

CLIMATE RISK AND FARMING WEBINAR SERIES



Climate Risk Management

With Melissa Rebbeck



Climate & Agricultural
Support PTY LTD

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in training for
rural people
and
communities



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IV



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ADVANCED
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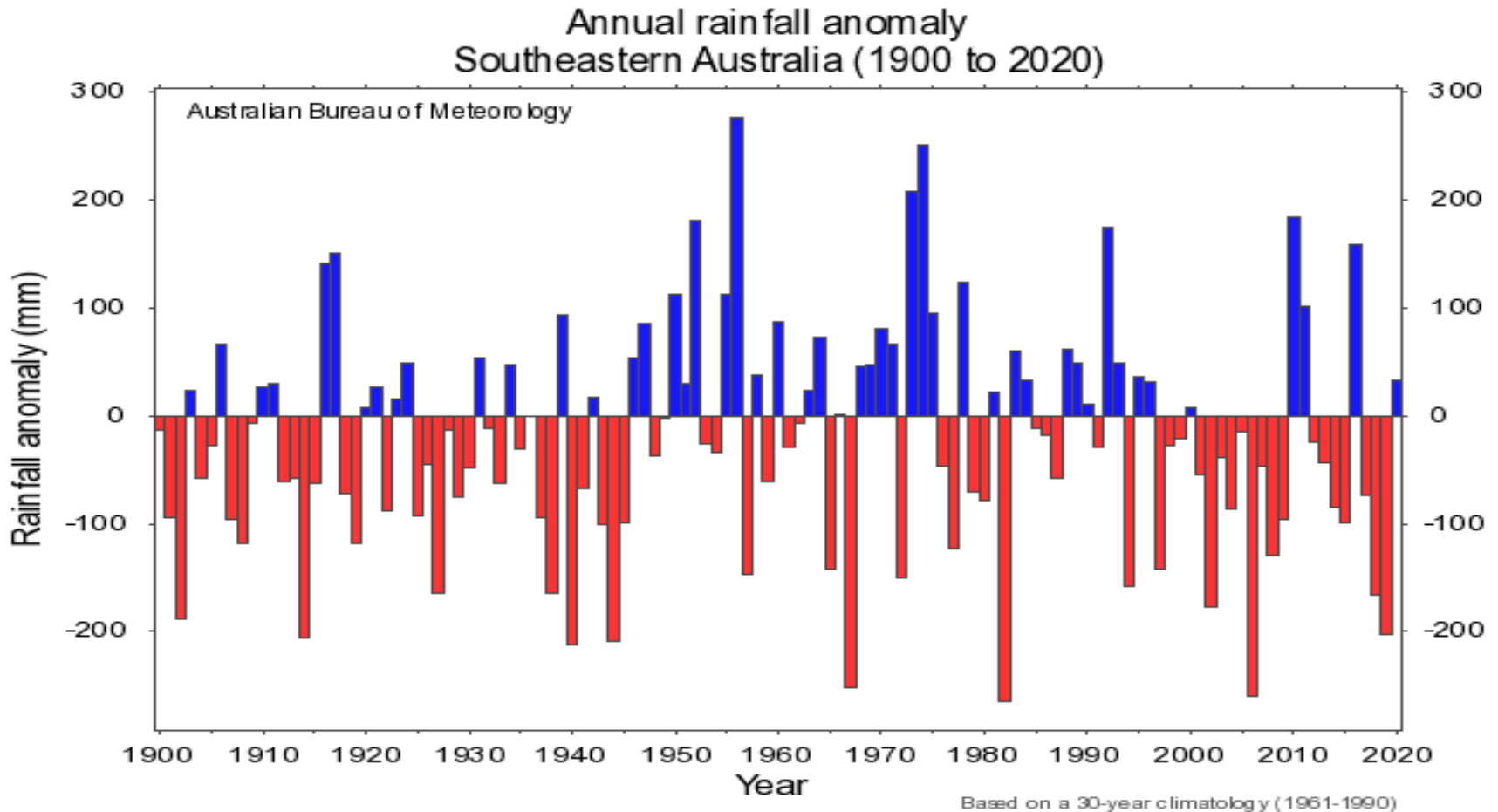
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What we will cover

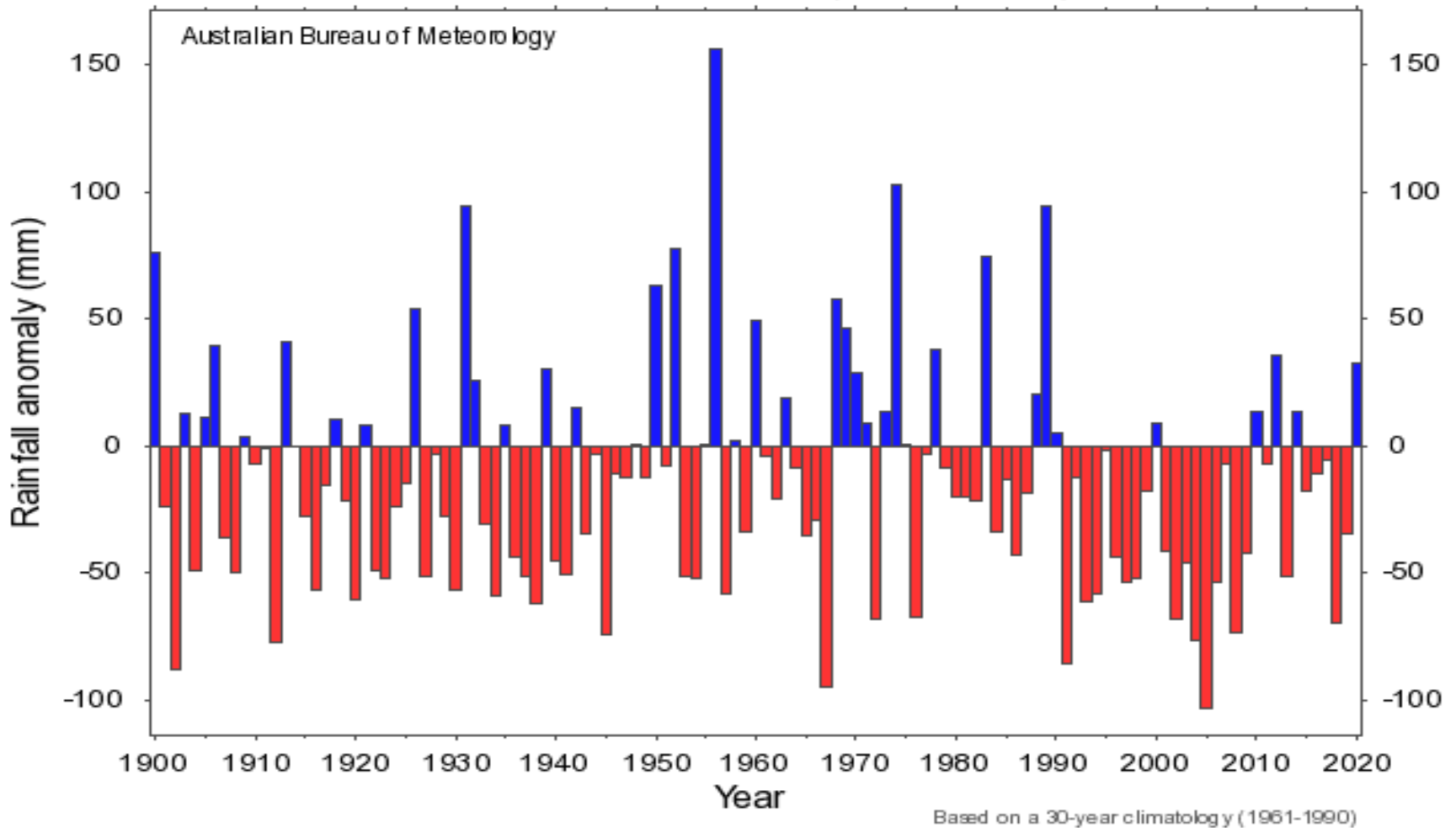
- The various climate and weather risks that affect a farm system.
- Weather and climate drivers and interpretation and accuracy of outlooks for your region
- The actual risks of an event occurring using tools (e.g. Australian Rainman)
- How to find this information on internet including weather and climate drivers – see links throughout presentation
- Discuss and prepare for these risks in a farming system

Annual rainfall trend south-eastern Australia



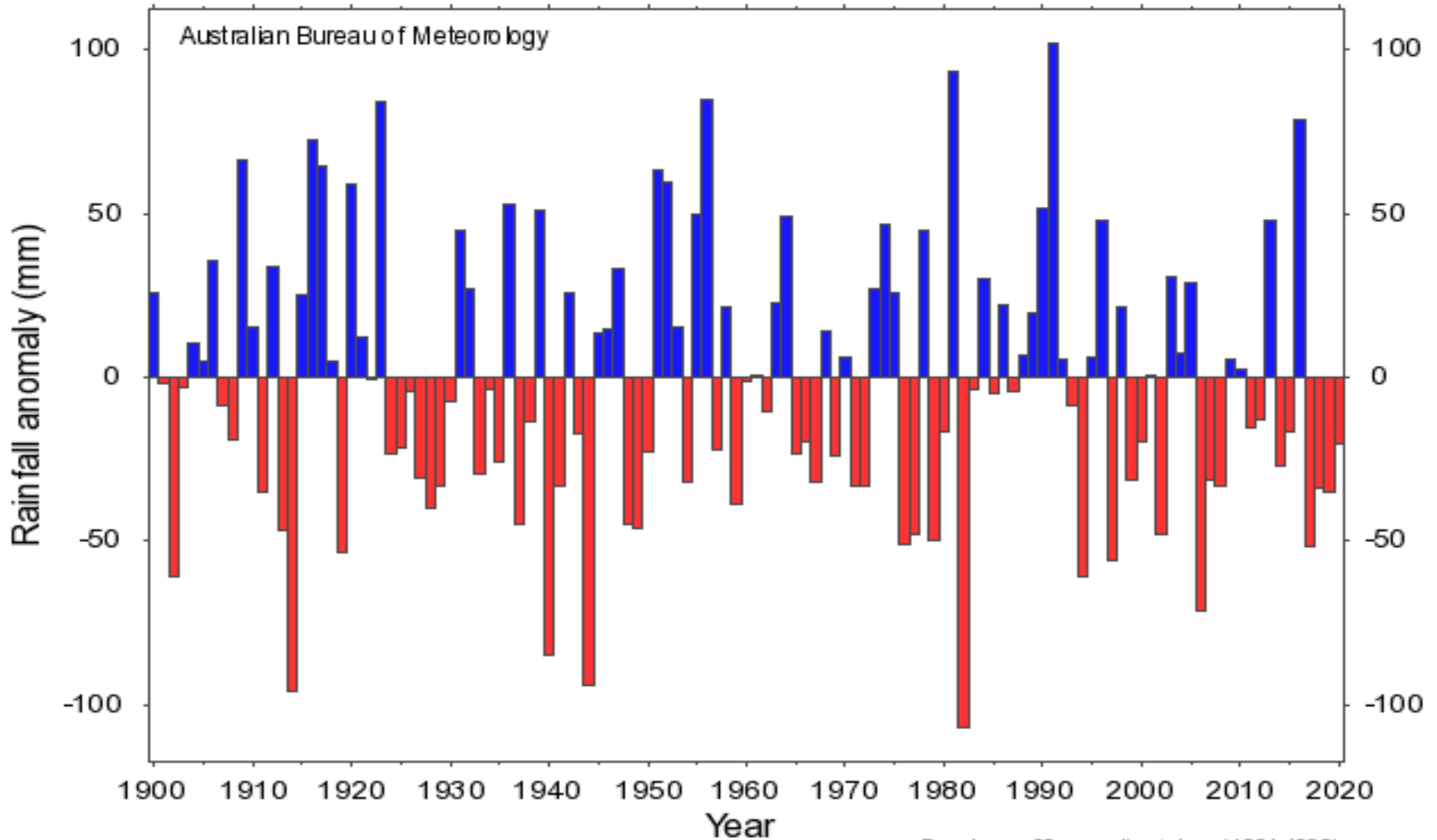
Autumn rainfall variations southeastern Australia

Autumn rainfall anomaly Southeastern Australia (1900 to 2020)



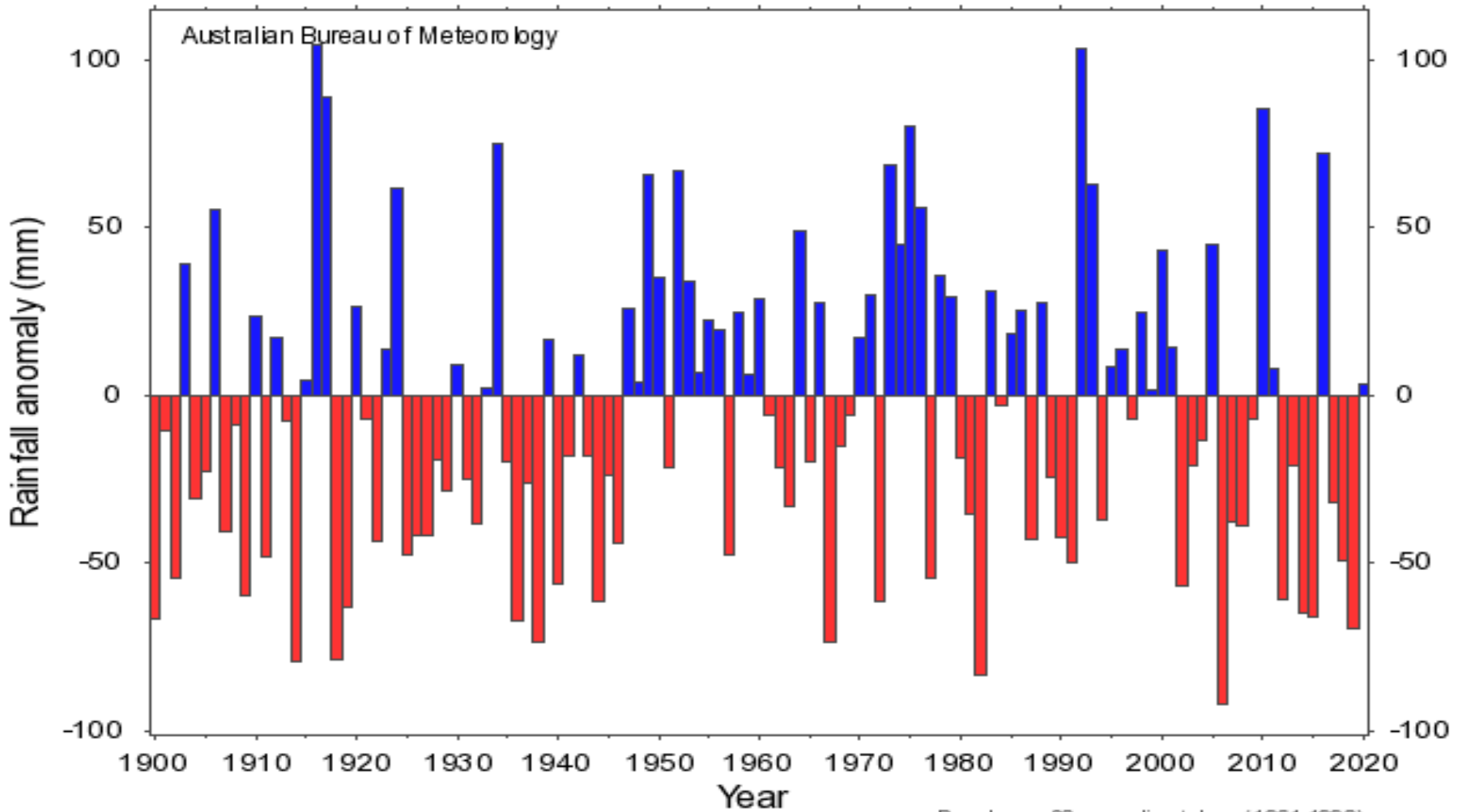
Winter rainfall variation South-eastern Australia

Winter rainfall anomaly Southeastern Australia (1900 to 2020)



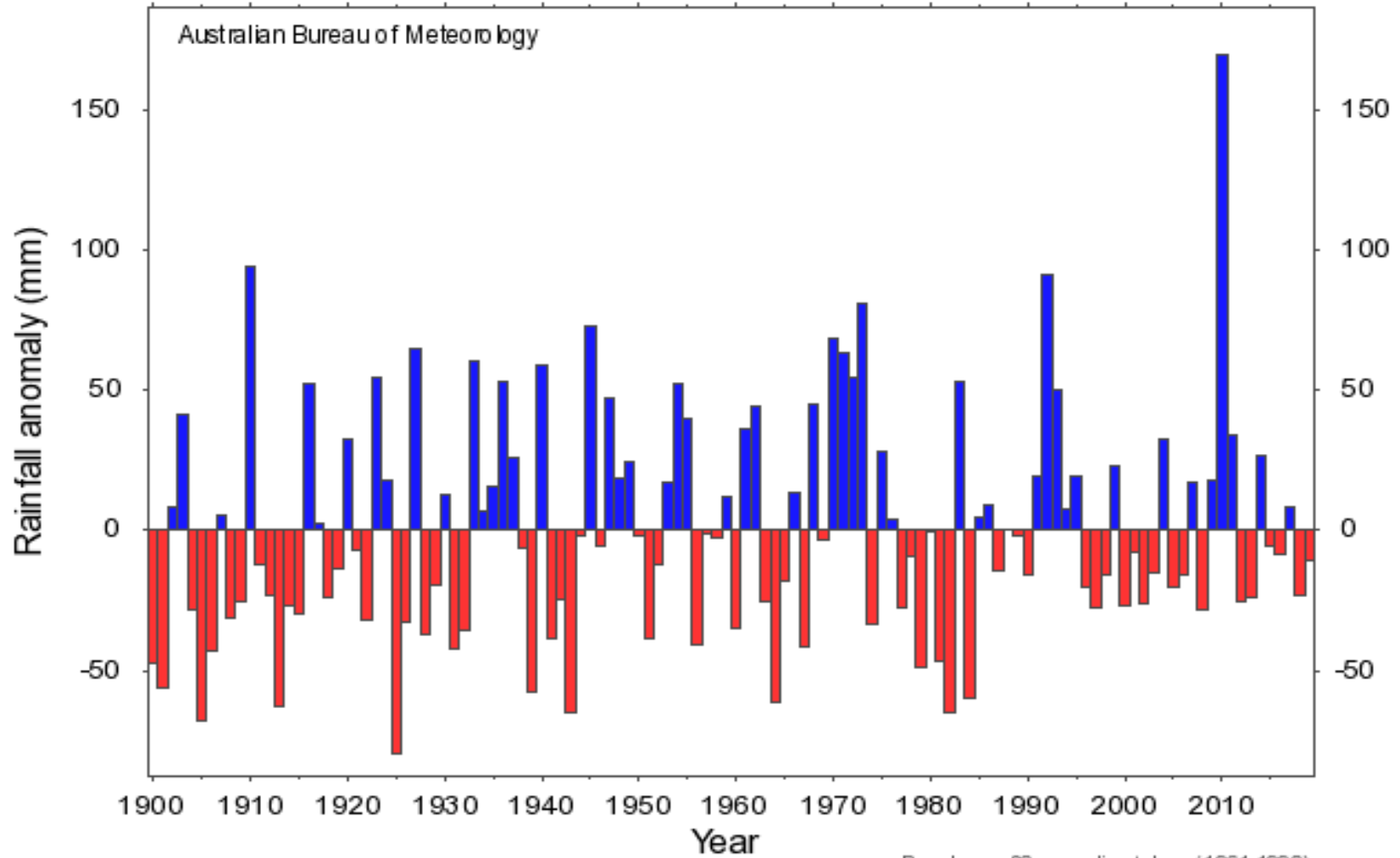
Spring rainfall variation South-eastern Australia

Spring rainfall anomaly Southeastern Australia (1900 to 2020)



Summer rainfall variation South-eastern Australia

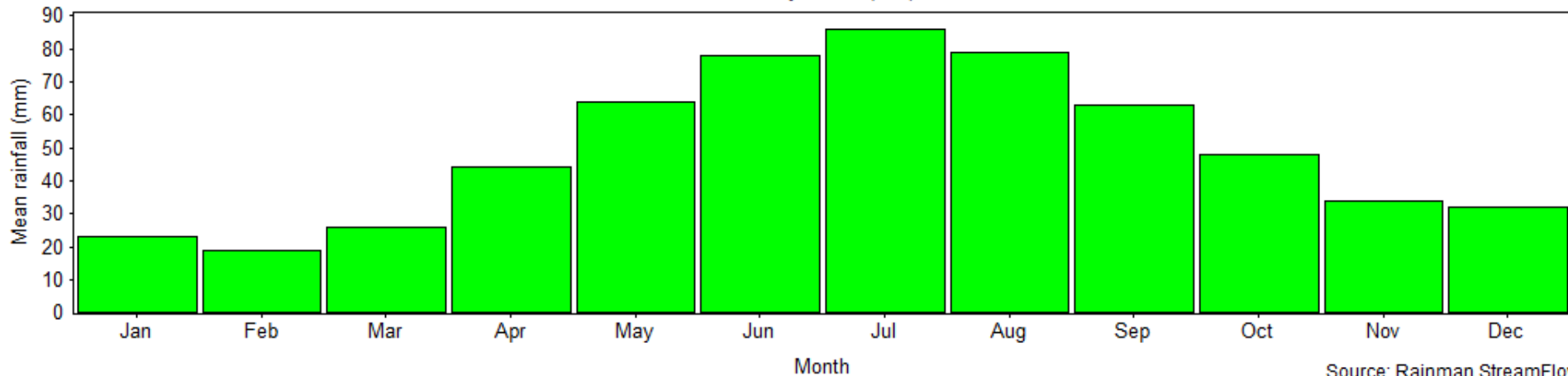
Summer rainfall anomaly
Southeastern Australia (1900-01 to 2019-20)



Monthly Rainfall at Lucindale

Monthly rainfall (mm) recorded at LUCINDALE POST OFFICE

Mean monthly rainfall (mm)



Source: Rainman StreamFlow

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean	23	19	26	44	64	78	86	79	63	48	34	32	598
Median	17	11	19	37	61	75	82	75	60	43	29	27	596
Standard deviation	21	22	27	30	33	37	36	35	29	27	22	27	118
Highest on record	114	117	151	151	162	180	206	176	188	126	100	176	920
Lowest on record	0	0	0	0	6	11	24	9	12	1	1	0	305
Mean raindays	5	4	6	10	14	15	17	17	14	11	8	7	128
No. of years	142	141	141	141	141	141	141	141	141	141	141	141	141

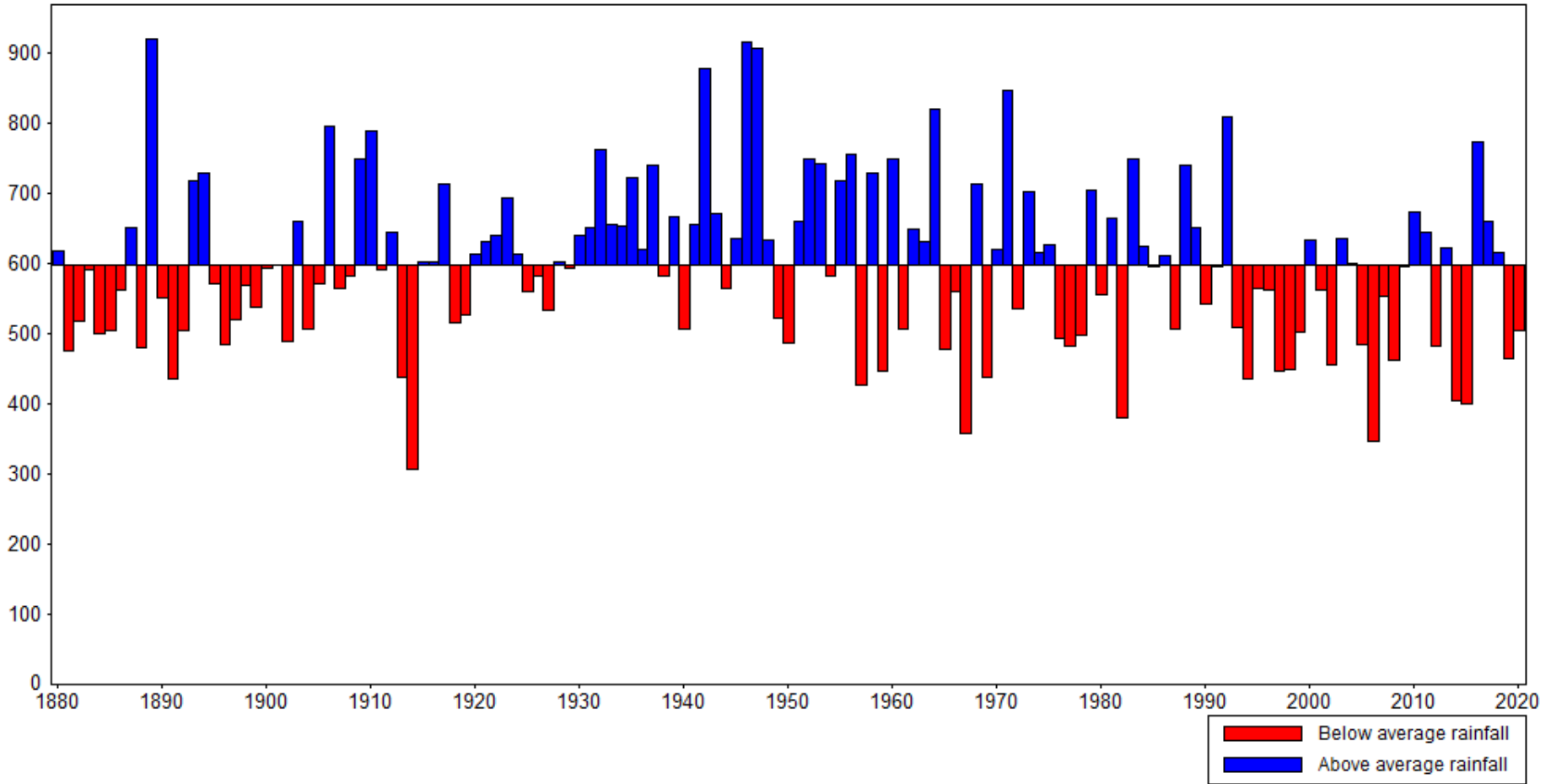
Annual Average Rainfall – Lucindale

Rainman StreamFlow analysis tool | Department of Agriculture and Fisheries,
Queensland (daf.qld.gov.au)

Historical record of seasonal rainfall (mm) at LUCINDALE POST OFFICE

Long-term average rainfall (Jan to Dec) is 598 mm

Rainfall period: Jan to Dec



Starting year of rainfall period

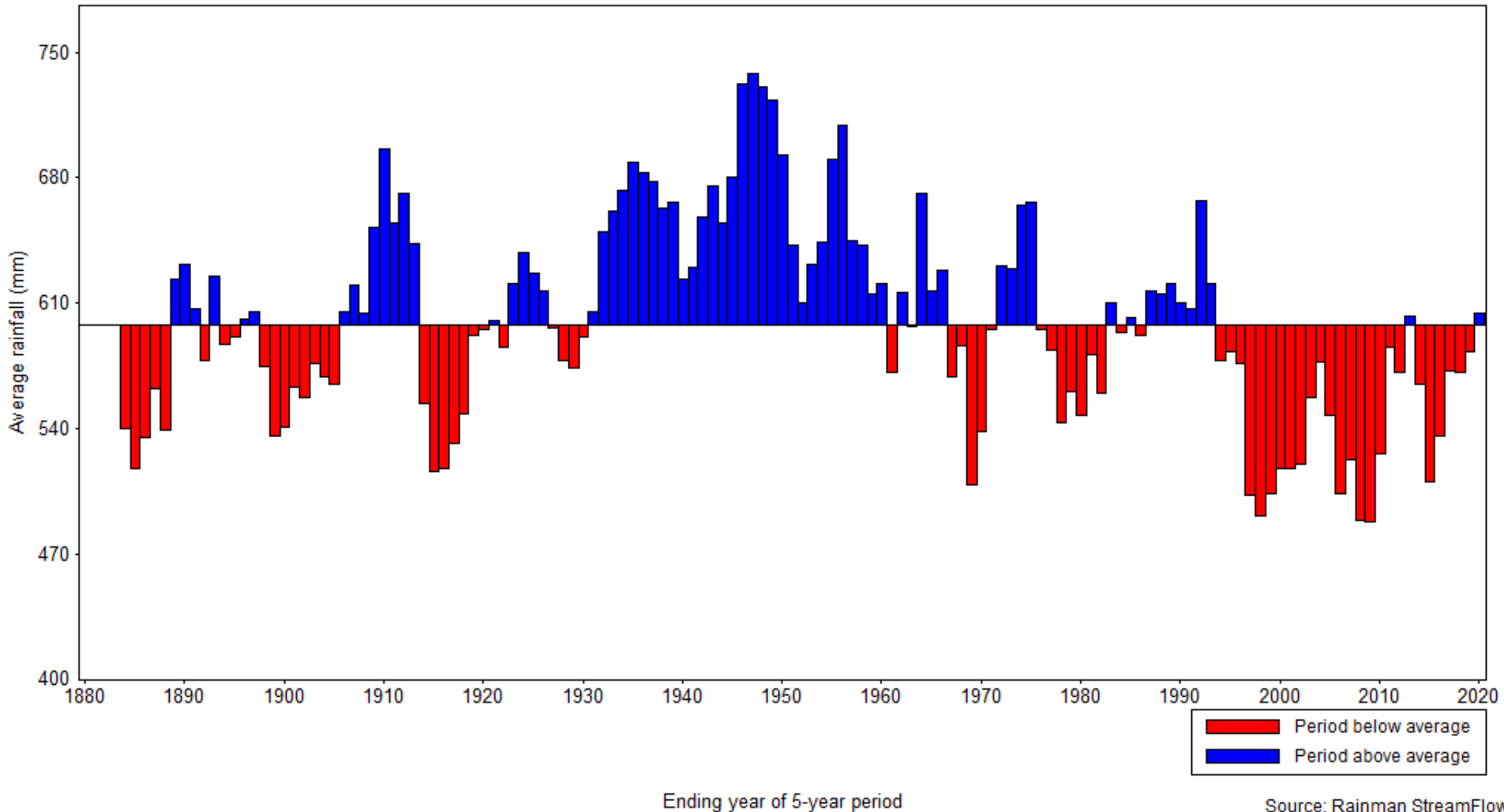
Source: Rainman StreamFlow



5 - Year Moving Average Lucindale

5-year moving average rainfall (12 months, Jan to Dec in year 1) at LUCINDALE POST OFFICE

Long-term average rainfall (12 months, Jan to Dec in year 1) is 598 mm



Ending year of 5-year period

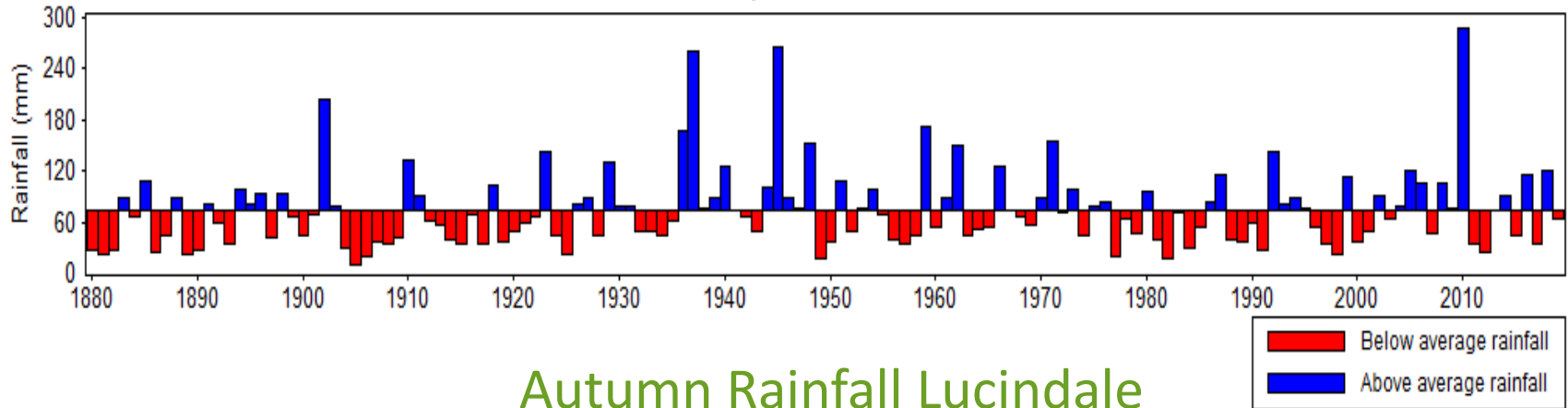
Source: Rainman StreamFlow

Summer Rainfall Lucindale

Historical record of seasonal rainfall (mm) at LUCINDALE POST OFFICE

Long-term average rainfall (Dec to Feb) is 74 mm

Rainfall period: Dec to Feb

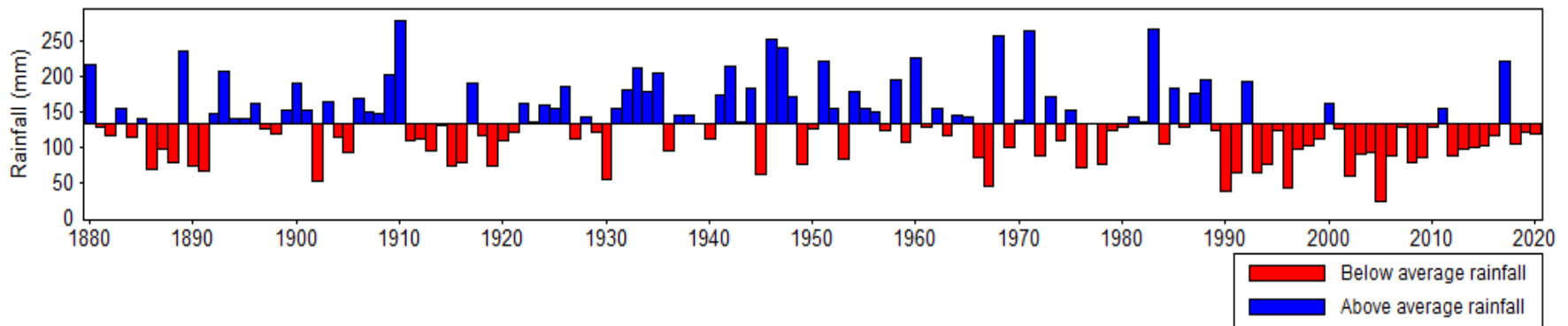


Autumn Rainfall Lucindale

Historical record of seasonal rainfall (mm) at LUCINDALE POST OFFICE

Long-term average rainfall (Mar to May) is 134 mm

Rainfall period: Mar to May

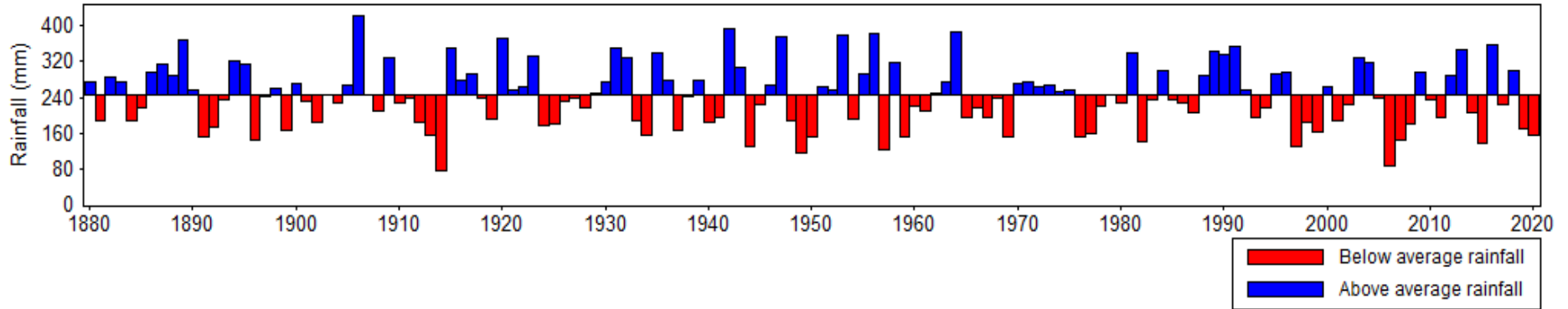


Winter Rainfall Lucindale

Historical record of seasonal rainfall (mm) at LUCINDALE POST OFFICE

Long-term average rainfall (Jun to Aug) is 244 mm

Rainfall period: Jun to Aug



Starting year of rainfall period

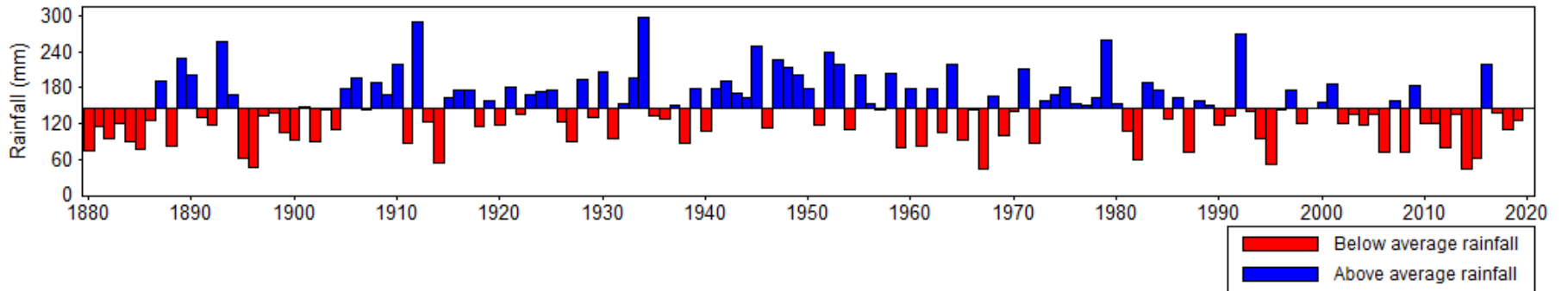
Source: Rainman StreamFlow

Spring Rainfall Lucindale

Historical record of seasonal rainfall (mm) at LUCINDALE POST OFFICE

Long-term average rainfall (Sep to Nov) is 145 mm

Rainfall period: Sep to Nov

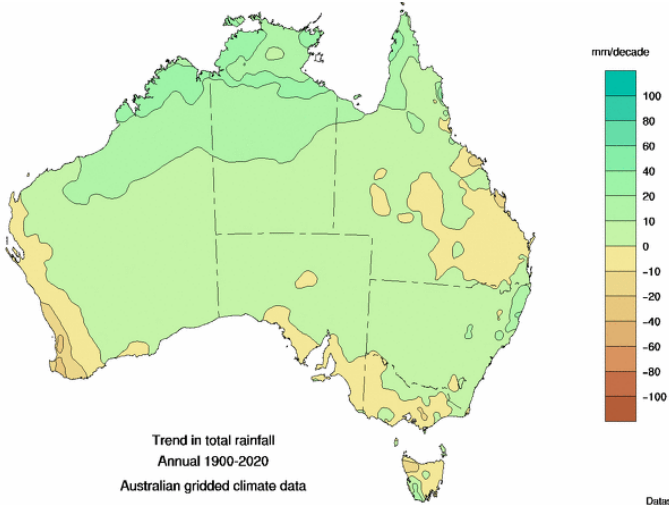


Starting year of rainfall period

Source: Rainman StreamFlow

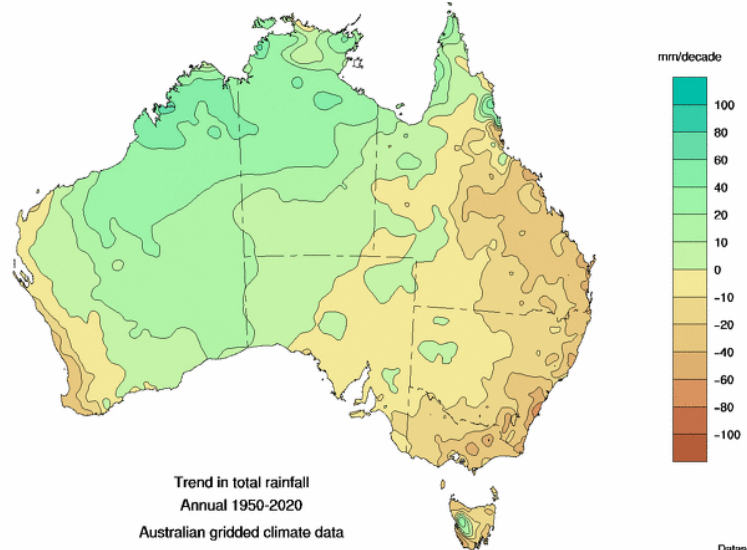
Australian Rainfall Trends

1900-Present



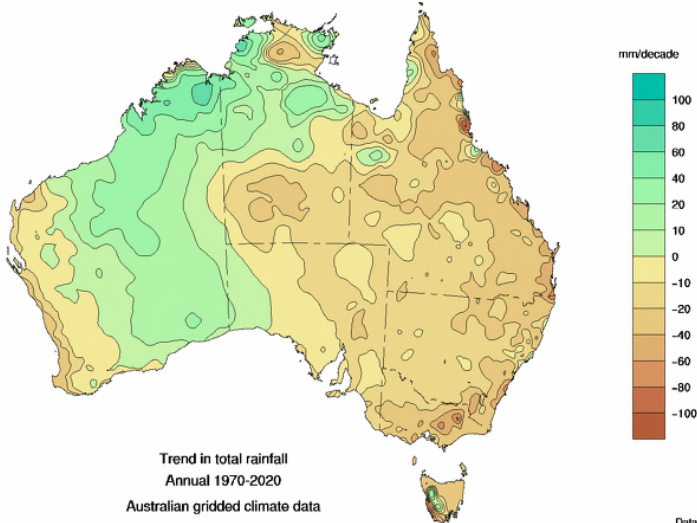
© Commonwealth of Australia 2021, Bureau of Meteorology

1950-Present



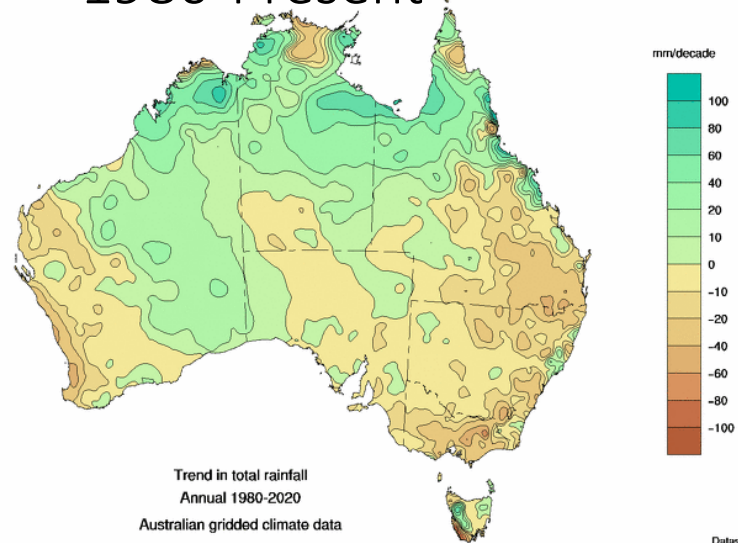
© Commonwealth of Australia 2021, Bureau of Meteorology

1970-Present



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1980-Present



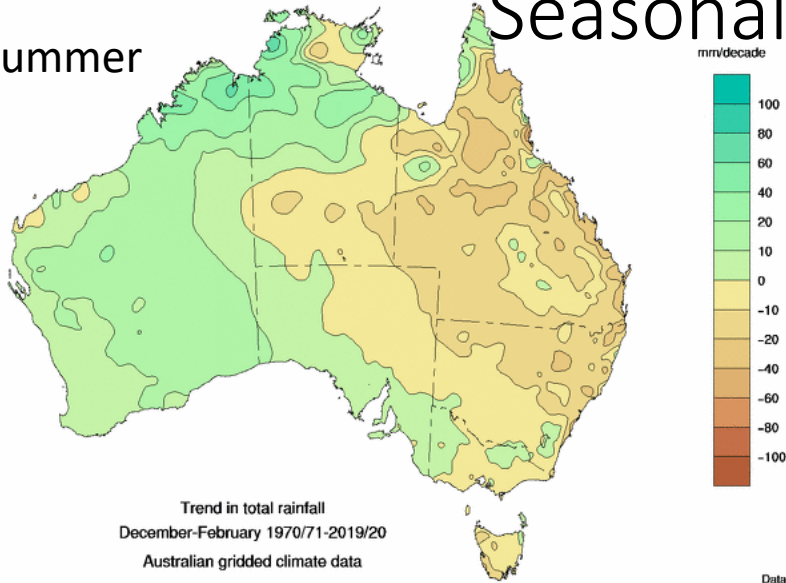
Dataset: AGCD v2
Issued: 18/02/2021

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Dataset: AGCD v2
Issued: 18/02/2021

Seasonal Rainfall Trends

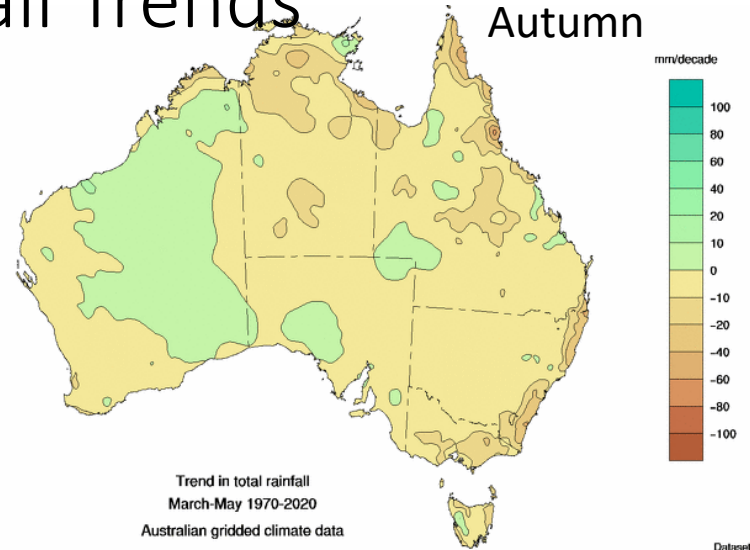
Summer



© Commonwealth of Australia 2021, Bureau of Meteorology

Dataset: AGCD v2
Issued: 18/02/2021

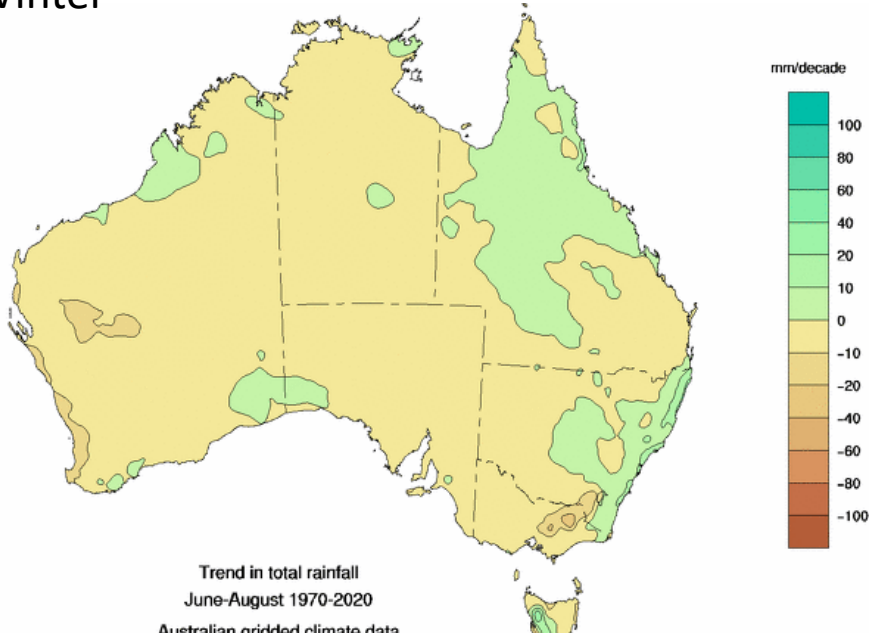
Autumn



© Commonwealth of Australia 2021, Bureau of Meteorology

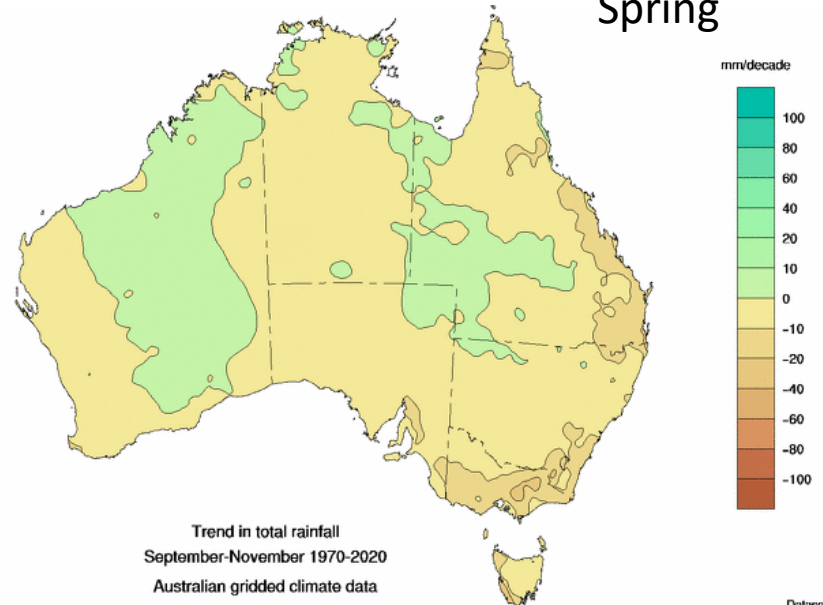
Dataset: AGCD v2
Issued: 18/02/2021

Winter



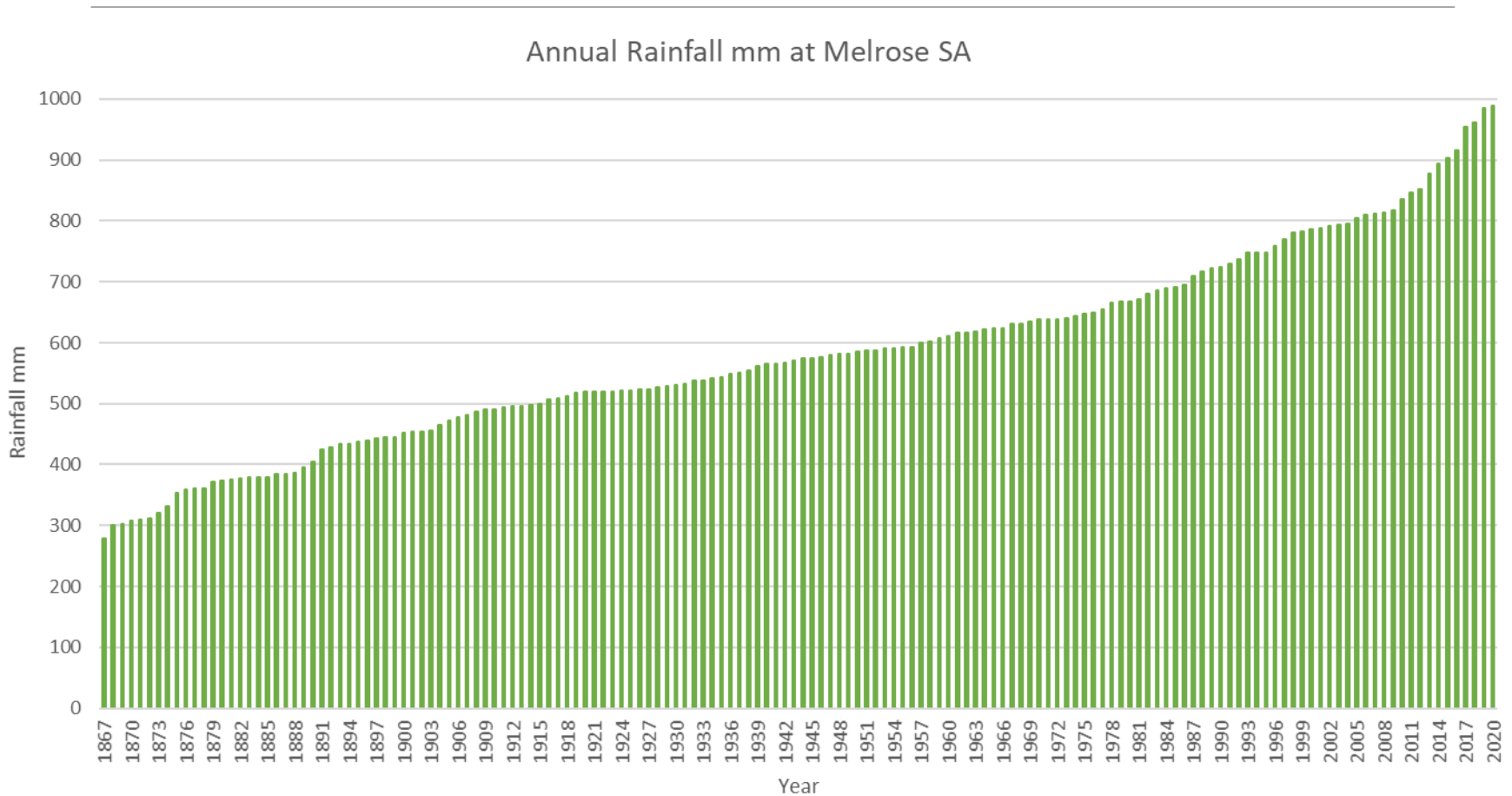
© Commonwealth of Australia 2021, Bureau of Meteorology

Spring



Dataset: AGCD v2
Issued: 18/02/2021

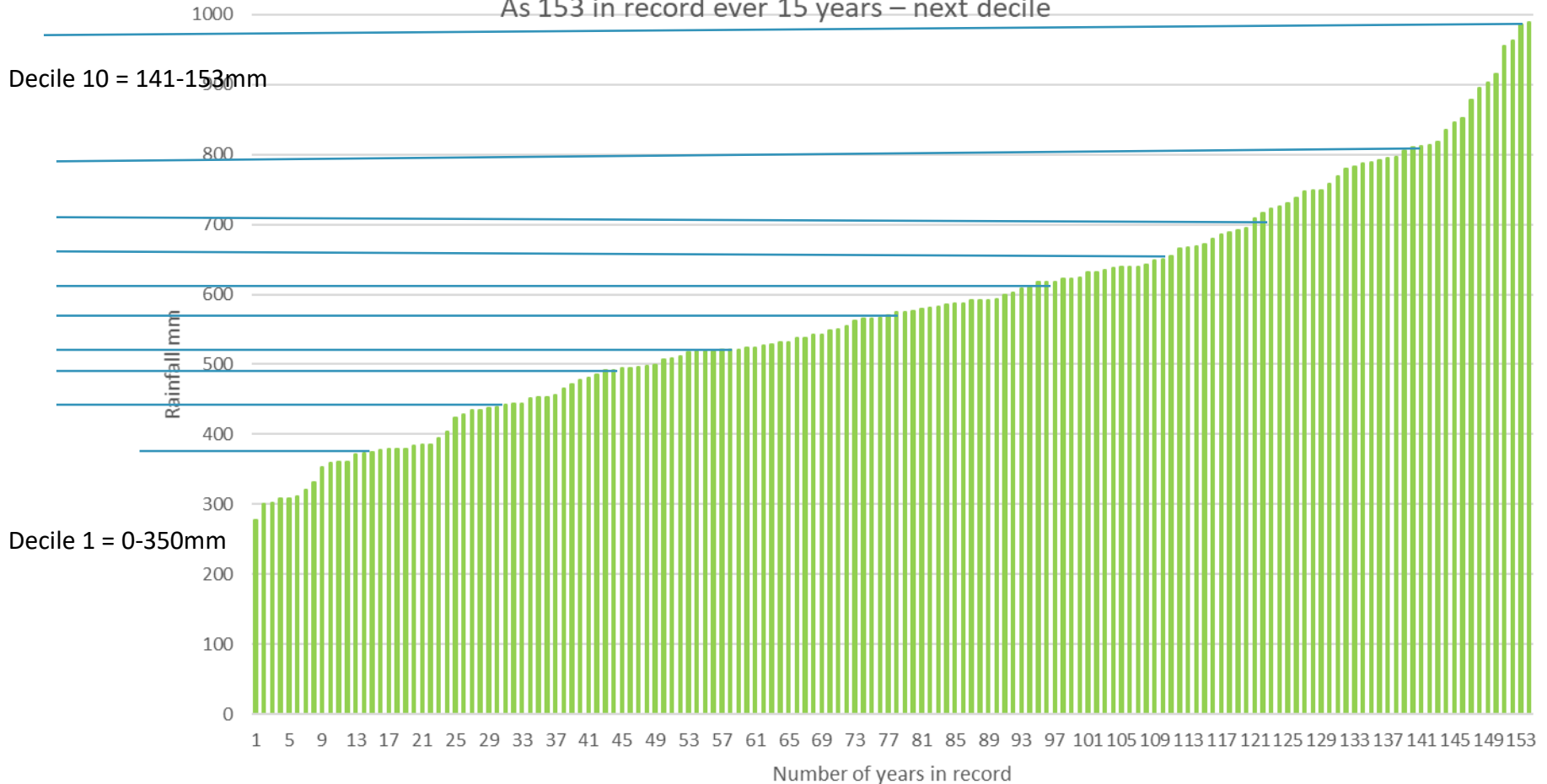
Calculating rainfall deciles



Example of calculating rainfall deciles

Rainfall sorted lowest to highest at Melrose and divided into 10 categories.

As 153 in record ever 15 years – next decile



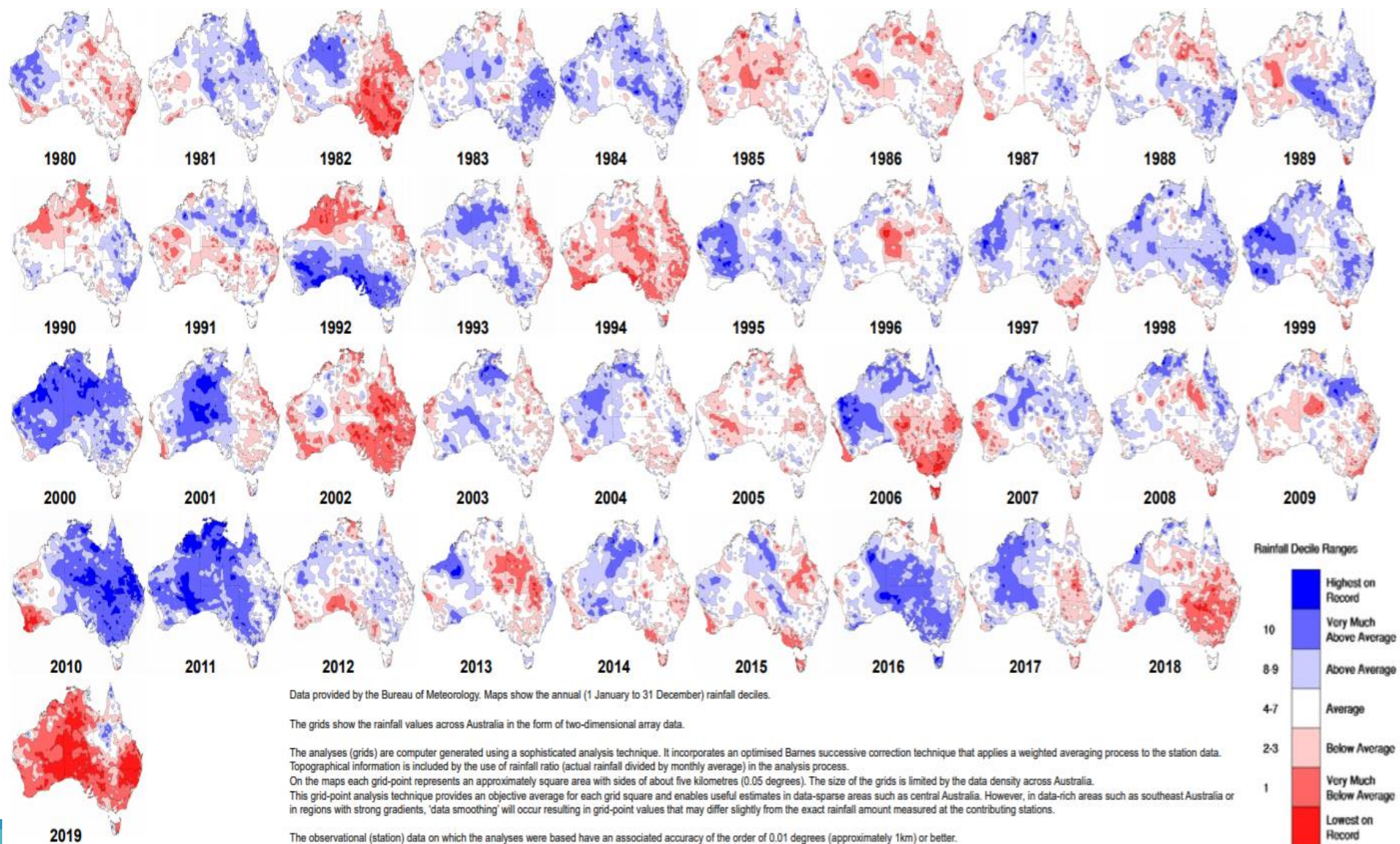
Monthly Probabilities of Rainfall

Probabilities of monthly rainfall recorded at MELROSE POST OFFICE

Amounts of rain (mm) received or exceeded in 100%, 90% ... 0% of years.

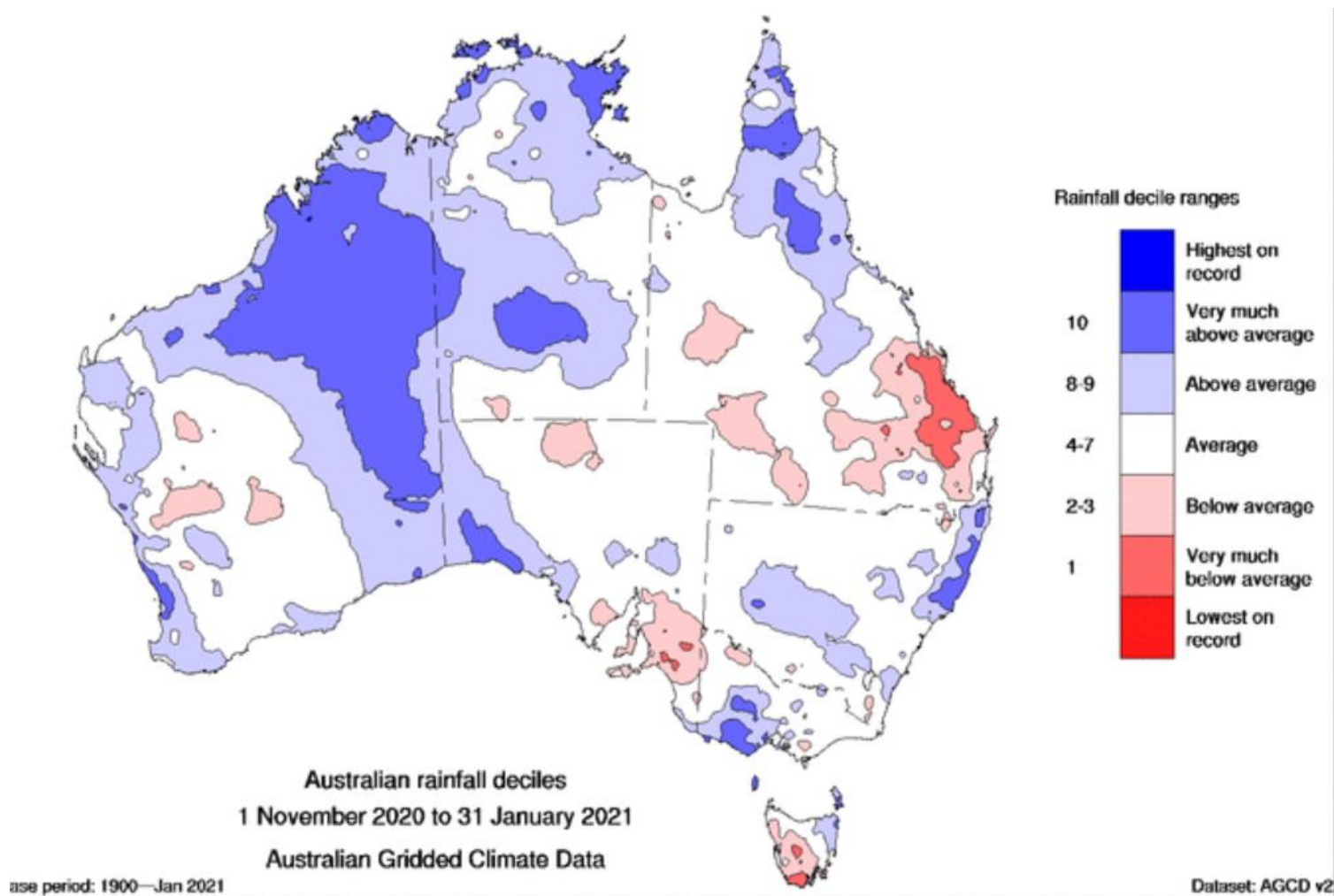
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Lowest on record	0	0	0	0	3	0	4	3	5	1	0	0	278
90% yrs at least	1	0	1	4	14	14	26	26	17	9	5	4	378
80% yrs at least	3	2	3	8	24	38	38	37	28	19	10	8	443
70% yrs at least	7	4	6	15	32	49	45	53	35	27	18	12	496
60% yrs at least	12	8	9	24	41	58	59	60	46	34	23	16	527
median, 50% yrs	18	12	14	32	51	64	68	67	54	42	30	22	572
40% yrs at least	22	21	19	41	60	78	77	77	61	50	37	30	607
30% yrs at least	33	29	28	49	75	96	91	89	77	64	44	36	644
20% yrs at least	46	41	36	63	96	114	106	104	92	91	61	43	723
10% yrs at least	62	62	65	91	132	138	127	116	129	105	79	52	802
Highest on record	193	206	217	167	264	242	241	175	207	223	136	150	988
Mean	28	25	25	38	63	75	74	71	64	52	37	29	582
Standard deviation	34	34	33	33	50	47	43	38	43	40	30	27	160

Australian Rainfall Decile Maps



2019

Recent and historical rainfall maps, Australian Bureau of Meteorology (bom.gov.au)

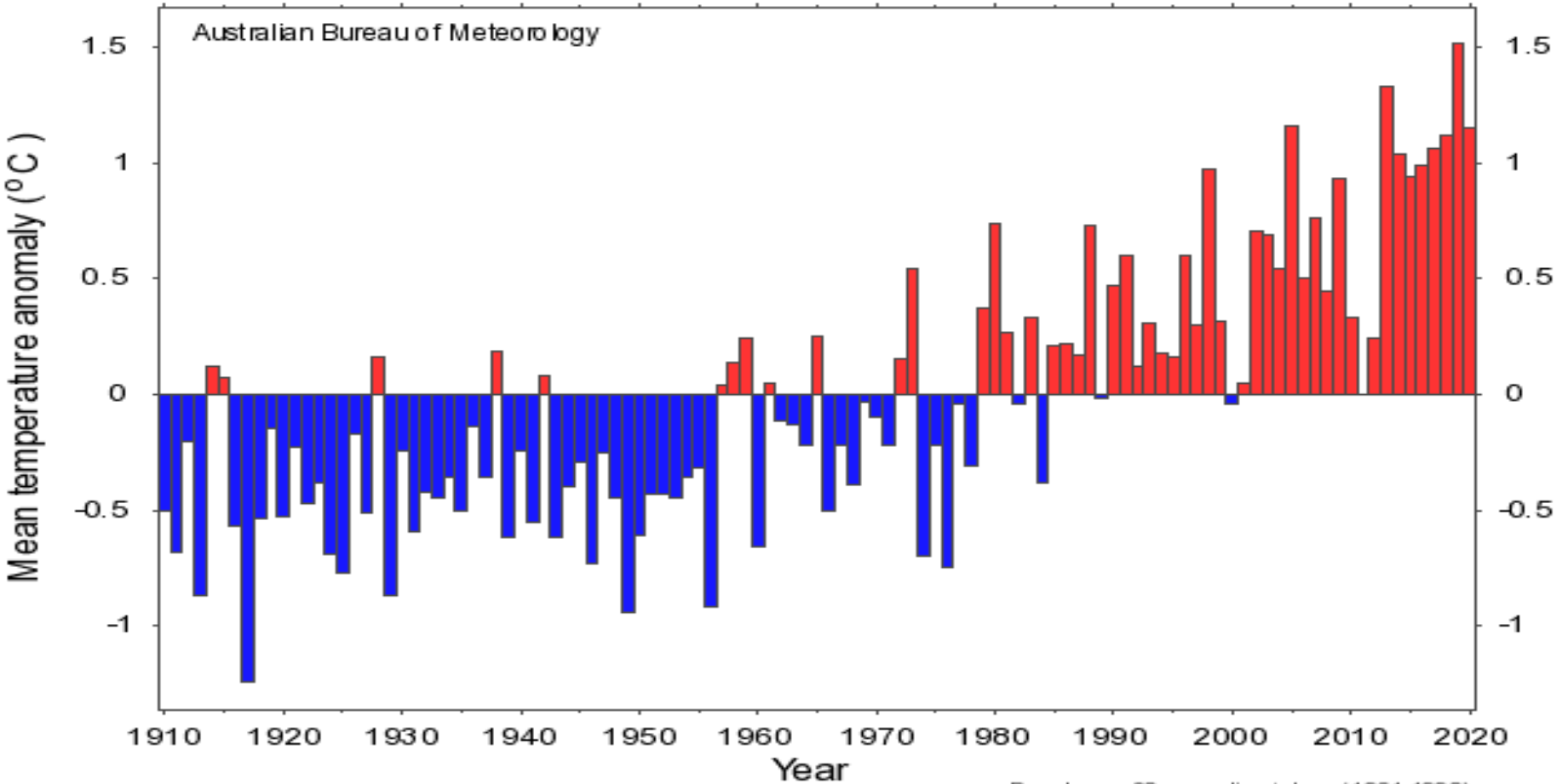


Rainfall variability in Millicent SA

Lowest			Middle			Highest
360-442	443-524	525-606	607-688	689-770	771-852	853-934
360	444		635	694	772	964
	480		647	708	781	
			657	733	791	
			688	748	795	
				763	824	
					846	
					850	
5%	10%		20%	25%	35%	5%

Temperature Trends

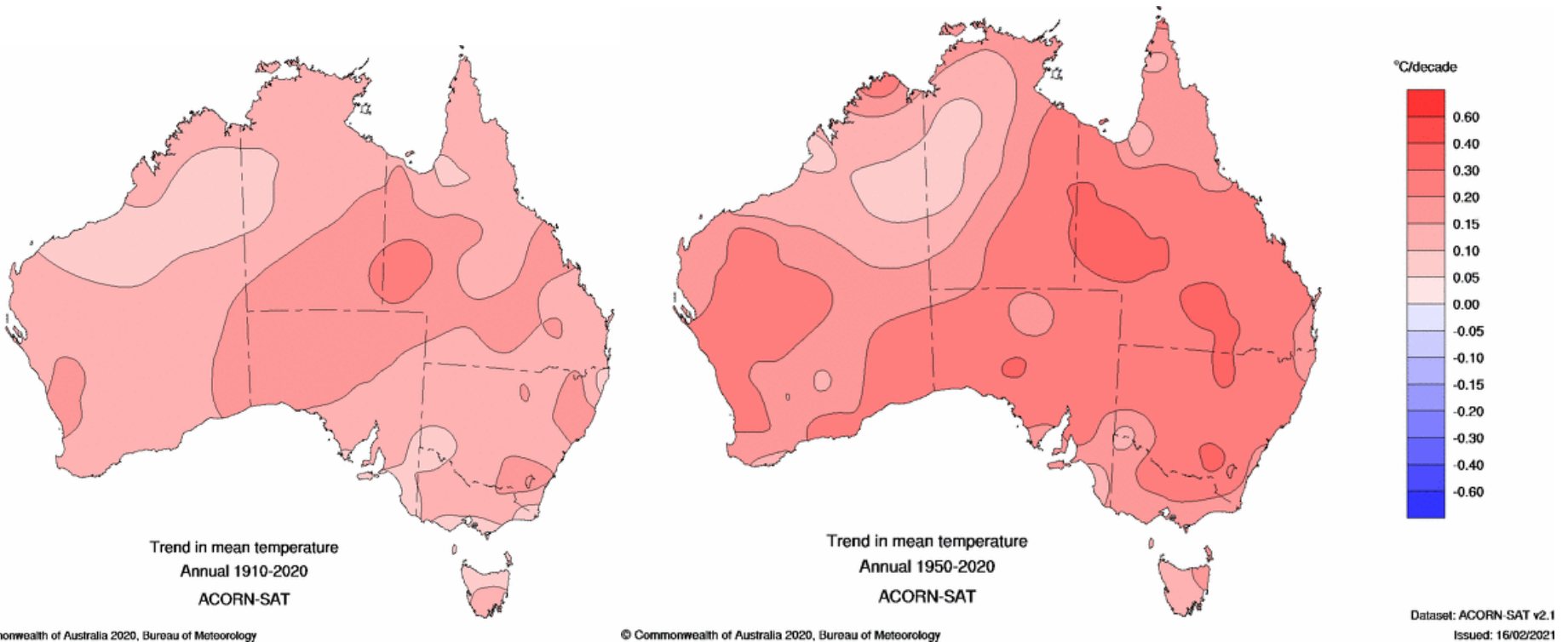
Annual mean temperature anomaly
Australia (1910 to 2020)



Annual Temperature Trends

1910-2020

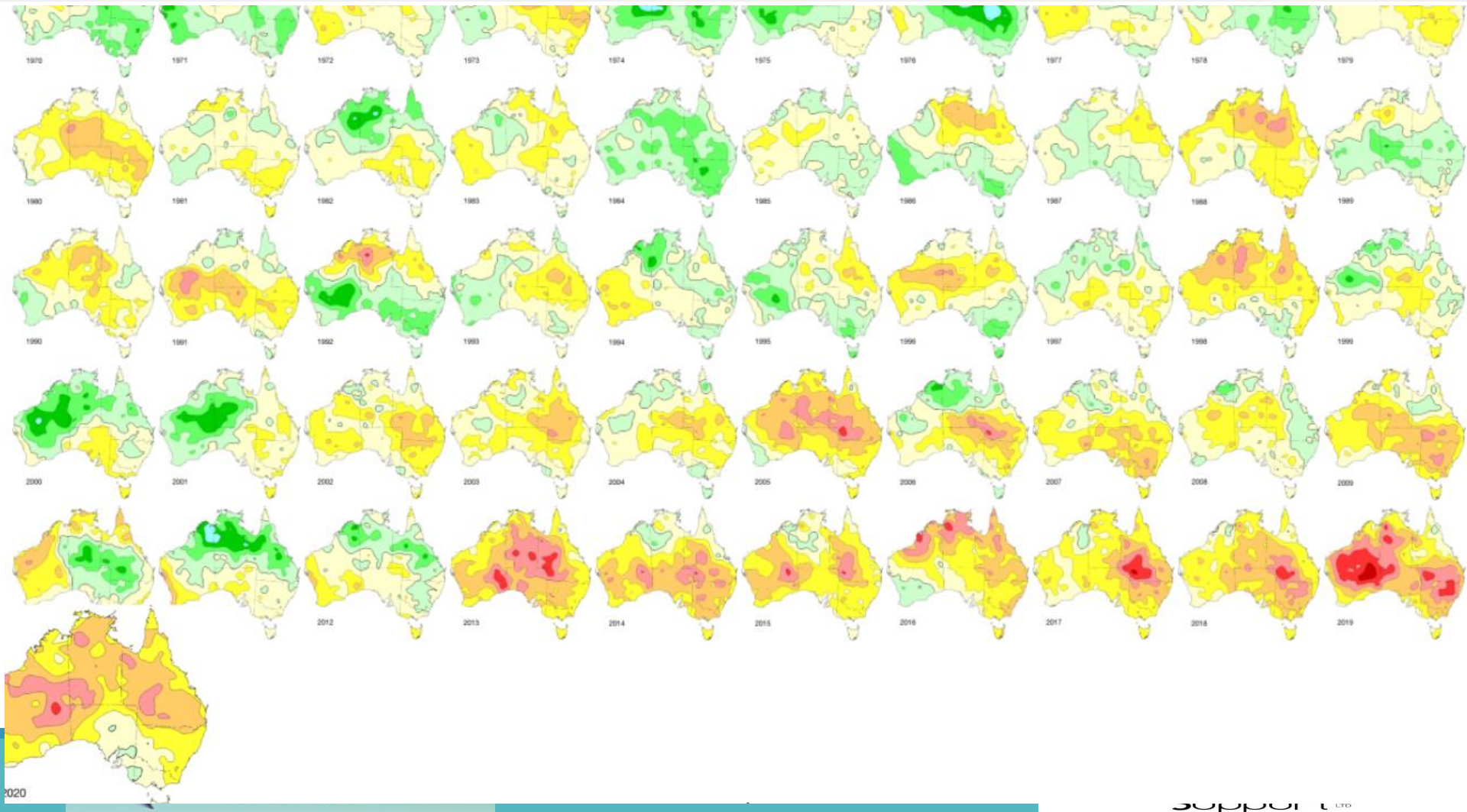
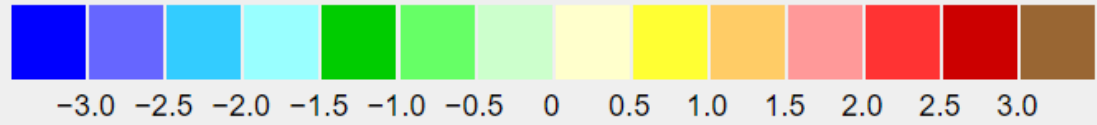
1950-2020



Warmed by 0.3degrees/decade since 1950

Temperature Trends Poster

12-monthly mean temperature anomaly °C
map legend



What we will cover

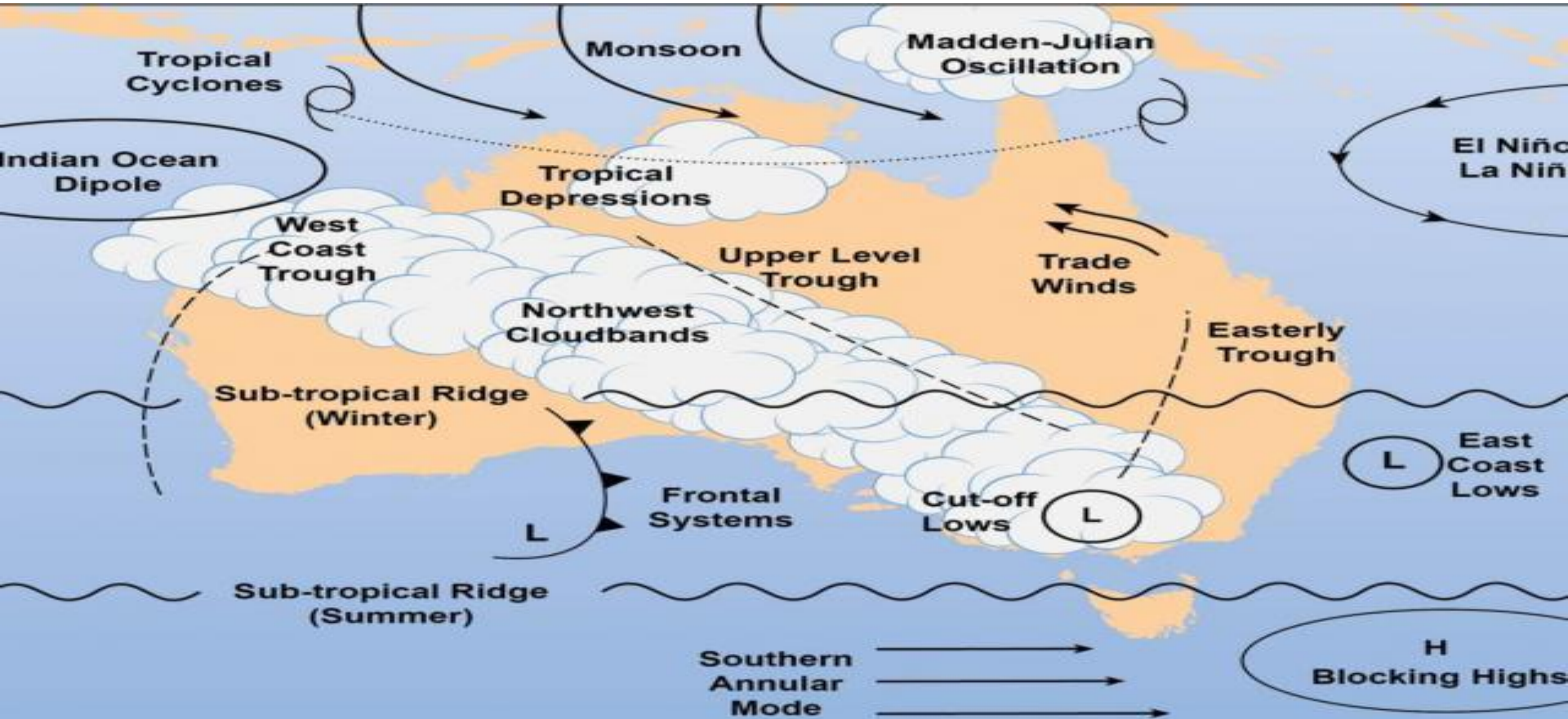
- The various climate and weather risks that affect a farm system.
- Weather and climate drivers and interpretation and accuracy of outlooks for your region
- The actual risks of an event occurring using tools (e.g. Australian Rainman)
- How to find this information on internet including weather and climate drivers
- Discuss and prepare for these risks in a farming system

The Weather and climate drivers

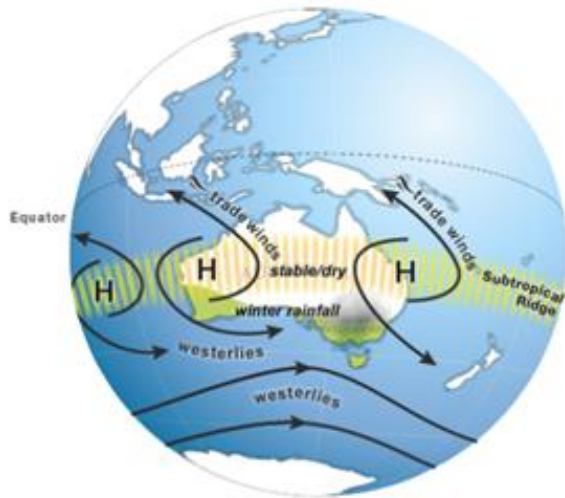
The weather is a description of the current state of the atmosphere including wind, cloudiness, temperature, humidity, precipitation etc.

Climate drivers influence the weather.

Eg: Indian Ocean Dipole, Southern Oscillation Index, Southern Annular Mode

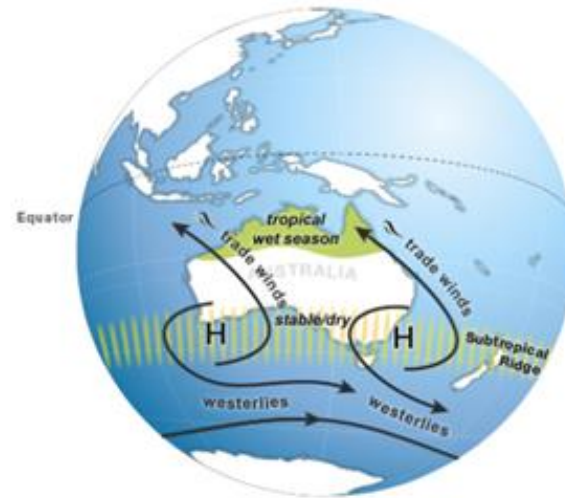


Low and High Pressure Systems



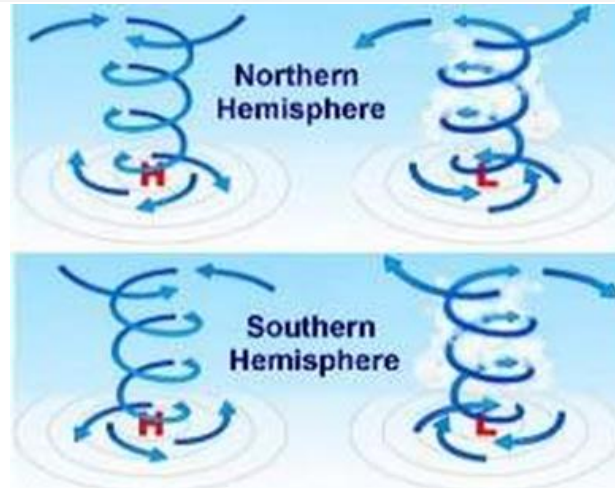
Subtropical Ridge: Winter

© Commonwealth of Australia 2013.

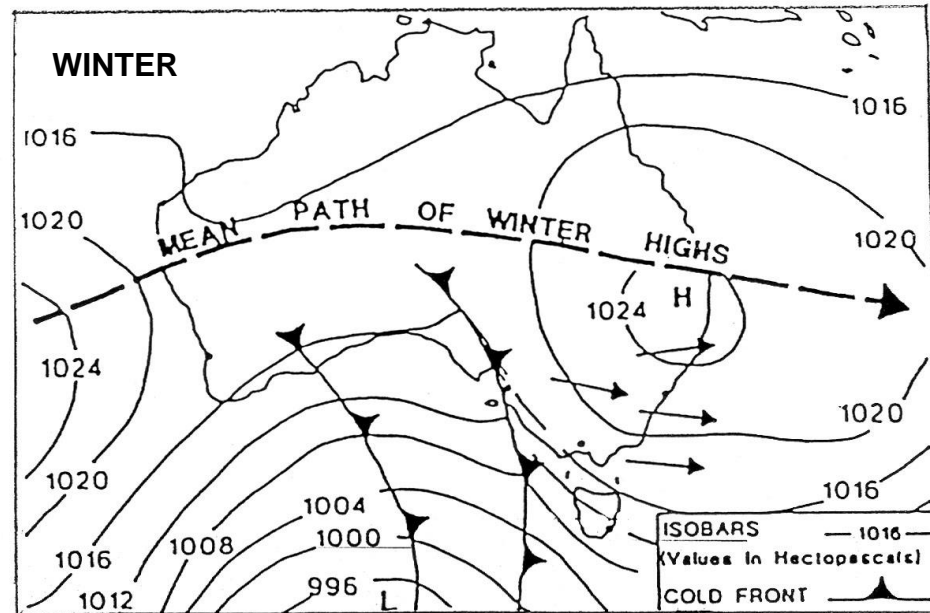
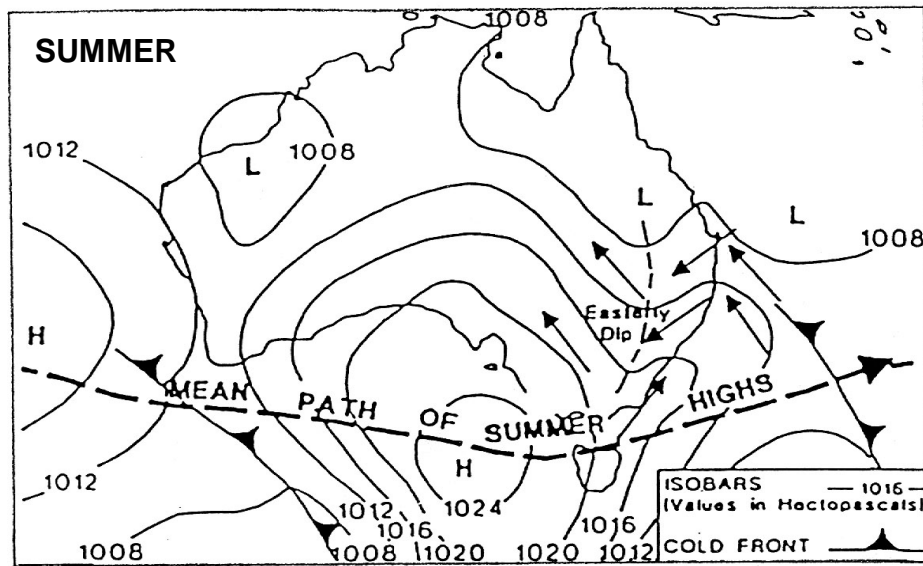


Subtropical Ridge: Summer

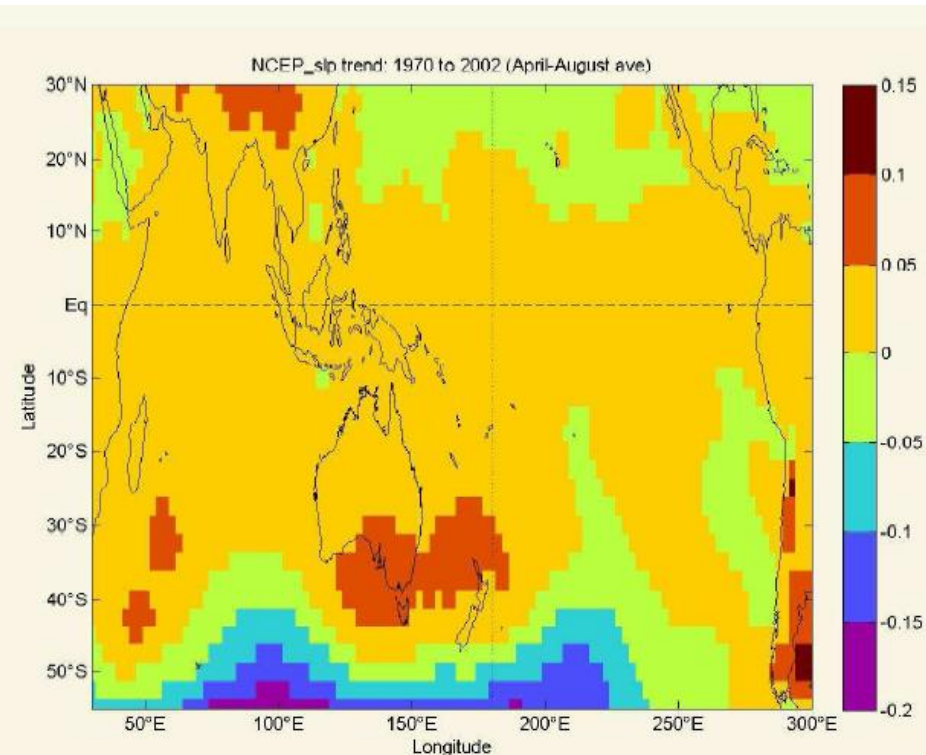
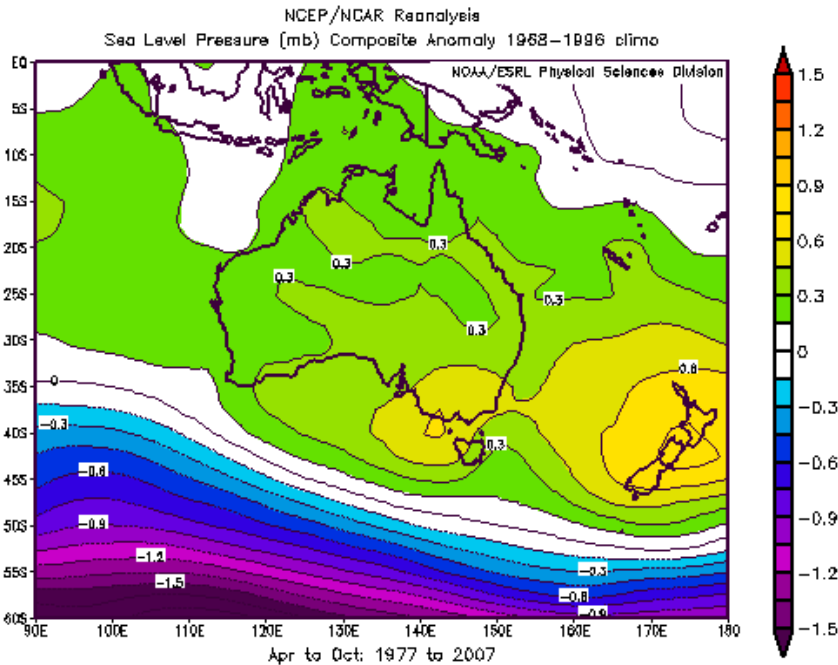
© Commonwealth of Australia 2013.



Understanding weather



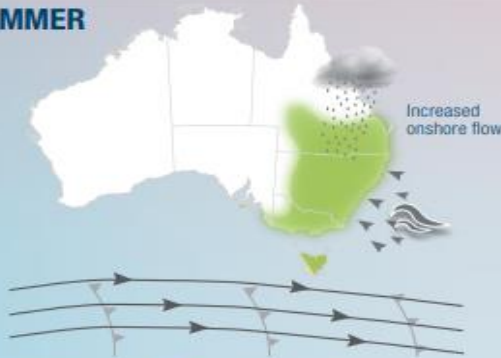
High Pressure



- High pressure systems larger
- Pressure at centre of high larger
- High pressure systems not moving further north as often giving cold fronts

Southern Annular Mode – SAM

SUMMER



WETTER THAN NORMAL DRIER THAN NORMAL

MORE RAINFALL IN THE EAST

REDUCED CHANCE OF EXTREME HEAT IN SPRING AND SUMMER

MORE FREQUENT WITH LA NIÑA

POSITIVE PHASE

• WINDS FURTHER SOUTH THAN NORMAL

WINTER



WETTER THAN NORMAL DRIER THAN NORMAL

MORE RAINFALL IN EAST; MORE EAST COAST LOWS

LESS RAINFALL IN PARTS OF FAR SOUTH

LESS SNOW IN ALPINE AREAS

ANNULAR MODE IN AUSTRALIA WHAT IS IT?

The Southern Annular Mode, or SAM, describes the north-south shift of rain-bearing westerly winds and weather systems in the Southern Ocean, from their normal position

AFFECTS
RAINFALL AND TEMPERATURE DIFFERENTLY
DEPENDING ON TIME OF THE YEAR

3
PHASES

- POSITIVE
- NEUTRAL
- NEGATIVE

WHEN DO THEY OCCUR?

SAM CAN OCCUR AT ANY TIME OF THE YEAR

POSITIVE OR NEGATIVE PHASES CAN LAST FROM

A WEEK TO SEVERAL MONTHS

SUMMER



WETTER THAN NORMAL DRIER THAN NORMAL

LESS RAINFALL IN THE SOUTHEAST AND EAST

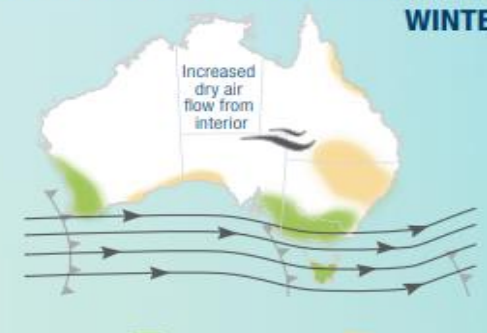
GREATER CHANCE OF SPRING HEATWAVES IN SOUTHERN AUSTRALIA

MORE FREQUENT WITH EL NIÑO

NEGATIVE PHASE

• WINDS FURTHER NORTH THAN NORMAL

WINTER



WETTER THAN NORMAL DRIER THAN NORMAL

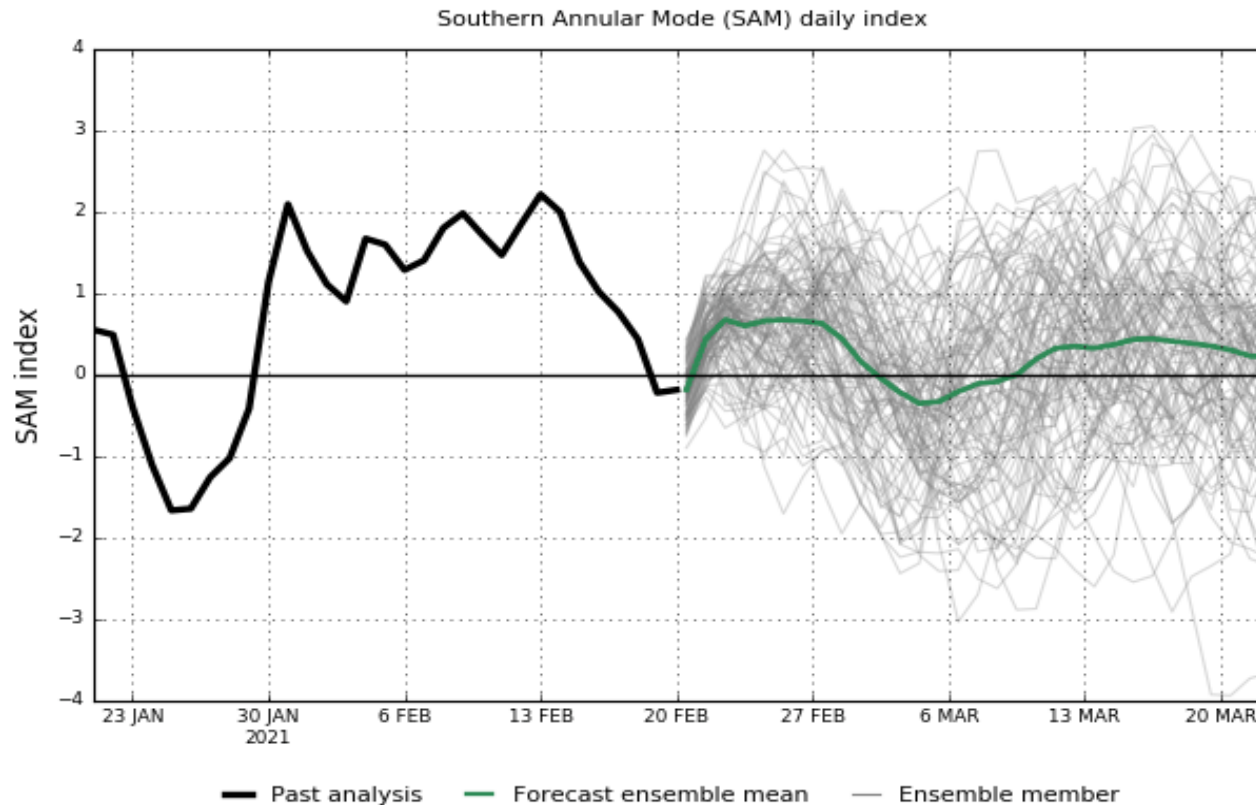
MORE RAINFALL IN SOUTHWEST AND SOUTHEAST

LESS RAINFALL IN PARTS OF THE EAST

MORE SNOW IN ALPINE AREAS



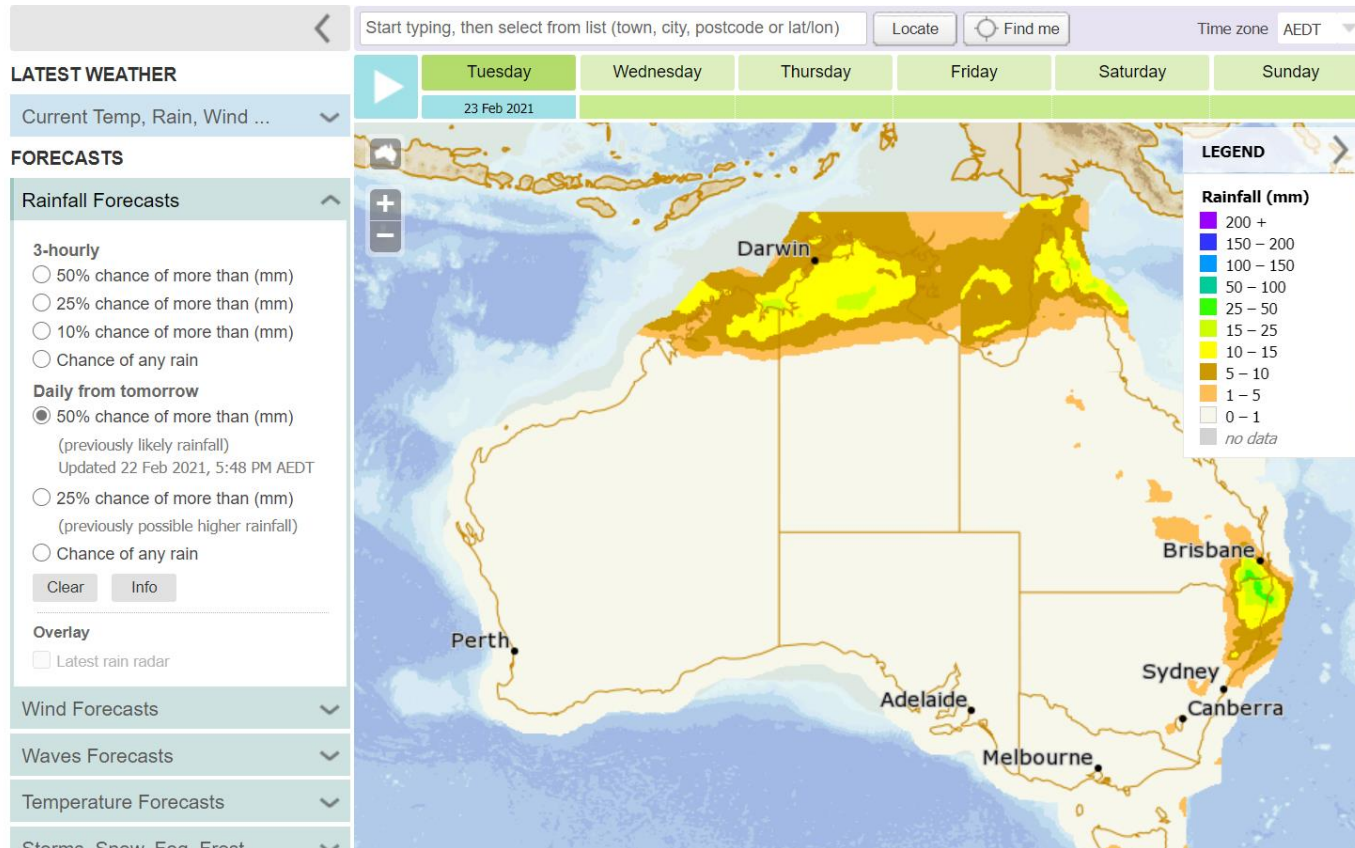
Southern Annular Mode (SAM) outlook



www.bom.gov.au/climate
Commonwealth of Australia 2021, Australian Bureau of Meteorology

Model: ACCESS-S1
Model run: 20 Feb 2021 Base period 1990-2012

MetEye (bom.gov.au)



ENSO = El Nino/Southern Oscillation

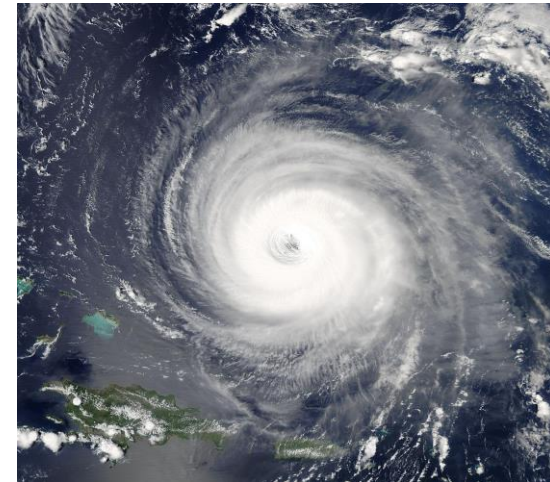
Walker Circulation – movement of warm and cold water

SST – Sea Surface Temperatures

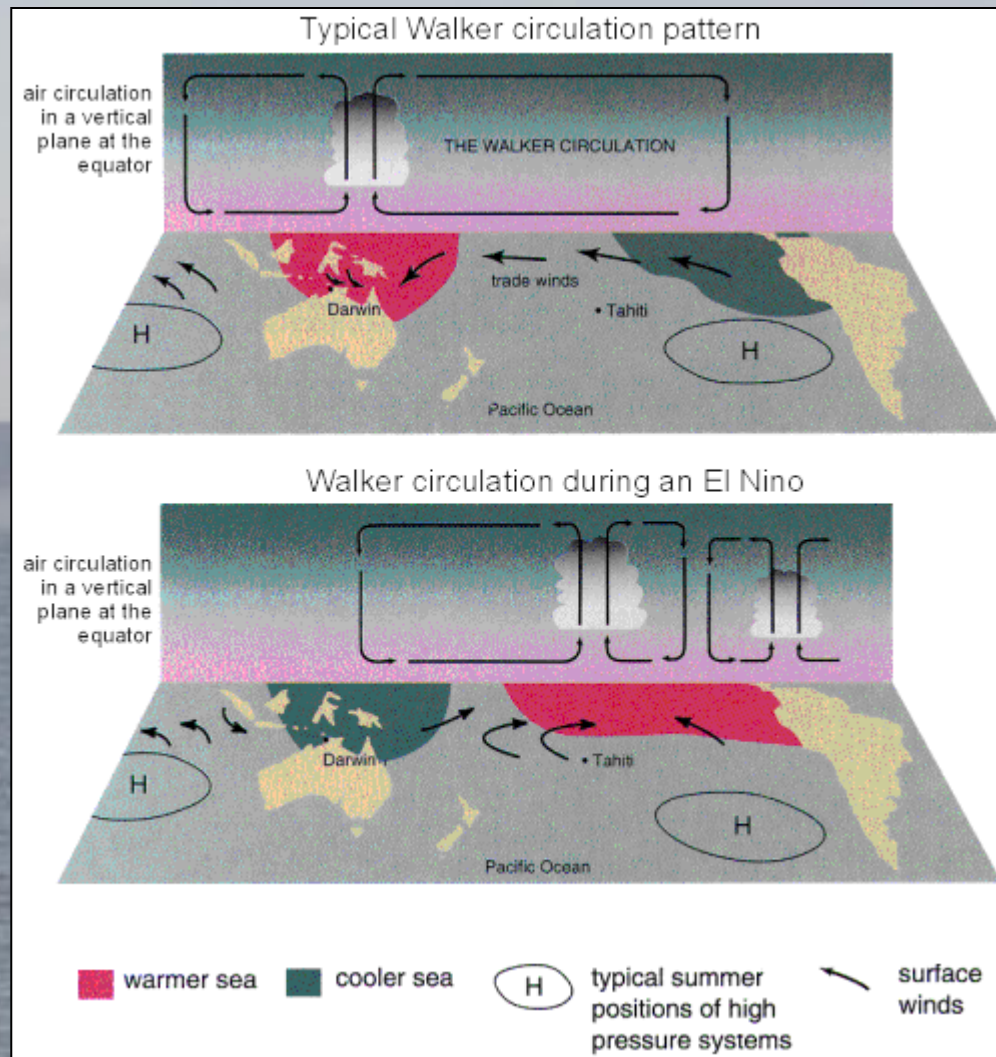
SOI – Measurement of air pressure difference between Tahiti and Darwin influences warm and cold water movement

El Nino – Cold water pacific above Aust

La Nina – Warm water pacific above Aust



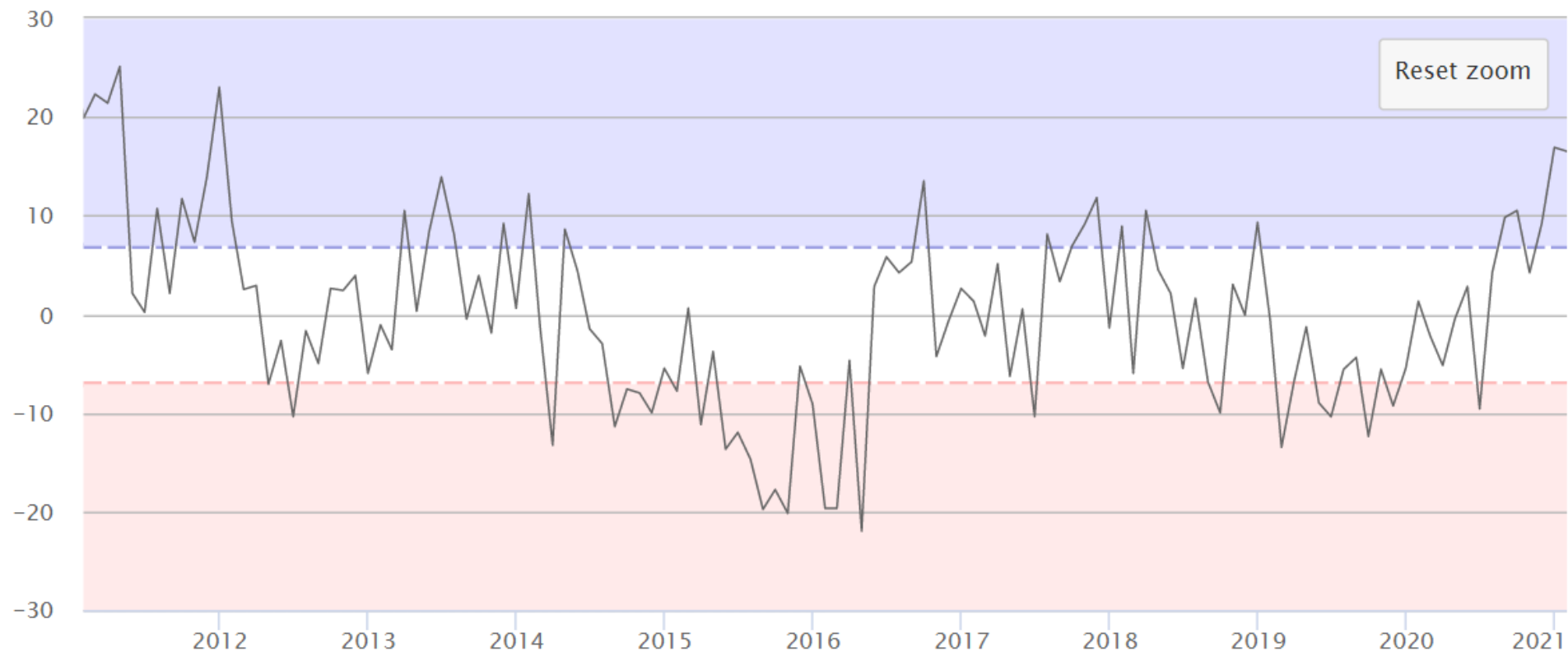
The pacific ocean – El Nino/La Nina



Southern Oscillation Index

A measure of the air pressure difference between Tahiti and Darwin.

Southern Oscillation Index - monthly

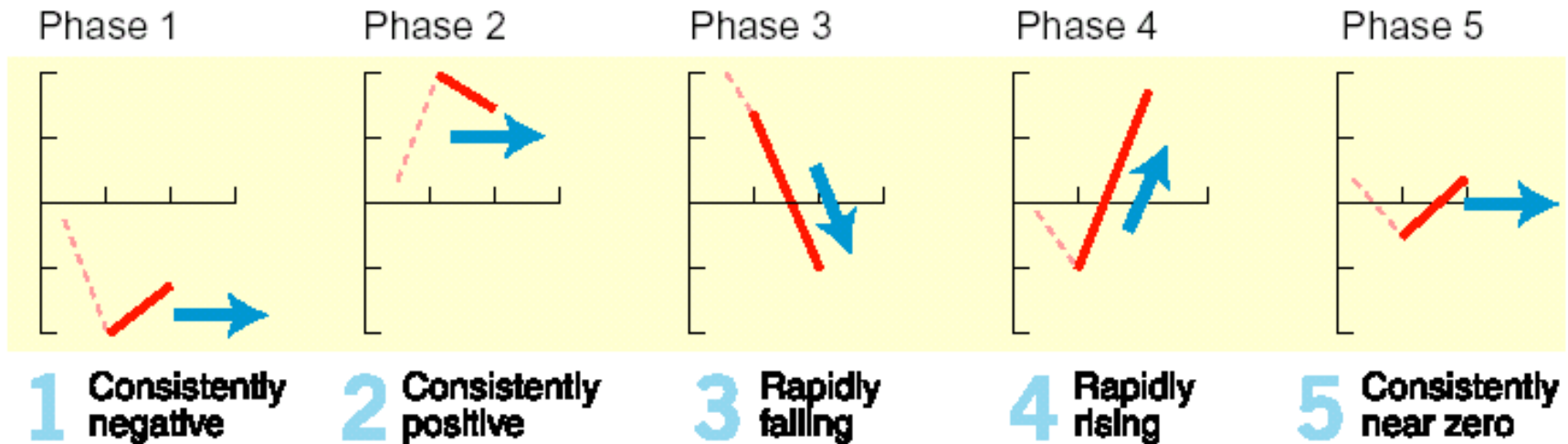


Southern oscillation index

The SOI can be expressed as phases.

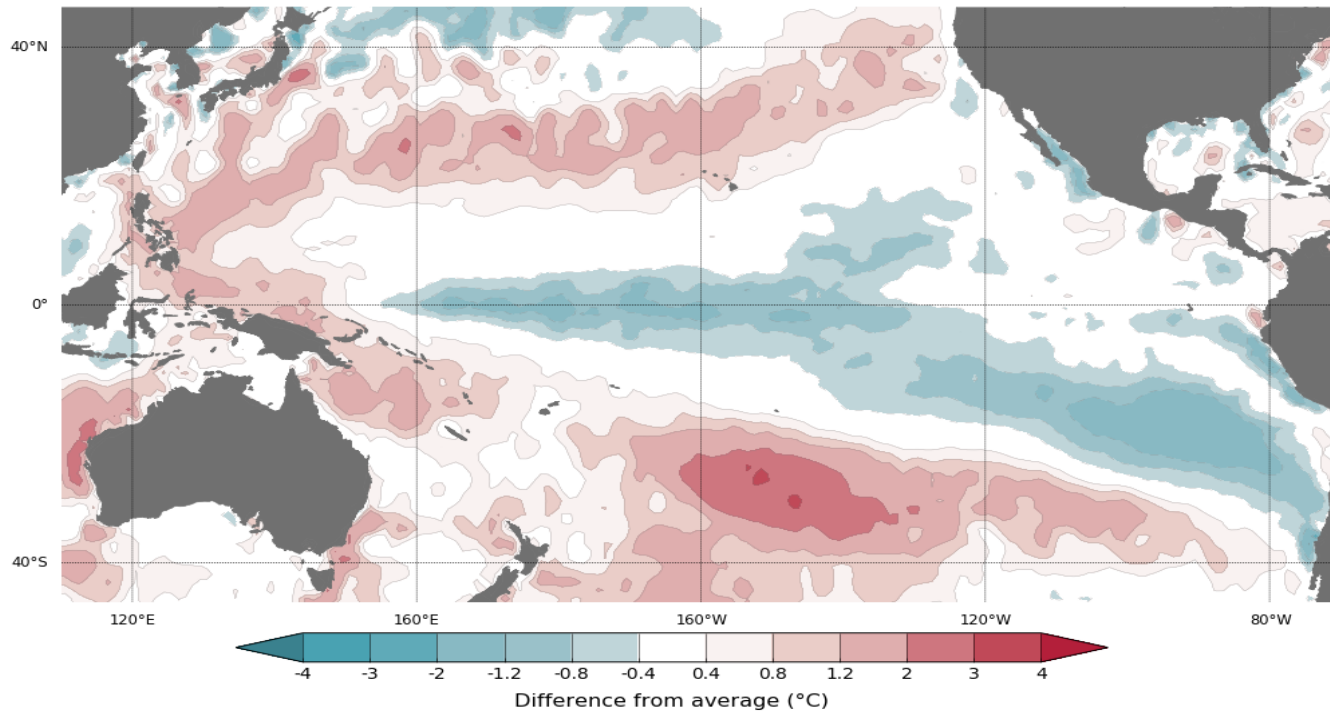
A strongly negative SOI (below -10) or rapidly falling phase is characteristic of El Niño.

A strongly positive SOI (above +10) or rapidly raising phase is characteristic of La Niña.



Sea surface temperatures

Difference from average sea surface temperature observations
January 2021



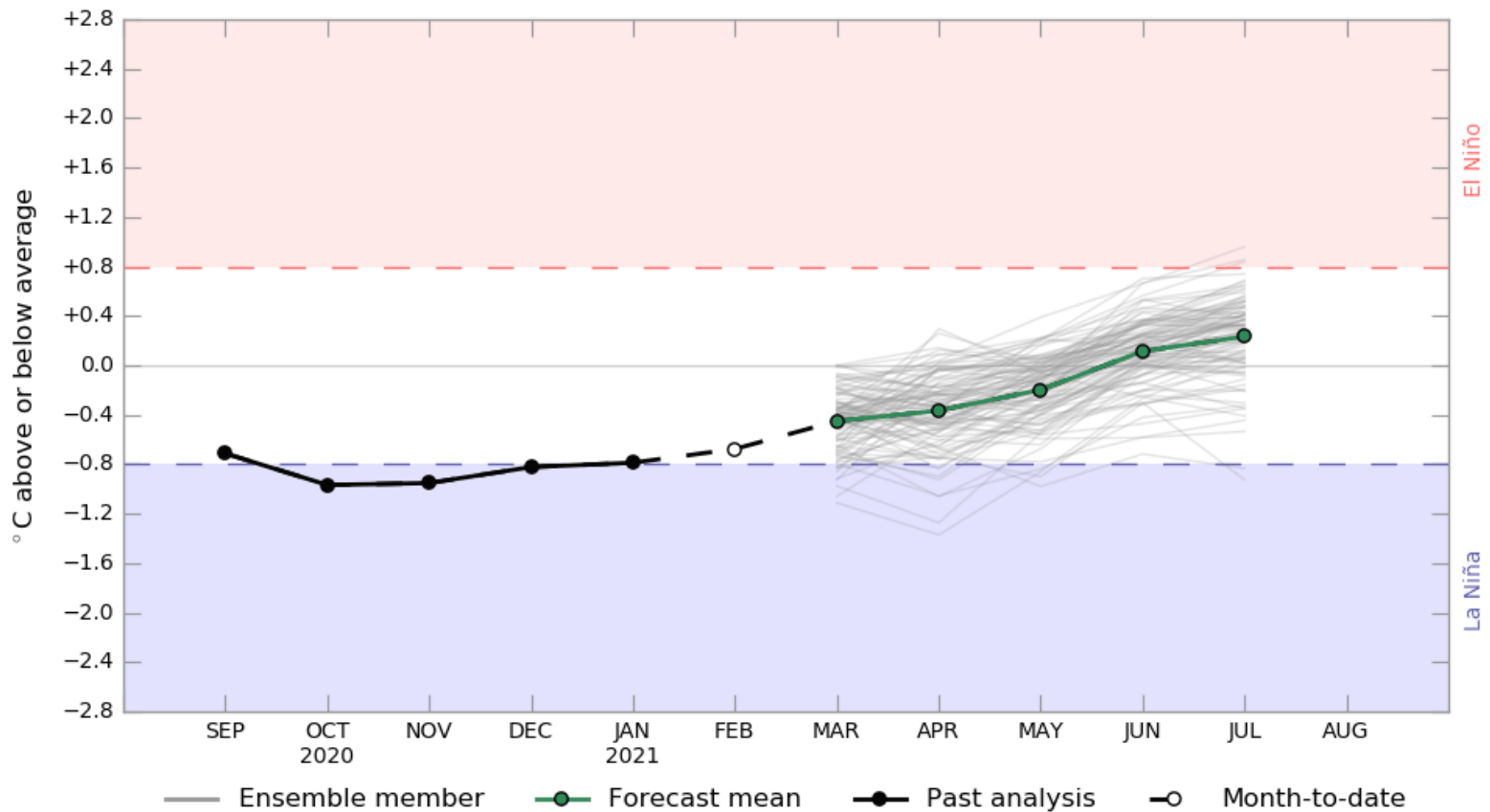
Data: BOM SST
Climatology baseline: 1961 to 1990
© Commonwealth of Australia 2021, Australian Bureau of Meteorology

Monthly average: January 2021
Created: 15/02/2021
<http://www.bom.gov.au/climate>

(286) La Niña in Australia - YouTube

Pacific ocean

Monthly sea surface temperature anomalies for NINO3.4 region



ENSO = El Nino/Southern Oscillation

Walker Circulation – movement of warm and cold water

SST – Sea Surface Temperatures

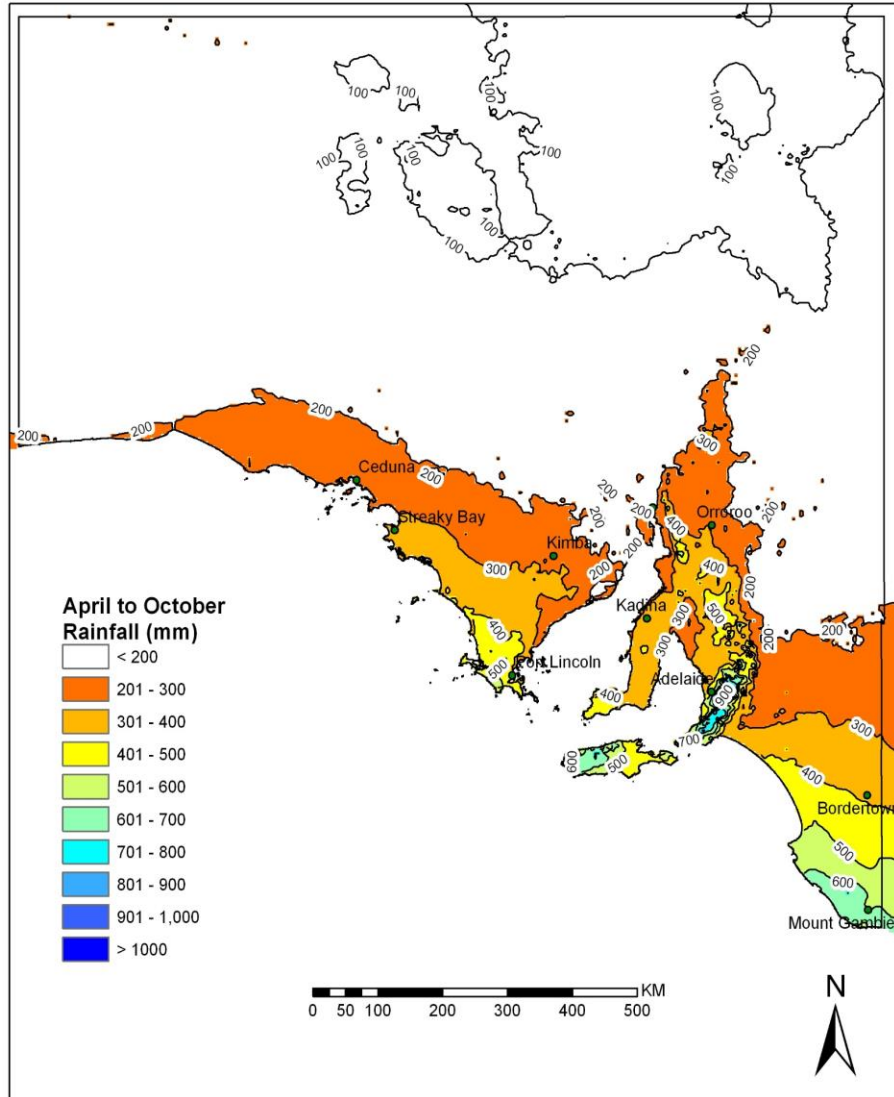
SOI – Measurement of air pressure difference between Tahiti and Darwin influences warm and cold water movement

El Nino – Cold water pacific above Aust

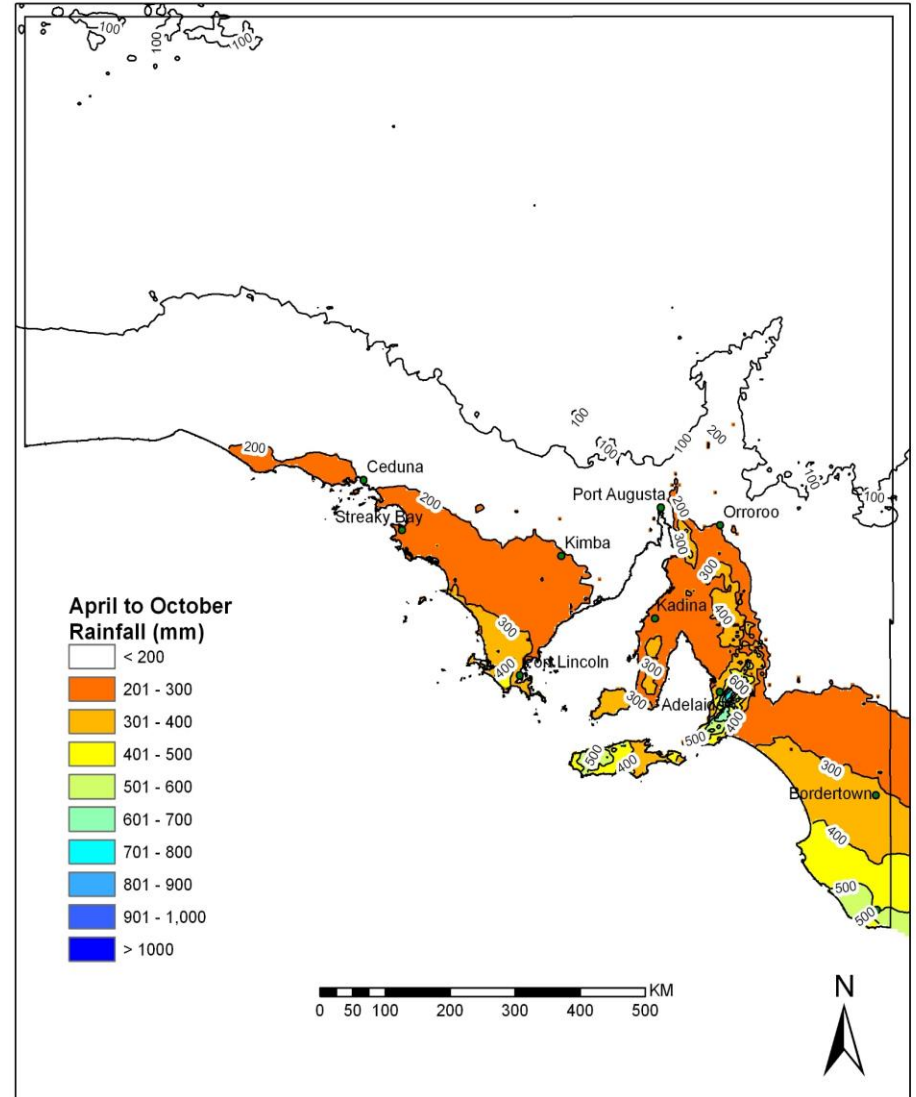
La Nina – Warm water pacific above Aust

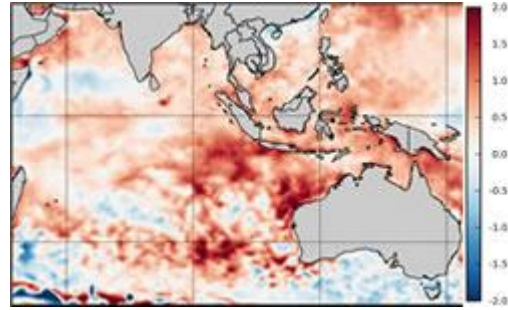


Mean growing season rainfall (April to October) with SOI > 5



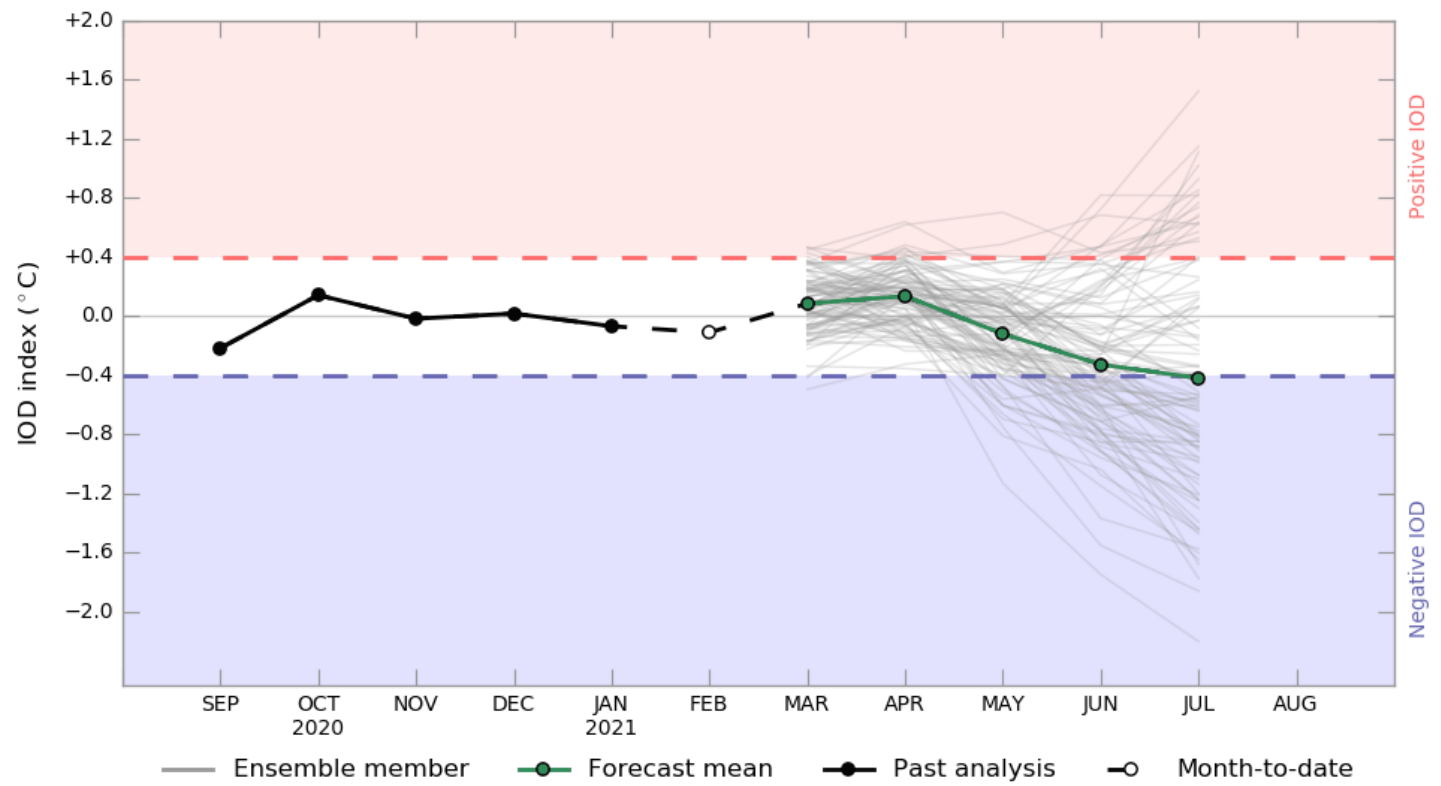
Mean growing season rainfall (April to October) with SOI < -5





Indian Ocean Dipole

Monthly sea surface temperature anomalies for IOD region

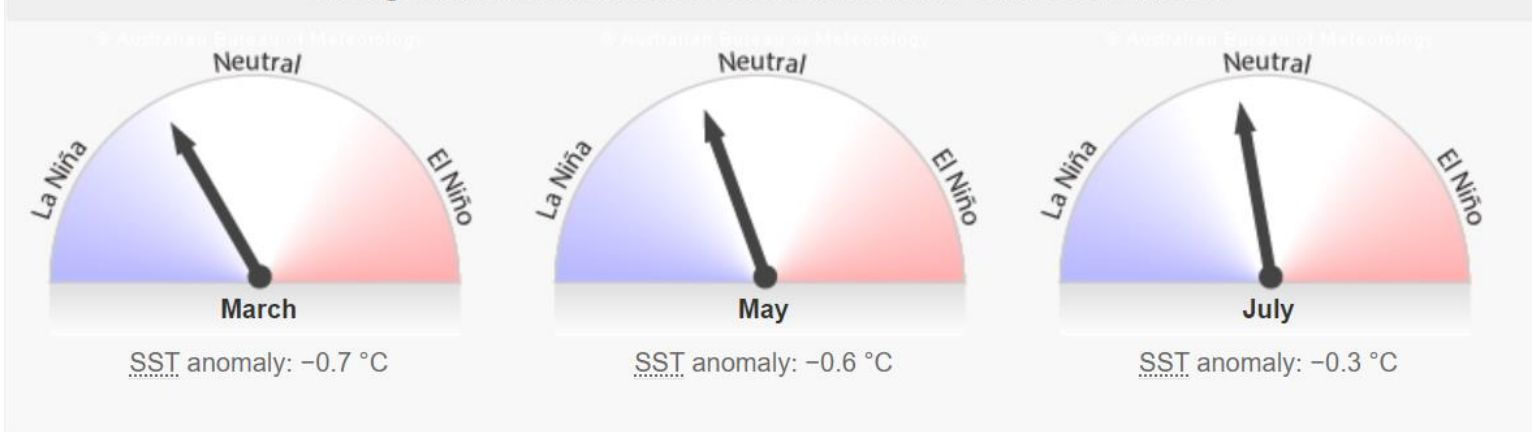


www.bom.gov.au/climate
Commonwealth of Australia 2021, Australian Bureau of Meteorology

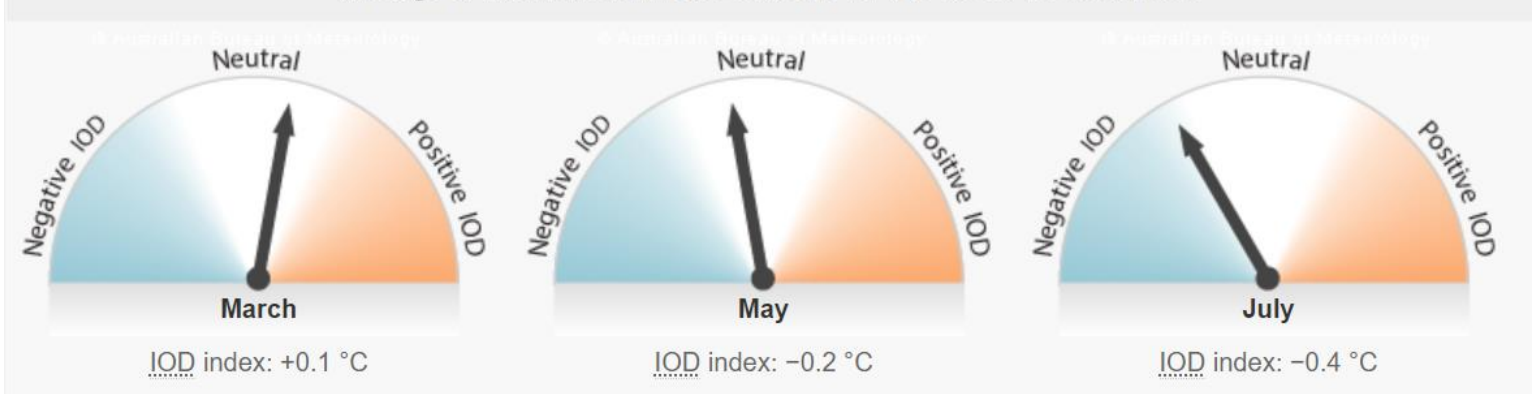
Model run: 13 Feb 2021
Model: ACCESS-S1
Base period 1990-2012

ENSO and IOD outlook

Average of international model outlooks for NINO3.4 Issued 16 February 2021



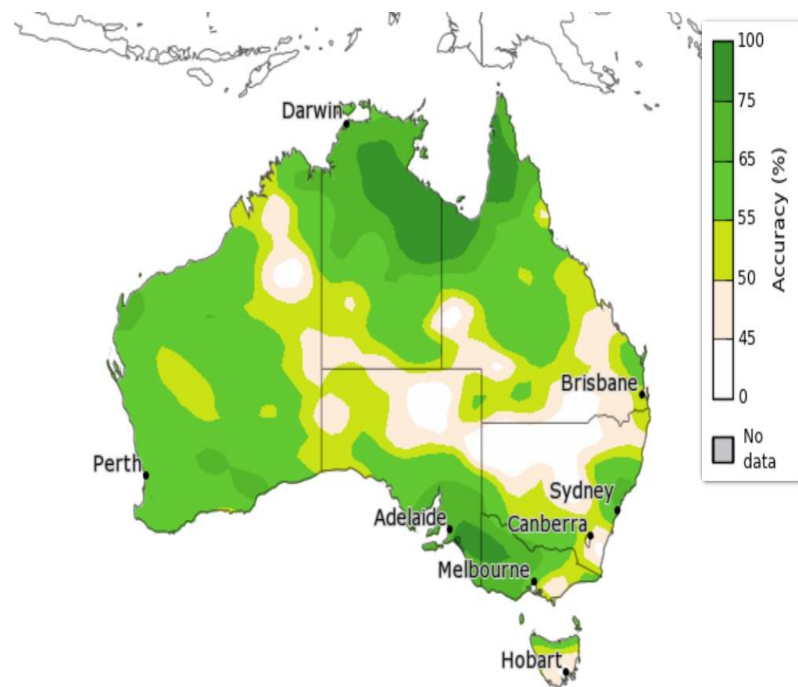
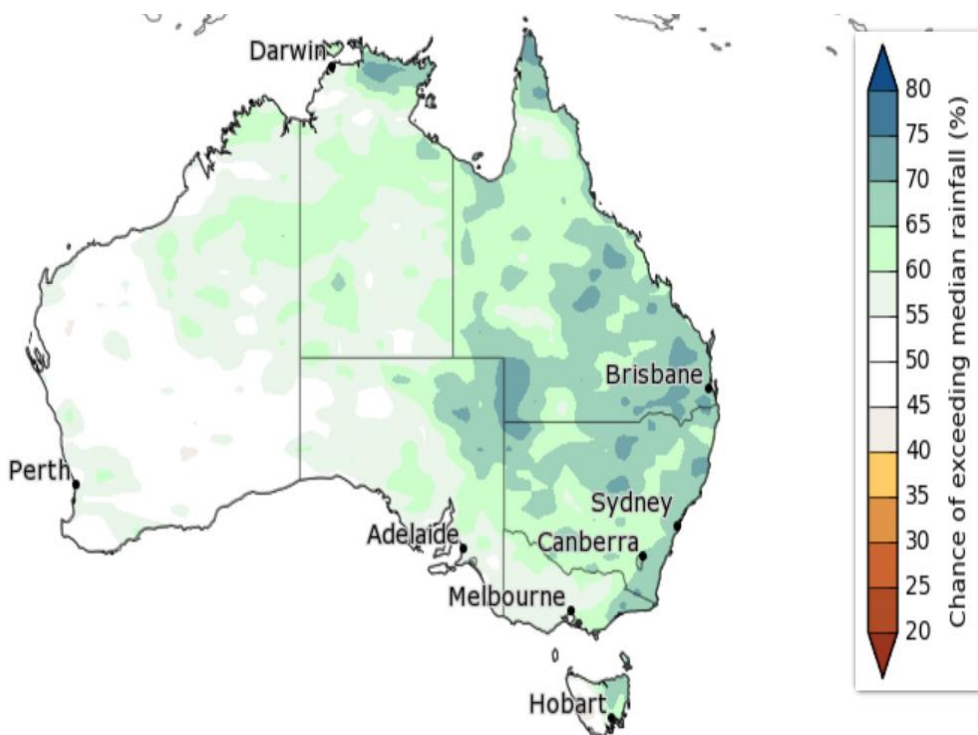
Average of international model outlooks for IOD Issued 16 February 2021



Outlook Feb – May 2021

ENSO (El Nino/Southern Oscillation)	La Niña active but reached its peak. Some influence for next month on upper Eastern Aust SST above normal around Aust
IOD	Neutral may trend negative (=good for rain)
SAM	Positive over next few weeks
BOM Outlook compiled	Wetter than normal conditions for Feb to May in many areas

Overview— - Climate Outlooks (bom.gov.au)

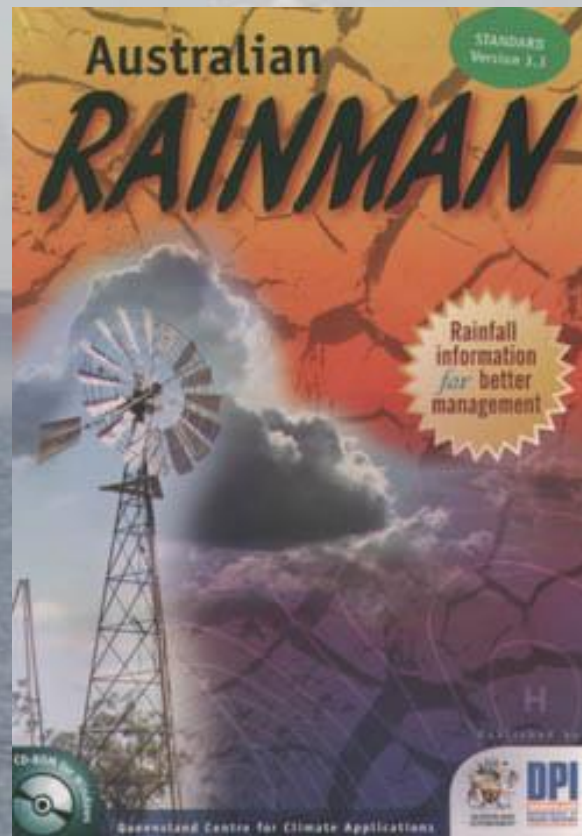


Issued: 18 February 2021

What we will cover

- Understand the various climate and weather risks that affect a farm system.
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Rainman StreamFlow analysis tool | Department
of Agriculture and Fisheries, Queensland
(daf.qld.gov.au)

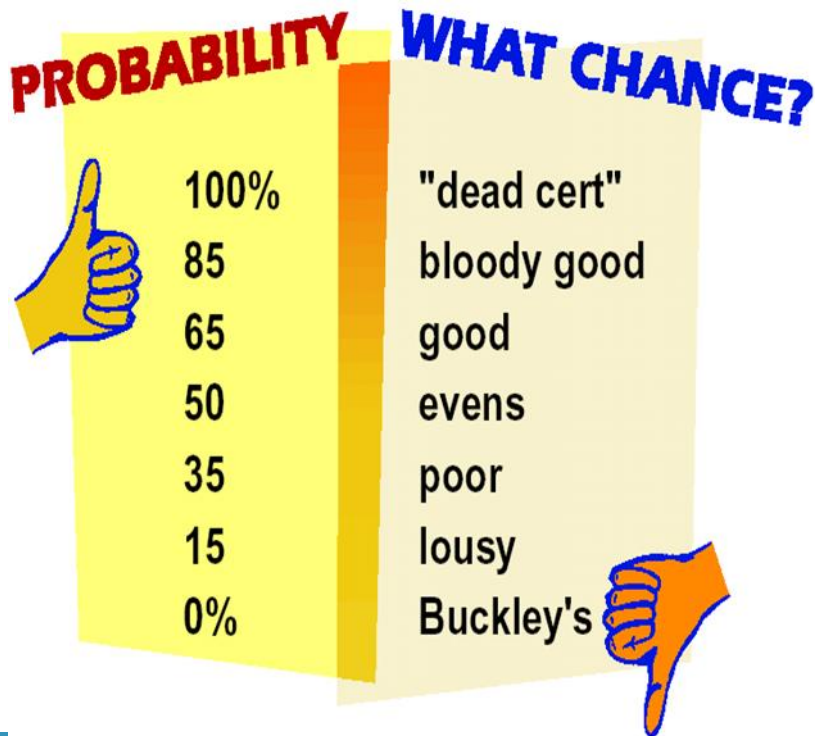


Actual Climate Risk

Rainfall outlooks and seasonal outlooks are also probabilities

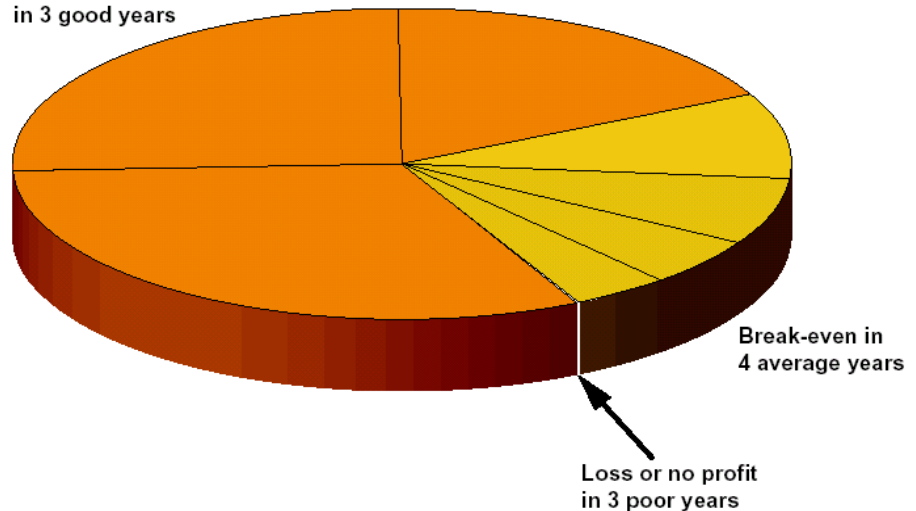
Risk is often associated with uncertainty, a chance of failure or losing.

Risk can also represent opportunity and potential for gain



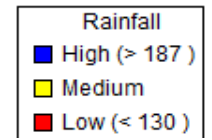
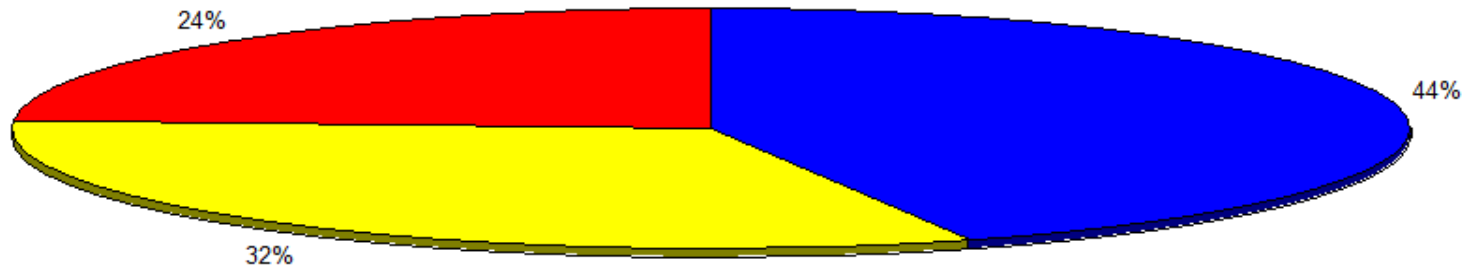
Profits from wheat In low rainfall regions

80% of total profit is made
in 3 good years



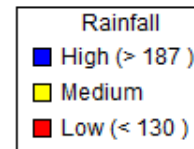
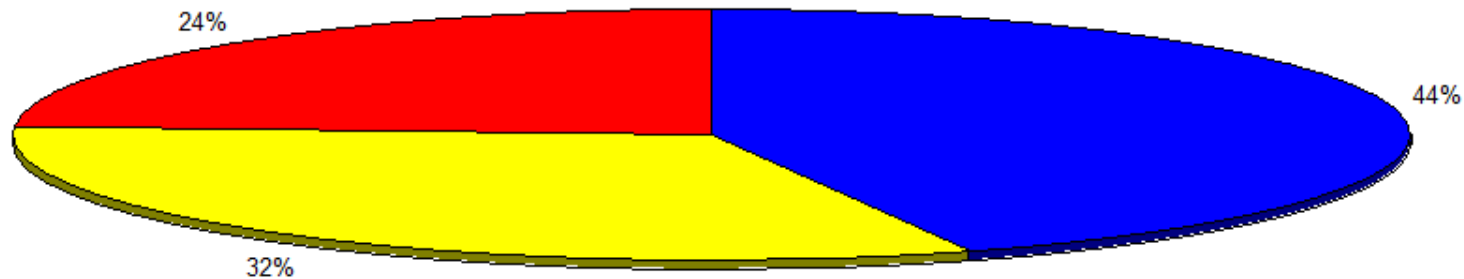
Chance of rainfall at BUNDARRA POST OFFICE

Analysis of historical data (1884 to 2021) using Average SOI: May to Jul Leadtime of 0 months Rainfall period: Aug to Oct
 The average SOI/rainfall relationship for this season is statistically significant because KW test is above 0.9, and Skill Score (19.8) is above 7.6 ($p = 0.997$).



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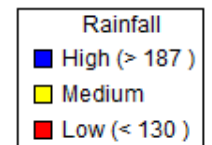
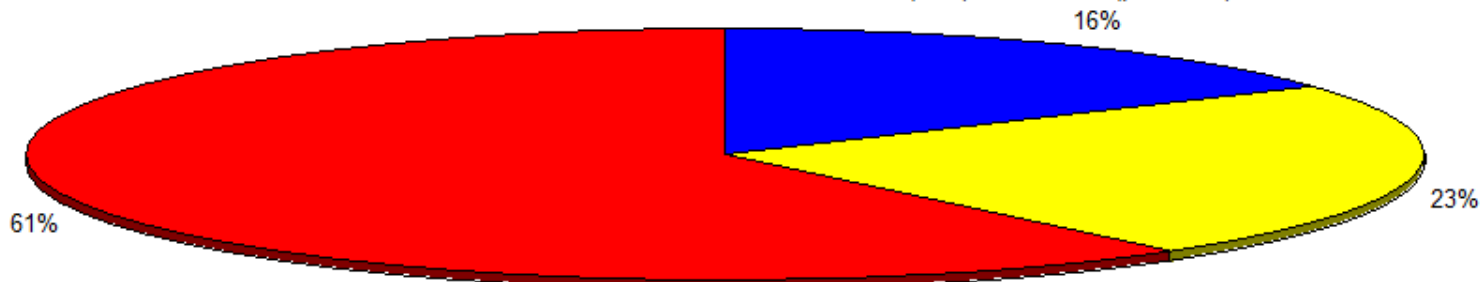


SOI above +5

Source: Rainman StreamFlow

Chance of rainfall at BUNDARRA POST OFFICE

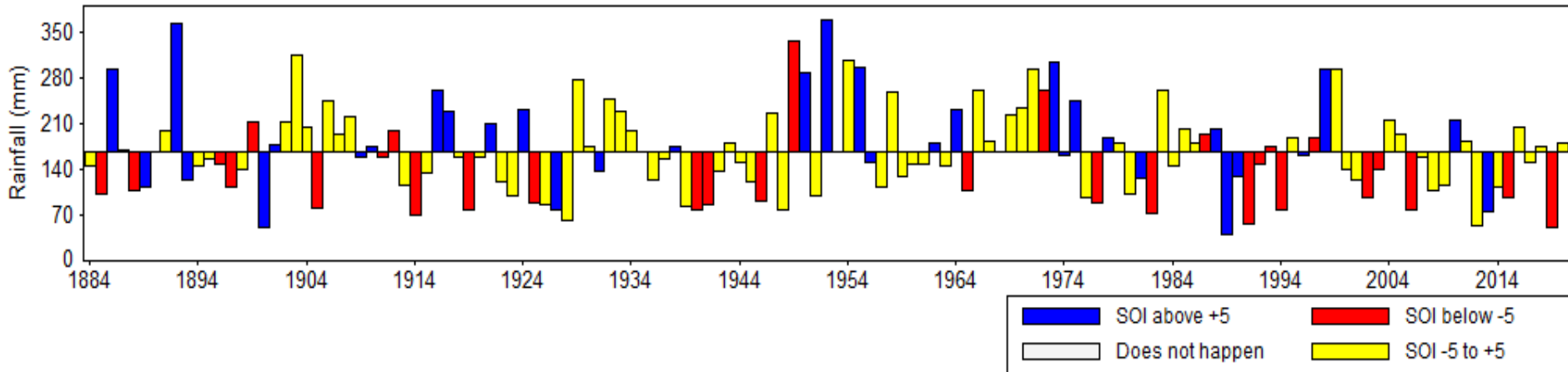
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SOI phase influence on rainfall

Historical record of seasonal rainfall at BUNDARRA POST OFFICE

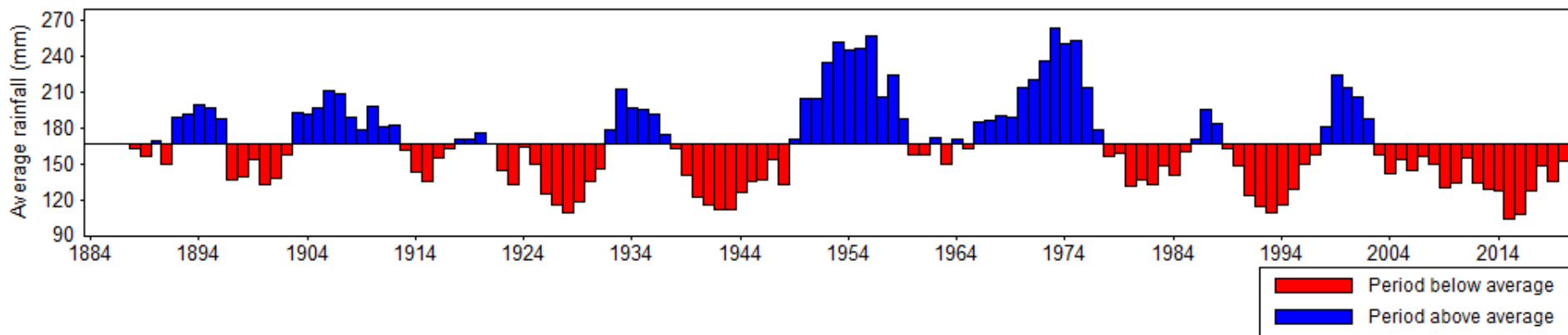
Analysis of historical data (1884 to 2021) using Average SOI: May to Jul Leadtime of 0 months Rainfall period: Aug to Oct



Source: Rainman StreamFlow

5-year moving average rainfall (3 months, Aug to Oct in year 1) at BUNDARRA POST OFFICE

Long-term average rainfall (3 months, Aug to Oct in year 1) is 166 mm

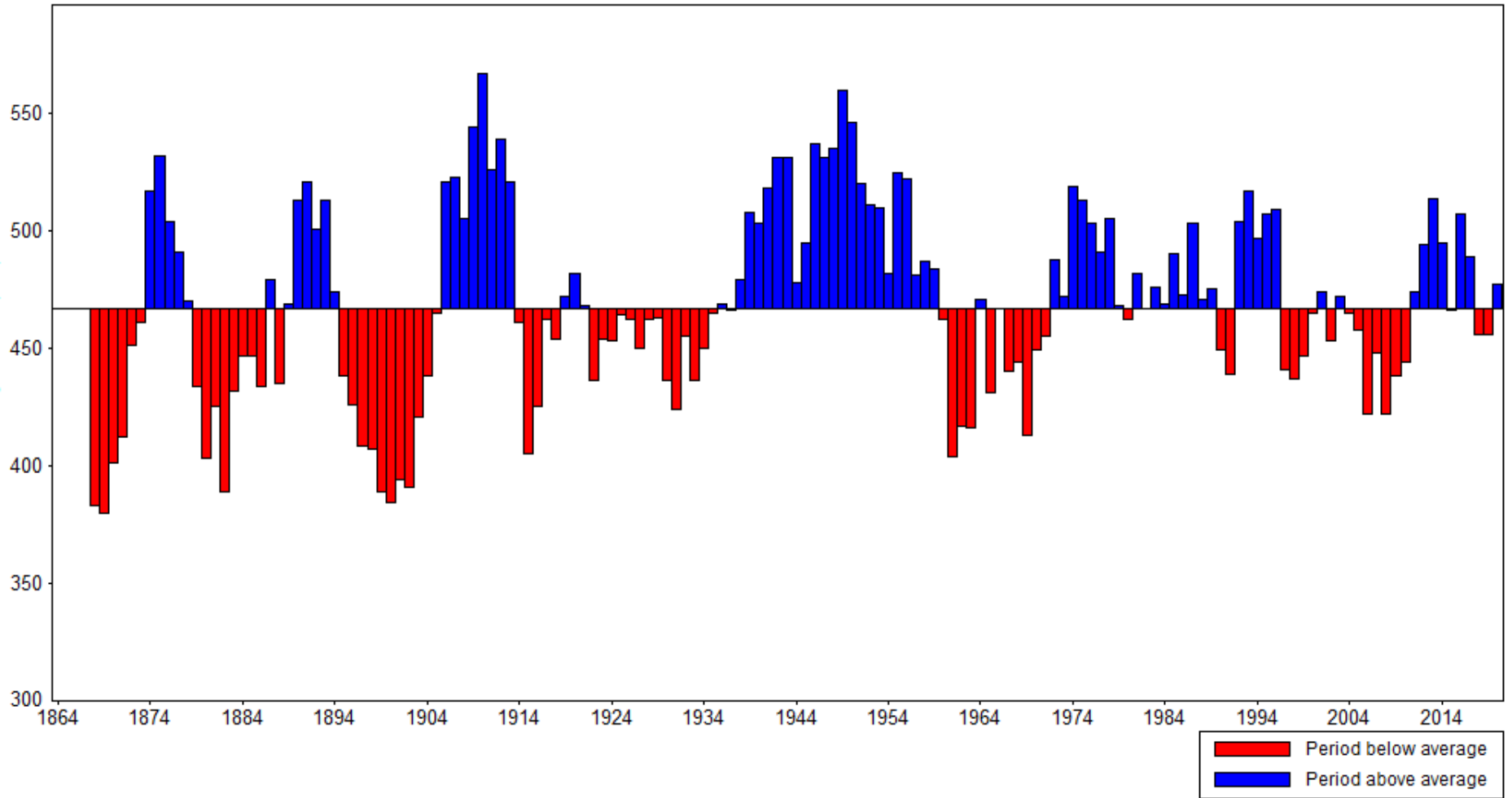


Source: Rainman StreamFlow

5 year moving average of rainfall at Goolwa

5-year moving average rainfall (12 months, Jan to Dec in year 1) at GOOLWA POST OFFICE

Long-term average rainfall (12 months, Jan to Dec in year 1) is 467 mm



Ending year of 5-year period

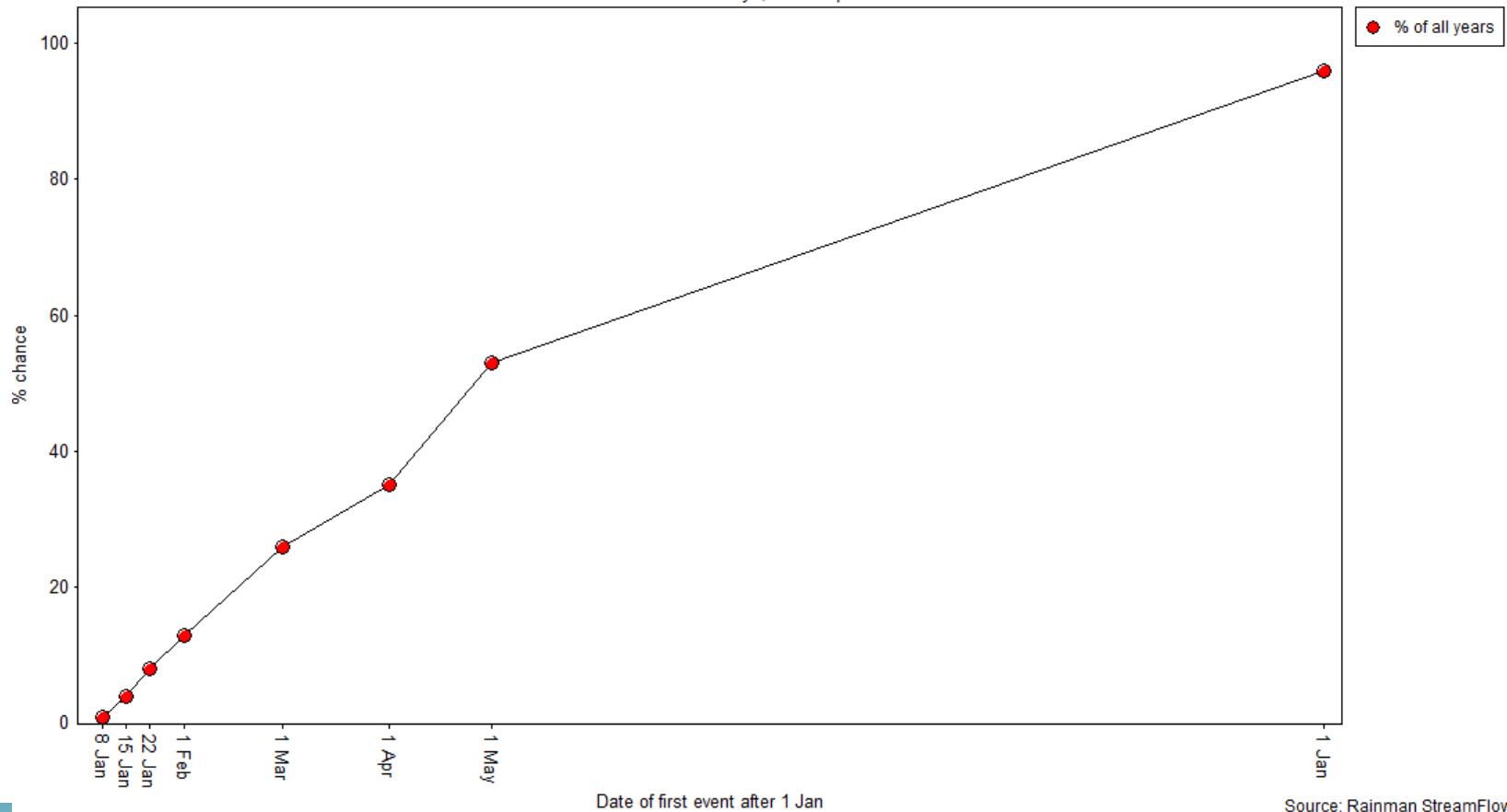
Source: Rainman StreamFlow

Chance of a rainfall break

Date of first event at GOOLWA POST OFFICE

Analysis of historical data (1884 to 1996).

Event at least 25 mm in 3 days, Rainfall period: 1 Jan to 31 Dec



Source: Rainman StreamFlow

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Links throughout presentation

[Climate Driver Update \(bom.gov.au\)](#)

[Overview— - Climate Outlooks \(bom.gov.au\)](#)

[New BOM Weather App](#)

[Rainman StreamFlow analysis tool | Department of Agriculture and Fisheries, Queensland \(daf.qld.gov.au\)](#)

[The Southern Annular Mode \(bom.gov.au\)](#)

[Climate Kelpie](#)

[MetEye \(bom.gov.au\)](#)

[Recent and historical rainfall maps, Australian Bureau of Meteorology \(bom.gov.au\)](#)

[Climate change and variability: Tracker: Australian trend maps \(bom.gov.au\)](#)

[Climate Model Summary, Bureau of Meteorology \(bom.gov.au\)](#)

[Australian rainfall deciles since 1900 \(bom.gov.au\)](#)

[Australian 12-monthly mean temperature anomalies since 1911 \(bom.gov.au\)](#)

[Climate Driver Update \(bom.gov.au\)](#)

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Decision	Trigger factor	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Sowing time	Stored soil moisture																
	Rainfall to date																
	Timing of Break																
	Breaking rain amount																
	Winter Outlook																
	Spring Outlook																
	Rainfall Distribution outlooks																
	Frost frequency																
	Heat Stress																
	Strong Winds																
	Weed germination																
	Wheat prices																
Area Sown	Seasonal Outlook																
	Short term Outlooks																
	Wheat prices																
Cereal Choice	Seasonal Outlook																
	Previous crops sown																
	Current price																
	Vulnerability to frost																
	Vulnerability to heat stress																
Fertiliser rates	At sowing fertiliser	Stored soil moisture															
		Rainfall to date															
		Timing of Break															
		Winter Outlook															
Top dress N	Timeliness of rain																
	Amount of rain to date																
	Spring Outlook																
	Current delta T																
Soil	Potential yield outlook																
	Short term outlook																
	Fungicide application																
Harvest	Rainfall distribution outlooks																
	Maturity of cereals																
	Disease outbreaks																
	Frost																
	Likelihood of heat stress																
	Likelihood of strong winds																
Short term outlooks																	

Note - wgr means Wimmera Grains only

CLIMATE RISK AND FARMING WEBINAR SERIES



Webinar 2 - Climate Change – 10th March

- Looking at climate change and agricultures contribution
- Look at climate change trends and projections in a region
- Look at climate change evidence
- Look at how farmers have adapted to change
- Opportunities to plan for climate change short, medium and longer term

Webinar 3 - Adaptation and mitigation of climate change (drought preparation and management) – 24th March

- The carbon cycle.
- Carbon sequestration and soil health management
- Water infiltration and water use efficiency
- Regenerative agriculture opportunities
- Other options to adapt and mitigate climate change in agriculture



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<https://www.surveymonkey.com/r/climateriskandfarming>

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