

Climate Outlook Services

What are they, how can you build one, how it takes time and effort, and why it is worth it!

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Overview

- What is a climate service?
- Why are climate services critical?
- Example of a climate service
- Engaging with users
- Example of a current researchto-operations project

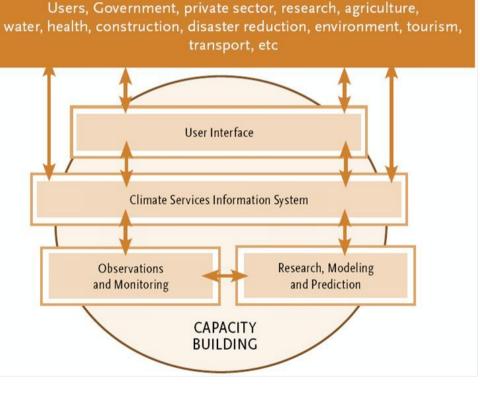






What is a Climate Service?

- Climate Services assist decision
 making
- They require engagement and respond to user needs
- Based on high quality, reliable, supported data
- A constant two way 'conversation'
- Provide context
- May be combined with non-met data, or feed into non-met systems



http://www.wmo.int/gfcs/what are climate weather services



Benefits of improving the service

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

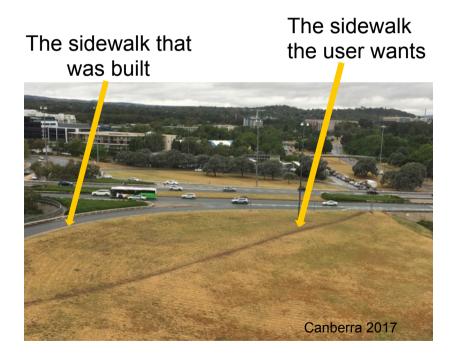


Why consult?

No matter how accurate a weather forecast or climate outlook is:

- If it doesn't provide information users need
- If it isn't issued when users are making their critical decisions
- If it is misinterpreted
- If it cannot help make a decision....

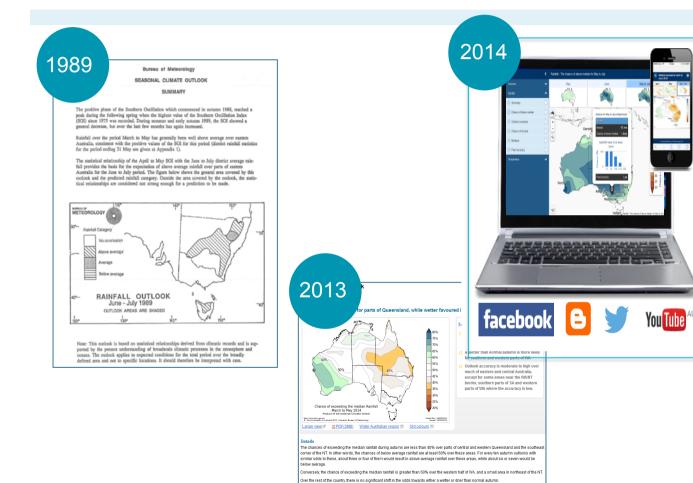
*The forecast has little real value





Australian Government Bureau of Meteorology

History of Australia's climate outlook service



2018



A drier spring likely for large parts of Australia

Spring (September to November) is more likely to be drier than average for southvest WA, most of SA, the southern NT, initian NSW (vest of the divide), Victoria, Tasmania, and northern Queensland. Elsewhere, there are roughly equal chances of a vetter or drier than average three months, meaning

there is no strong indication either way that it will be particularly wet or dry. September is likely to be drier than average in western WA, the Top End and eastern parts of the NT,

Queensland, northeast NSW, most of Tasmania, and Victoria as well as adjacent areas across the border in NSW and SA.

Much of eastern and southern mainland Australia have experienced a very dry winter and start to the year, so an outlook with increased chances of drier conditions indicates areas currently experiencing drought are less likely to see significant resplicit in the coming three months.

Historical outlook accuracy for September to November is moderate to high over most of the country

except for western WA where accuracy is low to very low. See map for more detail.

2019 FORTNIGHT WEEK

Over the rest of the co

Climate Indiances
He Hinks-Solution (EHSO) remains neutral, with the majority of atmospheric and oceanic indicators slose to their forsy-term
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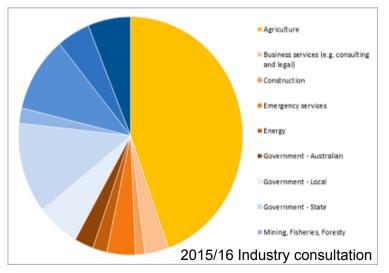
The Indian Ocean Dipole is typically too weak to have a significant influence on the Australian climate during the autumn period.



Various rounds of industry stakeholder engagement at BoM

- What climate/weather sensitive decisions are made?
- When are these decisions made?
- What lead time is needed?
- What type of data is needed?
- What is the best way to supply data?
- (What's your internet speed?)
- Do people understand the information?
- Are there gaps?
- Preferences for outlook types & presentation
- Preferences for accessing climate information
- Gauge satisfaction
- Showing some 'blue sky' ideas...
- Can we come back and talk again?
- Is this what would help you?







Some key findings...

Users told us they wanted:

- Overview simple outlook
- Advanced outlook ability to tailor and drill into data
- Past accuracy information
- Video climatologist explains the outlook
- Data to feed into decision-support model



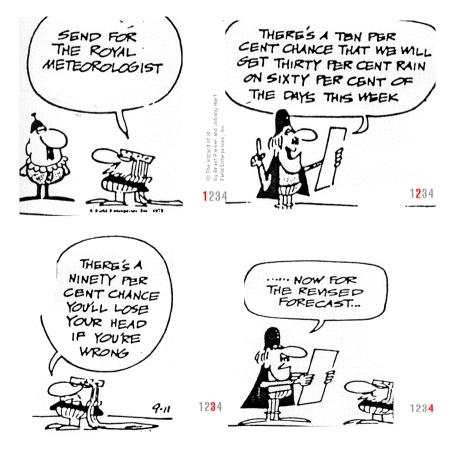




Some key challenges...

Understanding probabilities

2015/16 engagement: User comprehension is linked with user satisfaction i.e. those that answered comprehension questions incorrectly were 3 times as likely to be dissatisfied with the service



Conveying accuracy/skill



- Ensemble verification is complicated. How best to convey?
- Forecast quality does not necessarily reflect value
- Summary skill measure average skill over hindcasts. Does not show how skill changes over time (windows of forecast opportunity)
- Large sampling uncertainty around scores for quantities that are of most interest to the user e.g., regional rainfall
- Hindcast ensemble size (e.g., 11-members) is considerably smaller than real-time (e.g., 99-members)
- The years included in hindcast period will influence the skill
- Observational data available for data assimilation becomes more sparse as go back in time (quality of initial state influences forecast skill)

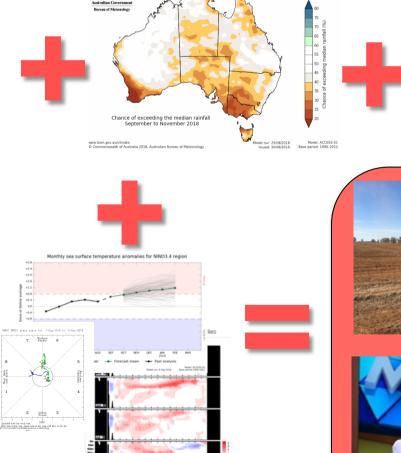
Challenge: Models becoming more computationally expensive – constraints on hindcast size – Number of years, number of start dates per year and ensemble size



What is a BoM Climate Service? Seasonal Outlooks



- Talking with users
- Outlook probabilities
- Accuracy/skill measures
- Uses climate driver analysis
- Provided on time, every time
- Delivery via multi channels





Accuracy: chance of above median rainfall eptember to November (initialised: 25 August



Rural RnD4Profit Project: Forewarned is forearmed



Department of Agriculture and Water Resources

Forewarned is forearmed: managing the impacts of extreme climate events



Managed by Meat and Livestock Australia; 17 collaborating partner organisations; 2017-2022

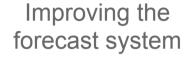


1. The foundation



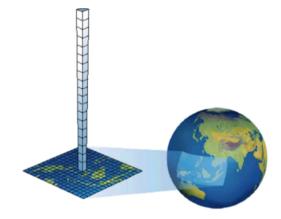
Department of Agriculture and Water Resources

Assessing user needs



Underpinning science





PHASE 3 167 days

Rural RDC & other partners Meat and Livestock Australia LTD Grains RDC Sugar Research Australia LTD Cotton RDC Rural Industries RDC Dairy Australia LTD Wine Australia Australian Pork LTD Suncorp

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

Work package 1: User needs and Forecast system development



Assessing user needs



What kind of extreme?

Critical times of year

How far in advance do you need to know?

A run of very hot nights in September is bad for

I really need to know if Oct-Dec is going to be a very wet season. Ideally I need to know this by July. If I knew, then I could make decisions to ...

Early frosts have a very negative impact. If I knew there was an increased likelihood of a frosts more than one week in advance, I could....

Critical timescales (weeks/months/seasons)

Prolonged heavy rain in October is..... If I knew there were going to be more than average extremely wet days I could.....

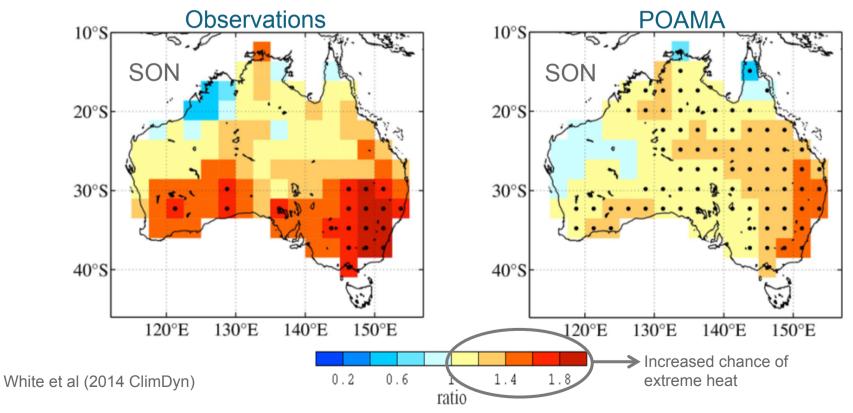




Underpinning science e.g. ENSO

Increased chance of heat extremes during El Niño especially in Spring

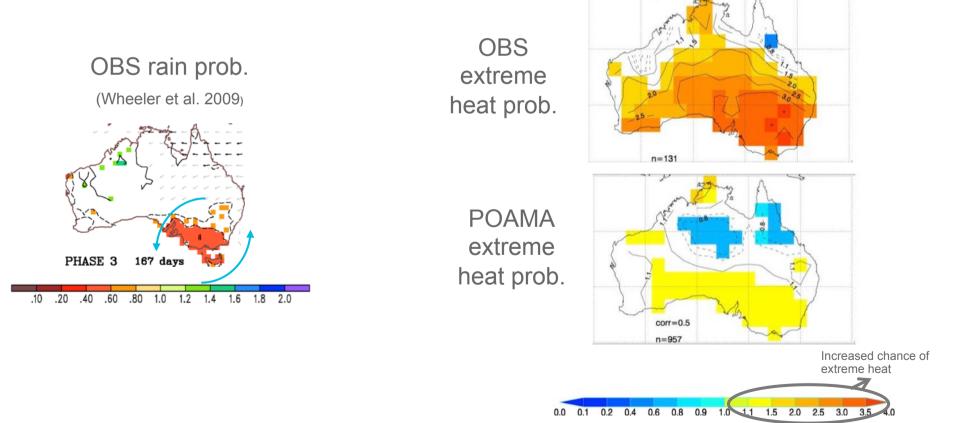
Heat extreme: weekly-mean Tmax anomaly in decile 10 (above 90th percentile)



Probability of weekly mean Tmax exceeding the 90th percentile, expressed as ratio to the mean probability



Spring season (SON) when MJO in phase 3



Probability of weekly mean Tmax exceeding the 90th percentile, expressed as ratio to the mean probability



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2. Developing and delivering forecasts





Lat: -37.81 / Lon: 144.96

- Develop a range of heat, cold and rainfall experimental extremes forecast products from ACCESS-S;
- Evaluate the accuracy and utility; .
- Make experimental products available on a research web server for trial and feedback; .
- Deliver operational forecasts on the BoM public webpage for a subset that have sufficient accuracy • and utility.



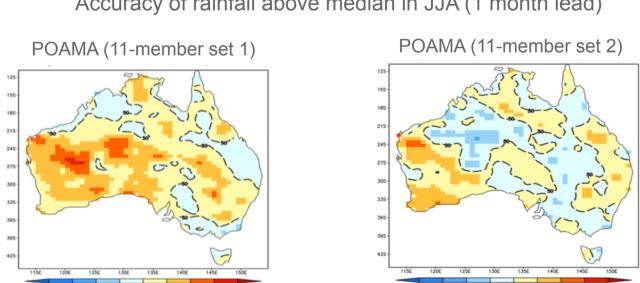
I want to know the skill for my region!

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

To assess skill for a particular month or season



Is 23 years with 11 members enough for regional skill?

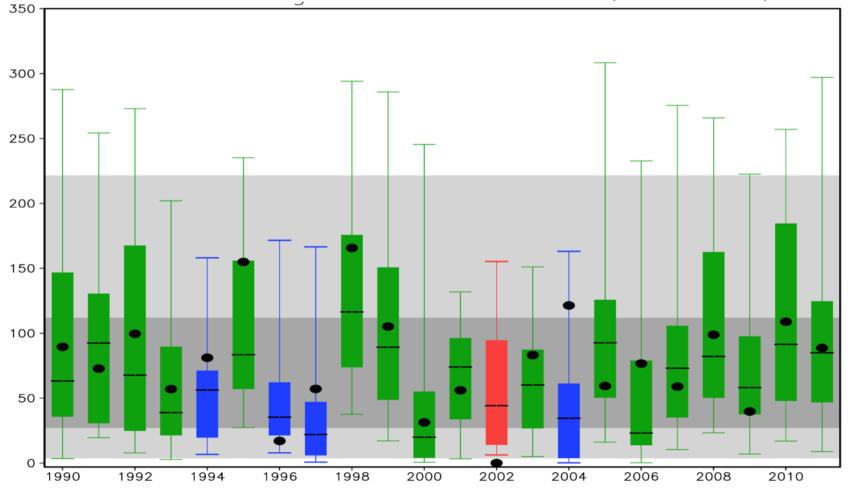


Accuracy of rainfall above median in JJA (1 month lead)



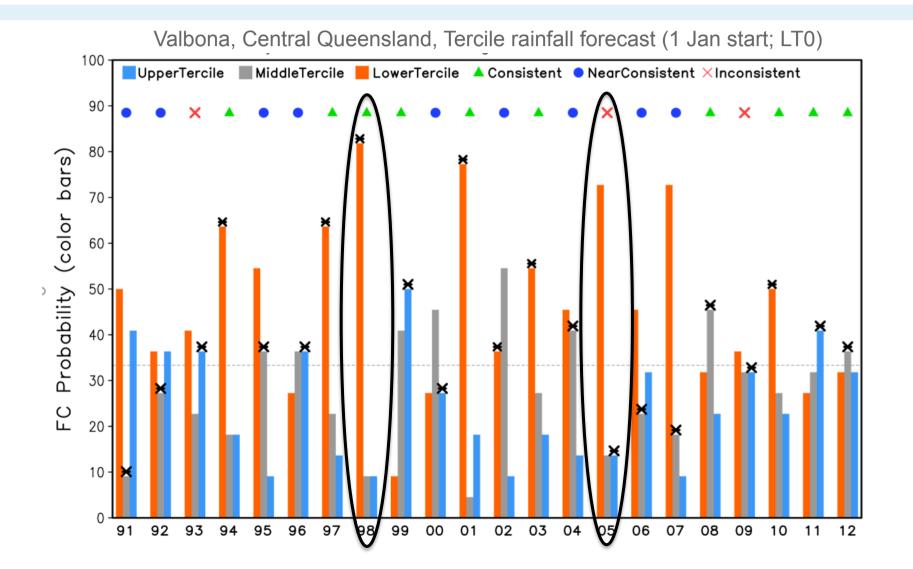
Show past cases....

Valbona, Central Queensland, Accumulated rainfall (1 Jan start; LT0)





Show past cases....





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3. Linking forecasts and user decisions



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





Work package 3: Interfacing to Industry decisions



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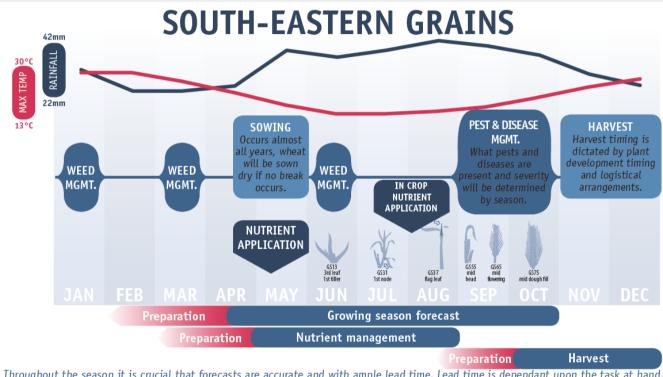
Bureau of Meteorology

Linking forecasts and user decisions



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SOWINGNUTRIENT MANAGEMENTWEED MANAGEMENTHARVESTCultivar or variety may be altered due to seasonal conditions. Available soil moistur 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:- week and multi-week for logistics- week and multi-week for logistics- week and multi-week for logistics- May to October forecast for cultivar and variety decisions- August to October for application and rate variety decisions- August to October for application and rate	initiougnout the season it is the	ependant upon the task at nand.		
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5 11	- week and multi-week for logistics	- week and multi-week for logistics	- week and multi-week for logistics	- week and multi-week for logistics
variety decisions	- May to October forecast for cultivar and	- August to October for application and rate		
	variety decisions			



4. Extension and training



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Work Package 4: Extension and training





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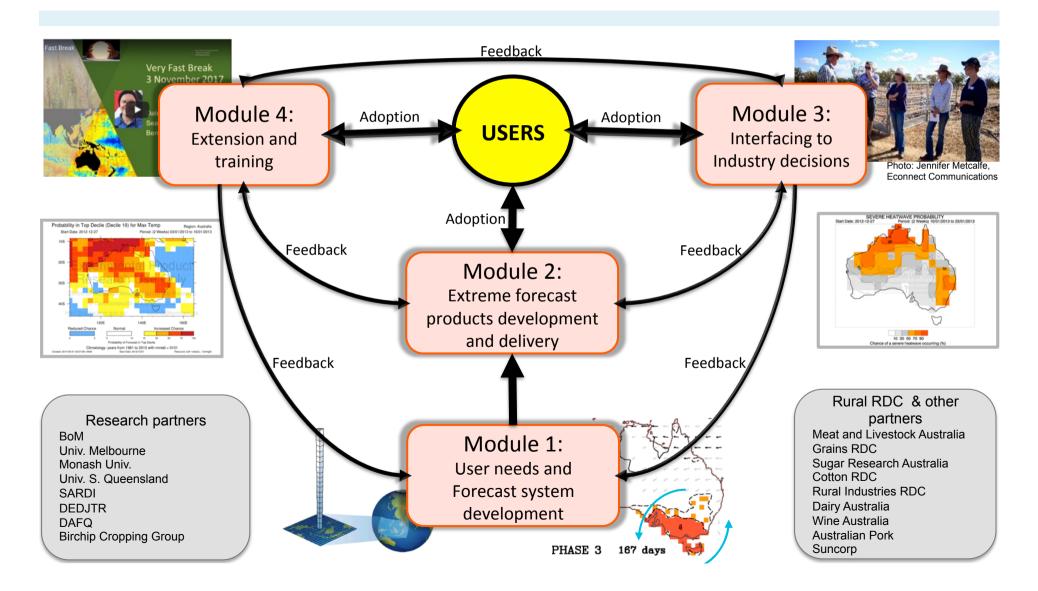


Rural RnD4Profit Project: Forewarned is forearmed



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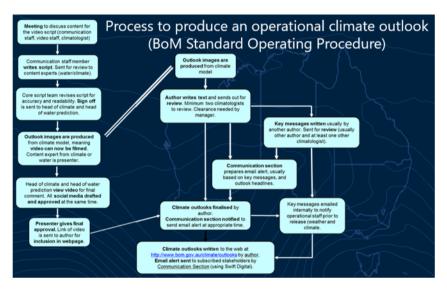
So how can I make my research 'service ready'?

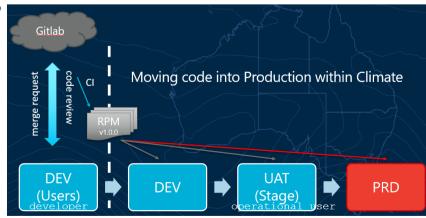


Not all research should be purely aimed at a service! But...

Within the limitations of the science:

- Think about the end user talk with them about needs
- Ensure that ultimately your work satisfies a user 'pull'
- How will the service 'survive' past your project?
- Is the **code** written in a 'supported' language?
- Is the **code documented**? Archived/packaged/reviewed?
- Is the code/system to produce the product transferrable?
- Are the outputs accessible (e.g., WCAG2.0)?
- Can you re-assess the outputs with users?
- Is there a **feedback** mechanism?







Summary

A Climate Service

- is a step up from a climate map or climate data
- is driven by user needs and user decision making
- turns data into information and intelligence
- is adaptable and transferrable; it should be made to survive into the future without your personal assistance
- is HOW you extract value from climate research and products



https://www.meted.ucar.edu/training_module.php?id=1247