A NACP climate roadshow in Queensland's Gulf Country

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The Approach

In the last week of August during the 2022 dry season, climate researchers Dr Chelsea Jarvis (University of Southern Queensland) and Dr Andrew Marshall (Bureau of Meteorology) travelled to northwest Queensland as part of the Northern Australia Climate Program (NACP)[1] to give tailored climate talks at five of the seven Gulf Country cattle stations owned by the Stanbroke integrated beef and cattle company[2]. The station visits comprised Fort Constantine (Monday 29th August), Kamilaroi and Donors Hill (Tuesday 30th), Glenore (Wednesday 31st), and Augustus (Thursday 1st September).

After a very dry start to the year in what was expected to be a La Niña-driven wet monsoon season, the Stanbroke group were thirsty for knowledge about the climate drivers of influence for their region and how best to access and use weather and climate forecasts across a range of key decision-making timescales.

We set out with enthusiasm and a full itinerary comprising five 2.5-hour presentations over four days (including two talks at 6:30 am), totalling just over 1,200 km and almost 14 hours of driving (Fig. 1). Or 16 hours of driving if you include the turn-offs we missed on the Monday and Wednesday.

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[1] NACP (nacp.org.au) is a partnership between the Queensland Government (with funding from the Drought and Climate Adaptation Program), Meat and Livestock Australia, and the University of Southern Queensland, to bring together expert climate scientists, advisors, and regional producers to deliver innovative research, development, and extension outcomes for helping the grazing industry manage drought and climate risk across northern Australia.
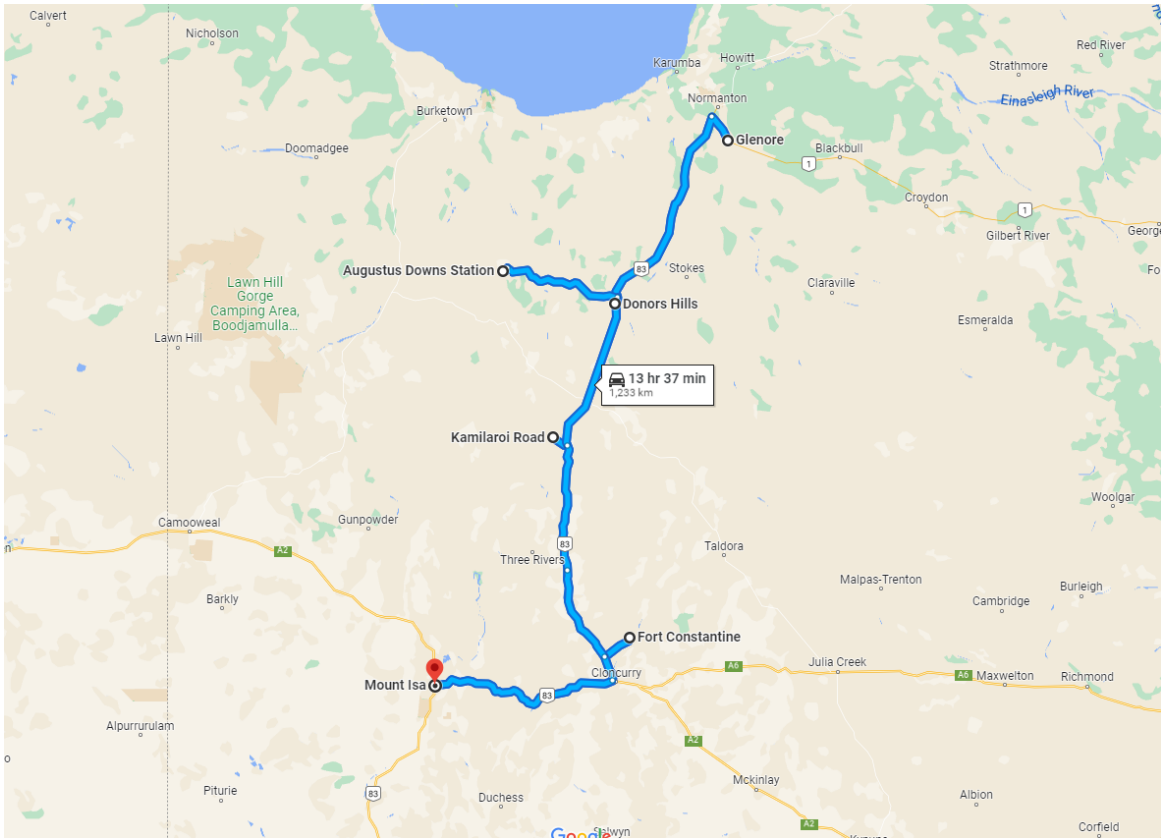
[2] https://www.stanbroke.com/

Fig. 1: Itinerary for the NACP roadshow in Queensland's Gulf Country (source: Google Maps).

The Delivery

The drive from Mt Isa to Fort Constantine on the Monday was visually spectacular, not just for the semi-arid landscapes but also for the electrical storm brewing on the horizon. After skirting some light rain on its eastern edge, we learnt this was part of a severe weather system making headlines in the Northern Territory and bringing 51 mm of rain to nearby Camooweal[3]. In the coming days we were to pore over the satellite image and weather chart, noting the system's resemblance to a northwest cloudband and its likely association with the negative Indian Ocean Dipole (IOD) event currently underway.

It is unusual for the IOD to have such a pronounced impact in this part of the country, with the major climate influencers being the Madden-Julian Oscillation (MJO) on the multi-week timescale and the El Niño–Southern Oscillation (ENSO) on the seasonal timescale. These two drivers were the focus of our presentations through the week, particularly the MJO which was the lesser known of the two throughout the stations.

[3] https://www.abc.net.au/news/2022-08-30/freak-storms-lashes-the-barkly-homestead-nt/101387250

We highlighted the importance of the MJO for the Gulf Country with a summary of its impacts on rainfall primarily during the build-up (October-December) and mature (January to April) stages of the wet season, its impacts on daytime and overnight temperatures throughout the year, its modulation of tropical cyclone activity, and how its own behaviour changes during El Niño and La Niña years.

We showcased real-time prediction products ranging from synoptic weather maps to seasonal climate forecast probabilities, explained how to interpret and understand probability forecasts, discussed the important distinction between forecasting high rainfall and forecasting a high chance of above median rainfall, and introduced our audiences to a wealth of climate outlook information to help with managing their monthly grazing schedules.

All these aspects generated further conversation and many questions, with one of the main points of discussion and curiosity throughout the visit being: What was the cause of the very dry start to the year, and subsequent failure of the monsoon for the Gulf region, despite the active La Niña event in the Pacific?

To address this, we showed that during February and March 2022, the MJO was strong mostly in phases 2 and 3 (Fig. 2, left) – a part of its lifecycle that typically brings drier than normal conditions to large parts of northern Australia[4]. Rather than continuing into its 'wet phases' after the first dry spell in February (as may happen in a 'typical' MJO event), the MJO became inactive for about two weeks (with little impact for the north) before re-emerging in March, even stronger in its dry phases.

Thus, the MJO's drying behaviour in February and March – two crucial months for the northern rainfall season – appeared to outweigh the anticipated wet influence of La Niña, consistent with the unseasonally dry conditions in much of northern Australia (Fig. 2, right). In line with the four-week timescale for predicting the MJO in ACCESS-S2, the Bureau's real-time forecasts were able to capture the dry signal over large parts of the north up to about a month ahead.
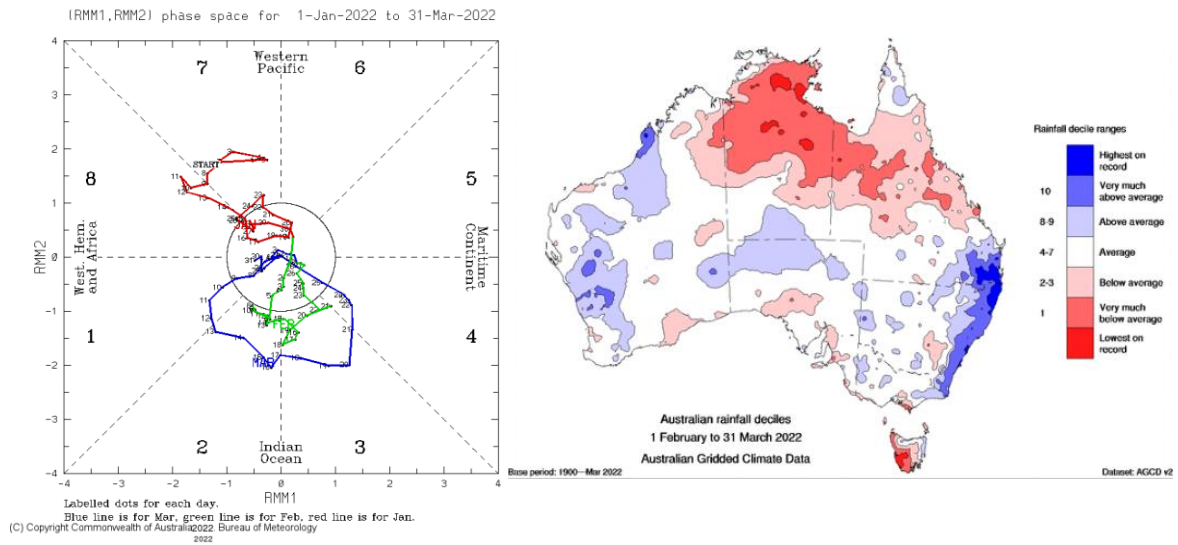
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[4] http://www.bom.gov.au/climate/mjo

Fig. 2. Left: MJO phase space analysis for 1 January to 31 March 2022 (source: bom.gov.au/climate/mjo). Right: Australian rainfall decile average for 1 February to 31 March 2022 (source: bom.gov.au/climate/maps/rainfall).

The Outcome

We came away from our four invigorating days at Stanbroke armed with take-home messages and new perspectives on the importance of climate information for agricultural practices in tropical northwest Queensland.

As researchers, we were rewarded with the knowledge that climate driver forecasts and impact assessments, such as those related to the MJO[5,6], will now be heavily utilised for planning and management in the Gulf, given the key role of multi-week rainfall variations in the timing of on-property practices such as burns and cattle musters.

The importance of combining real-time forecast information with a solid understanding of climate drivers and their local influences was highly appreciated by the team at Stanbroke. Such knowledge is vital for making well informed decisions and managing risks when using climate forecasts at different lead times. Knowing how, why, and when a forecast can change as drivers with different prediction timescales come into play can help demystify a forecast and build trust in weather and climate services.

Our engagement with participants was also helped, as always, by Chelsea's popular MJO dance (Fig. 3, right), which will no doubt continue to propagate through the Gulf Country for years to come.

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[5] http://www.bom.gov.au/climate/enso/#tabs=Tropics
[6] http://www.bom.gov.au/climate/mjo/#tabs=Averages

Fig. 3. Left: looking back at the storm along Burke Developmental Road on the first day. Right: Chelsea showcases her much-loved MJO dance to the team at Glenore.