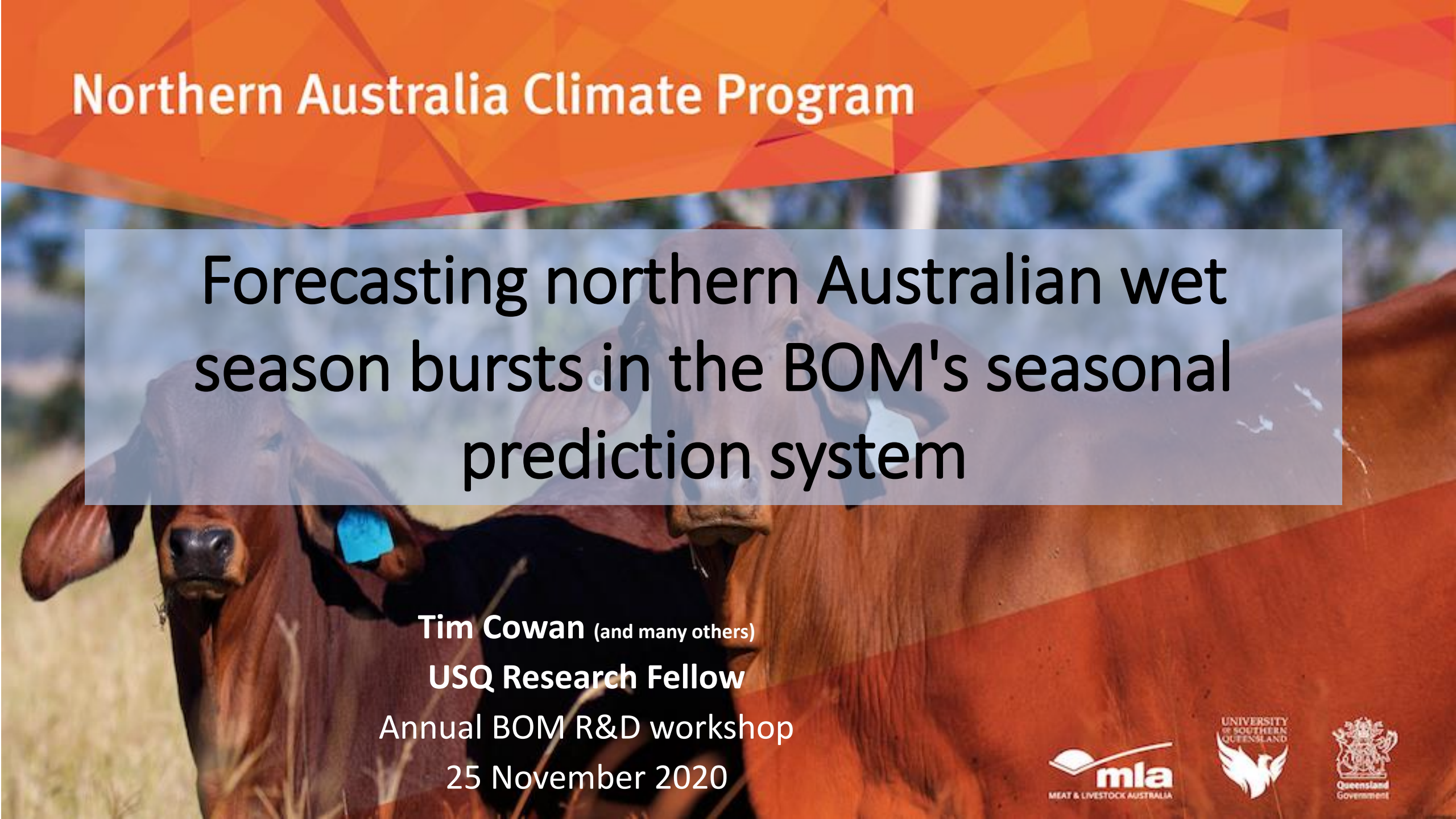
Northern Australia Climate Program

Forecasting northern Australian wet season bursts in the BOM's seasonal prediction system



Tim Cowan (and many others)

USQ Research Fellow

Annual BOM R&D workshop

25 November 2020

mla MEAT & LIVESTOCK AUSTRALIA

UNIVERSITY OF SOUTHERN QUEENSLAND

Queensland Government

Northern Australian Climate Program

Aim: Improve the drought preparedness and resilience of red meat and livestock producers across northern Australia

Research

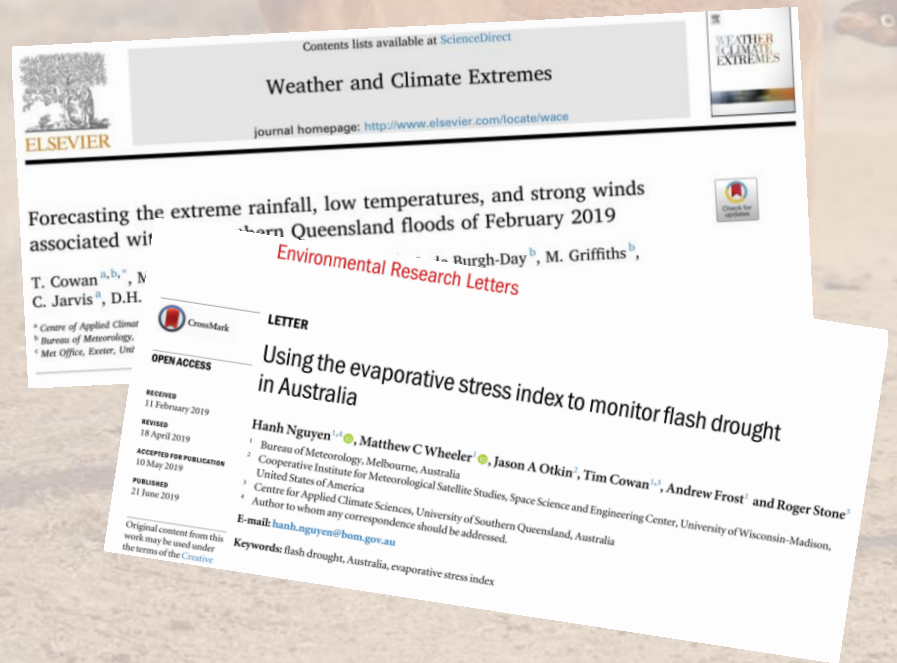
Improving forecasts

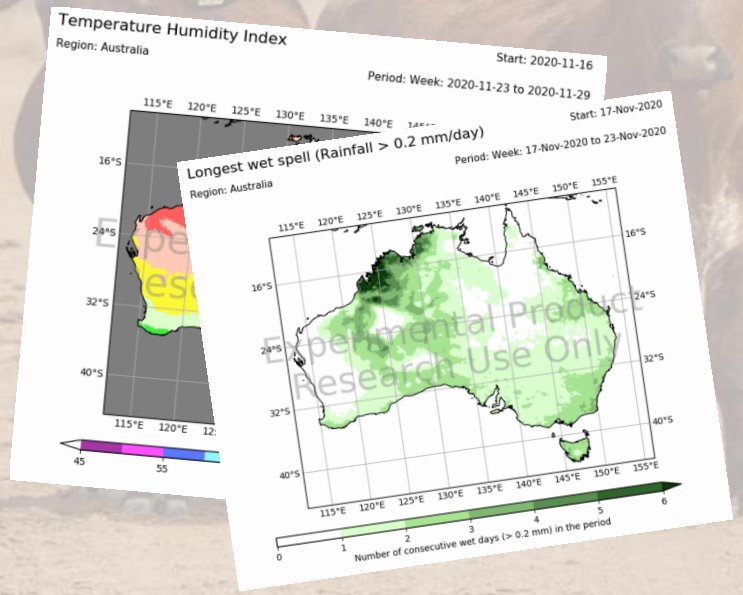
Development

Developing tailored products

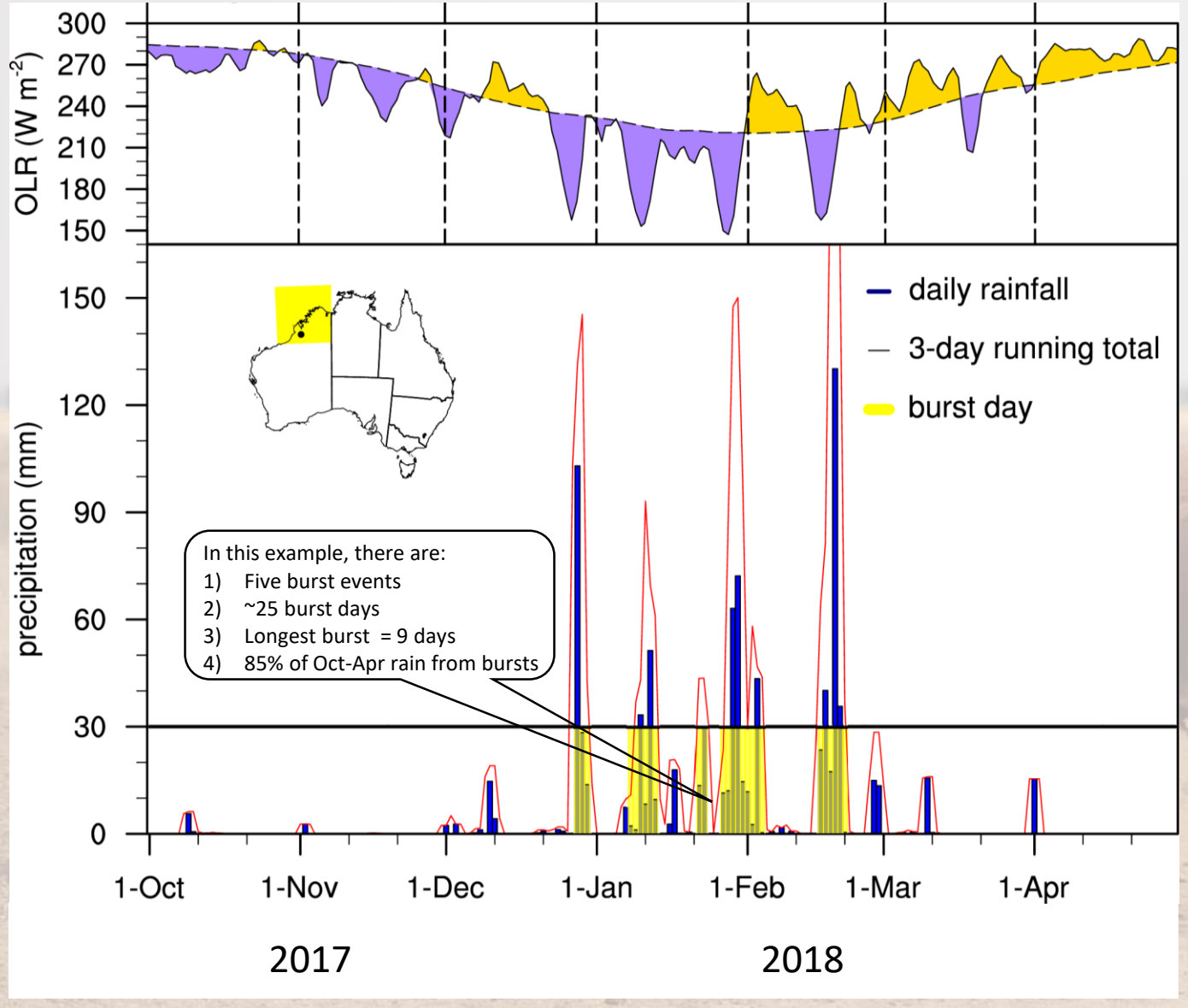
Extension

Deliver climate service to regional communities

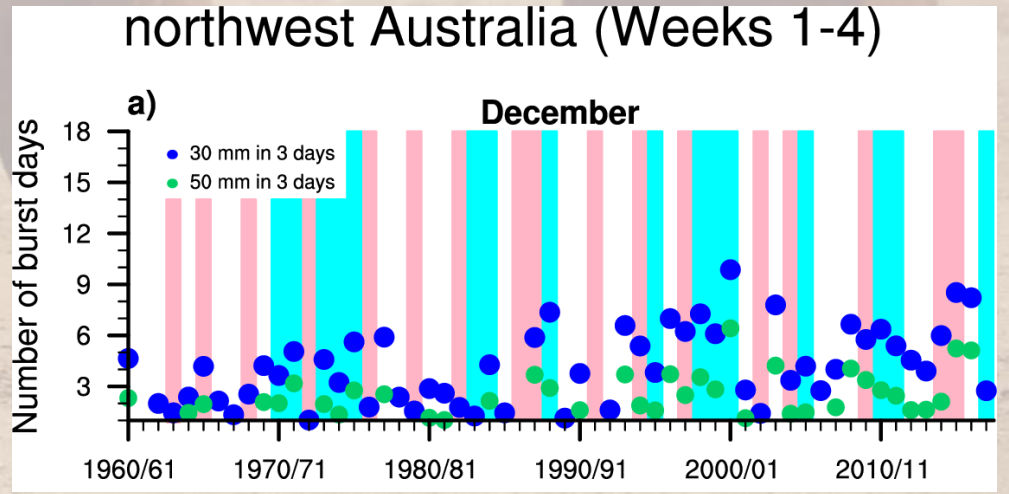




Northern Aust. rainfall bursts



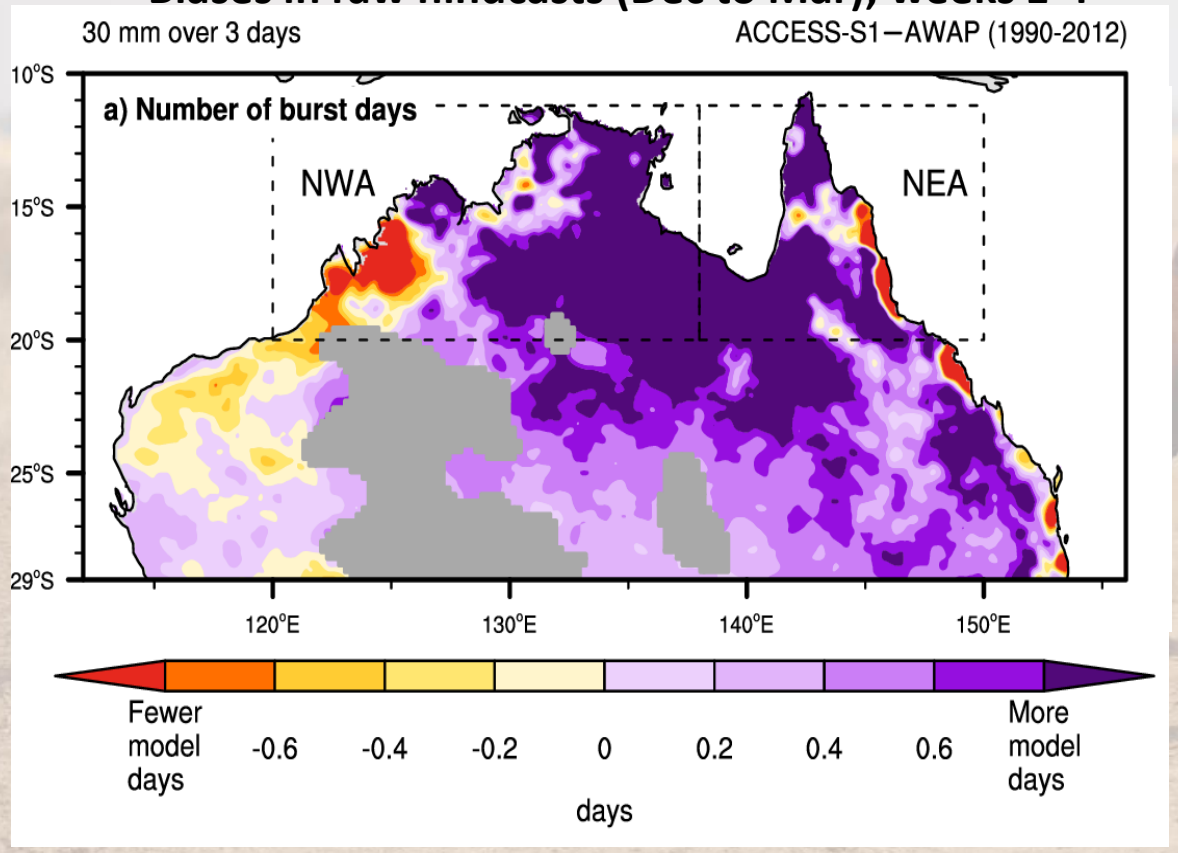
- Rainfall bursts: "*wide-spread, soaking rain spread over a few days*".
- Bursts sustain summer pasture growth, allowing beef industry to exist across northern Australia's semi-arid tropics.
- First wet season bursts: used to define a green date, when there is sufficient new pasture growth for livestock foraging.
- Currently there is no operational burst forecast product (just a prototype).
- **Burst definition** needs to be **simple to understand** and able to be **modified to suit different regions**.



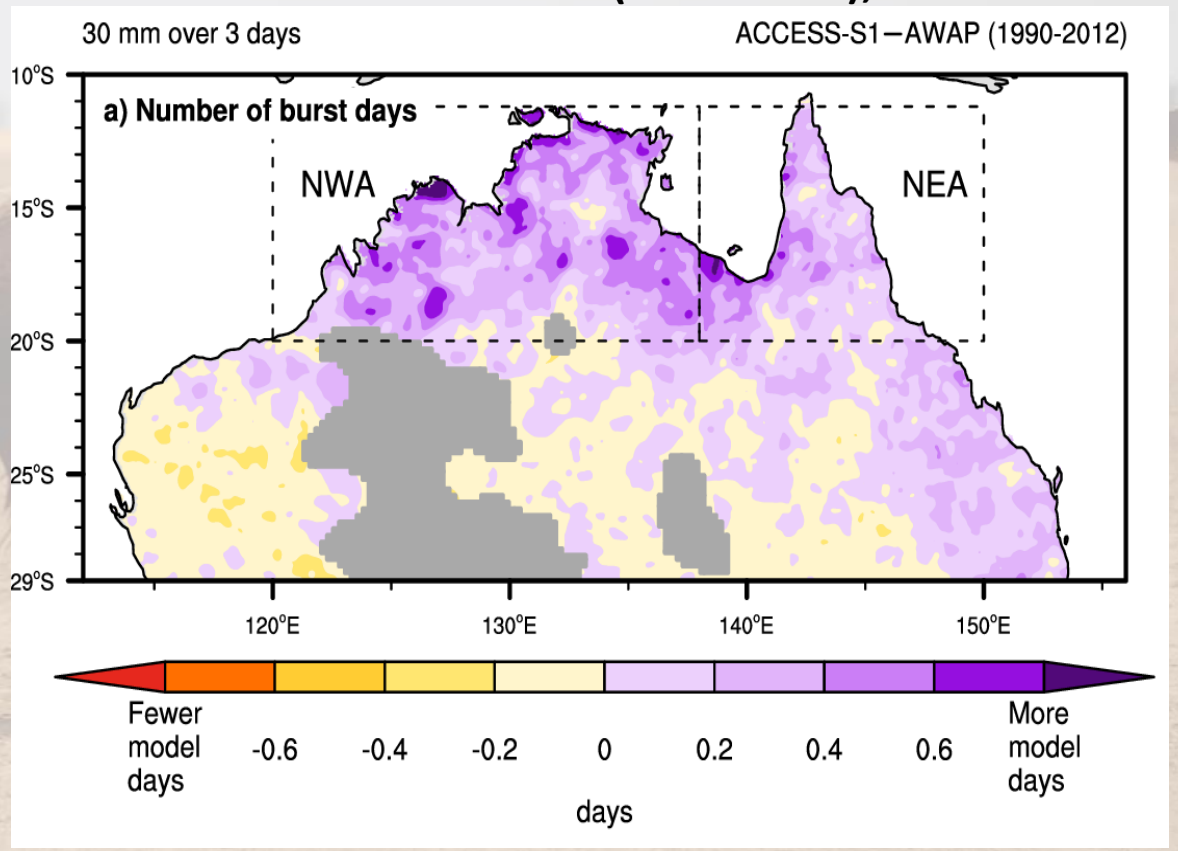
Evaluating burst biases in ACCESS-S1 (Dec-Mar)

- Utilise an 11-member hindcast ensemble with four start dates per month (**1st**, 9th, 17th, 25th).
- Hindcast period: 1990-2012.
- Focus on the first 28 days of the hindcast (weeks 1 to 4), based on predictive skill of MJO (Marshall et al. 2019).
- Use hindcasts calibrated to observations (5 km resolution) that remove biases.

Biases in raw hindcasts (Dec to Mar); weeks 1-4

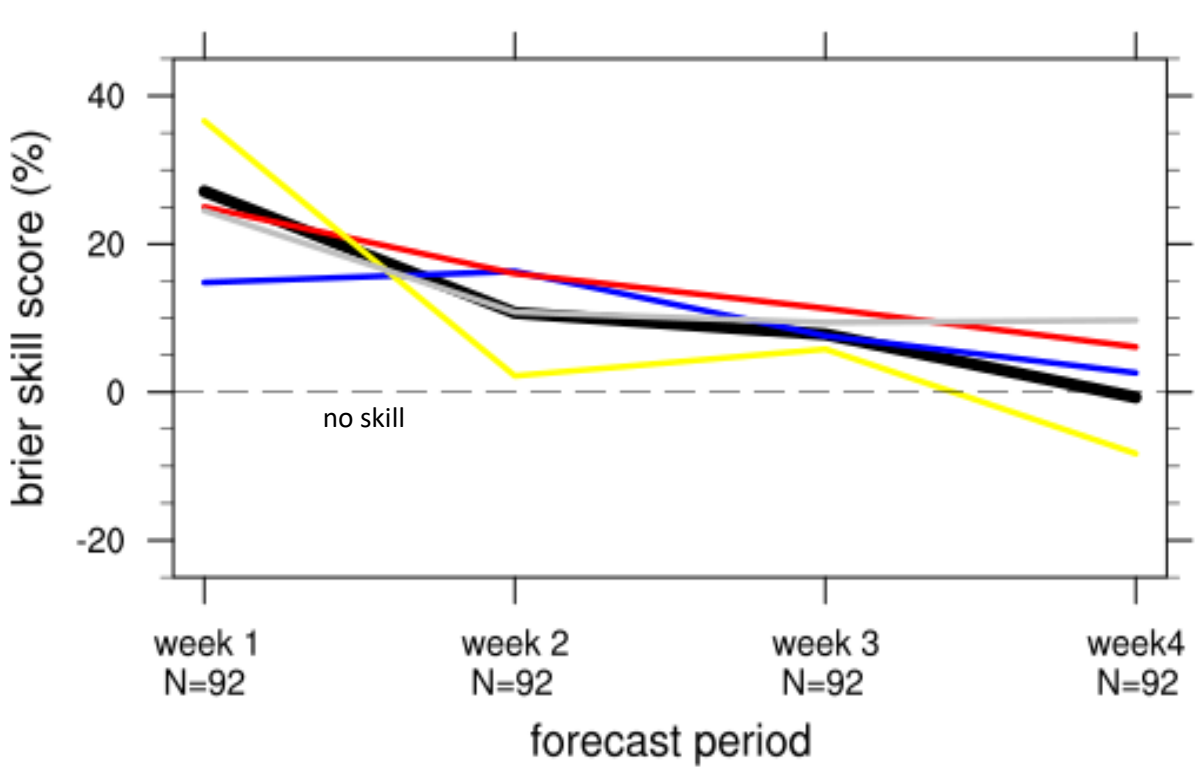


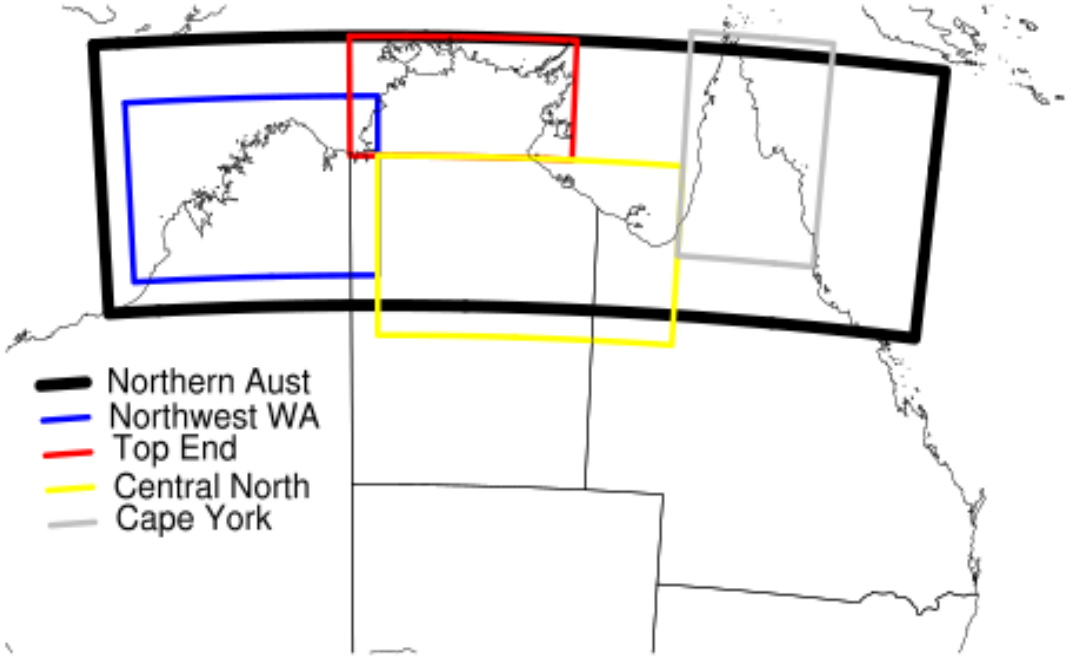
Biases after calibration (Dec to Mar); weeks 1-4



Burst event skill assessment

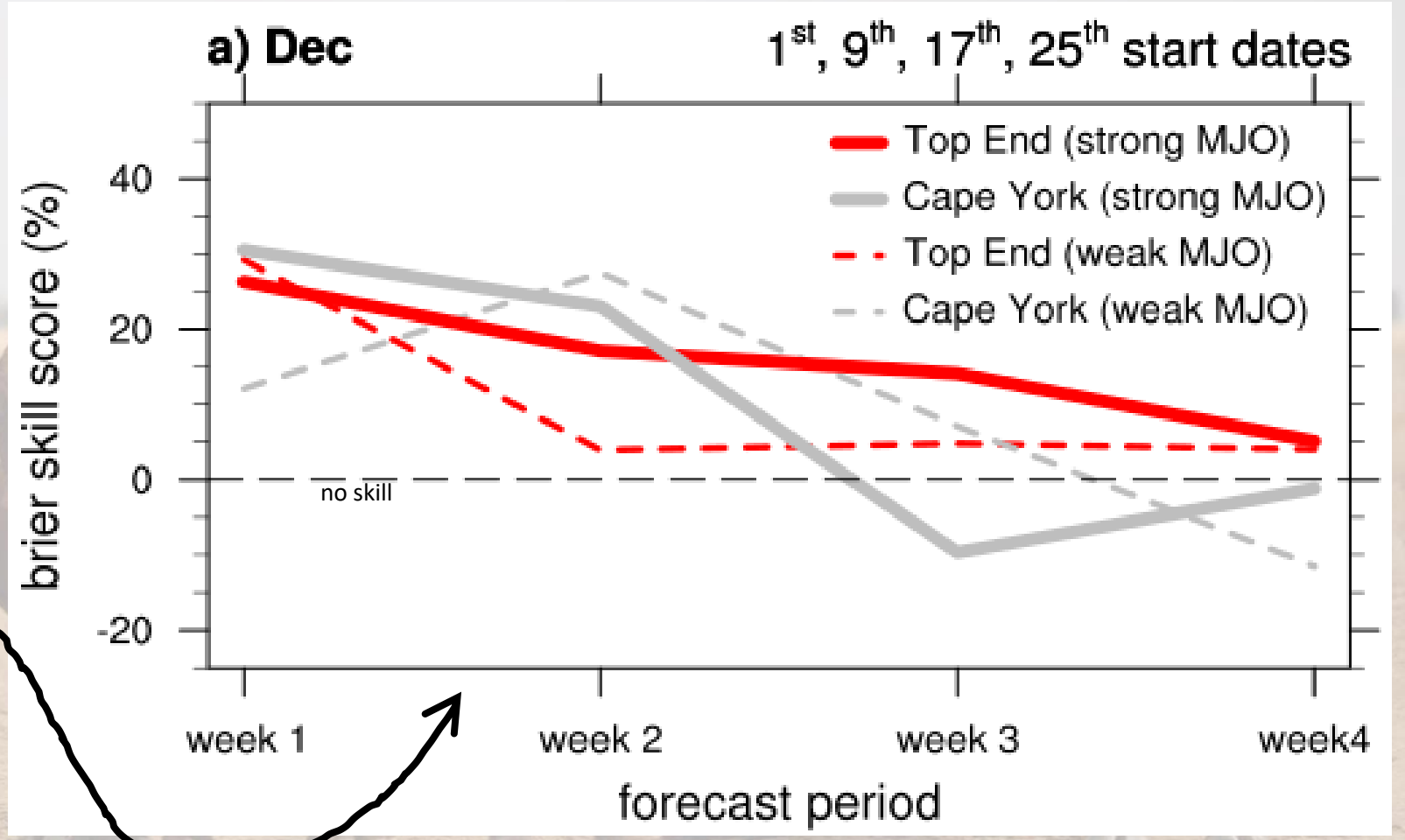
- **<u>Brier Skill Score</u>: the relative skill of a prediction over a climatology forecast.**
- Below: What is the skill in predicting a burst event in the forecast period (e.g., days 1-7, days 8-14, etc.)?
- Tested for 1st start dates for Dec-Mar over 1990-2012 (N = 92) across northern Australia and four subregions.





MJO influence on hindcast skill of bursts

- ACCESS-S1 skilfully predicts the MJO out to ~28 days (Marshall et al. 2019).
- We test whether a prediction of strong MJO amplitudes (> 1.2 for 7 days) or weak MJO amplitudes (< 1.2 for 7 days) enhances burst prediction skill.
- We focus on combining four start dates, looking out to week 4 for Cape York and the Top End.
- Results suggest any skill in burst prediction that arises due to the MJO amplitude is highly regionally dependent (confirms observations from Berry & Reeder 2016).



New burst product on the BOM's Forecast Visualisation Tool

NACP View
ACCESS-S1

Forecast / Hindcast

Forecast Start Date: 2020 | Nov | 13

Feedback

General Products

Climate Drivers
- > Ocean SST indexes

Basic Charts
- > Atmospheric Maps
- > Probability scenarios
- > Ocean Maps

Regions Stations
- > Climagram with OBS
- > Climagram
- > 30 day Meteogram
- > Pie Charts

NACP Project

MJO
- > MJO phase diagram

Monsoon
- > Rainfall Onset
- > **Burst potential map**

Flash Drought
- > Flash Drought Index

Cold Extremes
- > Chill Index (southern livestock) Potential
- > Mean number of Chill Index (southern livestock) days

FWFA Project

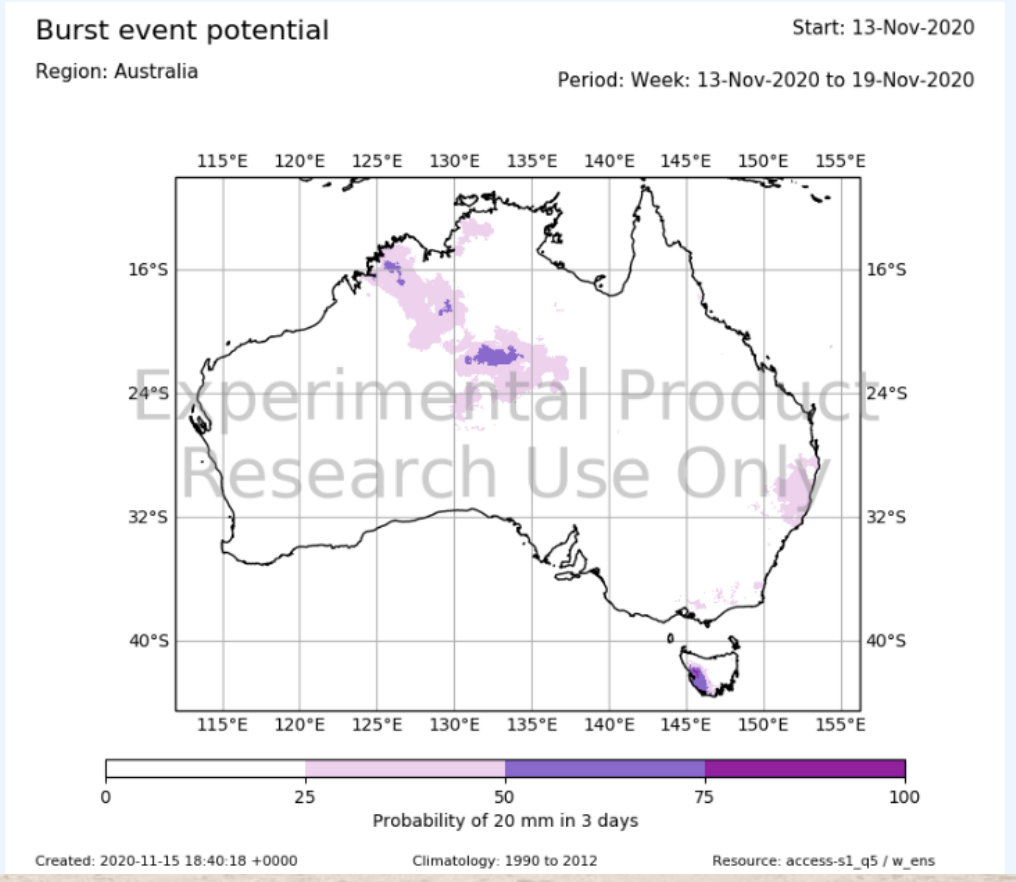
General Products
- > Top/bottom decile maps
- > Daily distributions
- > Decile bars
- > Hot & Cold days plume

Heat Extremes
- > Heat wave map
- > Hot days map
- > Mean number of hot days
- > Hot days plume (stations)
- > Temperature-humidity (THI) maps
- > Temperature-humidity (THI) daily distributions (stations)
- > Mean number of THI days
- > THI probability scenarios

Cold Extremes
- > Cold wave map
- > Cold days map
- > Mean number of cold days
- > Cold days plume (stations)
- > Frost potential map

Product Characteristics

Variable: Rainfall | Domain: Australia | Forecast Period: Week 1 | Output Options: Probability of 20 mm in 3 days



http://poama.bom.gov.au/access-s1/nacp/

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Product Characteristics

Potential for a burst event to start in the coming weeks and fortnights

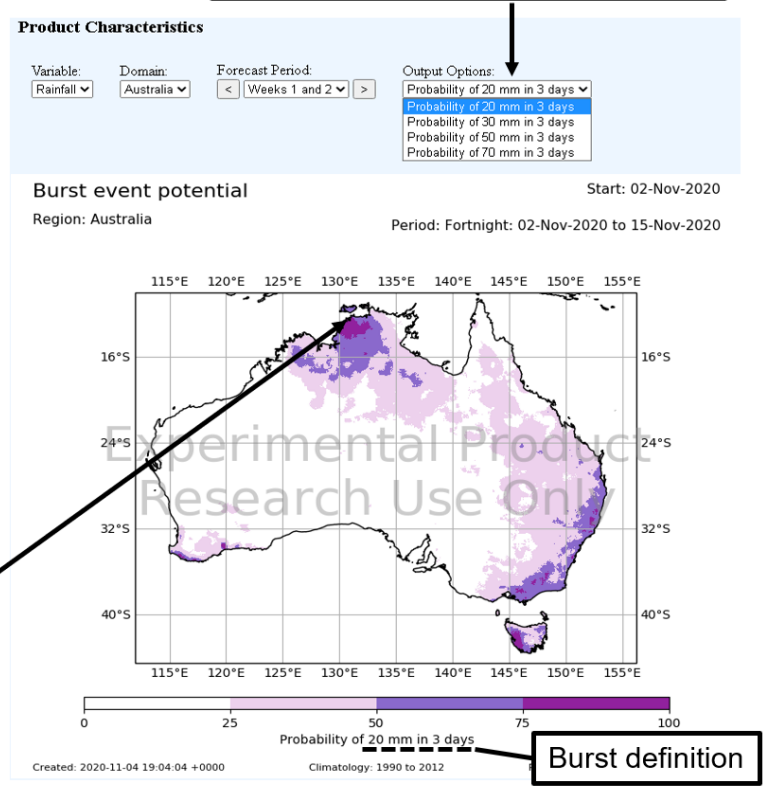
A burst event is an accumulation of rainfall over a threshold amount in a 3-day period (e.g. a 20 mm in 3 days burst event means at least 20 mm of rain falls over that three day period).

The maps display the potential for a rainfall burst event to start in the forecast period. Burst event potential is the percentage of ensemble members that predict a burst event. A burst can extend across two forecast periods.

Different thresholds can be selected from the far right drop down menu.

There is a 75 to 100% chance of a "20 mm in 3 days" burst event occurring at Darwin in this fortnight.

Different thresholds can be selected: 20 mm, 30 mm, 50 mm, 70 mm



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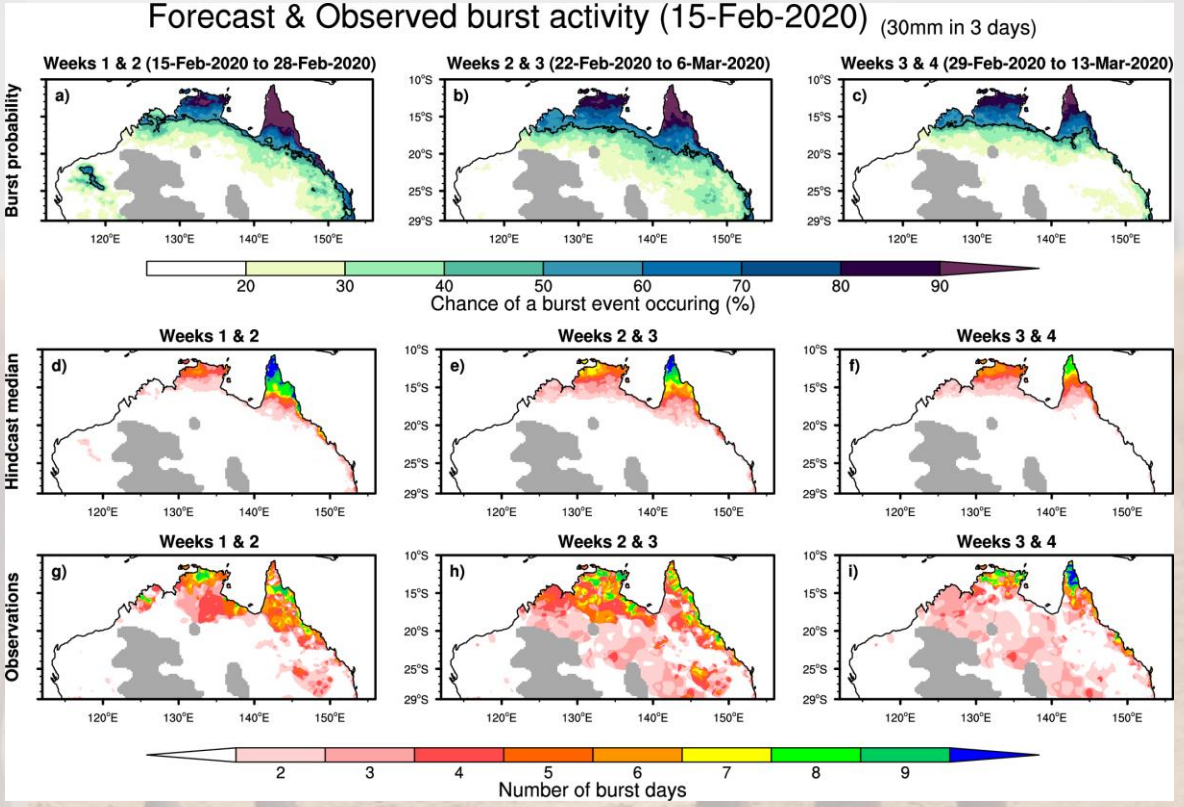
http://poama.bom.gov.au/access-s1/nacp/

Summary points

- **Burst potential product:**
  - Burst prototype forecast product is now available, providing forecasts for weeks 1 to 3 and fortnights 1 to 3.
  - Despite ACCESS-S1 overestimating burst activity, it shows good skill, out to week 3, with improved skill in the far north.
  - Enhanced predictive skill in early-mid summer bursts over the Top End when ACCESS-S1 predicts strong MJO. Opposite true for Cape York.
- **Next up:**
  - Verifying burst activity for 2020/21.
  - Developing a green date and/or cessation date products from a seasonal perspective (lead time → months to seasons).



Any questions?

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