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

Tim Cowan (and many others)
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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
Burst event definition: 30 mm in 3 days

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.

In this example, there are:
1) Five burst events
2) ~25 burst days
3) Longest burst = 9 days
4) 85% of Oct-Apr rain from bursts

**northwest Australia (Weeks 1-4)**

- Number of burst days
- 30 mm in 3 days
- 50 mm in 3 days
- December
Evaluating burst biases in ACCESS-S1 (Dec-Mar)

- Utilise an 11-member hindcast ensemble with four start dates per month (1st, 9th, 17th, 25th).
- 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.
Burst event skill assessment

- **Brier Skill Score**: 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**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Domain</th>
<th>Forecast Period</th>
<th>Output Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Probability of 20 mm in 3 days</td>
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</tbody>
</table>

### NACP Project
- **MPO**
- **Monsoons**
- **Rainfall**
- **Burst potential map**
- **Flash Drought**
- **Flash Drought indices**
- **Cold Extremes**
- **Chill index (October-November) Potential**
- **Mean number of Chill index (October-November) days**

### FWEA Project
- **Top boother decile maps**
- **Daily distributions**
- **Decile bars**
- **Heat & Cold days plane**
- **Heat Extreme**
- **Heat wave map**
- **Hot days map**
- **Heat wave plane (national)**
- **Temperature-humidity (T-H) plane (national)**
- **Days outside of THI days**
- **Heat probability scenario**
- **Cold Extreme**
- **Cold wave map**
- **Cold days map**
- **Cold wave plane (national)**
- **Days outside of TCI plane**
- **Cold probability scenario**

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.
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:**
- Developing a green date and/or cessation date products from a seasonal perspective (lead time → months to seasons).
Any questions?

Tim Cowan
University of Southern Queensland
(based at Bureau of Meteorology)
Tim.Cowan@bom.gov.au