



Australian Government

Bureau of Meteorology

Modelling Centre Updates: BoM

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WGSIP21, Moscow, May 2019





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Summary: Modelling system plans

ACCESS-S1

Operational (August 2018)

- UKMO global coupled model (GC2). Atmos: ~60km (N216); Ocean: 25km
- Uses UKMO assimilation & BoM ensemble generation (atmos perturbations + stochastic physics)
- Hindcast: 23 years (1990-2012); 11 ensemble members
- Real time: 99 members (uses burst and lagged)
Sub-seasonal: 6-weeks
Seasonal: 6 months
- Downscale/calibrate to 5km

ACCESS-S2

Operational mid-2020

- UKMO global coupled model (GC2) Atmos: 60km; Ocean: 25km
- BoM weakly coupled ensemble optimum interpolation assimilation
- Hindcast: 37 years (1981-2017); 27 ensemble members
- Real time: 99 members (uses burst and lagged)
Sub-seasonal: 6-weeks
Seasonal: 8 months
Multi-year: 5 years
- Downscale/calibrate to 5km

ACCESS-S3

Operational in 2023+

- Improved global coupled model (GC4/5+ local improvements) Atmos: 60km; Ocean: 25km
- BoM weakly coupled EnKF + add altimeter and sea-ice
- Hindcast: 40 years? (1981-2021); >27? ensemble members
- Real time: 99 members (uses burst and lagged)
Sub-seasonal: 6-weeks
Seasonal: 9 months
Multi-year: 2 & 5 years
- Downscale/calibrate to 5km

Development will support a range of enhanced products and services

System development focus

Data assimilation & ensemble generation:

- Improving soil moisture & ocean initialisation
- Towards coupled DA (EnKF);
- Incorporating new variables (e.g., altimeter, SST)
- Stochastic physics in the ocean?

Model development:

- In partnership with Monash University (C Jakob) & UK MetOffice (some staff sit at UKMO)
- Key issue: convection. Big biases in Indian Ocean region affect teleconnections

System design considerations/issues:

- Hindcast design (length of period, size of ensemble within HPC constraints)
- Design HC to support applications and evaluation of "extremes"
- Optimal forecast ensemble: lag + burst?
- Extend to multi-year forecasts (driven by external demand)
- Seamless with NWP (products and/or systems)



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Underpinning science

Understanding the drivers of Australian mean and extreme climate on sub-seasonal to seasonal timescales in observations and the model

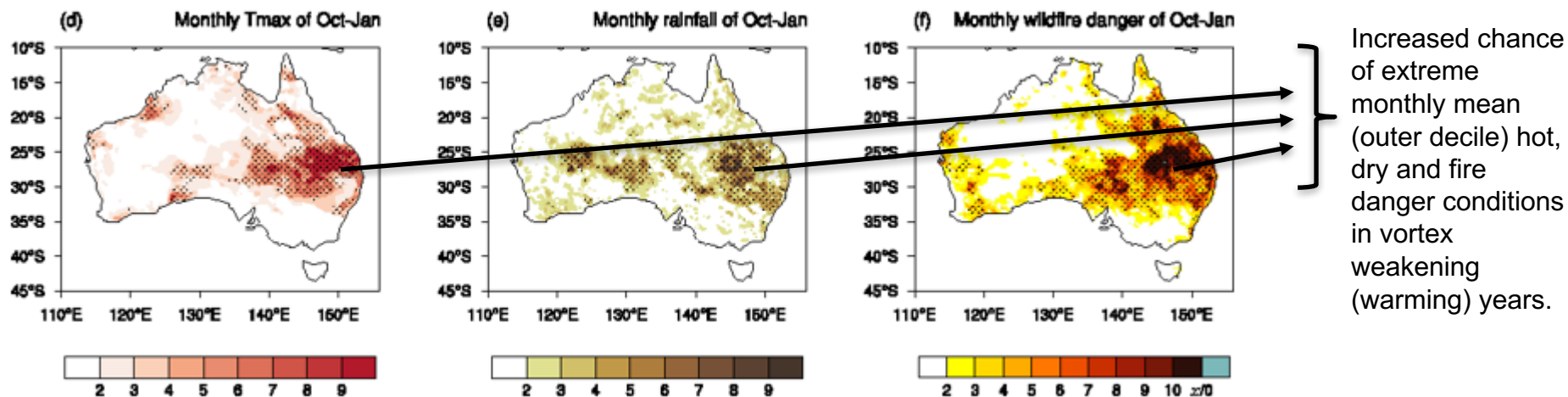
ENSO, IOD, MJO, SAM, stratosphere,

Recent work: influence of stratosphere and impact on forecasting heat extremes over Australia

Lim, Hendon, Thompson (2018) Seasonal Evolution of Stratosphere-Troposphere Coupling in the Southern Hemisphere and Implications for the Predictability of Surface Climate. *J Geophys Res Atmos* 123:1–15

Lim, Hendon, Boschaf, Hudson, Thompson, Dowdy, Arblaster (2019) Polar stratospheric impacts on hot and dry extremes over Australia. (submitted to *Nat. Geoscience*)

Hendon, Lim, Abhik (2019). Impact of Ozone on Predicting Downward Coupling from the Southern Hemisphere Polar Stratospheric Vortex: A Case Study for the 2002 Stratospheric Warming (in preparation)



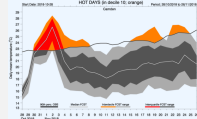
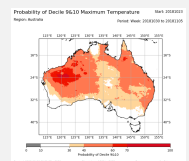
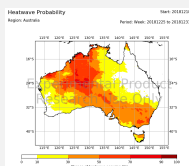
Ratio of the probability of occurrences of outer decile monthly mean during the 9 vortex weakening years compared to the 29 non-weakening years



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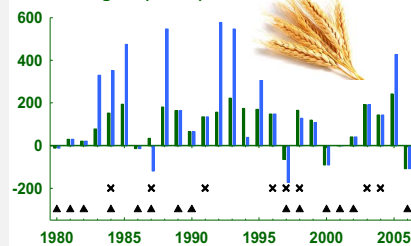
Interfacing to applications

Forecasting extremes



Crop modelling

Gross margins (\$/ha)



APSIM

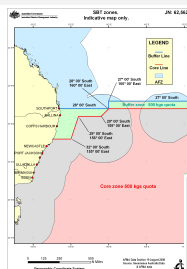
AGRICULTURAL PRODUCTION SYSTEMS SIMULATOR

Interfacing to other systems

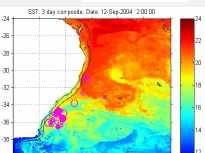


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Fisheries & marine applications

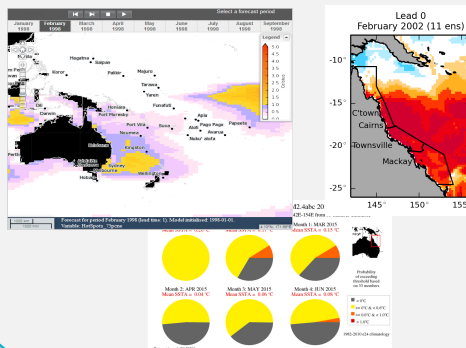


Projects with CSIRO

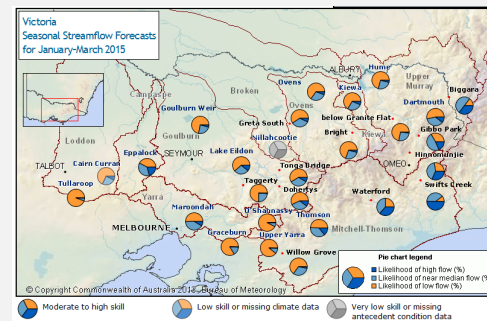


Project with NIWA

Coral bleaching risk in the GBR and Pacific Islands



Streamflow forecasting



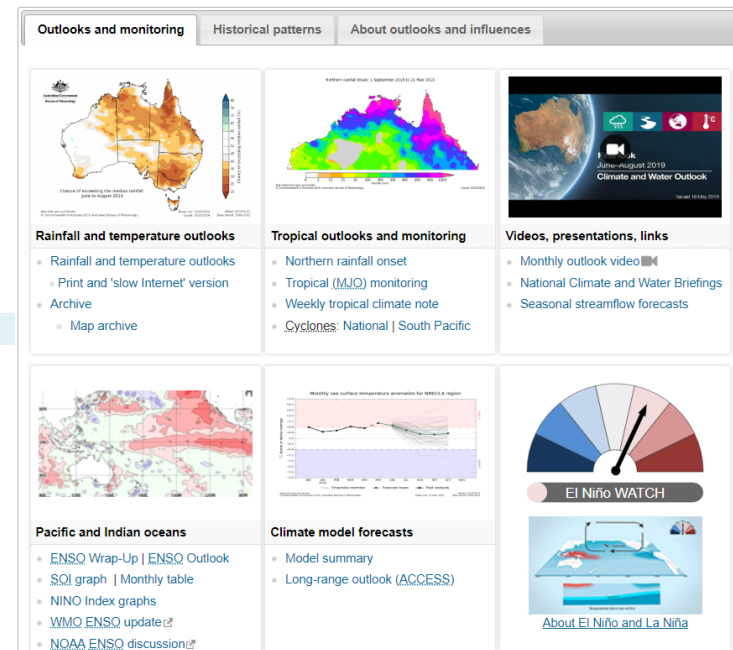


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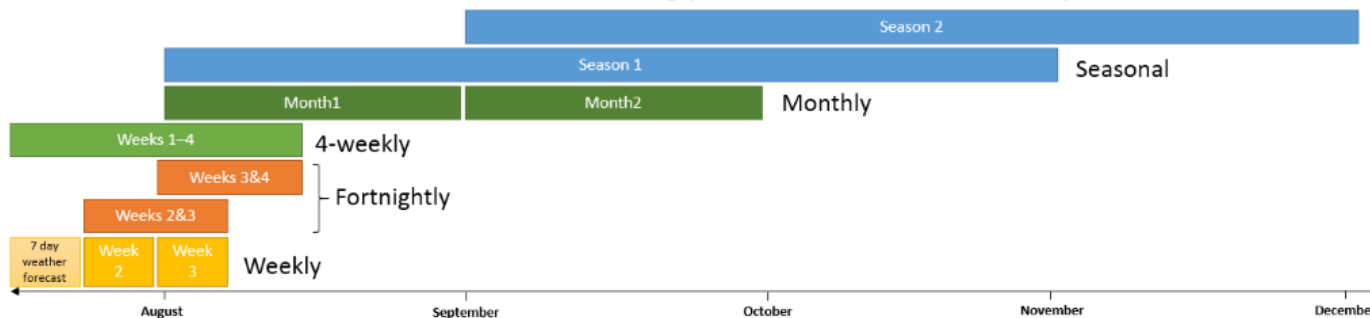
Climate services

<http://www.bom.gov.au/climate/ahead>

- Sub-seasonal (multi-week) forecasts available to public (later in 2019).
- All monthly/seasonal forecasts have been based on ACCESS-S1 since Aug 2018



The Bureau of Meteorology's Climate Outlook periods



- GPC-Melbourne: transitioning to ACCESS-S (still based on POAMA). New website forthcoming in next ~12 months