



Australian Government

Bureau of Meteorology

Multi-Week/Seasonal Prediction for Agricultural Applications in Australia

Oscar Alves
Bureau of Meteorology

Acknowledgements:

Bureau of Met seasonal prediction teams
University of Southern Queensland

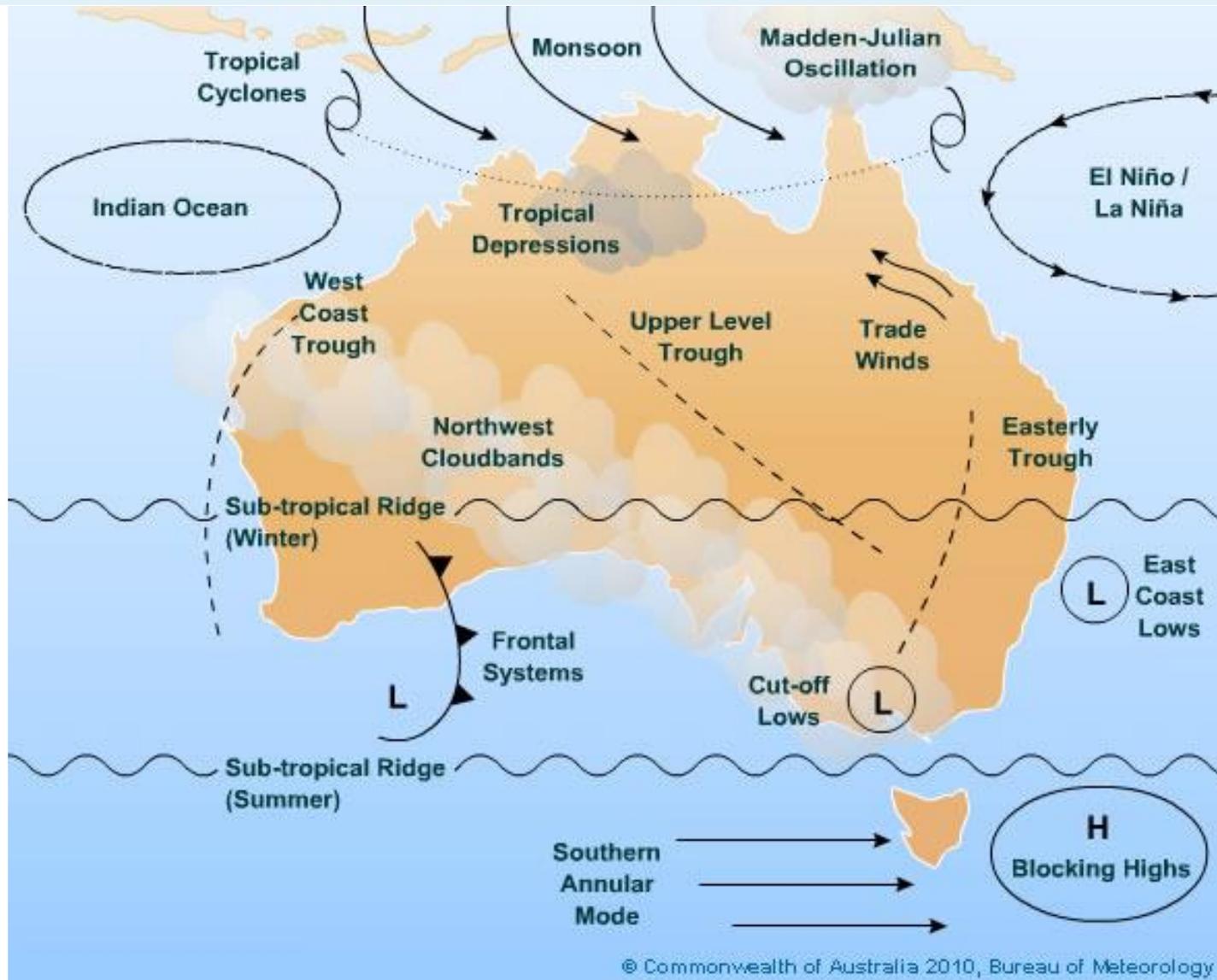


Plan

1. Brief introduction to climate variability in Australia
2. Brief introduction to Multi-week/seasonal dynamical forecast system in Australia
3. Agricultural applications
 - Overview and examples of key decisions
 - Ask Bill Tool
 - BoM Products - Queensland Floods case study
 - BoM Products - Predicting Extremes
 - Summary



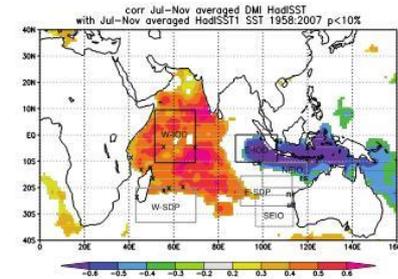
Australia Climate Drivers





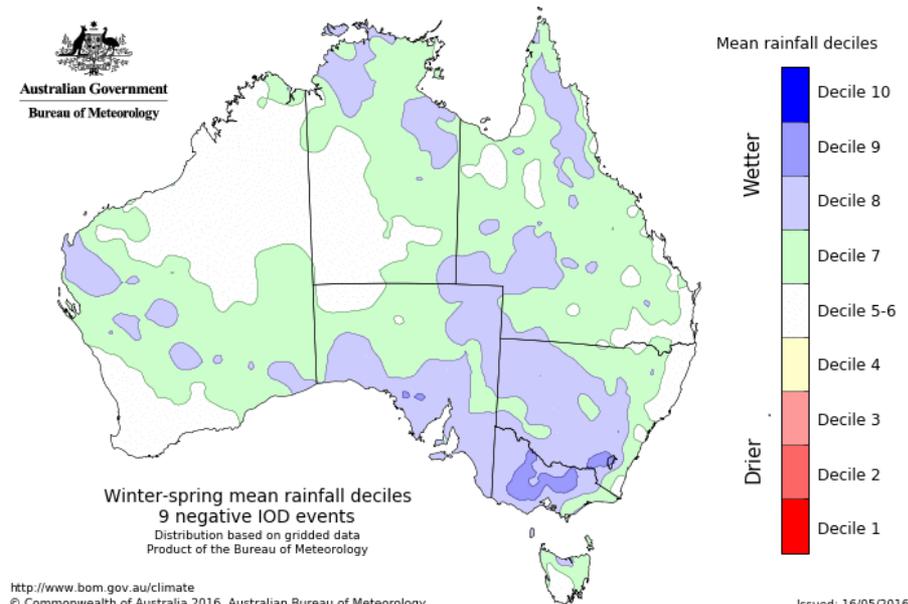
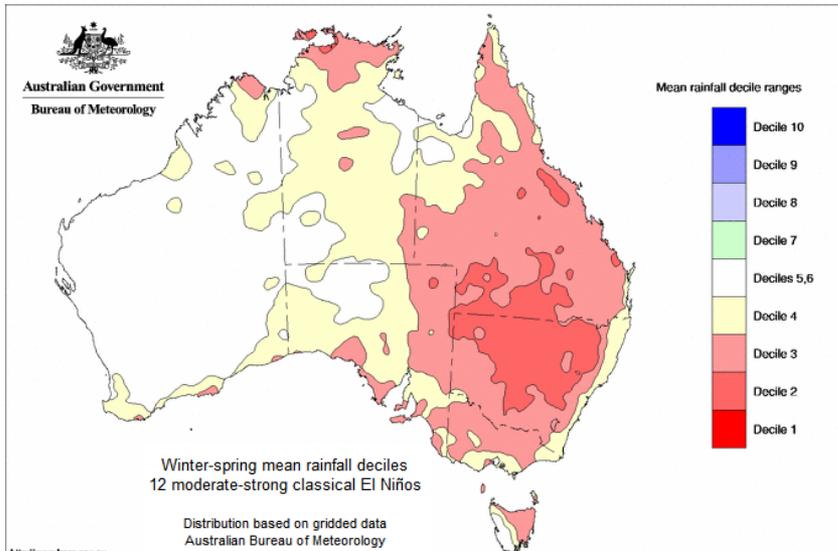
ENSO/IOD Teleconnections

IOD



El Nino Composite

Negative IOD Composite

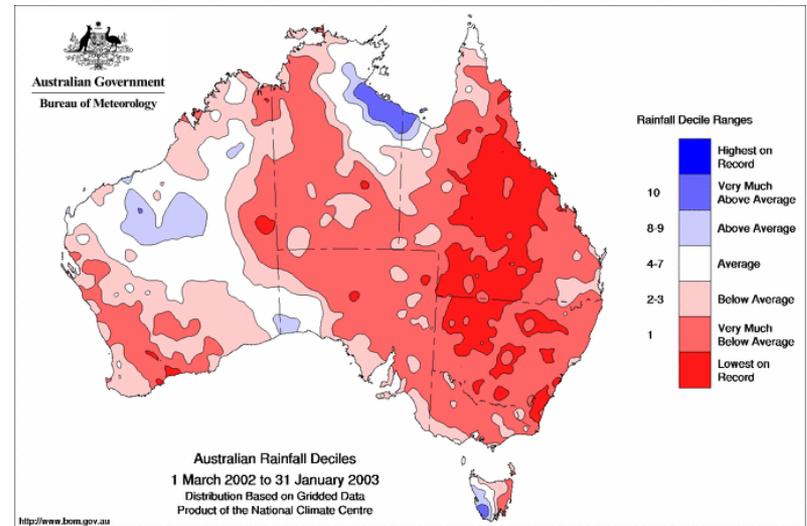
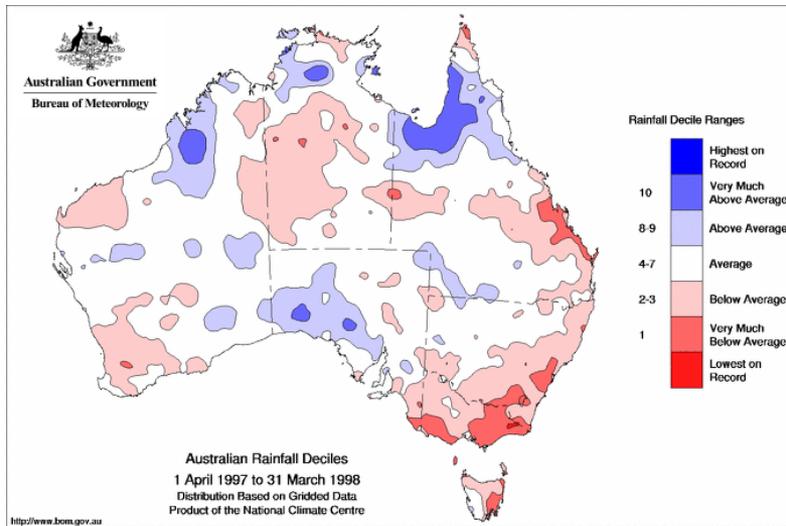




El Nino's Different

1997 Strong El Nino

2002 Weak El Nino





ACCESS-S1 Model

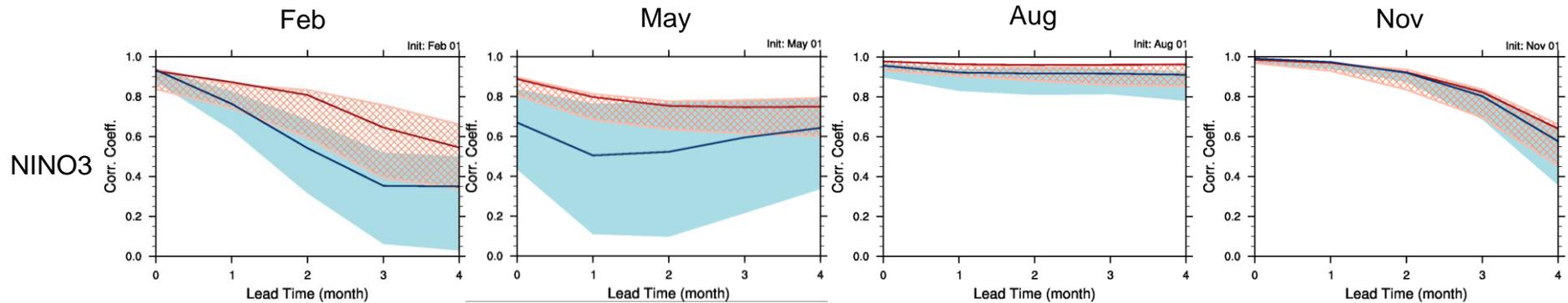
ACCESS-S1

- UKMO GC2 coupled model (60km atmos + $\frac{1}{4}$ degree ocean)
- Using UKMO initial conditions (NEMOVAR) + BoM ensemble generation (for multi-week)
- Went operational mid 2018
- Hindcasts: 23 years, 11 ensembles, 4 times per month
- Realtime: Each day 33 members to 6 weeks and 11 extended to 6 months
- Realtime products: 99 member ensemble based on lagging 3 days for multi-week and 9 days for seasonal

Prediction of El Nino

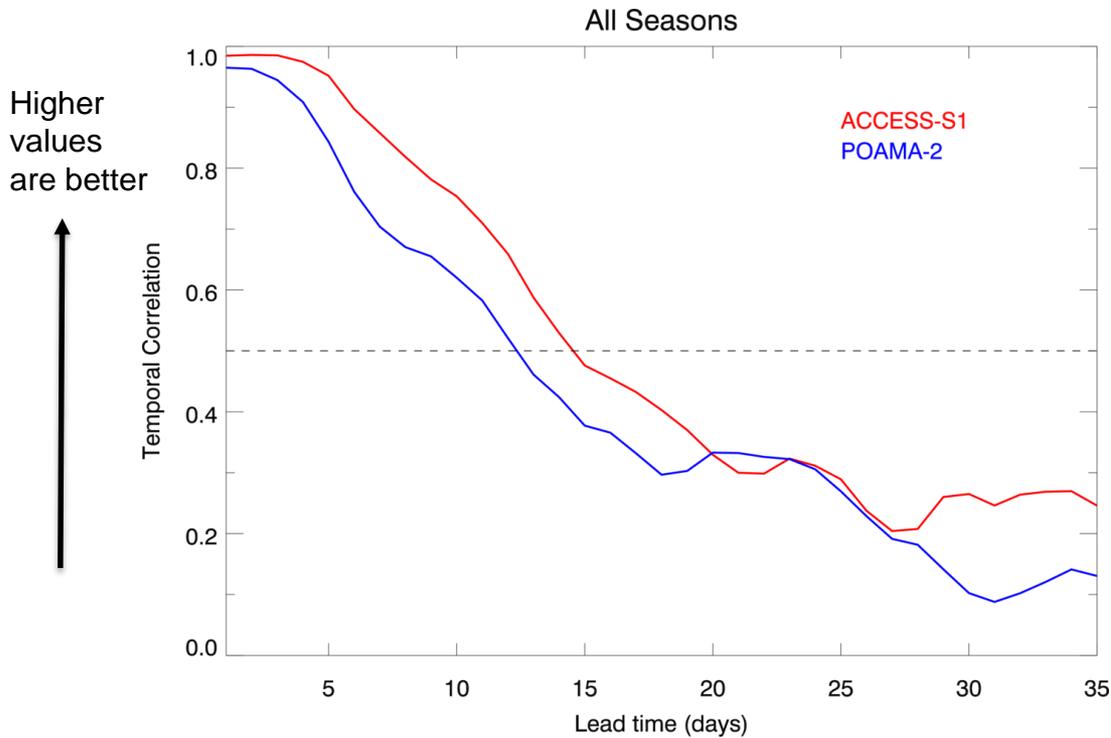
23 Years of Hindcasts

Correlation skill of forecasts of SSTA for NINO3

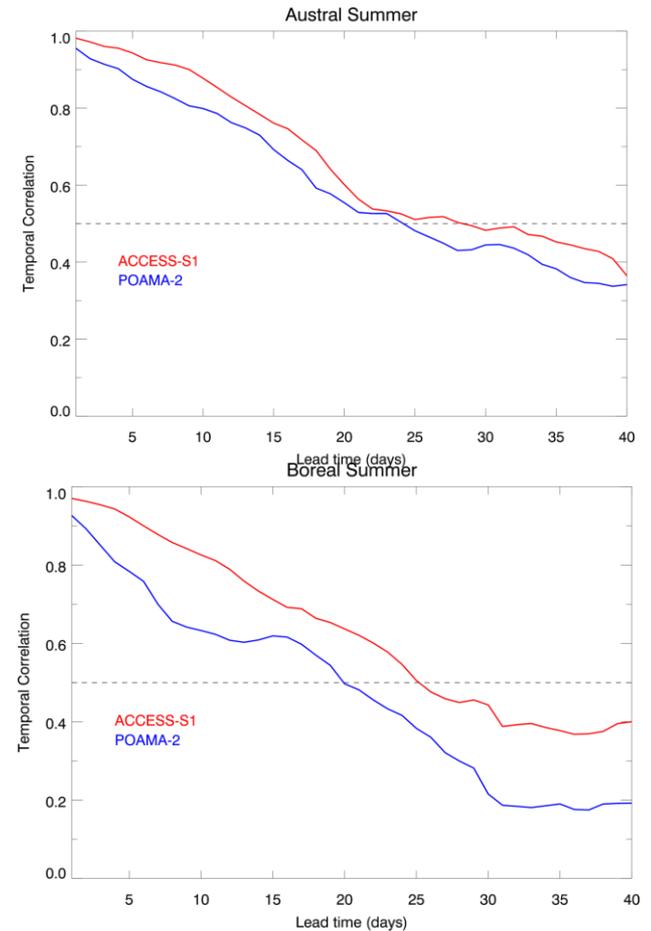


Prediction of the SAM and MJO

Southern Annular Mode



Madden Julian Oscillation



From Andrew Marshall

Prediction of Australian Climate



Average accuracy for all AUS and all times of year

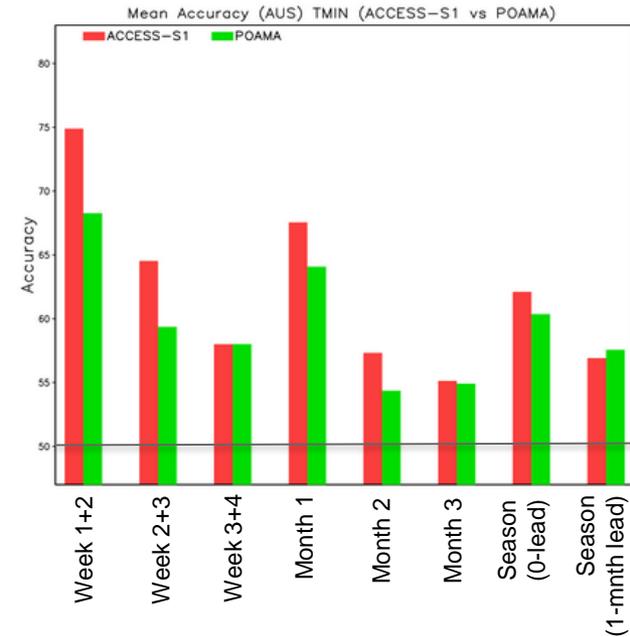
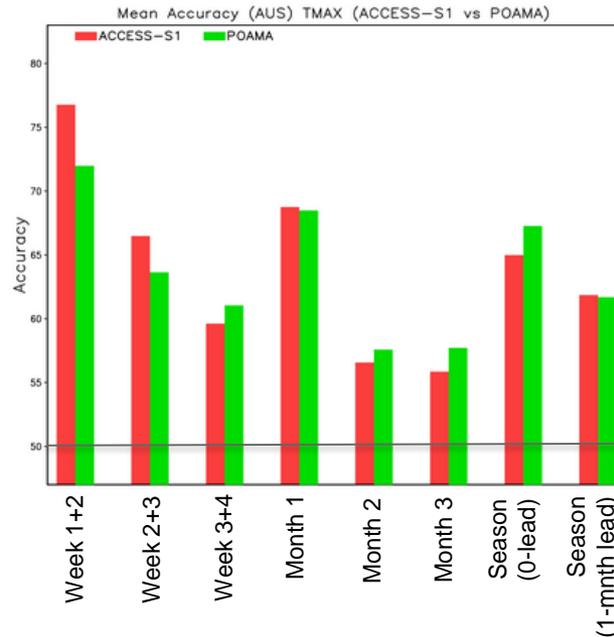
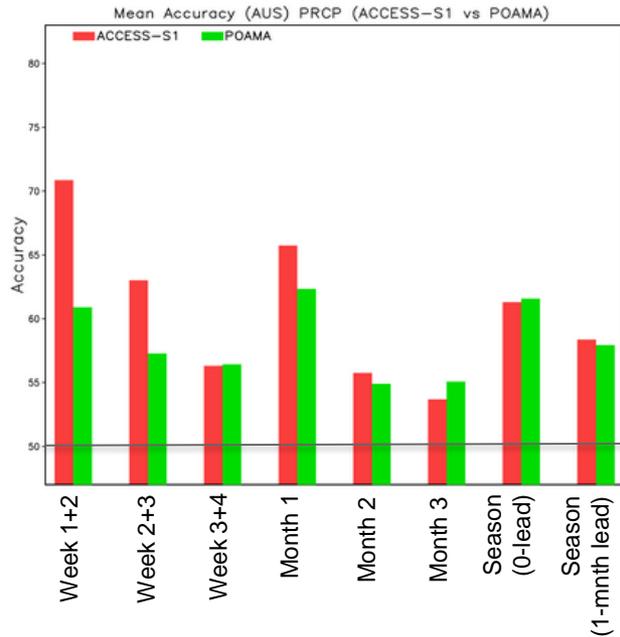
(For forecasts started on the 1st of every month in 1990-2012; n=276 i.e. 12 start_dates * 23yrs)

Forecasts of probability of above median

Rainfall

TMAX

TMIN



ACCESS-S1 POAMA

From Li Shi

Importance of accurate seasonal predictions to different sectors

Industry	Potential annual value of forecast
	A\$m
Construction	192
Electricity	2.3
Coal mining	68
Oil and gas	93
Transport	5
Water supply	28
Agriculture	1 567

Note: All values are given in Australian dollars at 2012 prices
Source: CIE estimates

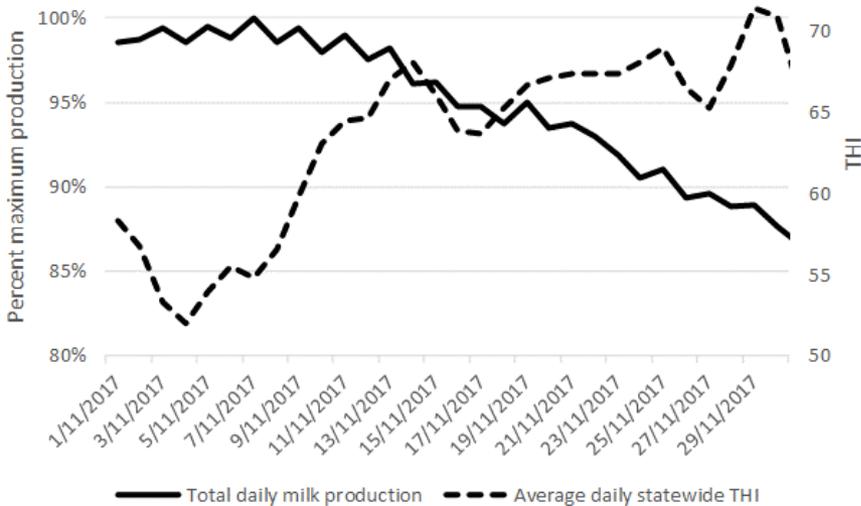
- Around 5% of Australian GDP is exposed to weather and climate
- Enable sectors to better manage climate risk, making industry more profitable
- Annual value of improved forecasts to agriculture alone around A\$1.6 billion (USD 1.2b)
- Significant value also estimated for other climate sensitive industries

THI – Temperature Humidity index used by Dairy Industry



Heatwaves affect milk composition and production

Example: Nov 2017 Victorian heatwave



- 2nd hottest November on record
- 12% decline in milk production from the first to last week
- A loss of 2,500 litres/average farm

<https://coolcowsdairyaustralia..com.au/>
<https://dairy.katestone.com.au/>

Forecast for:

Camden

[Back to Home Page >](#)

	Mon 19 Nov	Tue 20 Nov	Wed 21 Nov	Thu 22 Nov	Fri 23 Nov	Sat 24 Nov	Sun 25 Nov
THI Max	69	75	75	64	65	70	69
THI Min	56	57	63	55	53	54	56

Type of Alerts

You will receive alerts for the following conditions:

Heat wave: Maximum THI exceeds 82 for 1 or more of the next 3 days

Hot spell: Maximum THI exceeds 78 for 3 or more consecutive days during the next 7 days

Warm nights: Minimum THI exceeds 75 for 2 or more of the next 7 days

Atypical THI: THI exceeds 72 and the historical 90th percentile for at least 3 consecutive days in the next 7 days

Needs expanding into Multi-week timescale

Advances in R&D: Forecasting Extremes

Impacts of the November 2014 heatwave on the Gatton region



Sweetcorn cobs showing "blanking"

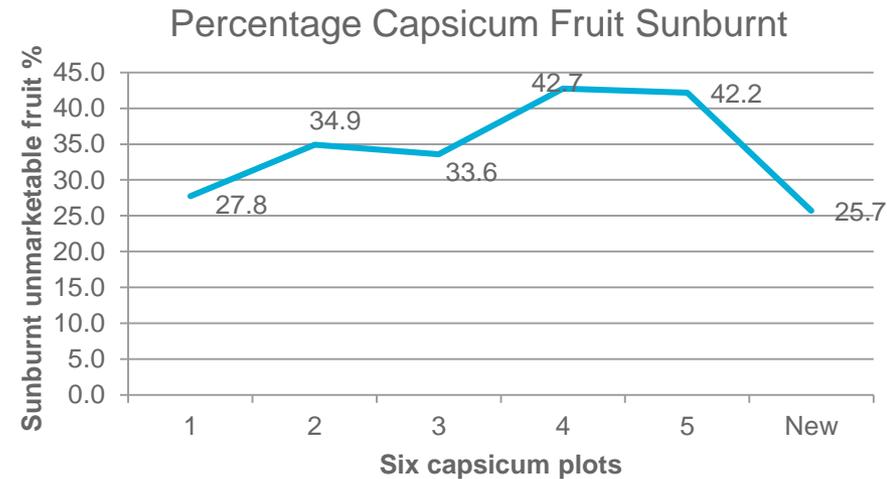


Sunburn and secondary rot



Sunburn on exposed fruit due to leaf wilting

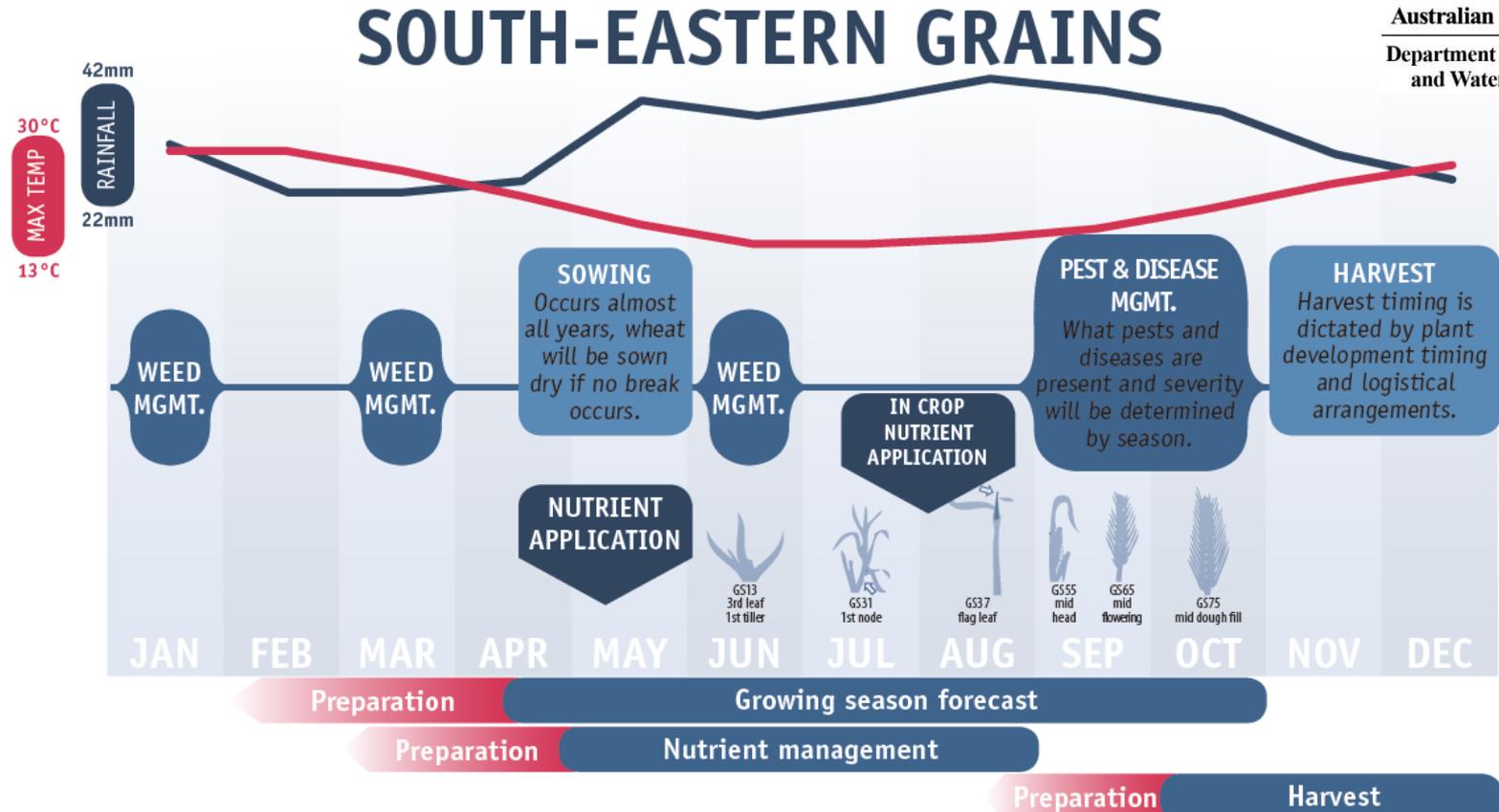
Capsicum harvested on the 25 Nov 2014 (from trials grown at Gatton Research Station by the Department of Agriculture and Fisheries)



Linking forecasts and user decisions



Australian Government
Department of Agriculture
and Water Resources



Throughout the season it is crucial that forecasts are accurate and with ample lead time. Lead time is dependant upon the task at hand.

SOWING	NUTRIENT MANAGEMENT	WEED MANAGEMENT	HARVEST
Cultivar or variety may be altered due to seasonal conditions. Available soil moisture is also required for decision making.	Can be one of the biggest input costs, but if forecasts are incorrect or timing not accurate the return on investment is greatly reduced.	Weed management will occur no matter what, however an accurate forecast is required to make the best logistical arrangements for crop type.	Harvest will occur no matter what, however accurate an forecast is required to make the best logistical arrangements for crop type.
Forecast needs:	Forecast needs:	Forecast needs:	Forecast needs:
- week and multi-week for logistics - May to October forecast for cultivar and variety decisions	- week and multi-week for logistics - August to October for application and rate	- week and multi-week for logistics	- week and multi-week for logistics

Weather and climate related risks

Example: cherry production



	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
Growth Stage	100% leaf fall		Bud swell	Bud burst	Shuck fall	-----Harvesting-----			-----Post Harvest-----		50% leaf fall	
Accumulated rain	Winter and spring drought leading to dry soil profiles and low farm dams					Inadequate summer rain to supplement irrigation					Indadequate autumn rain for soil and dams	
Rainy days							Run of rainy days spoiling fruit					
Hail	Hail damage to trees											
Wind					Hail damage to flowers and fruit							
Wind					Wind damage to flowers and fruit							
Accumulated cold	Insufficient cold units for synchronized flowering											
Accumulated heat						Development from full bloom to harvest shifting harvest to less ideal						
Night Temperature (Min T)				Frost damage to buds								
Day Temperature (Max T)					Too cold (<13) or too hot (>28)		Heat waves - hot days and hot nights					

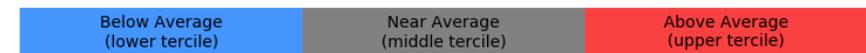
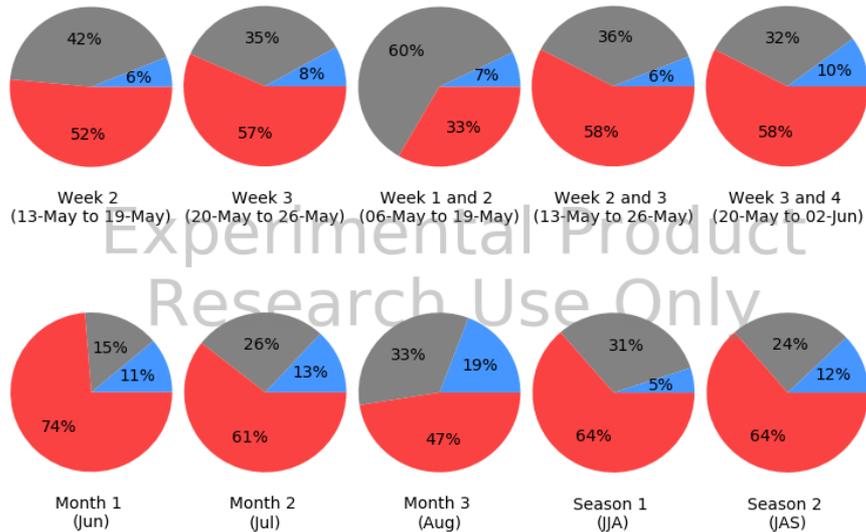
July 2019 Heat Wave Forecasts for the Lockyer Valley (horticulture)

Forecasting starting 6th May

Maximum Temperature Pie Charts

Region: Lockyer Valley

Start: 06-May-2019



Created: 2019-05-10 07:47:04 +0000

Climatology: 1990 to 2012

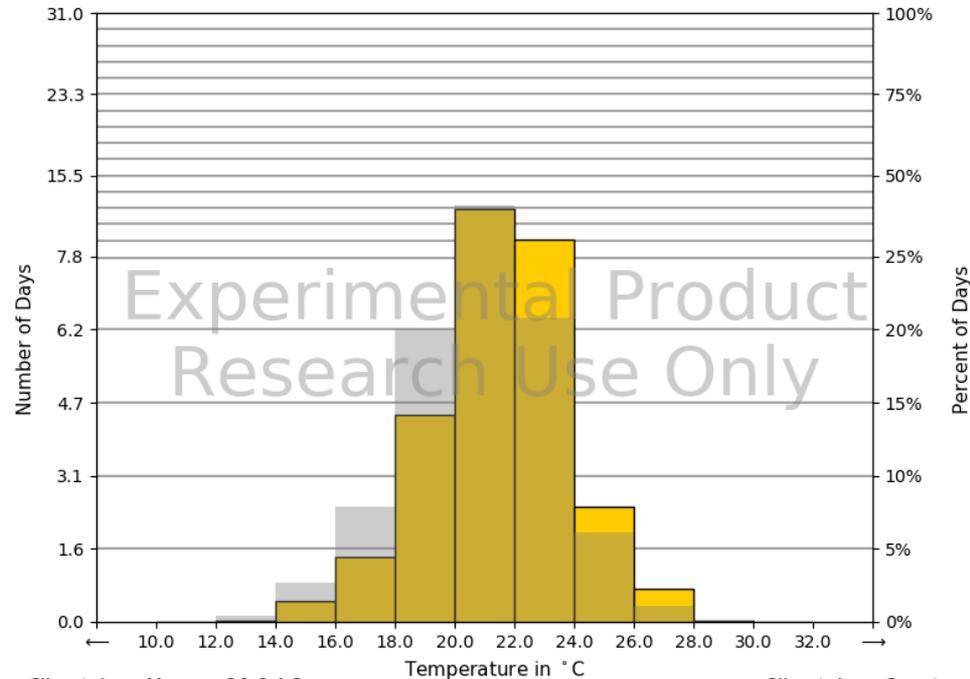
Resource: access-s1_ / w_ens_s_ens

Maximum Temperature Forecast and Climatology

Region: Lockyer Valley

Start: 06-May-2019

Period: Month 01-Jul-2019 to 31-Jul-2019



Climatology Mean = 20.8 °C

Forecast Mean = 21.5 °C

Created: 2019-05-10 03:45:57 +0000

Climatology: 1990 to 2012

Legend: Grey bar = Climatology Counts, Yellow bar = Forecast Counts

Resource: access-s1_rq5 / s_ens

Sample Responses from User Trials

Horticulture industry

“The Heatwave service gives .. extra few days warning ... to get sprinklers set up ... shade cloth covers on our hydroponic production...”.

“Getting the early warning means we can get organised and prepared – ... minimise flower drop, sunburn, think about future order programming and get the plants setup as best we can to cope with the approaching hot spell.”

A multi-location grower who plants in summer in the GB then moves crop to the Lockyer Valley for winter, planted longer than usual this year in the GB so as to avoid the forecast excessive autumn heat ...”.

*“We have brought forward our scheduled harvesting dates for both Butternut and Jap pumpkins by 5 to 7 days so as to avoid the predicted heat. ..We only have in 21 Ha this season so potential saving was **\$60,900**”.*

“Our **planting schedules were reduced** by 30% due to the **above average temperature forecasting** being predicted **and the lower monthly rain fall prediction**. ... planting schedules around these forecasts, ... for a longer growing and sustainable season.allowed us to command a better pricing at market level. ... We could fine tune our plantings and because of this our irrigation was not over capacity for the extreme conditions. That works out on 10 semitrailer loads at extra \$3 a carton for **7920 cartons** or about **\$23,000 in extra money in our pocket.**”.

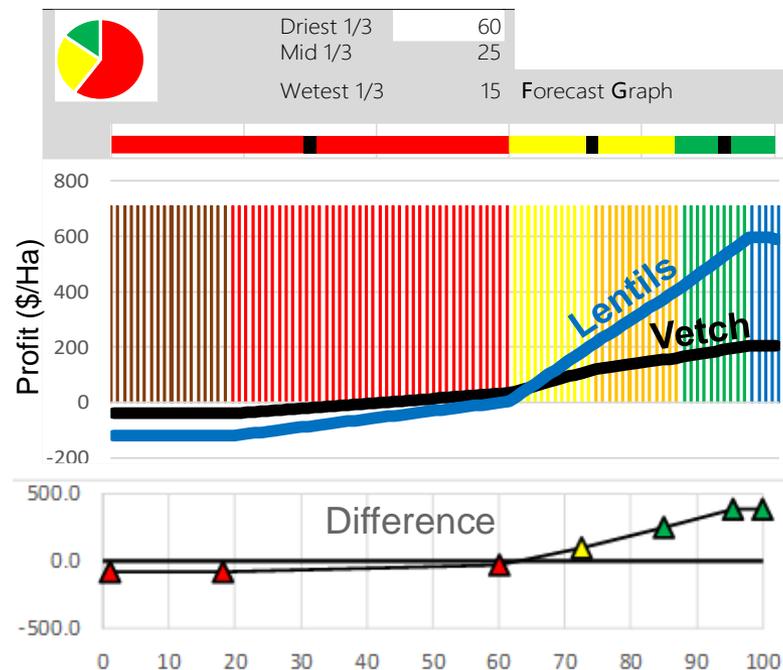
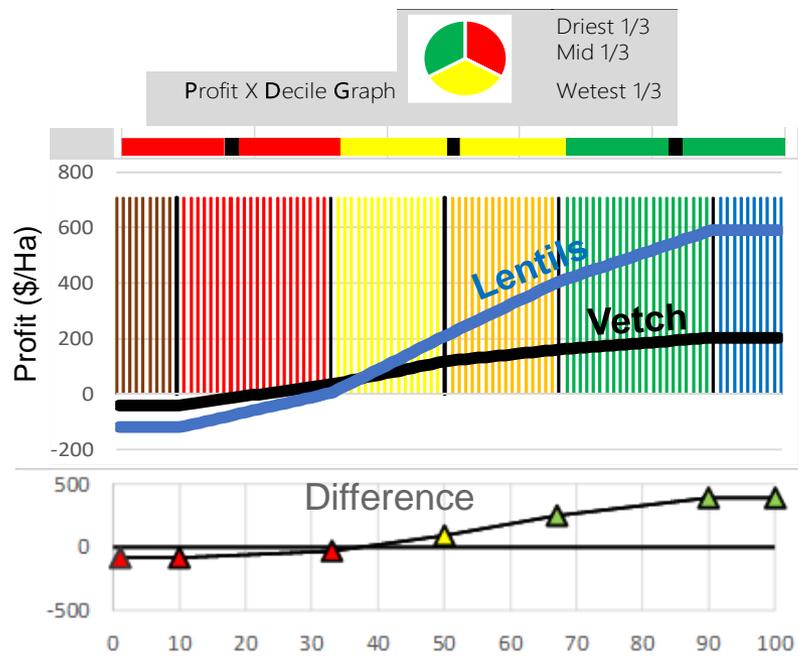
*“This is perhaps one of the most worthwhile projects undertaken by a government department in a long time. we were much better prepared for the heat event and saved our hydroponic lettuce crop because we changed our fertilizer programme knowing that that the water requirements would greatly increase and we would not need as many nitrates in our water resulting in a cos lettuce crop without tip burn, **probably saving us \$60 000.**”*

Ensemble forecasts and decision-making

Peter Hayman (SARDI) and Barry Mudge (Barry Mudge Consulting)

Barry Mudge (1/11/18)

Example: Planting vetch for sheep to graze **OR** lentils to be harvested



- Profit (\$/Ha) as a function of growing season rainfall decile (percentile)
- Compare "downside risk" and "upside benefit" wedges
- The upside benefit of planting lentils far outweighs the downside risk
- How does a forecast change the expected outcome?
 - downside risk increases with increased chance of being dry
 - 60% of the time vetch is better
 - BUT downside risk is still outweighed by potential gains if normal/wet season eventuates. For risk neutral farmer, lentils are still better

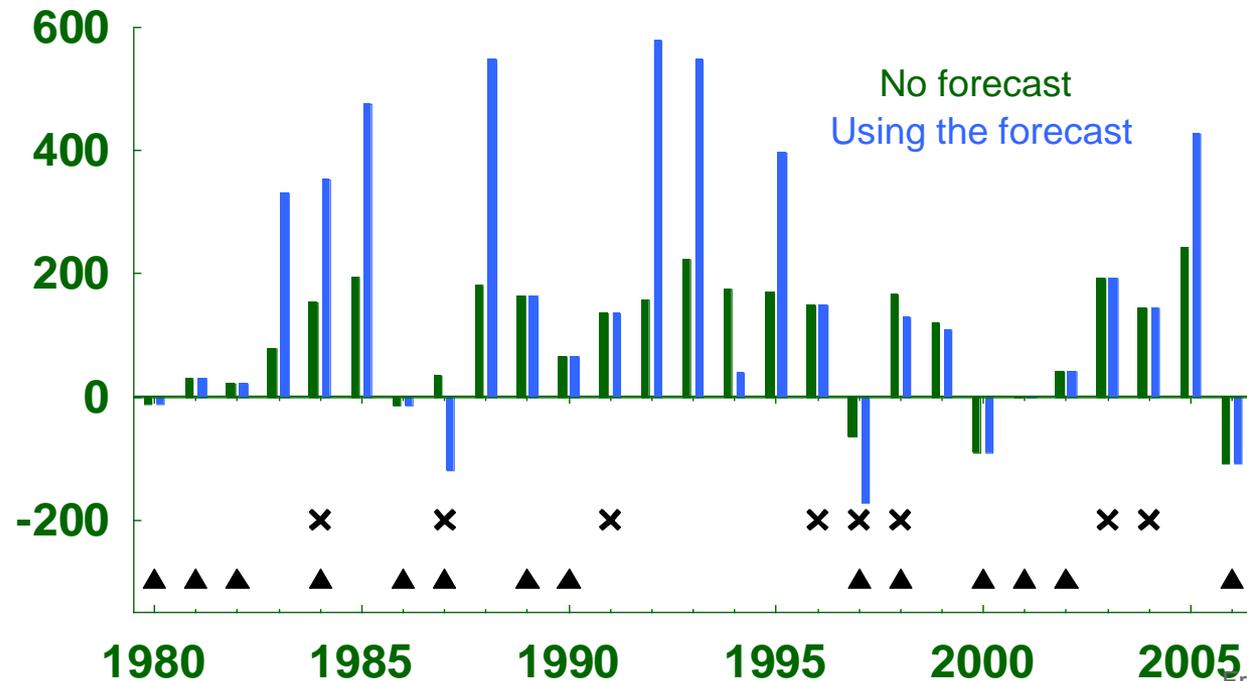
Advances in R&D: Interfacing to applications

Example: Crop modelling. Value of a seasonal rainfall forecast for nitrogen management on a wheat farm in south-west WA (2500 ha at Nyabing)

With Forecast – apply more fertiliser if wet forecast, less if dry

Without forecast – same average fertiliser each year

Gross margins (A\$/ha)



	Climatology (history)	Seasonal forecast (70% skill)
Profit	\$235 000	\$402 500

5km Calibrated Data

Quantile-quantile mapping

Straight to 5 km grid from 60km grid

Applied to daily data

Used Australian 5km observed gridded data

Rainfall, Tmax, Tmin, wind speed, solar radiation, evaporation

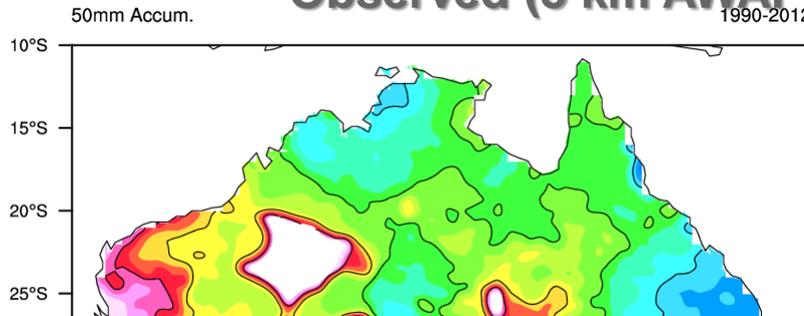
Every forecast ensemble member was converted to daily 5km gridded data (over Australia)

Monthly/Seasonal data based on time averaging of this daily data

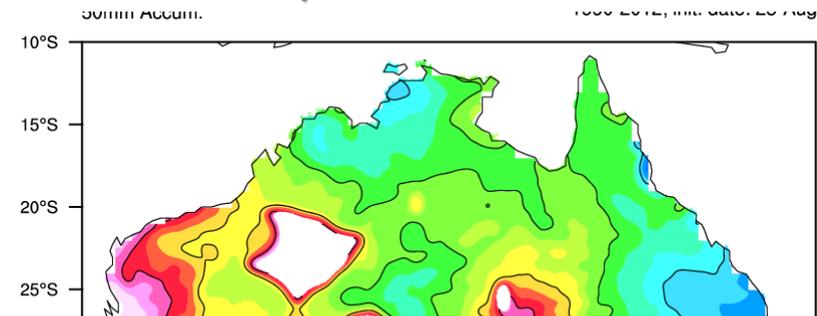
Wet Season Onset Date

The ACCESS-S1 hindcast medians, shown below, were initialised on the 25-Aug, and consist of 11 ensemble members. All plots below are smoothed 50x using a 1-2-1 spatial smoother.

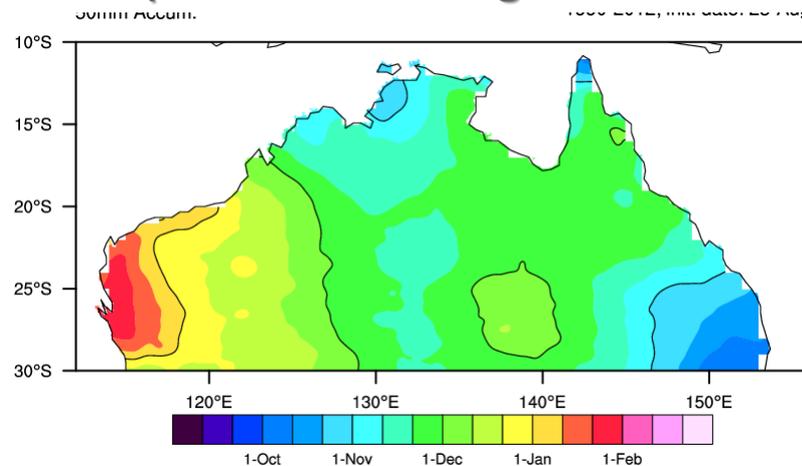
Observed (5 km AWAP)



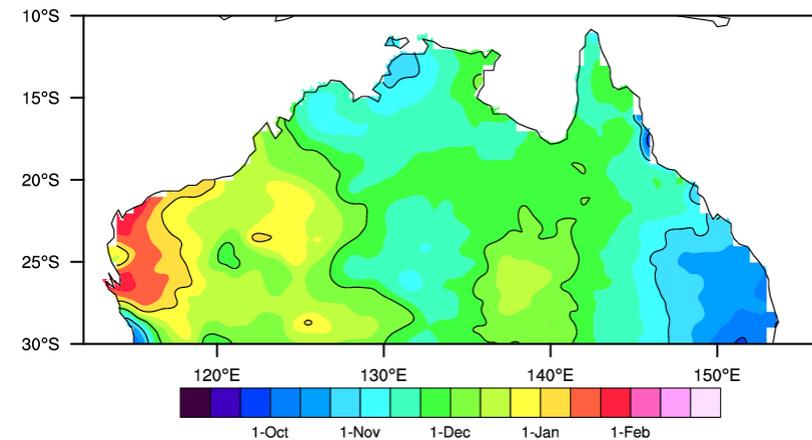
ACCESS-S1 (5 km calibrated hindcasts)



ACCESS-S1 (raw hindcasts regridded to AWAP)



ACCESS-S1 (5 km bias corrected hindcasts)



Northern Australian rainfall median onset → date at which an accumulation of 50 mm of rainfall is reached after 1 Sep.

Sheep CRC/ AskBILL Tool

What ASKBILL will do for you

 <p>Flies 14 day forecast Worms 21 day forecast</p>	 <p>Heat or chill 14 day warning</p>
 <p>Pasture 90 day forecast</p>	 <p>Condition Score 90 day forecast</p>

Sheep CRC Ask Bill Tool

Uses ACCESS-S 5km daily data feed to develop products on their tool

<

👤 Oscar Alves ▾

⚙️ Dashboard

⚠️ **Current Risks**

📖 My Properties

🗺️ Risk Maps

🔗 My Accounts

📖 User Manual

📝 Bill's Blog

💬 Contact Us

Current Risks for BOM Tobin TAS

LEGEND

There are no imminent risks

There is a high risk that needs to be managed

There is a medium risk

There is no target set in the forecast range to calculate risk

Click each button below to display the data available

Licence expires on - 06/01/2019

📖 Select Another Property

		Pasture Availability	Flies	Cold Sheep	Cold Lambs	Heat	Worms	Weight	Condition Score
		?	?	?	?	?	?	?	?
BOM Tobin TAS		✓					✓		
Boat wethers	Wethers		⚠️	✓					
Cull Merino Weaners	Weaners (12 wks - 1 year)		⚠️	✓					

3 Items

Sheep CRC Ask Bill Tool

Uses ACCESS-S 5km daily data feed to develop products on their tool

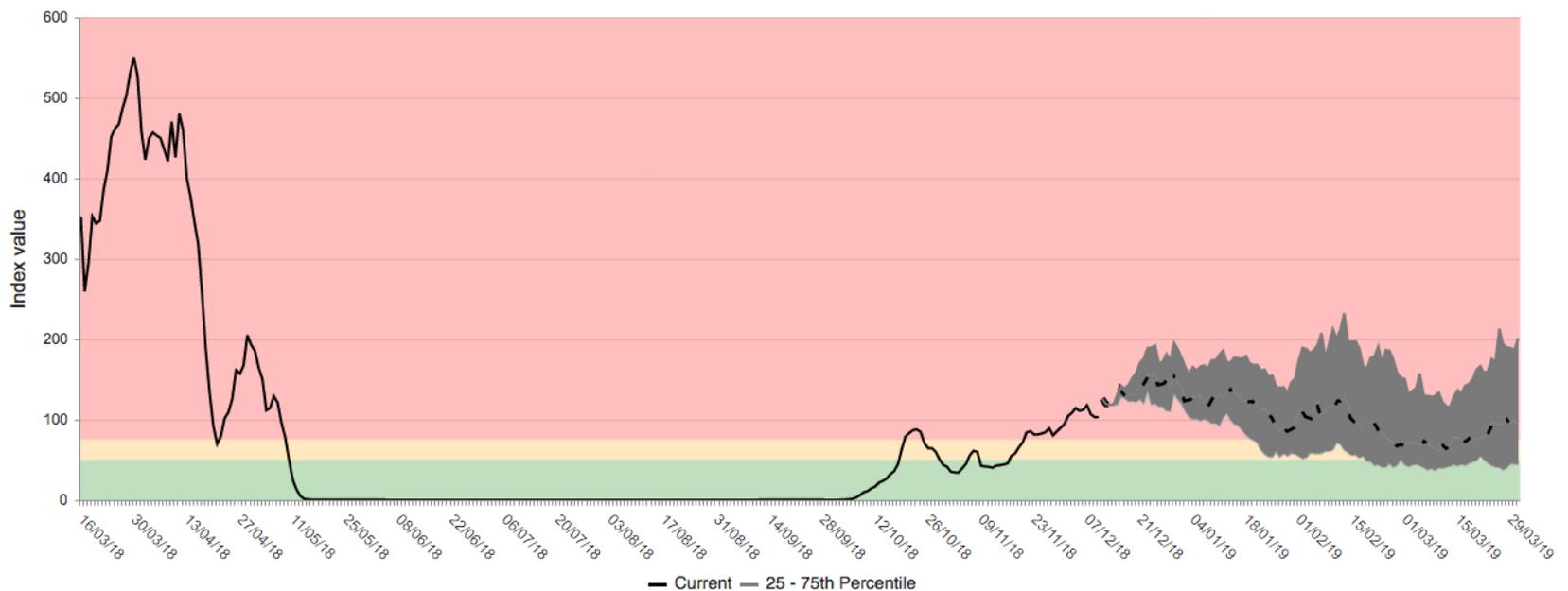
Blends in NWP forecast over first 5 days (Seamless products)

Risk Details

Risk Details - BOM Tobin TAS - Cull Merino Weaners : Weaners (12 wks - 1 year): Risk of flystrike for the next 180 days [?](#)

Advice for Flystrike

Options



Sheep CRC Ask Bill Tool

Manage Pasture



Edit Pasture - Goimbla

Date Recorded: 01/05/2018

Grazeable Area (ha): 320

? % Winter Active Grasses, Lucerne, Herbs: 20

? % Summer Active Grasses, Sub Tropical Grasses: 80

? Soil Fertility: Low to High slider

? Predominant Soil Type: Clay to Sand/Gravel slider

Winter Active Pasture Productivity: 61 (0 to 100 slider)

Summer Active Pasture Productivity: 49 (0 to 100 slider)

Soil Fertility Calculator

Clay Clay Loam Sandy Clay Sandy Clay Loam Loam Sandy Loam Loamy Sand Sand/Gravel

Entering farm data is easy using slider bars and drop down menus.



Australian Government

Bureau of Meteorology

Prototype Product Visualisation Tool

BoM View
ACCESS-S1

Forecast
 Hindcast

Forecast Start Date

< 2019 > < Aug > < 29 >

[Feedback](#)

General Products

Climate Drivers

- > Ocean SST indexes
- > Atmos drivers
- > MJO phase diagram
- > Hovmoller

Atmos Products

Basic Charts

- > 60km
- > 5km bias corrected
- > 5km calibrated
- > POE by probability
- > Rainfall Onset
- > Rainfall POE
- > Temperature POE
- > Temperature POB

Regions Stations

- > Pie Charts
- > Daily distributions
- > Quintile bars
- > 30 day Meteogram
- > Climagram
- > 2D consecutive POE
- > 2D POE any days

Heat Extremes

- > Heat wave map
- > **Hot days plume**
- > Hot days map
- > Temperature-humidity (THI) daily distributions (stations)
- > Temperature-humidity (THI) maps

Cold Extremes

- > Cold wave map
- > Cold days map
- > Frost potential map
- > Mean number of frost days

Ocean Products

Basic Charts

- > Horizontal Charts

Regions Stations

- > Ocean Plume
- > Ocean Pie Chart
- > Quintile bars
- > 2D consecutive POE
- > 2D POE any days

POE Charts

- > 25km SST
- > 25km SST by probability

CIS Products

Basic Charts

- > Anomaly Plots
- > Multi-Parameter Plots

Product Characteristics



Variable:

Maximum Temperature

Domain:

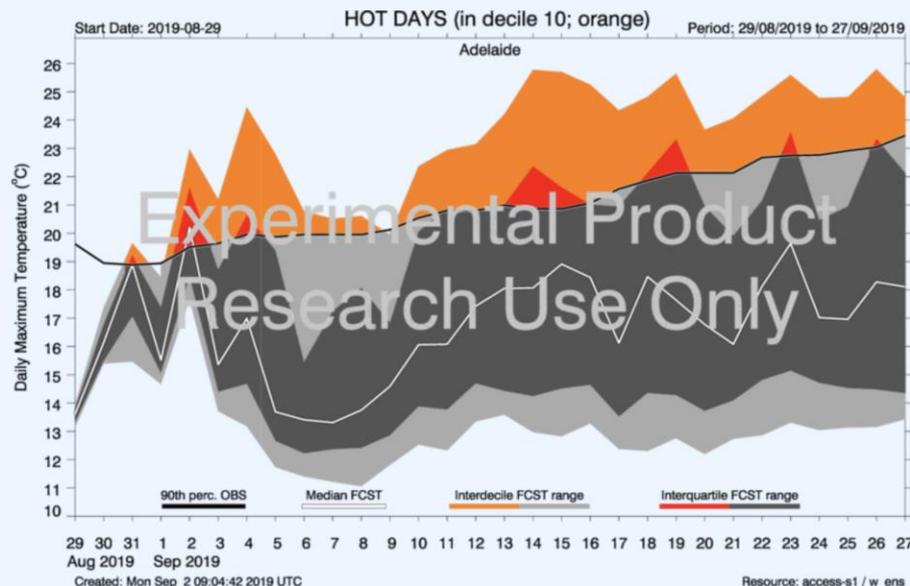
Adelaide

Forecast Period:

< - >

Output Options:

-



Source Image: plots/atmos_hotdaysplume/tasmax/adelaide/atmos_hotdaysplume_tasmax_adelaide_20190829_rt.png

Case Study: Northern Australian Climate Program

Feb 2019 Queensland Floods

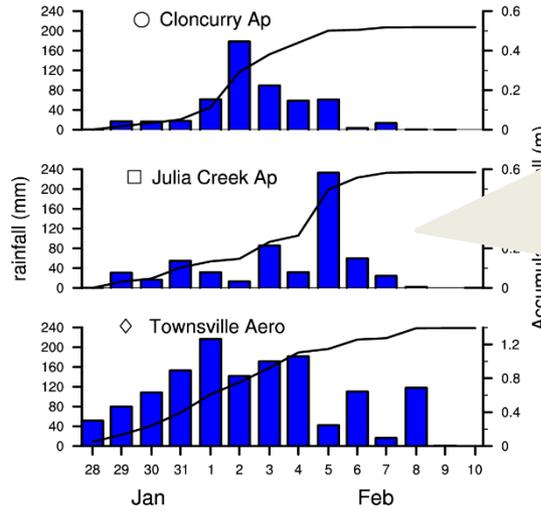
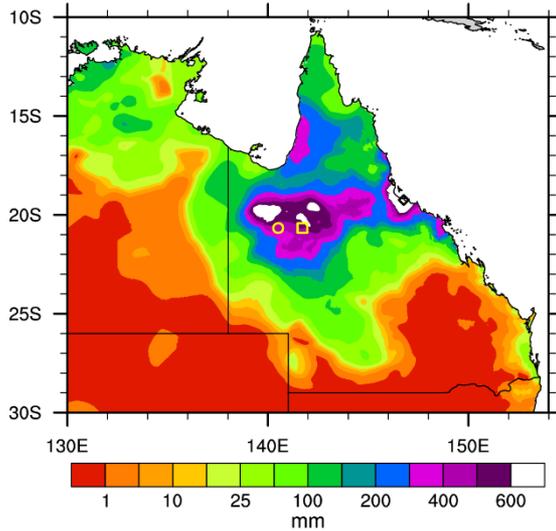
~500,000 cattle died

> \$0.5 Billion cost

Northern Australian Climate Program (NACP) is a partnership between the Queensland Government, Meat and Livestock Australia (MLA) and the University of Southern Queensland (USQ)...
"to improve seasonal and longer-term climate forecasting and develop tools and information systems, and provide support to use these forecasts". Partners have injected \$8 million into NACP, with half from MLA. "

Extremely wet and cold conditions for cattle

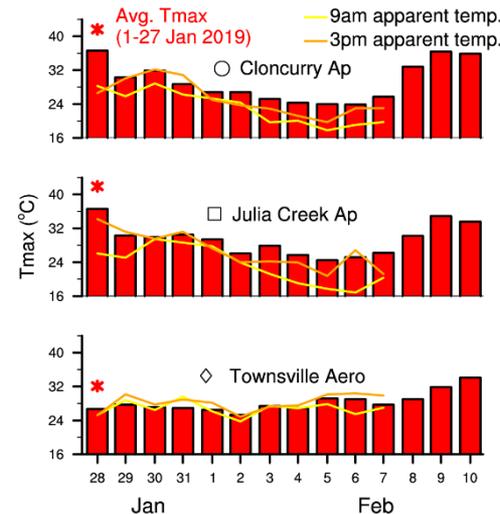
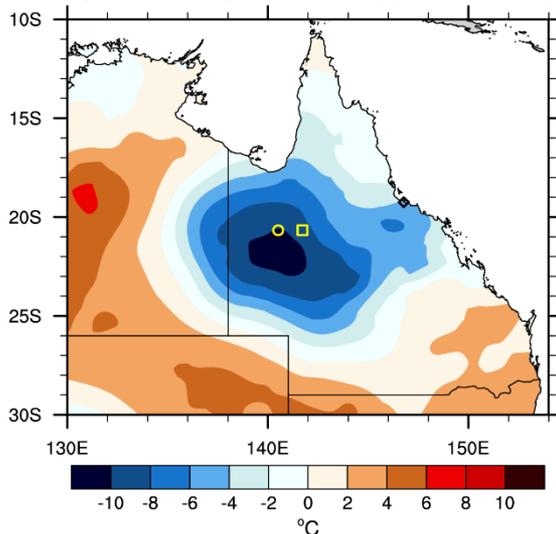
(a) Accumulated rainfall (31-Jan to 6-Feb)



Dudley Harrington, grazier from Julia Creek:

“(the rain) didn't really stop and the cold winds came and it was just relentless for about 11 days...we had very low temperatures and winds up to 65 kilometres an hour which just made it really tough on the cattle” (7.30 Report, ABC, 11 Feb 2019)

(b) Maximum temperature anomaly (31-Jan to 6-Feb)



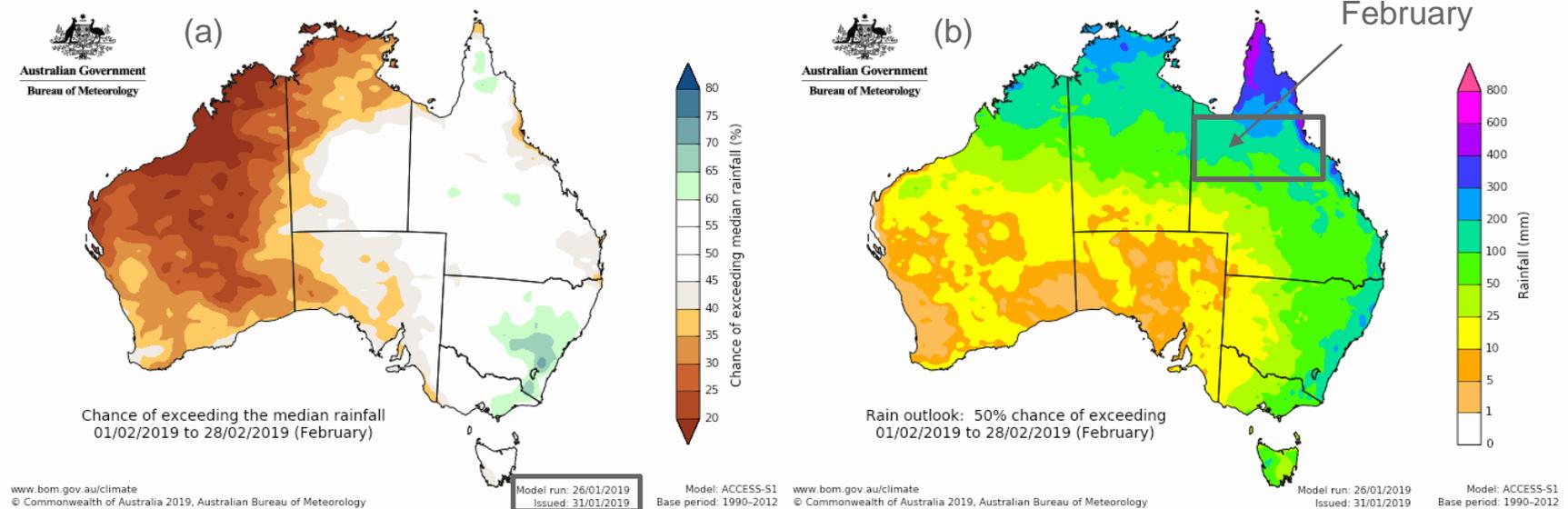
Megan Munchenberg, Gregory Downs Station (USQ ClimateMate): *“Anecdotal information is that Bos Taurus cattle (left) had a higher survival rate than Bos Indicus cattle (right)...(which) are typically carried in the north for their tolerance of extreme heat.”*



From Tim Cowan

Monthly Rainfall outlook issued on 31-January

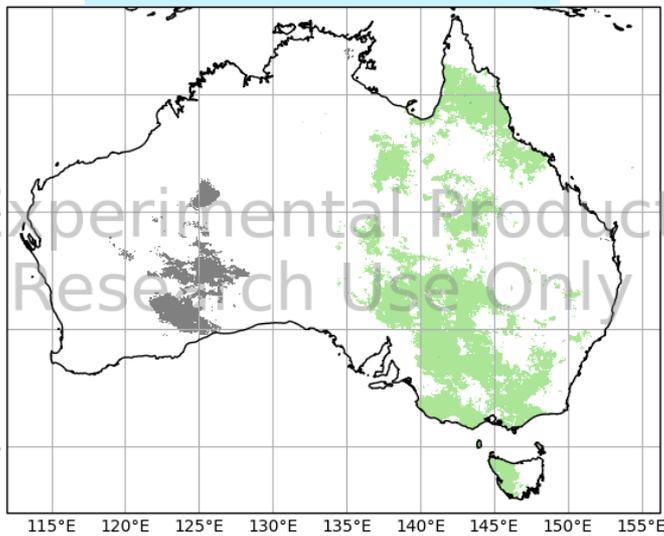
This amount of rainfall has a 50% of occurring during February



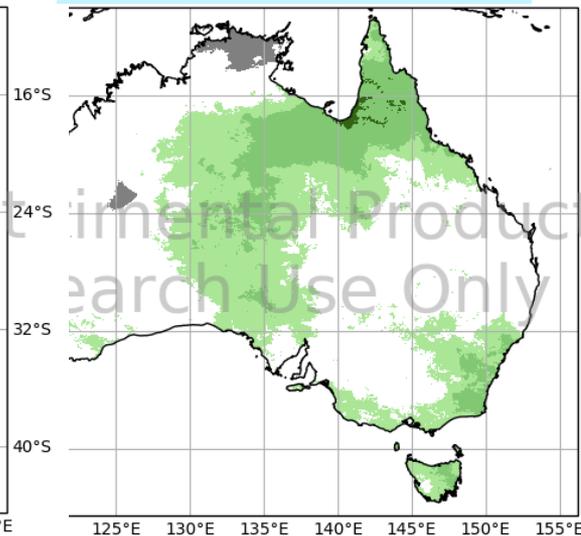
Model run: 26-Jan 2019

Calibrated 5km model rainfall forecasts (for 31-January to 6-February)

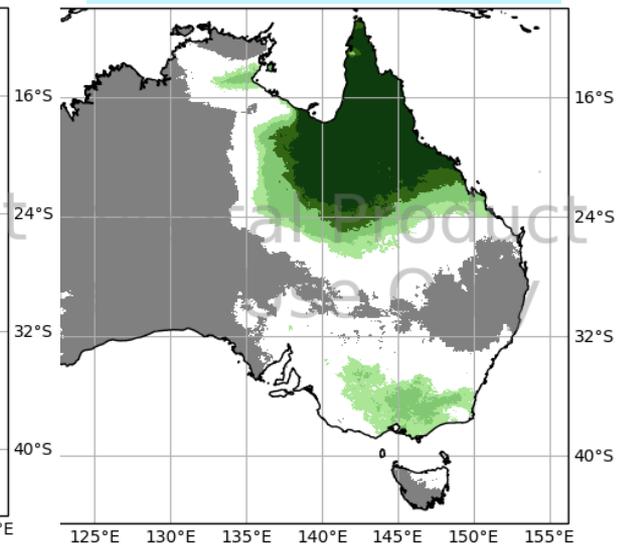
17-January forecast (WEEK 3)



24-January forecast (WEEK 2)

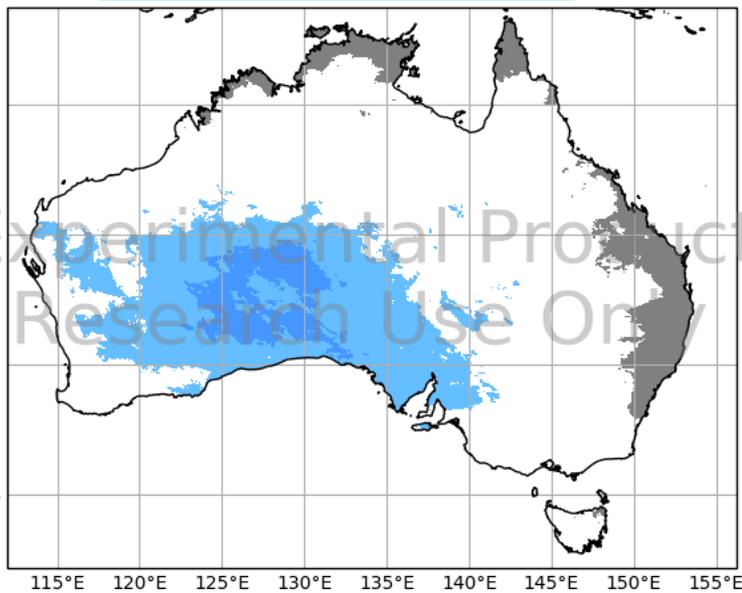


31-January forecast (WEEK 1)

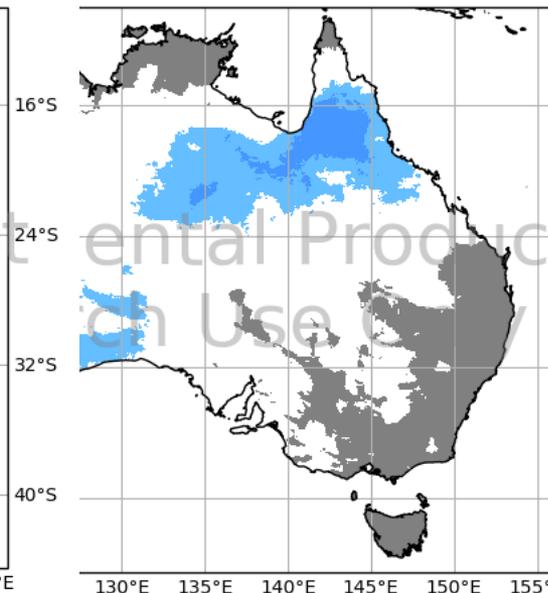


Calibrated model **Tmax** forecasts (for 31-January to 6-February)

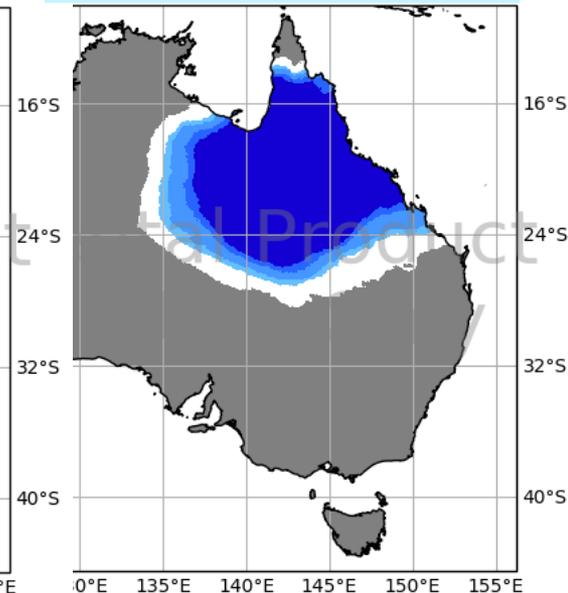
17-January forecast (WEEK 3)



24-January forecast (WEEK 2)



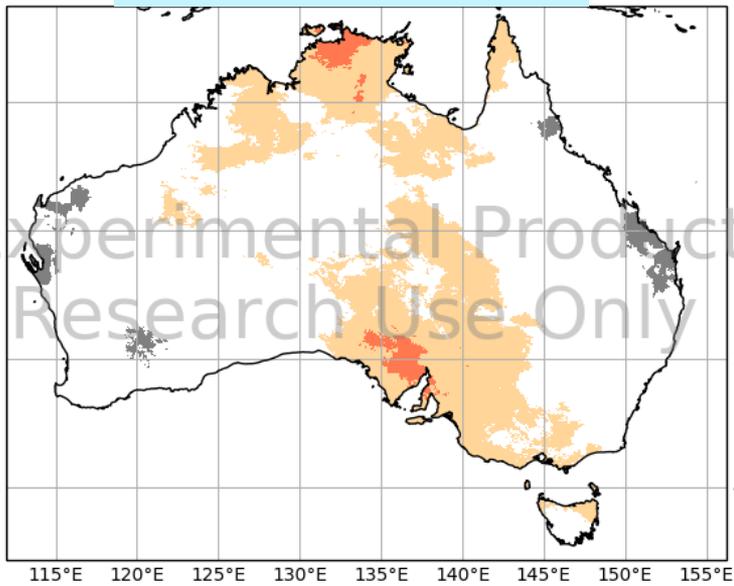
31-January forecast (WEEK 1)



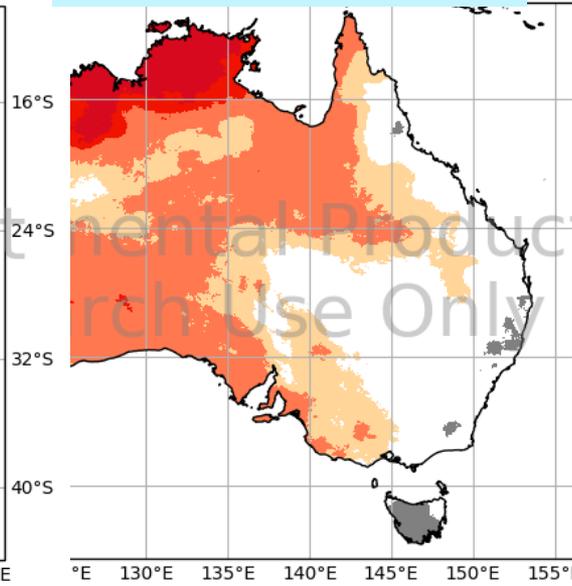
Probability of Decile 1&2

Calibrated model wind speed forecasts (for 31-January to 6-February)

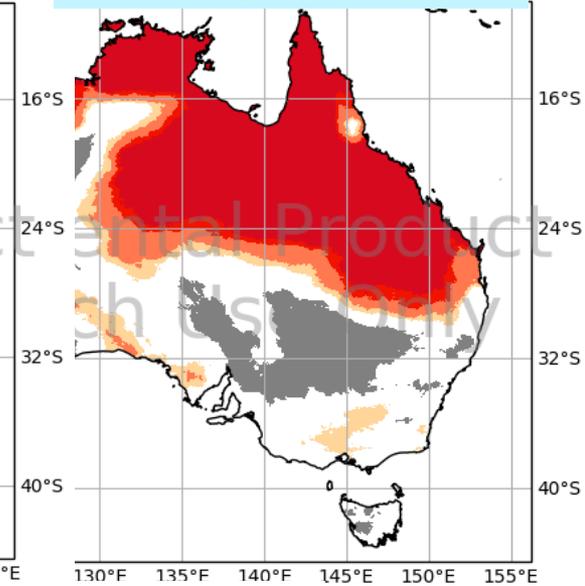
17-January forecast (WEEK 3)



24-January forecast (WEEK 2)



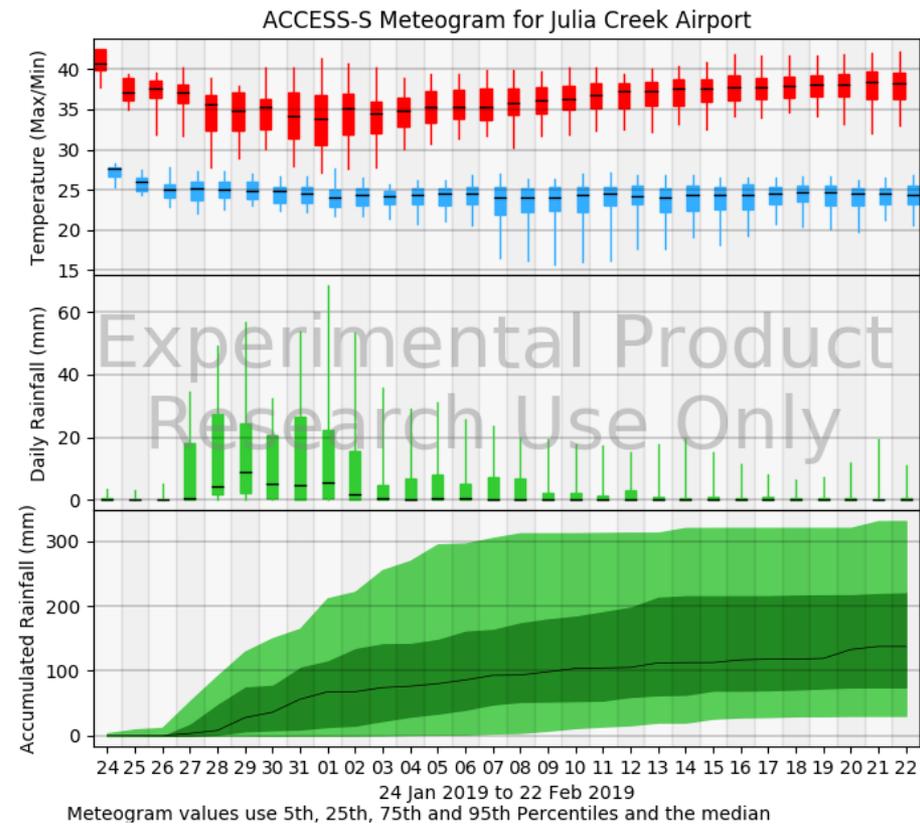
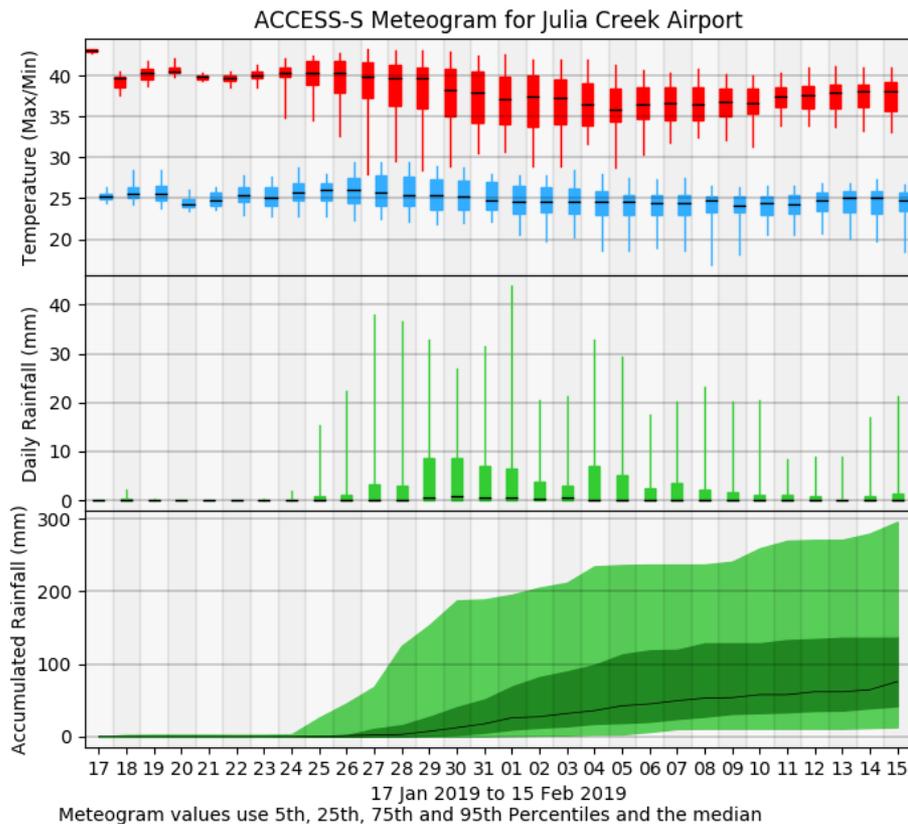
31-January forecast (WEEK 1)



Forecast prototype products showing Julia Creek 30-day Meteograms

Start date: 17th January

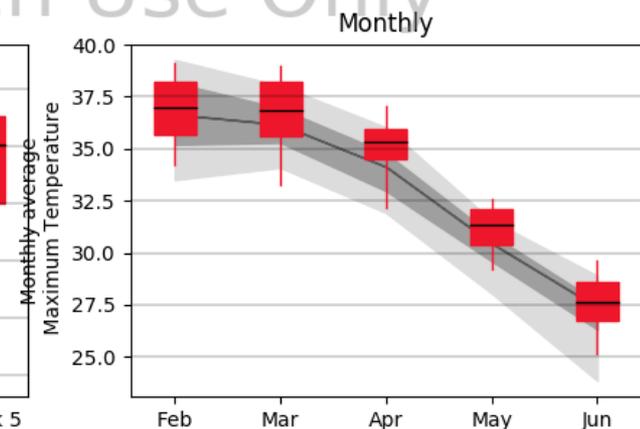
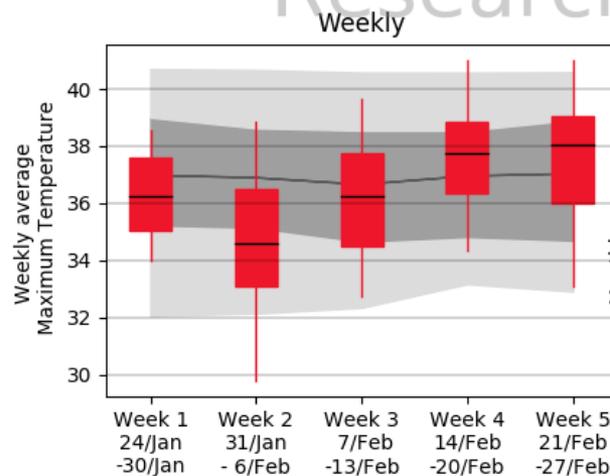
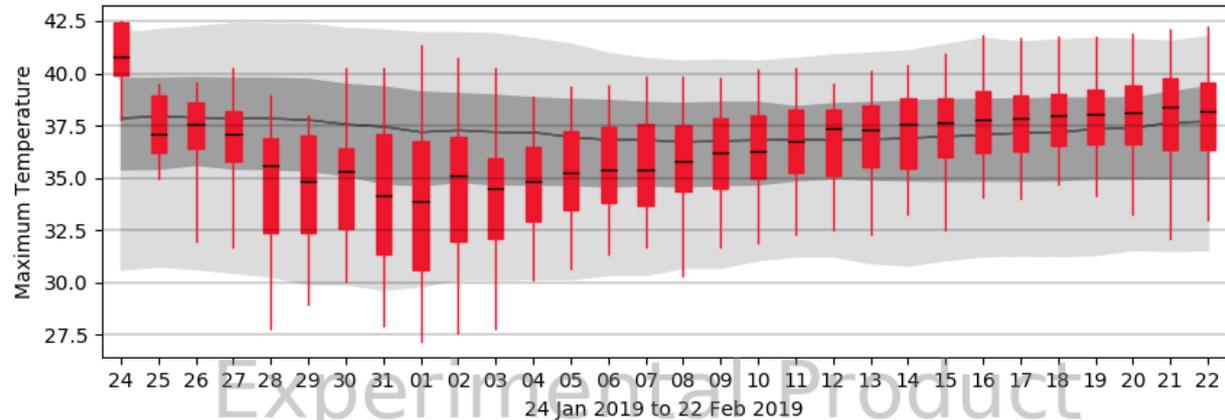
Start date: 24th January



Forecast prototype products showing Julia Creek Climagram

Start date:
24th January

Climagram: Maximum Temperature for Julia Creek Airport
Forecast starting 20190124



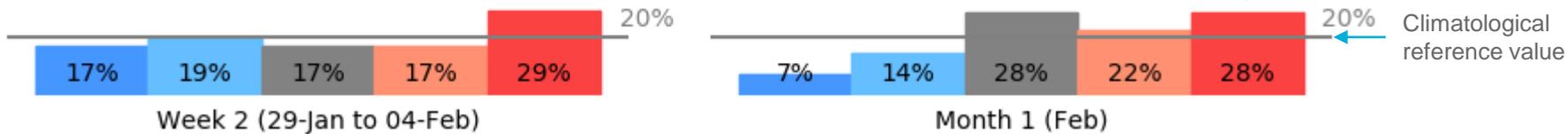
Climagram values use 5th, 25th, 75th and 95th Percentiles and the median. Grey shows AWAP 1980-2017 Climatology.

Decile bars

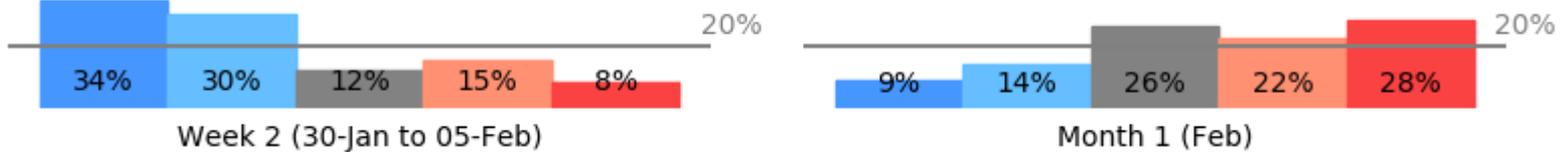
Maximum Temperature Decile Bars

Region: Julia Creek Airport

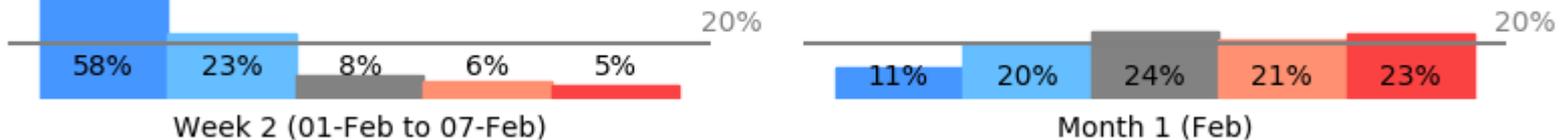
Start date: 22-Jan 2019



Start date: 23-Jan 2019



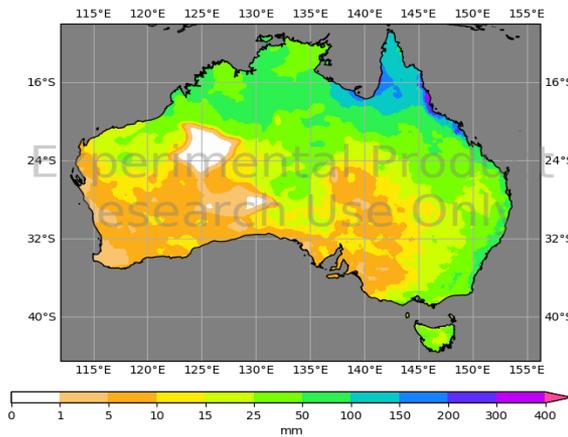
Start date: 25-Jan 2019



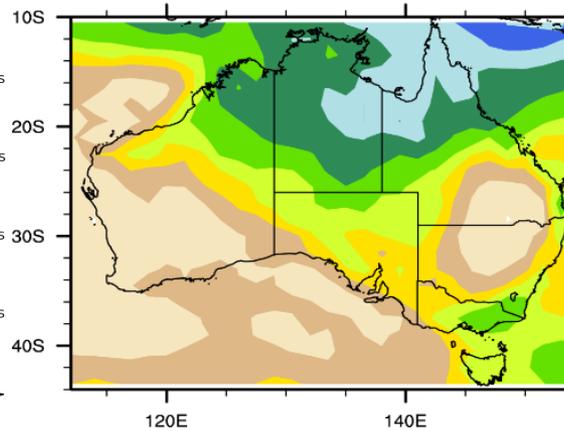
Other forecasts (init. 24 Jan) of total precip.

Accumulated rainfall (31-Jan to 6-Feb)

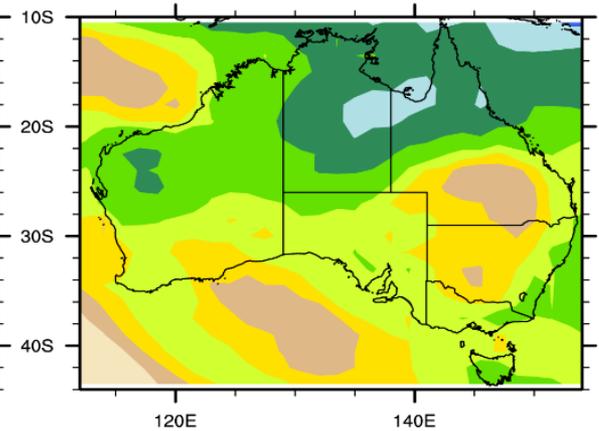
(a) ACCESS-S1 (99)



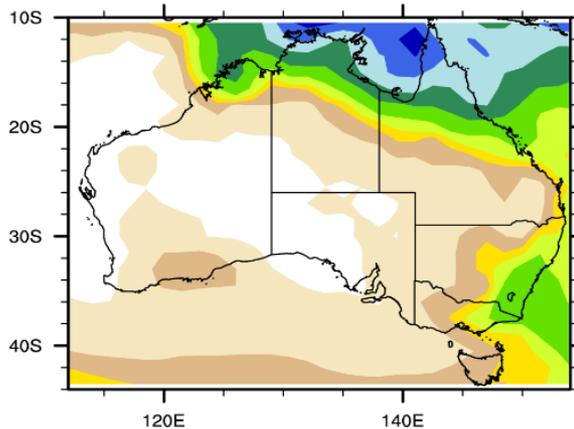
(b) ECMWF (50)



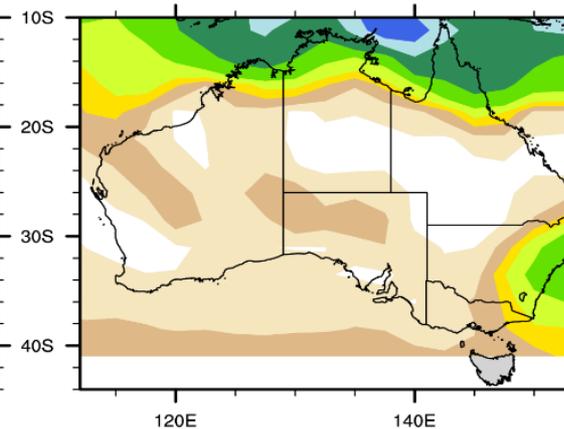
(c) Meteo France (50)



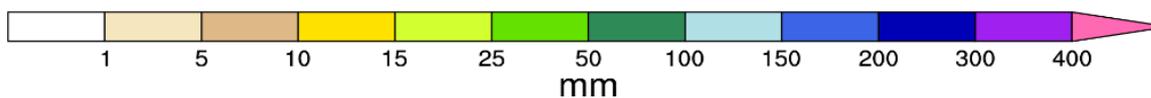
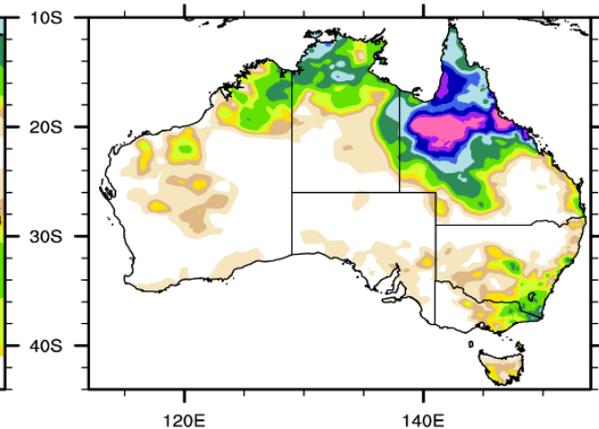
(d) NCEP (15)



(e) POAMA (32)



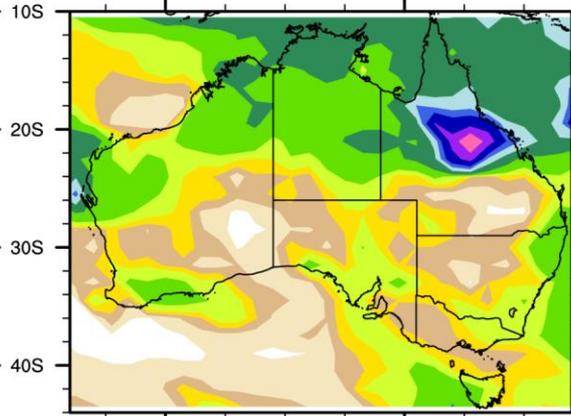
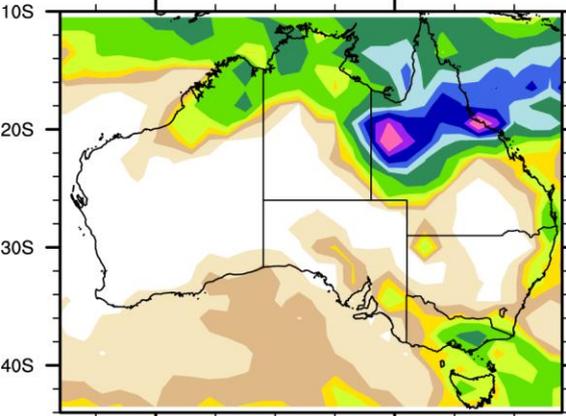
(f) Observations



High magnitude rainfall forecasts

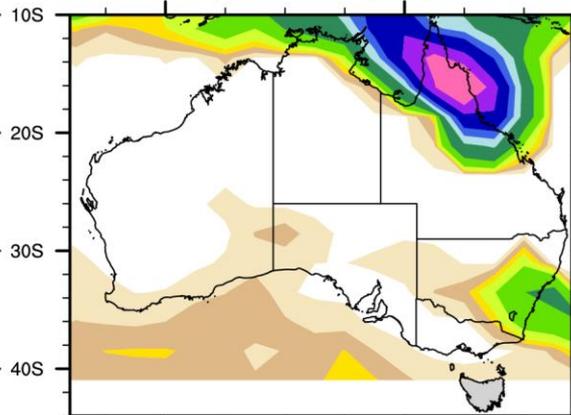
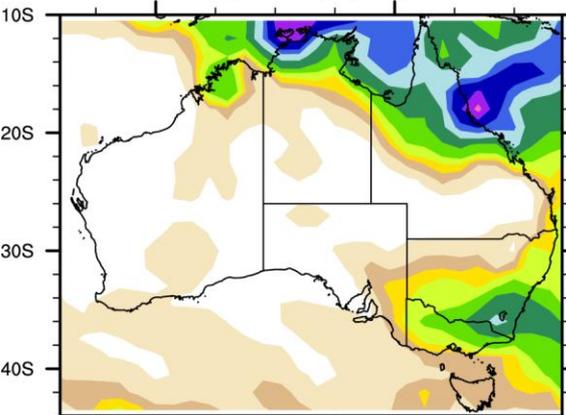
(b) ECMWF (Exp. 40)

(c) Meteo France (Exp. 49)

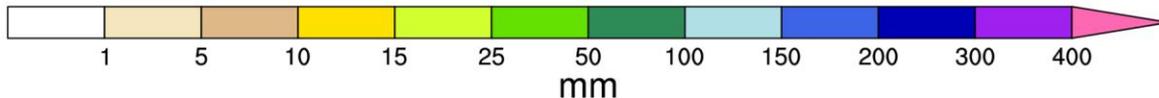
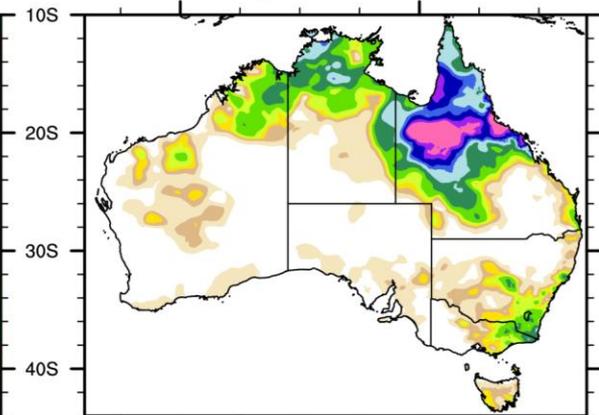


(d) NCEP (Exp. 13)

(e) POAMA (Exp. 24)



(f) Observations



What makes these individual runs different?
- Depict MJO stalling?
- Capture Tasman Sea blocking?

Forewarned is forearmed

\$14M Major Extremes Project

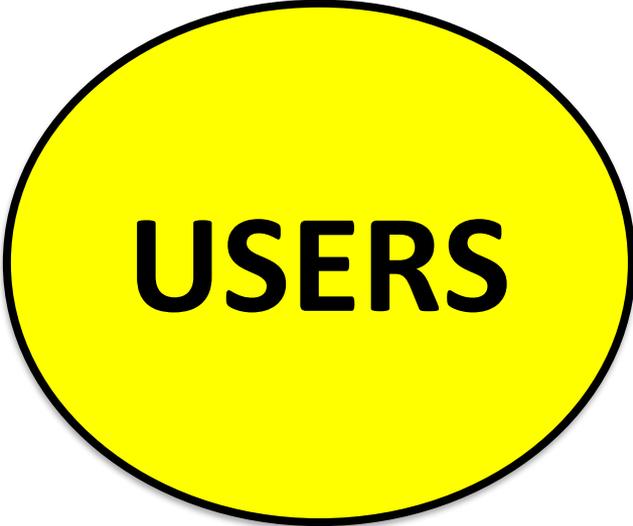


Australian Government
Department of Agriculture
and Water Resources

Forewarned is forearmed: managing the impacts of extreme climate events

Research partners

BoM
Univ. Melbourne
Monash Univ.
Univ. S. Queensland
SARDI
DEDJTR
DAFQ
Birchip Cropping Group



USERS

Rural RDC & other partners

Meat and Livestock Australia
Grains RDC
Sugar Research Australia
Cotton RDC
Rural Industries RDC
Dairy Australia
Wine Australia
Australian Pork

Getting **more** information from the forecast: Tercile probabilities

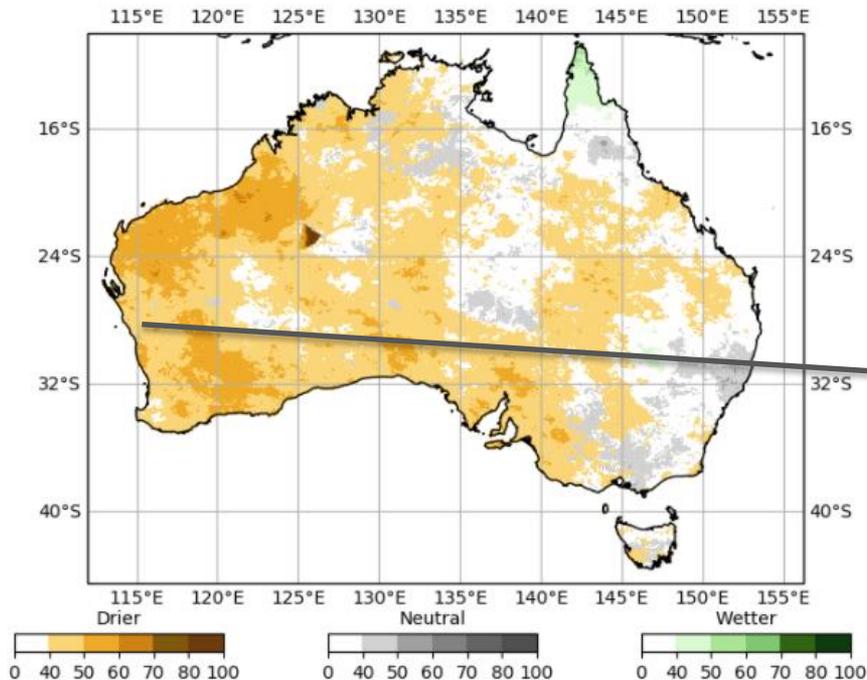
Forecast for JFM 2019 Rainfall: Probability for most likely tercile category

Precip Tercile Probabilities

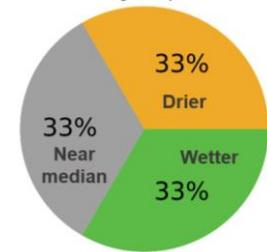
Start: 20181104

Region: Australia

Period: Season: 20190101 to 20190331

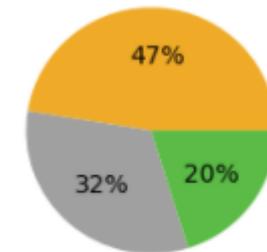


Climatological pie chart



Rainfall Pie Charts

Region: Mullewa



Season 2
(JFM)

Getting **even more** information from the forecast:

Chance of being in outer deciles (e.g., very dry)

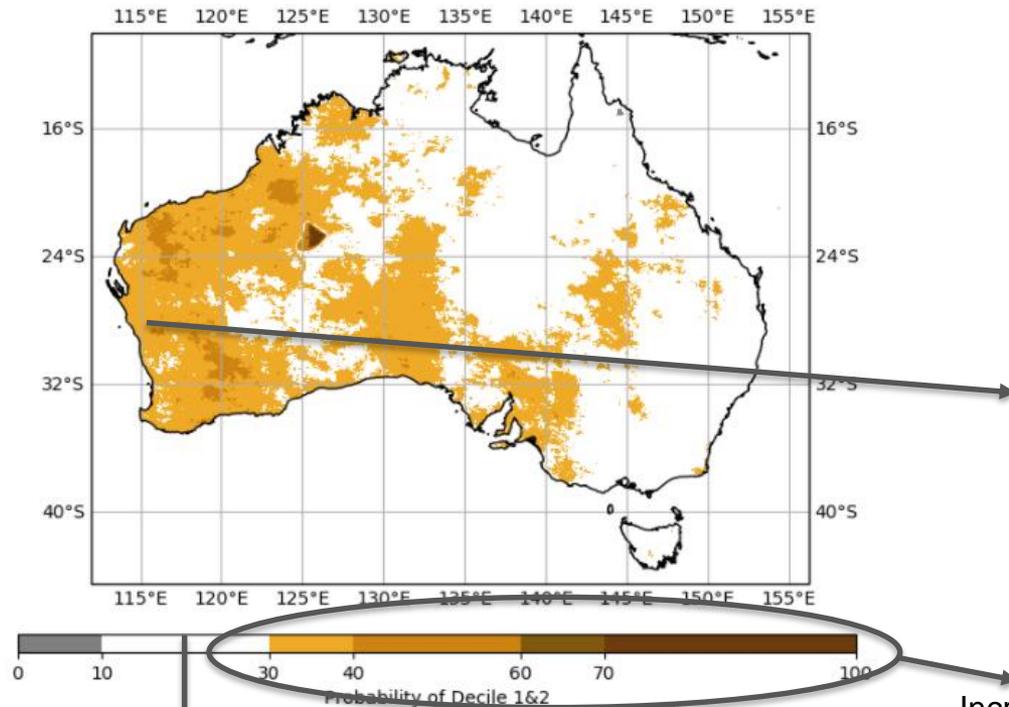
Forecast for JFM 2019 Rainfall: Chance of being in decile 1&2

Probability in Decile 1&2 Rainfall

Start: 20181104

Region: Australia

Period: Season: 20190101 to 20190331



Climatological bar



Rainfall Decile Bars

Region: Mullewa



Created: 2018-11-07 03:29:38 +0000

Climatology: 1990 to 2012

Resource: access-s1_q5 / s_ens

Climatological expected probability for Decile 1&2 (20%)

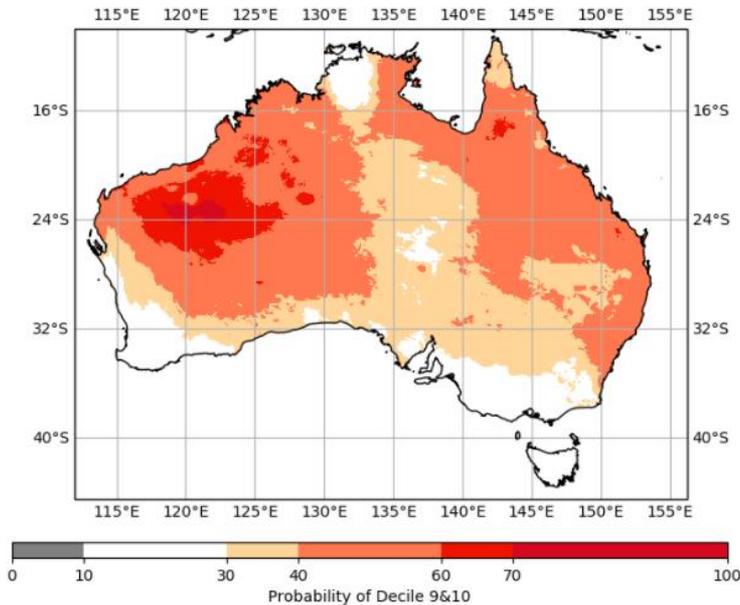
Increased likelihood of having Decile 1&2 (brown colours)
(i.e. of being amongst the driest fifth of JFM seasons)

Heat extremes example

Forecast for 30 Oct - 5 Nov (from 23 Oct, i.e., week 2 of the forecast)

Chance of having a decile 9-10 week

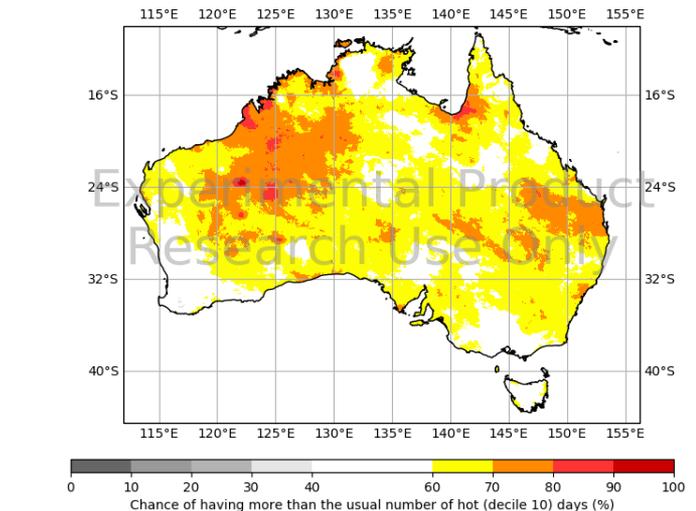
Probability of Decile 9&10 Maximum Temperature Start: 20181023
Region: Australia Period: Week: 20181030 to 20181105



Created: 2018-10-26 00:21:25 +0000 Climatology: 1990 to 2012 Resource: access-s1_q5 / w_ens

Chance of having more hot days+nights than usual in the forecast period

Hot Day and Night (Tmean) Probability Start: 20181023
Region: Australia Period: Week: 20181030 to 20181105



Created: 2018-11-08 23:50:32 +0000 Climatology: 1990 to 2012 Resource: access-s1_q5 / w_ens

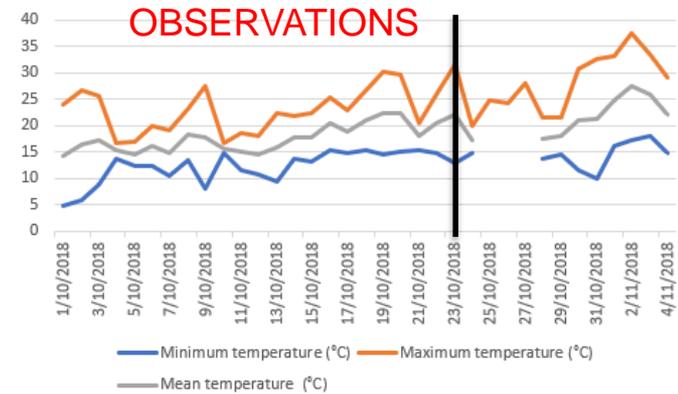
"Hot": decile 10 days

$T_{\text{mean}} > 90^{\text{th}}$ percentile threshold of observed daily T_{mean}

The days do not have to be consecutive

Camden (NSW)

34.04S, 150.69E



Black line: The **observed** 90th percentile threshold of daily T_{mean}

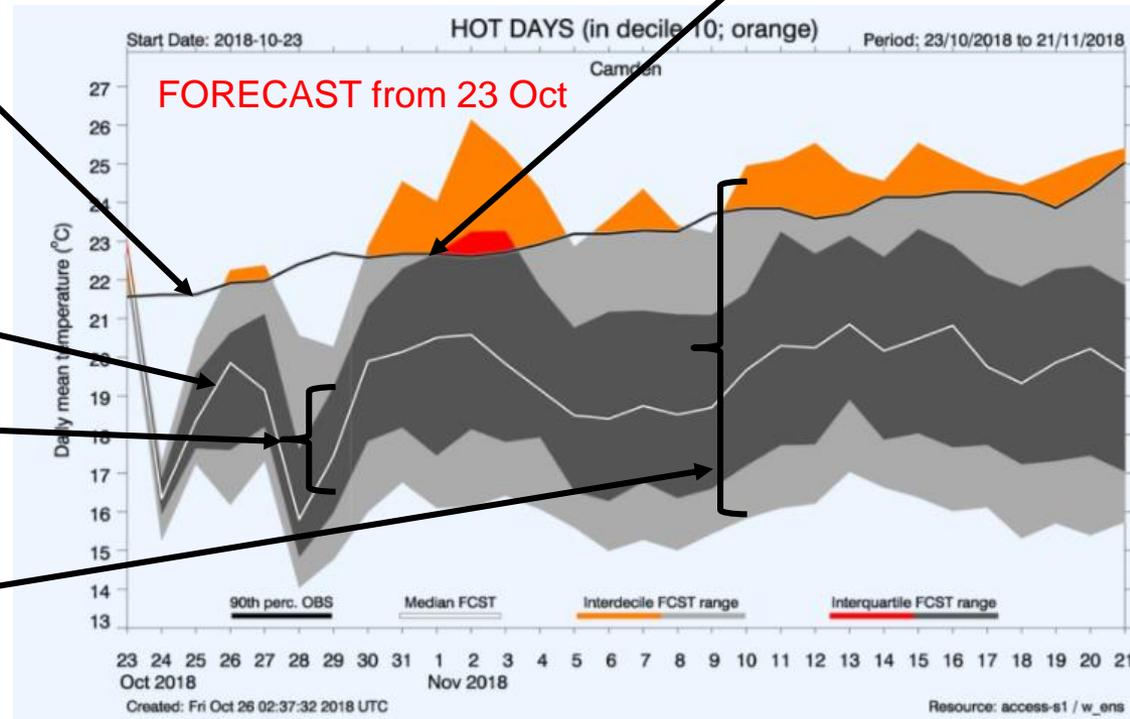
- Calculated by looking back over the historical period for the particular time of year. 10% of days are hotter than this threshold for the given time of year.

Increased hot day risk: "Orange" if some of the forecast ensemble are forecasting temperatures exceeding the historical (climatology) 90th percentile

This is the 75th percentile i.e. more than 25% of the ensemble are forecasting temps > historical (climatology) 90th percentile. The chance of "hot days" is 25% (i.e., more than double the normal risk, which is 10%)

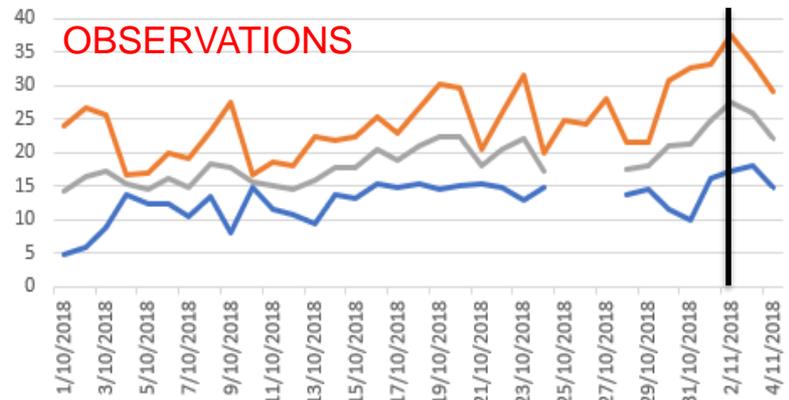
The "plume" is the forecast

- **White line:** middle (median) value of the forecast ensemble
- **Dark grey:** interquartile range (between the 25th and 75th percentiles of the forecast ensemble). 50% of the forecast distribution have values in this range.
- **Light grey:** interdecile range (between the 10th and 90th percentiles of the forecast ensemble). 80% of the forecast distribution have values in this range.



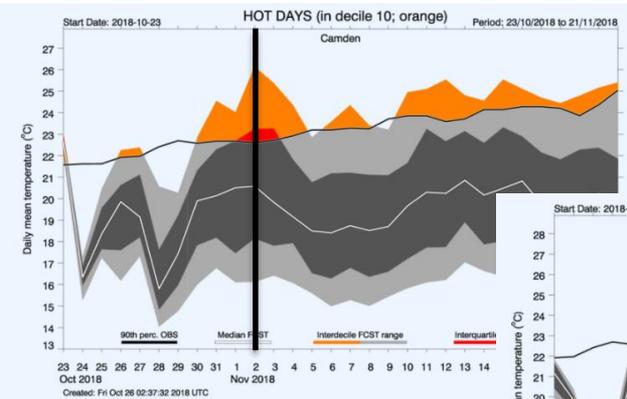
Camden (NSW)

34.04S, 150.69E

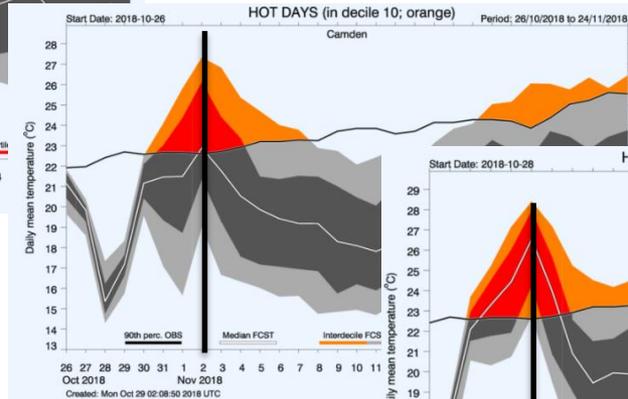


— Minimum temperature (°C) — Maximum temperature (°C)
— Mean temperature (°C)

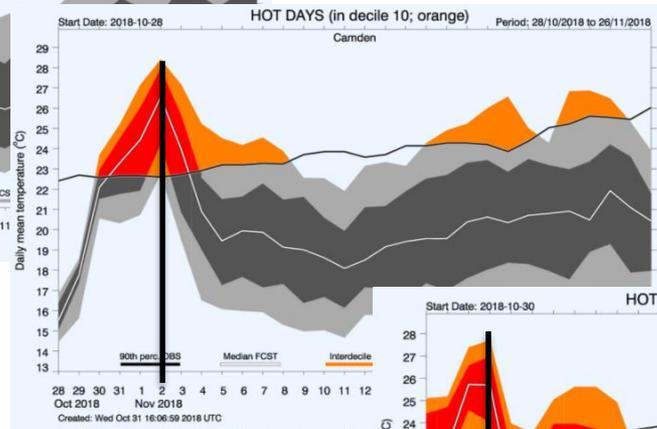
FORECAST from 23 Oct



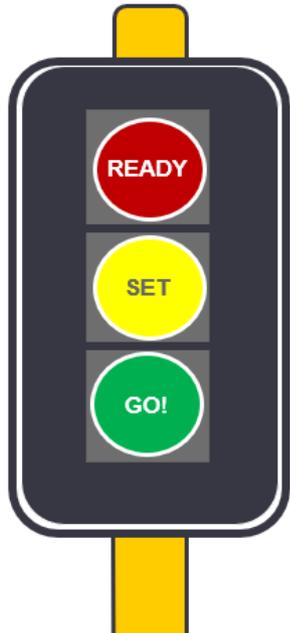
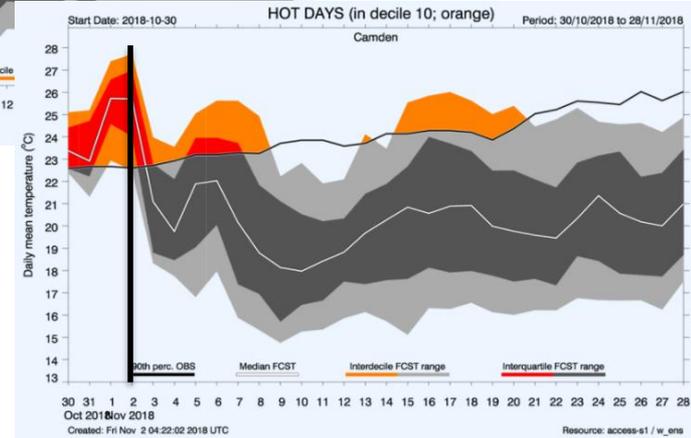
FORECAST from 26 Oct



FORECAST from 28 Oct



FORECAST from 30 Oct



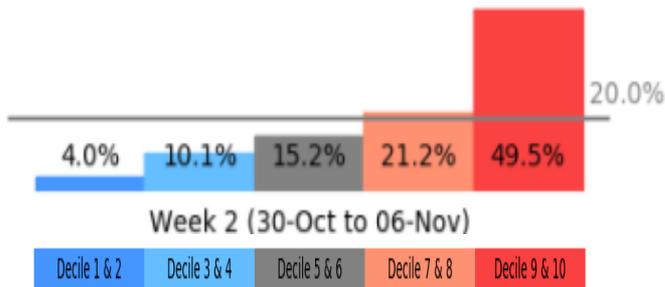
Risk = probability x impact

Camden (NSW)

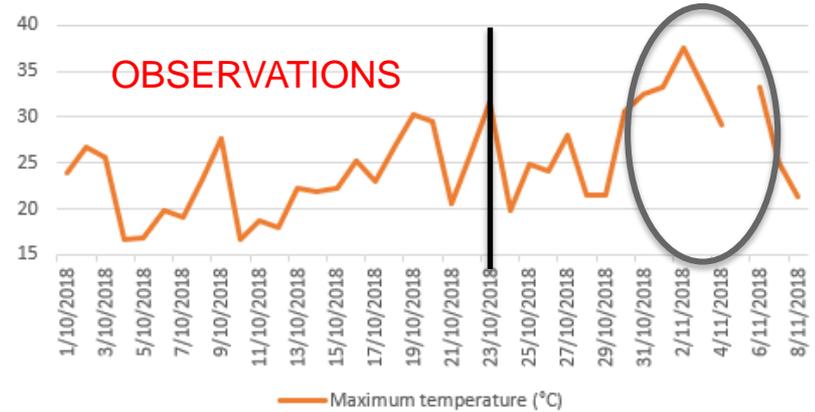
34.04S, 150.69E

Maximum Temperature Decile Bars

Region: Camden



Camden NSW Maximum Temperature

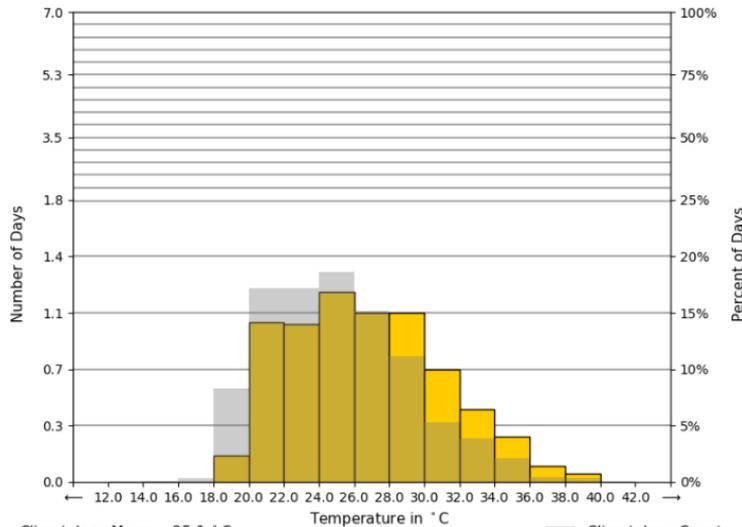


Maximum Temperature Forecast and Climatology

Start: 23-Oct-2018

Region: Camden

Period: Week 30-Oct-2018 to 05-Nov-2018

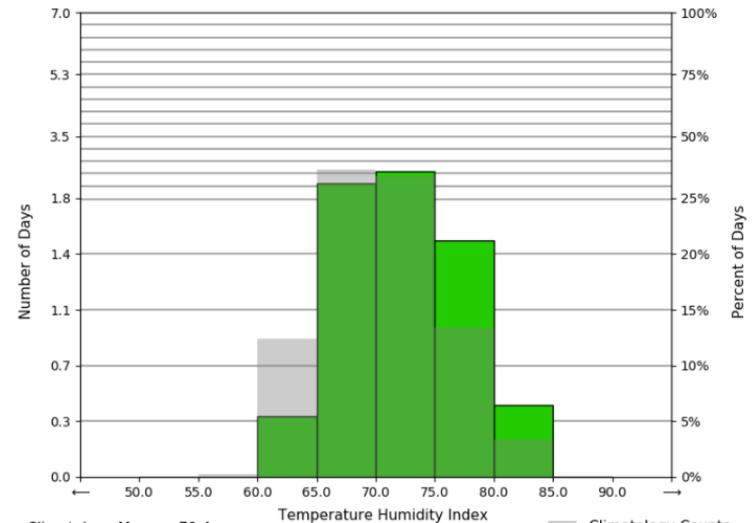


Temperature Humidity Index

Start: 23-Oct-2018

Region: Camden

Period: Week 30-Oct-2018 to 05-Nov-2018



Climatology Mean = 70.4

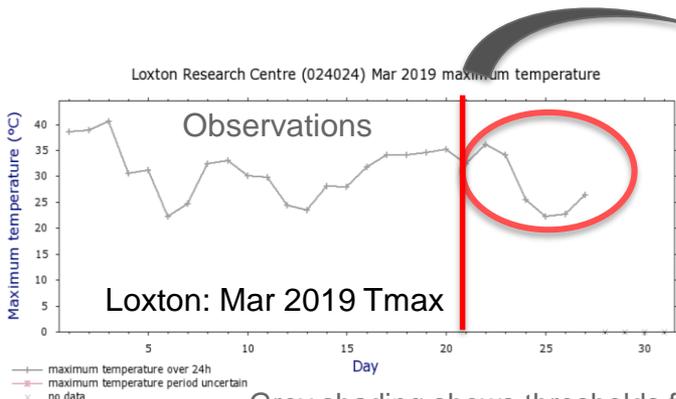
Forecast Mean = 72.1

Created: 2018-10-25 22:41:22 +0000

Climatology: 1990 to 2012

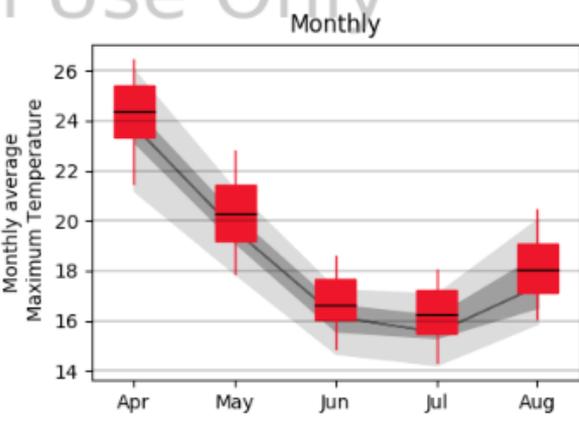
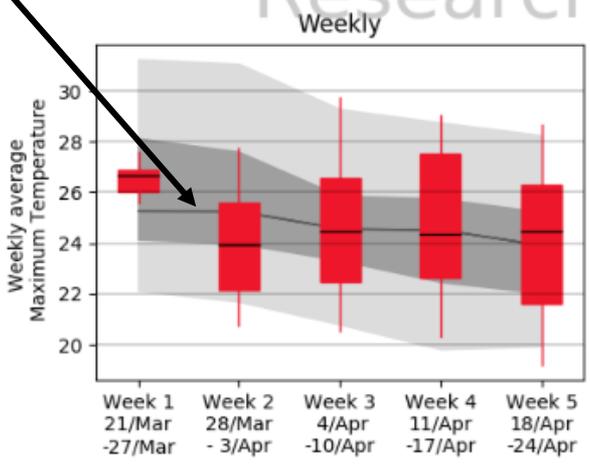
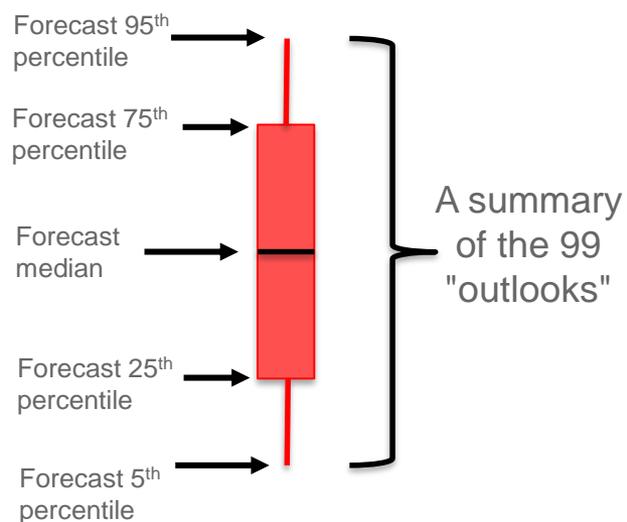
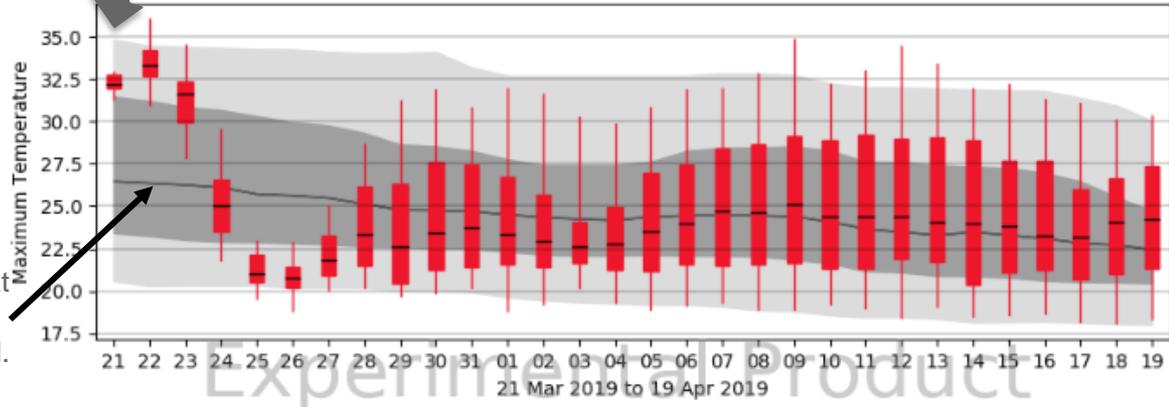
Resource: access-s1_sq5 / w_ens

Forecast timeseries example



Grey shading shows thresholds for what has historically happened for that time of year. Can see how forecast differs from what is "usually" expected. Grey line is the median – "average" value for that time of year.

Climagram: Maximum Temperature for Loxton Research Centre
Forecast starting 20190321



Climagram values use 5th, 25th, 75th and 95th Percentiles and the median. Grey shows AWAP 1980-2017 Climatolo



How accurate are the forecast ?

Most common user question ?

Issues:

- 23 years not enough for regional skill
- How do express information in a way that makes sense to a user
- How do you measure skill of more sophisticated products e.g. Climagrams/Meteograms

A Challenge !

I want to know the skill for my region!

ACCESS-S1 hindcast: 1990-2012 (23 years)

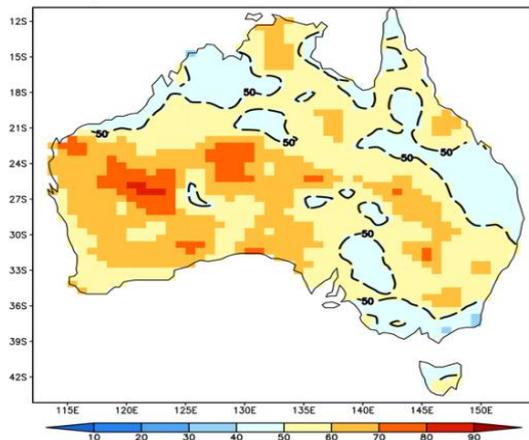
To assess skill for a particular month or season

$n=23$

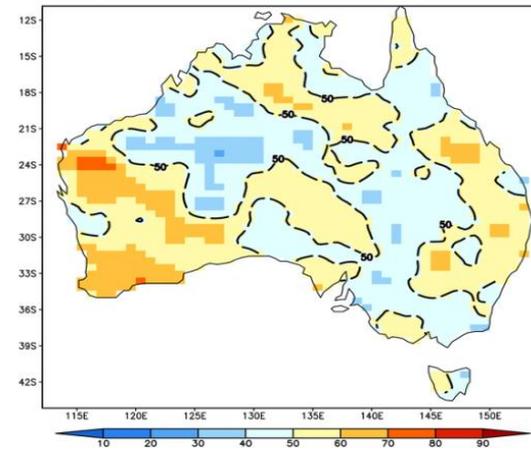
Is 23 years with 11 members enough for regional skill?

Accuracy of rainfall above median in JJA (1 month lead)

POAMA (11-member set 1)



POAMA (11-member set 2)

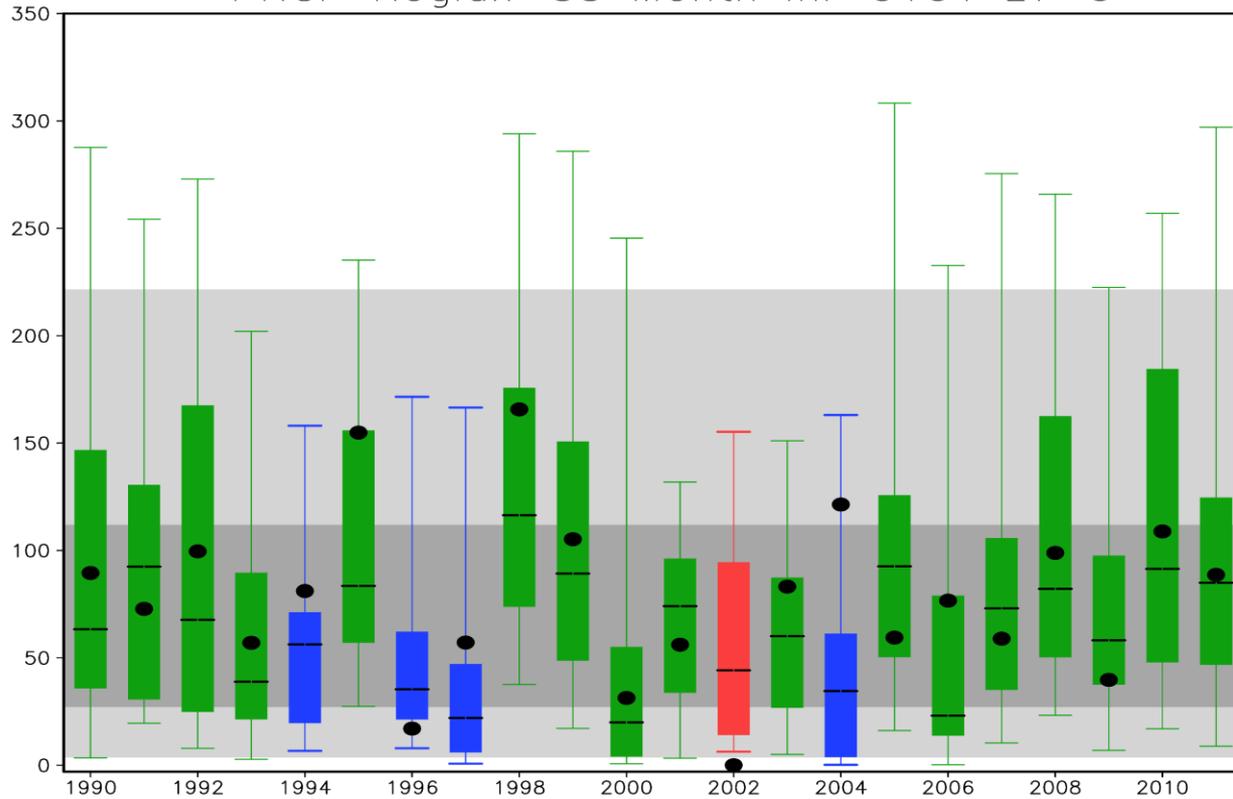


Model Past Performance

Biloela – Valbona: Forecast for January starting on 1st Jan

PRCP RegIdx=33 Month ini=0101 LT=0

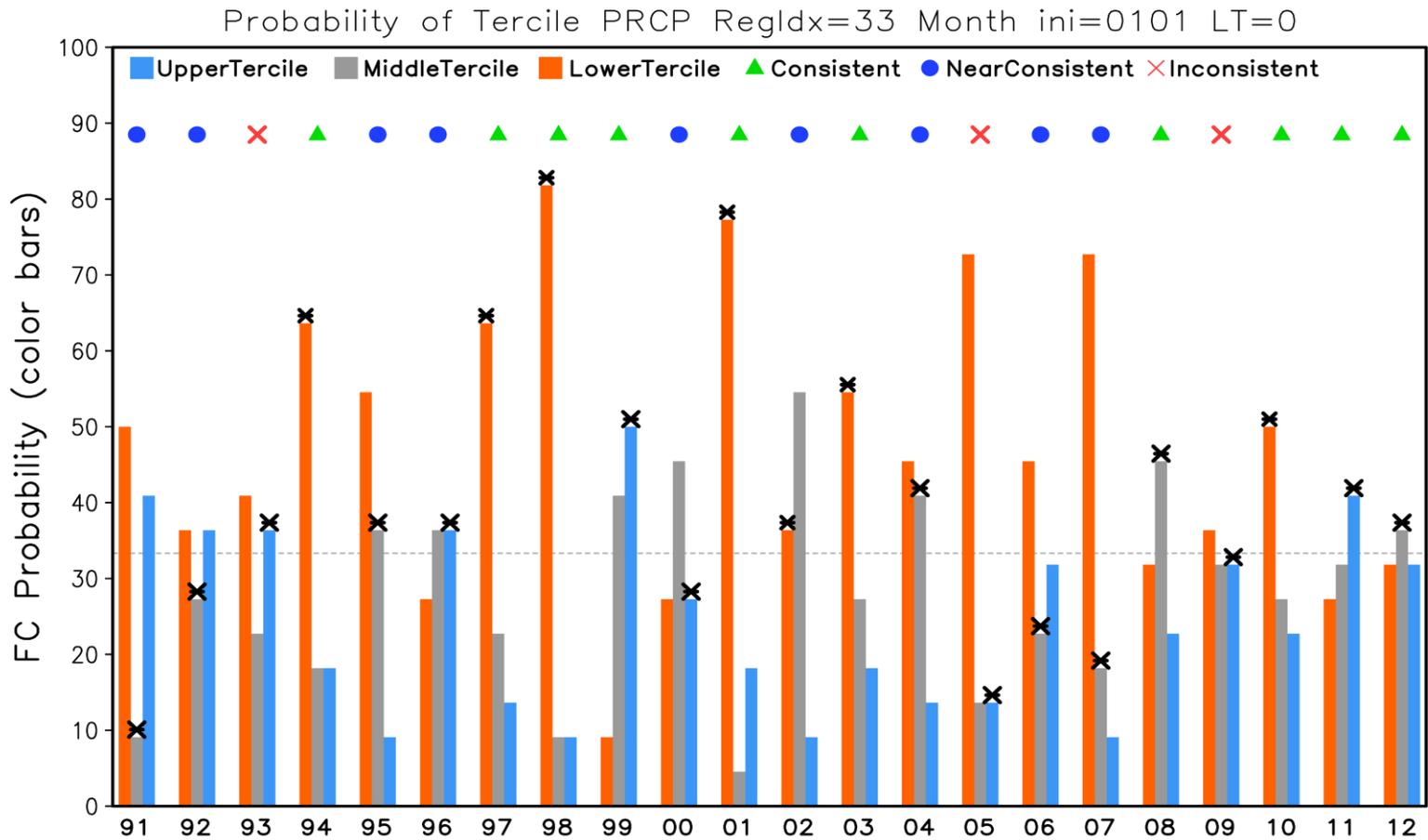
Rainfall



From Debbie Hudson/Li Shi

Model Past Performance

Biloela – Valbona: Forecast for January starting on 1st Jan



From Debbie Hudson/Li Shi



Summary

Agriculture can significantly benefit from accurate multi-week/seasonal forecast (~\$1.5 b/pa)

A range of products have been prototyped with users + positive feedback

Calibrating data daily to 5km over Australia was critical for seamless consistent products across scales (need tackle NWP in the future)

Applications case studies:

- Ask Bill tailored to decision faced by Sheep Farmers (farming decisions not weather decisions)
- Queensland floods – Week 2 advance warning – can we do better in the future ?
- Large range of extremes products (e.g. quintile probabilities, plumes etc)

Measuring and conveying skill remains a major issue