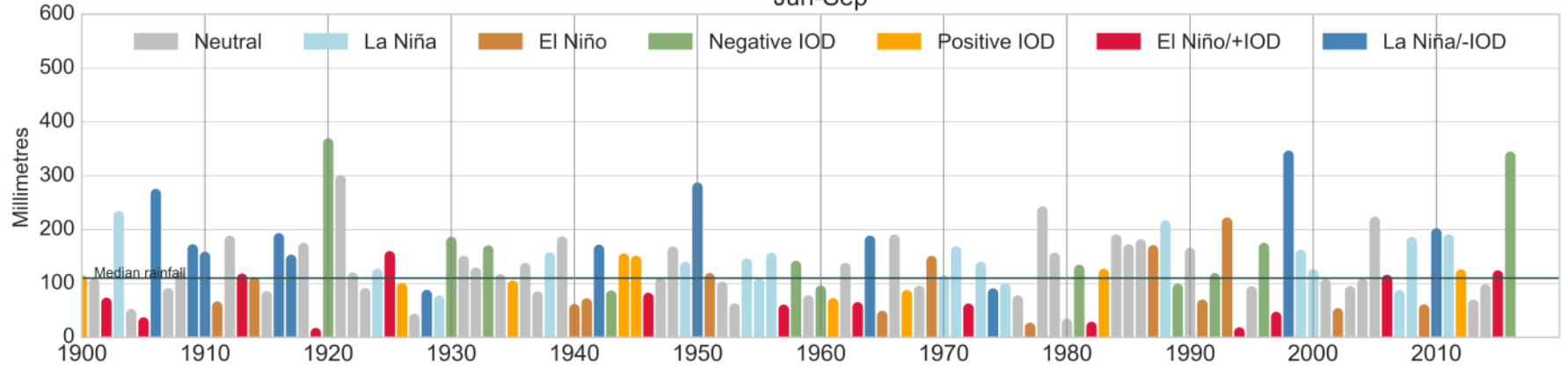
- 
- 2015 Hotter and drier - Strong **El Niño** and **+ IOD**
 - 2016 Wet – Strong **Negative IOD** event
 - 2017 Neutral climate influences, but tending hotter, with near average rainfall for the remainder of 2017

Thanks

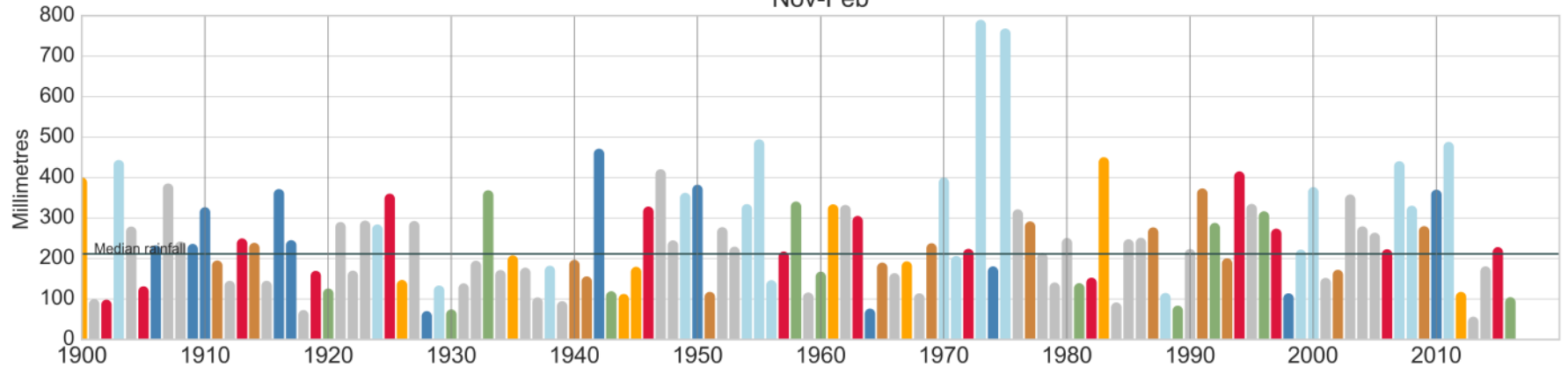
darren.ray@bom.gov.au

Cullarenebri rainfall

Jun-Sep



Nov-Feb

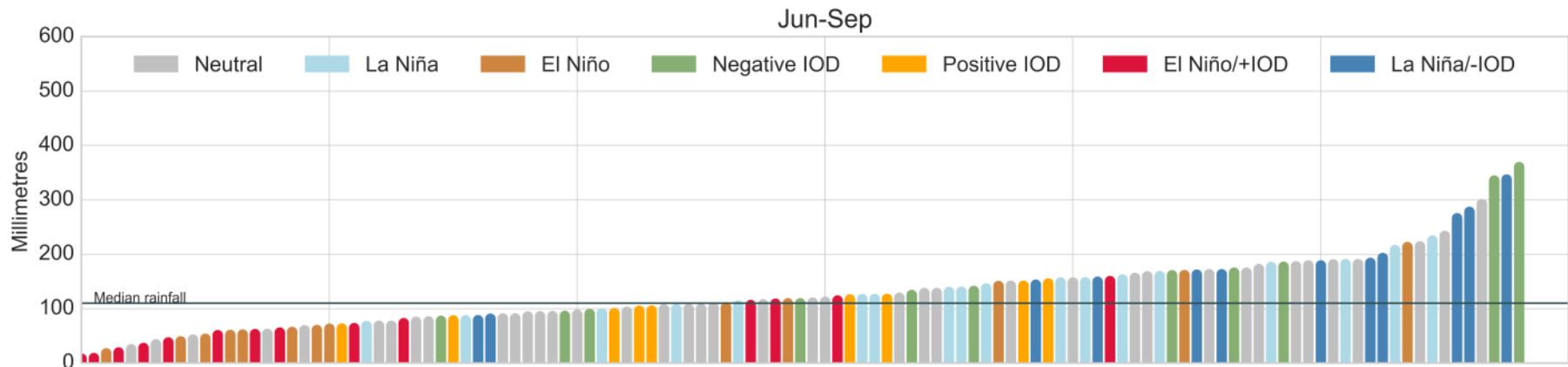


Jun-Sep

Millimetres

Median rainfall

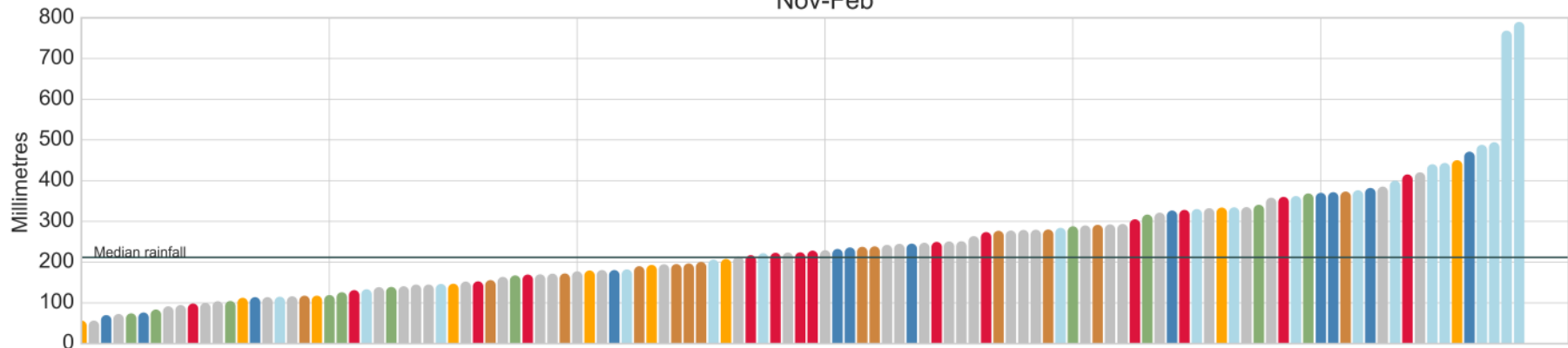
Legend: Neutral, La Niña, El Niño, Negative IOD, Positive IOD, El Niño/+IOD, La Niña/-IOD



Nov-Feb

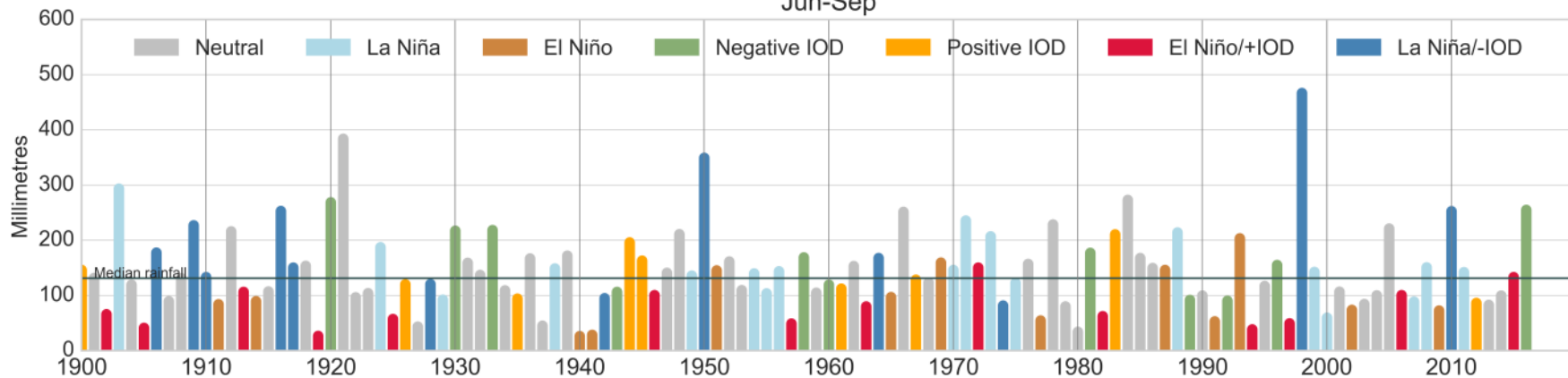
Millimetres

Median rainfall

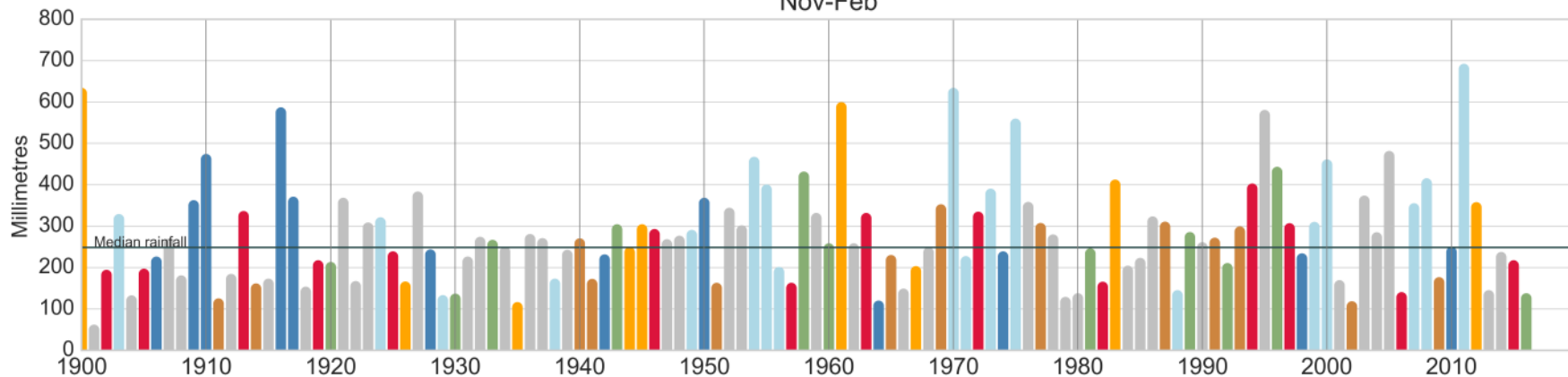


Tulloona rainfall

Jun-Sep



Nov-Feb

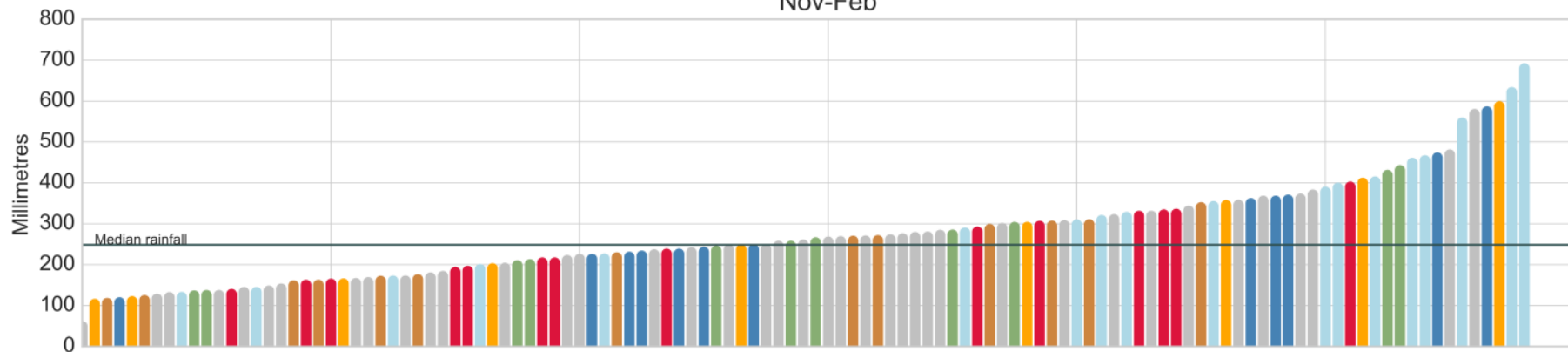


Tulloona rainfall (sorted by amount)

Jun-Sep

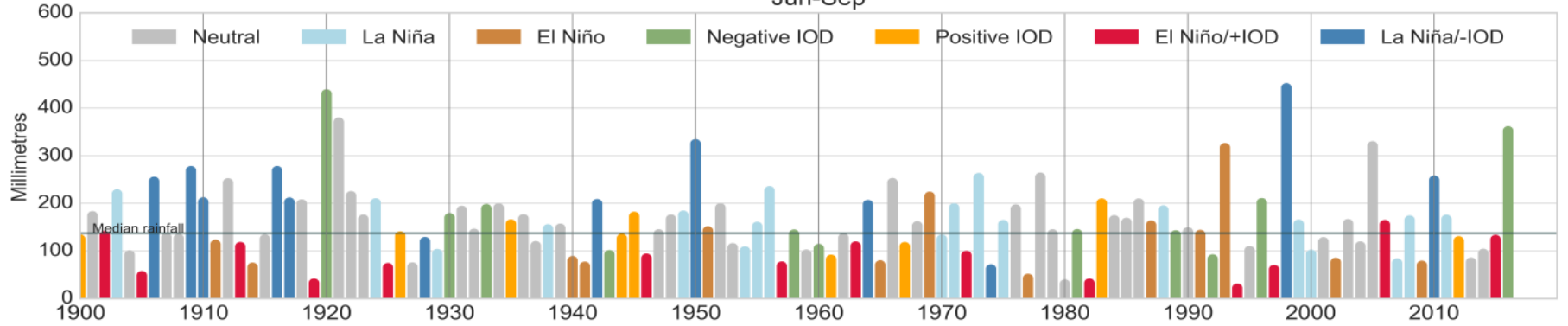


Nov-Feb

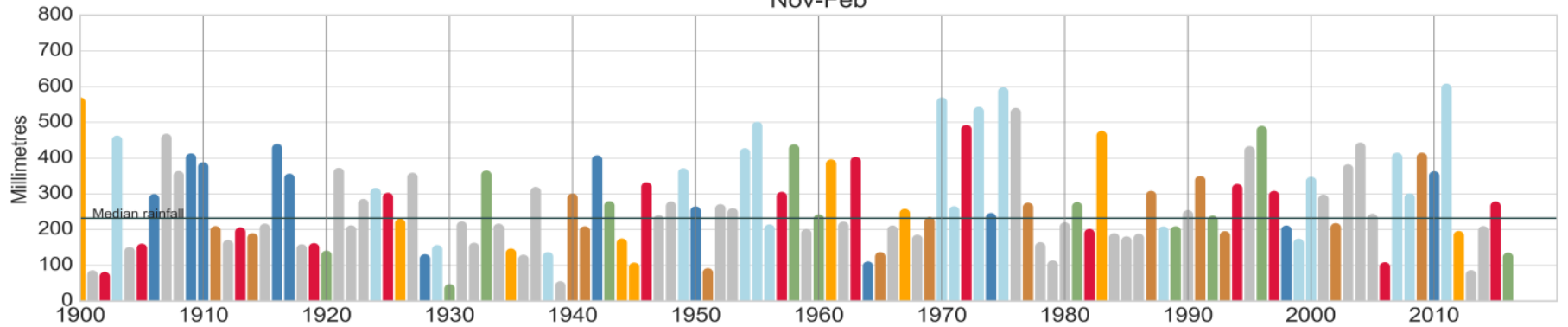


Wee Waa rainfall

Jun-Sep

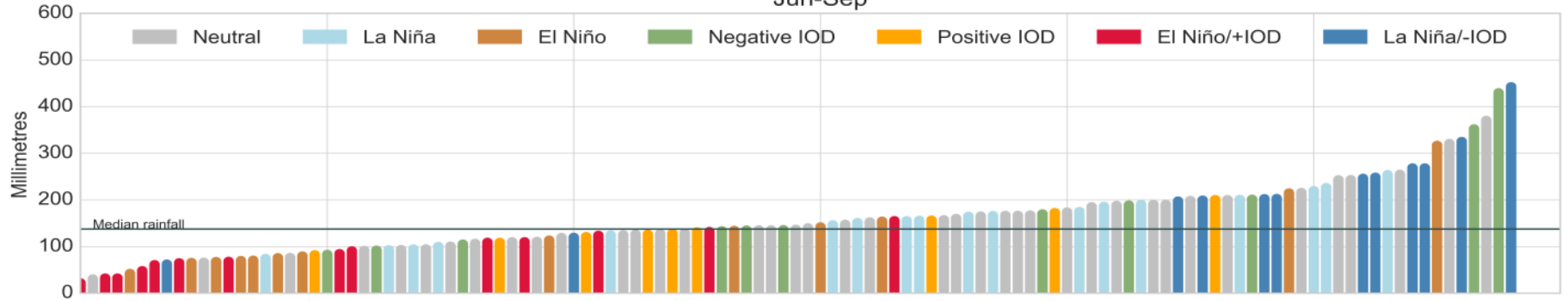


Nov-Feb



Wee Waa rainfall (sorted by amount)

Jun-Sep



Nov-Feb

