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WGSIP23 (November 2021)

ACCESS-S2: An upgraded seasonal prediction system, including new operational forecast products

Debbie Hudson
Bureau of Meteorology

Australian Government
Bureau of Meteorology

ACCESS-S1

- UKMO GC2 model
- UKMO initial conditions (NEMOVAR) + BoM ensemble generation
- 23-year hindcast period (1990-2012)
- Real-time products based on time-lagged 99-member ensemble
- Went operational mid 2018

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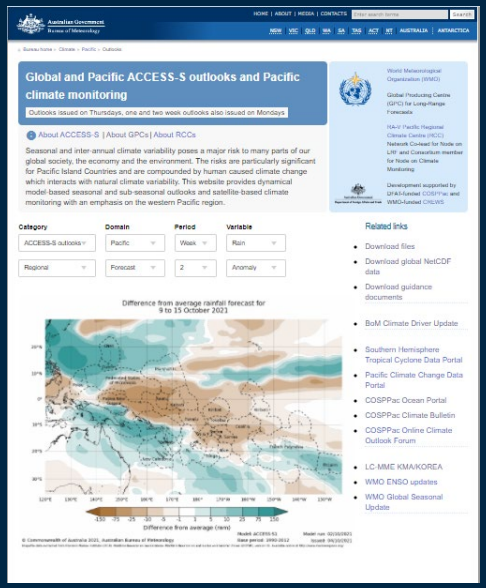
ACCESS-S2

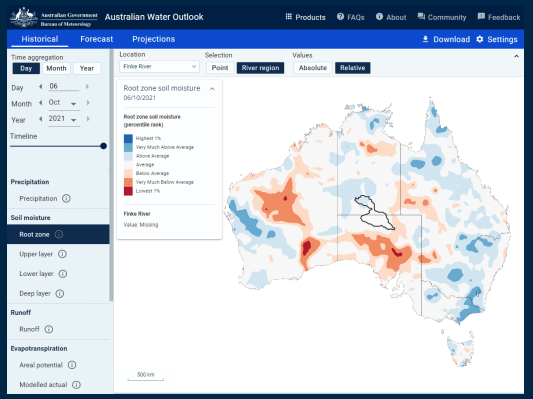
- In-house data assimilation (production of initial states)
- More timely forecasts
- Reduced reliance on UK Met Office for initial ocean states
- Same model, but some enhancements and corrections
- Longer hindcast set (1981-2018)
- Enhanced post-processing

ACCESS-S Version 2 "go-live" 19 October 2021

Seasonal Climate Outlook



Seasonal outlook for the Pacific Islands (COSPPac)



ACCESS-S inputs to Water Balance Model (AWRA-L) generates the Seasonal water outlook

Forecast data to several external customers

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ACCESS-S2 weakly coupled DA

Based on BoM/CSIRO Coupled EnKF software (Yonghong Yin, Pavel Sakov)

- Weakly coupled daily cycle
- Direct replacement of atmos basic variables
- Ensemble OI in ocean
- Ocean assimilation uses the background state from the coupled model
- Land surface and sea ice indirect through coupling
- Stronger nudging of SST than UKMO
- No altimeter assimilation (only T/S profiles)
- Multi-variate – ocean current increments
- 1981-present re-analyses
- Same perturbation scheme as in ACCESS-S1 for ensemble generation (only the atmosphere is perturbed)

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Data assimilation

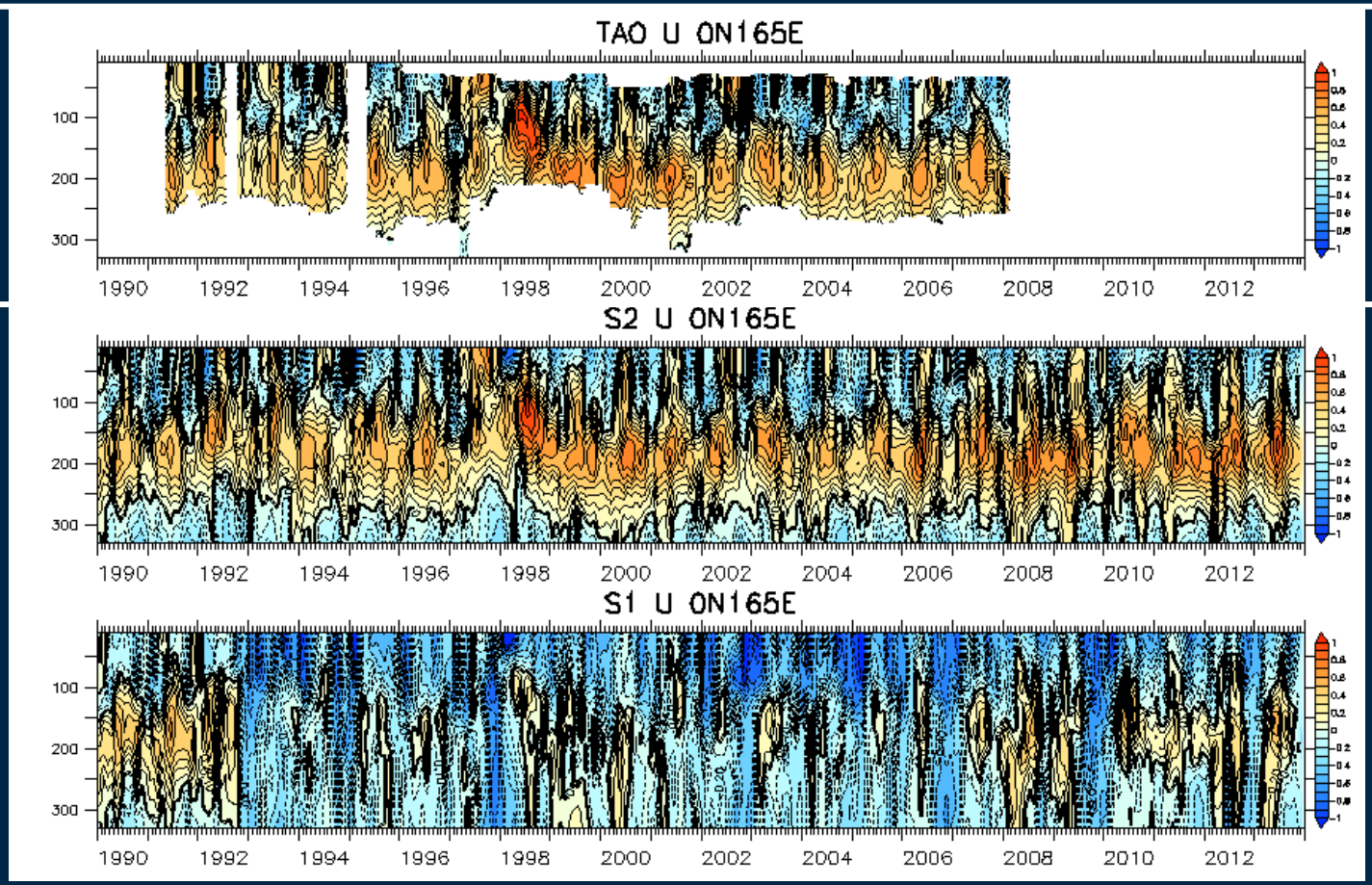
Example: ocean currents are better in ACCESS-S2

U (0N,165E) Monthly mean U from ADCP TAO/TRITON, ACCESS-S2, S1(1990-2013)

OBSERVED

ACCESS-S2

ACCESS-S1



From: Yonghong Yin

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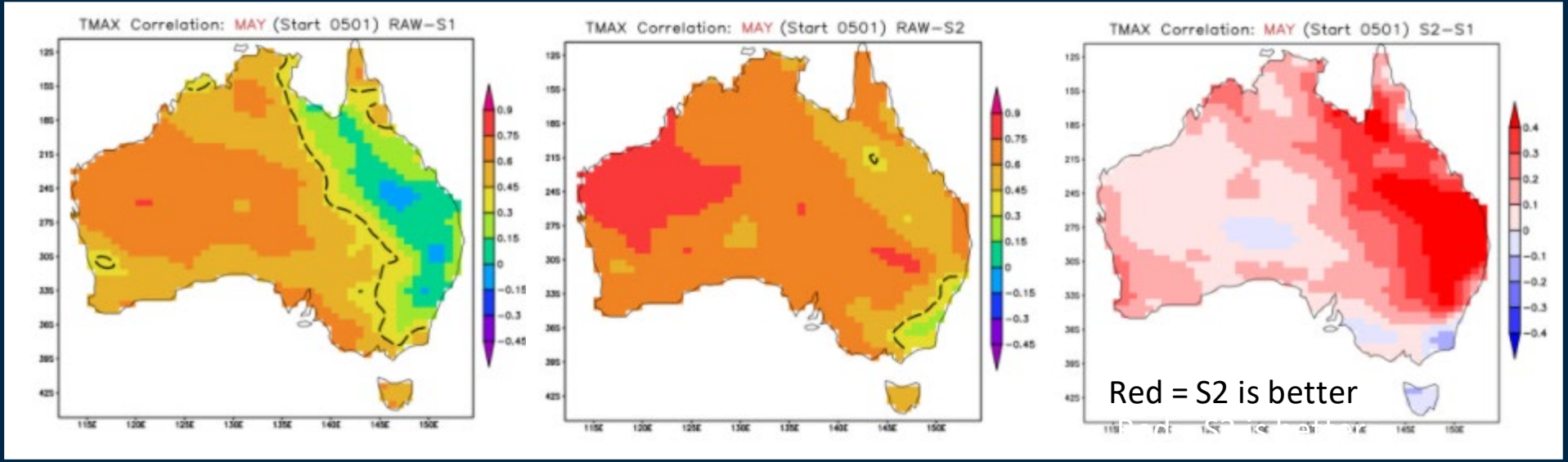
Improved skill over Australia

Maximum temperature: benefits of realistic soil moisture initialisation

ACCESS-S1 | ACCESS-S2 | Difference (S2 minus S1)



Correlation skill for May (from 1st May Starts)

From: Li Shi

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Improved ocean skill

Some indications of improved forecasts of ENSO, particularly for forecasts started in Autumn

Correlation skill

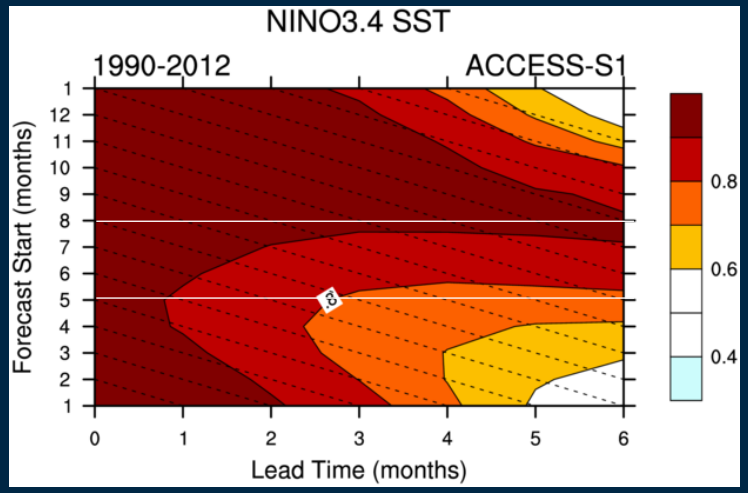
Redder is better

"Strength" of ENSO

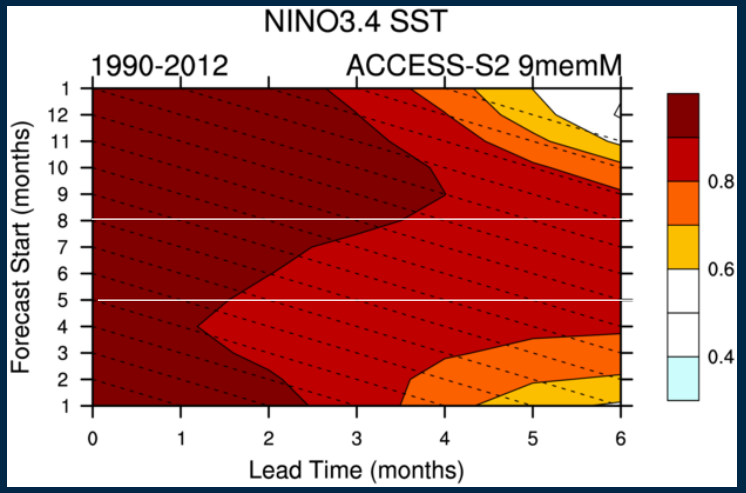
White is good

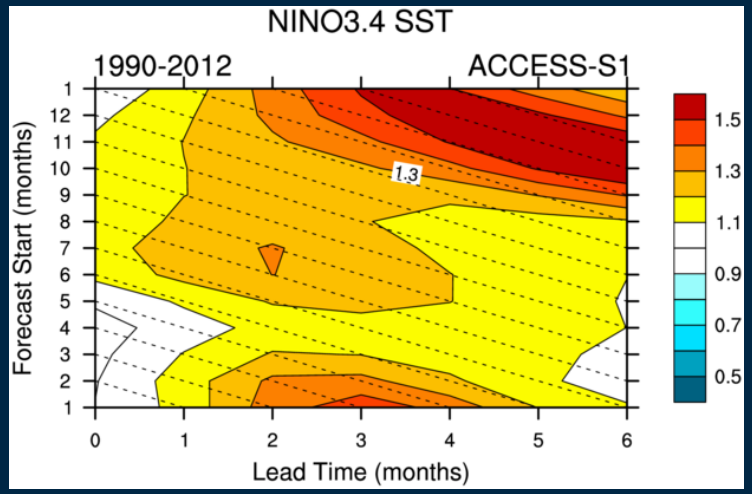
Ratio of model stddev/obs stddev

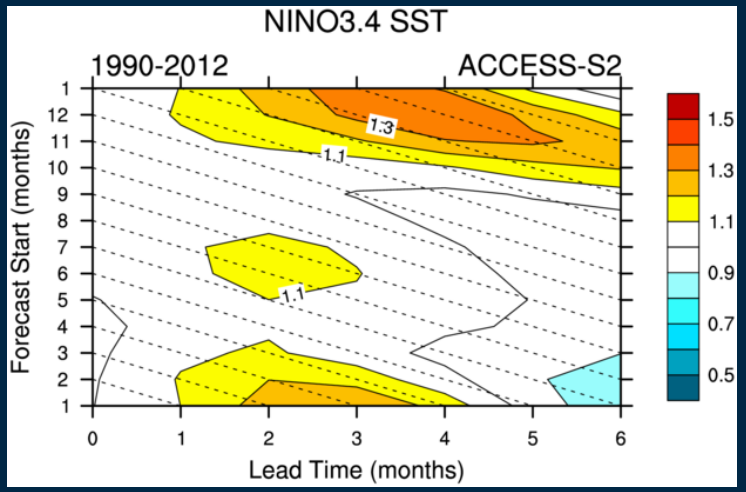
ACCESS-S1



ACCESS-S2







From: Eun-Pa Lim

(http://www.bom.gov.au/research/projects/FWFA/)

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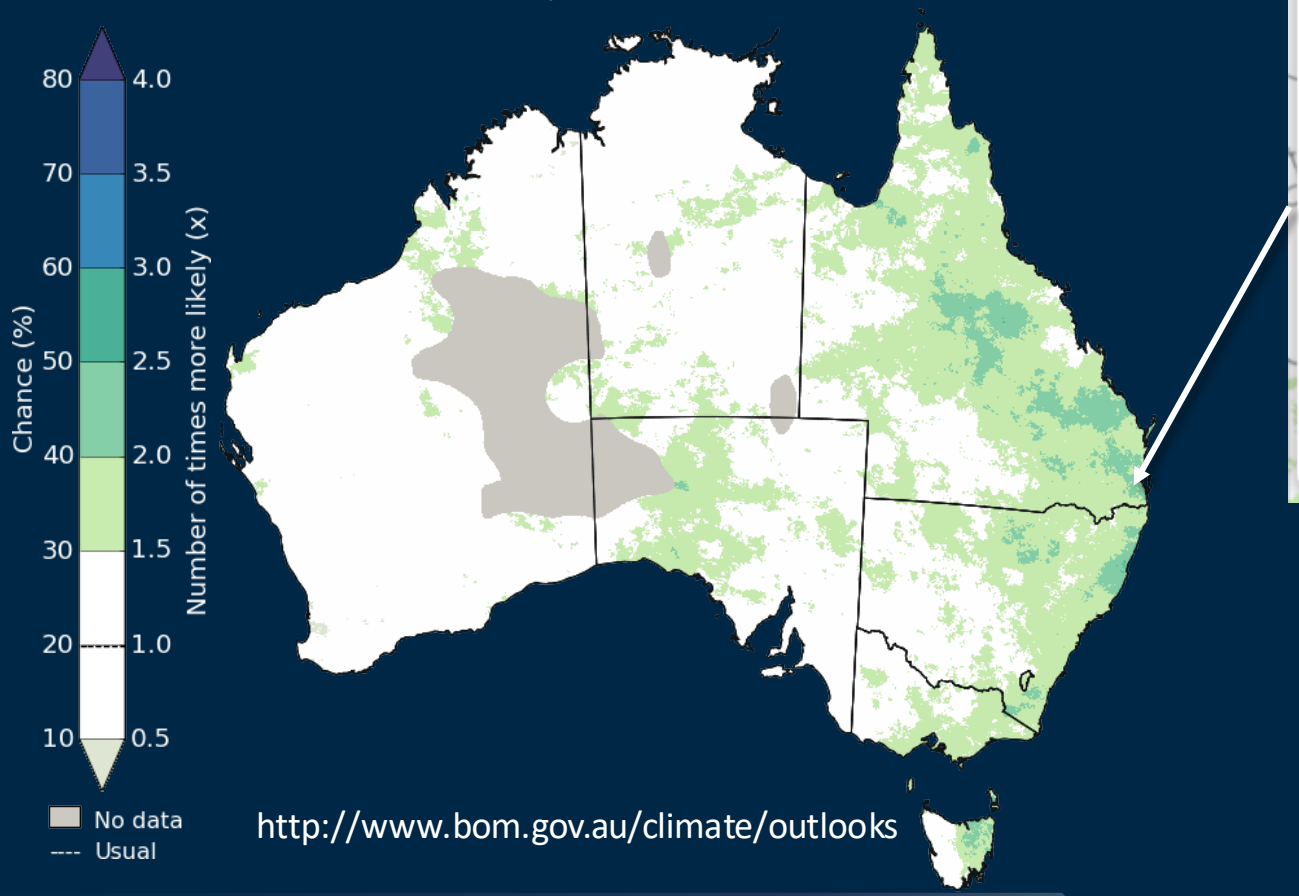
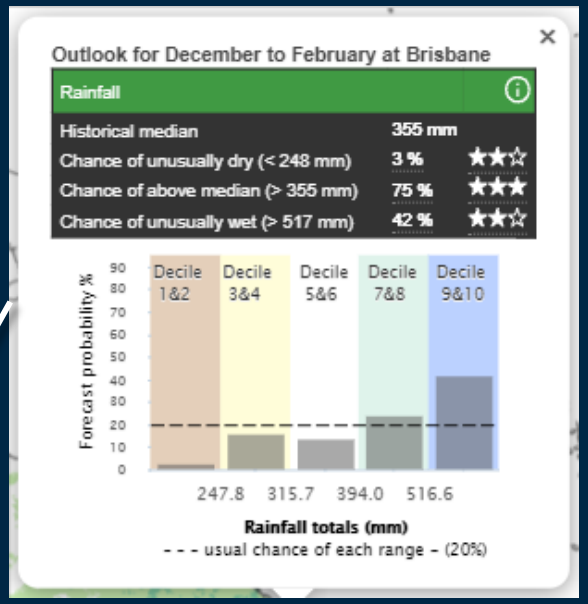
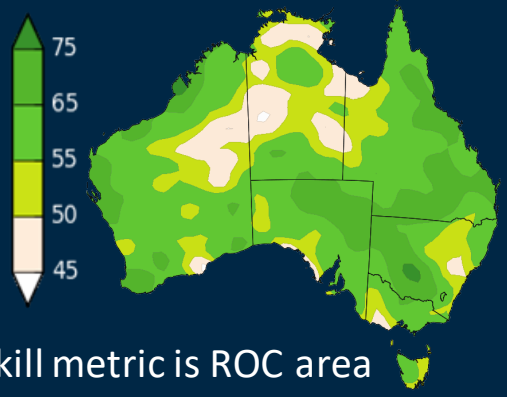
New products from agriculture "*Forewarned is Forearmed*" project

December 2021 – February 2022
Chance of unusually wet



http://www.bom.gov.au/climate/outlooks





Skill metric is ROC area

- Increased chance of unusually high rainfall (in top 20% of climatological period) in parts of eastern Australia.

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Forewarned is ForeArmed (FWFA) (2017-2022)

(http://www.bom.gov.au/research/projects/FWFA/)

Australian Government
Department of Agriculture, Water and the Environment

Managing and forecasting "extreme" climate events on multi-week and seasonal timescales

Research partners

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

USERS

Rural RDC partners

Meat and Livestock Australia
Grains RDC
Sugar Research Australia
Cotton RDC
AgriFutures Australia
Dairy Australia
Wine Australia
Australian Pork

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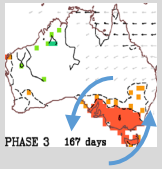
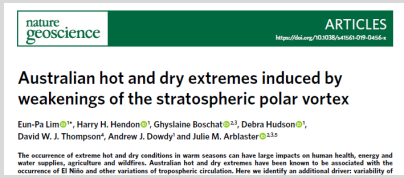
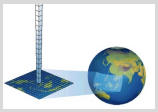
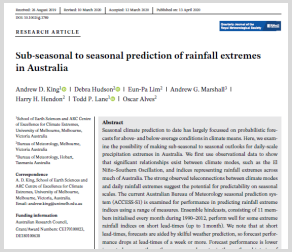
An end-to-end and well-connected approach

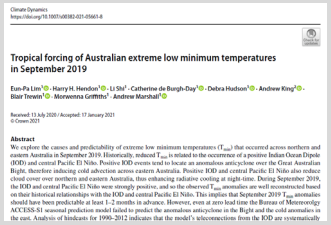
Underpinning Science



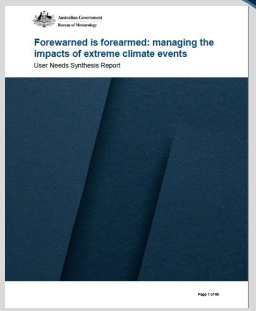






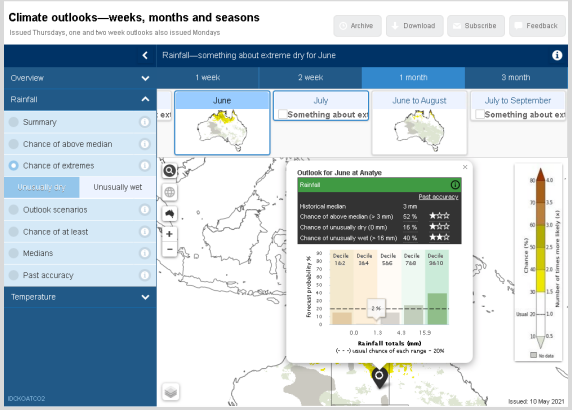


User needs

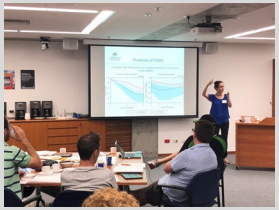


Interfacing to industry decisions

Forecast development and delivery



Extension and training



BCG
SHARED SOLUTIONS

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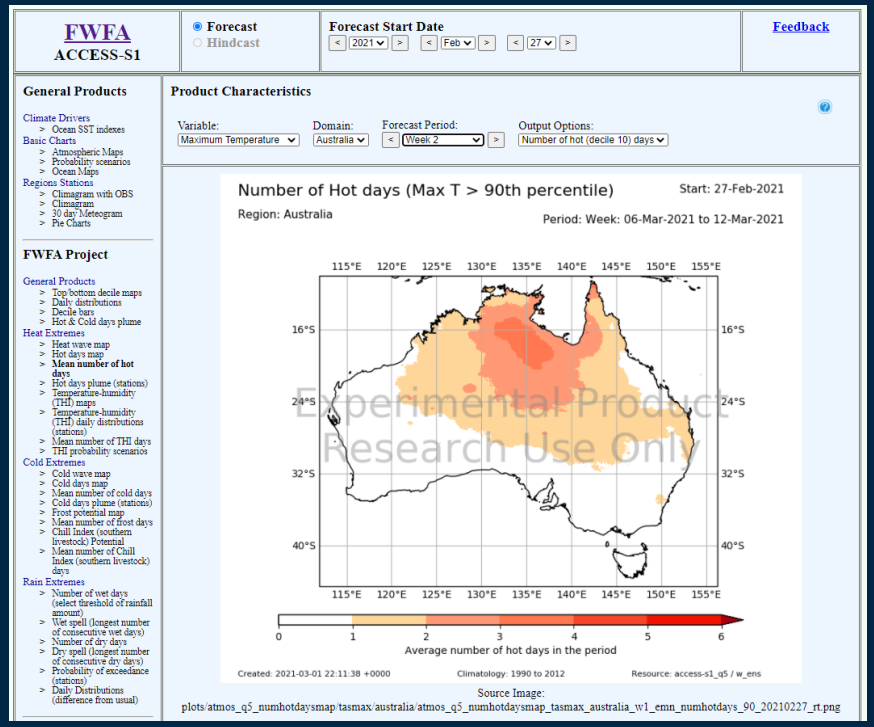
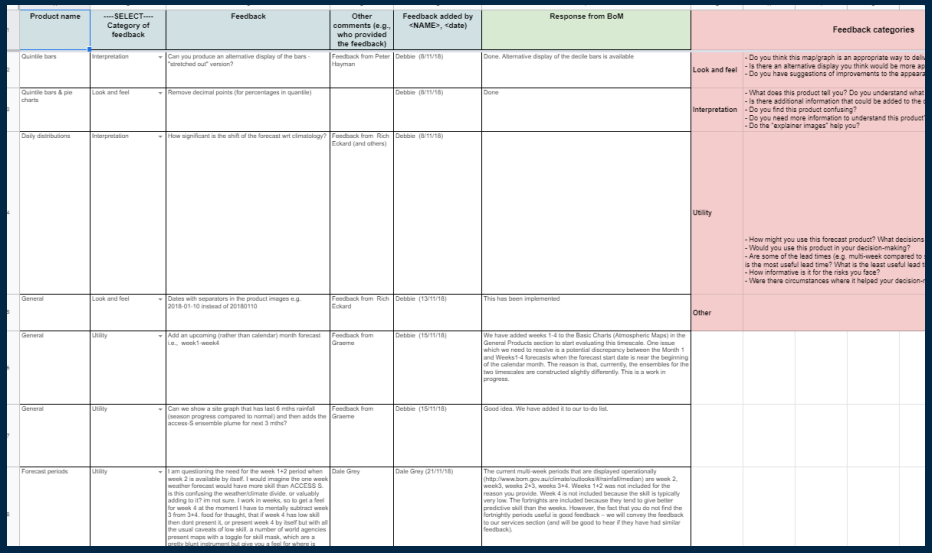
Developing and delivering new forecasts



- Develop a range of heat, cold and rainfall multi-week & seasonal experimental forecast products from ACCESS-S
- Make experimental products available on a research web server for trial and feedback

- Feedback from reference groups of users in the dairy, beef, sheep, grains, sugar and wine industries.
- Deliver five operational products in a staged approach



(http://www.bom.gov.au/research/projects/FWFA/)

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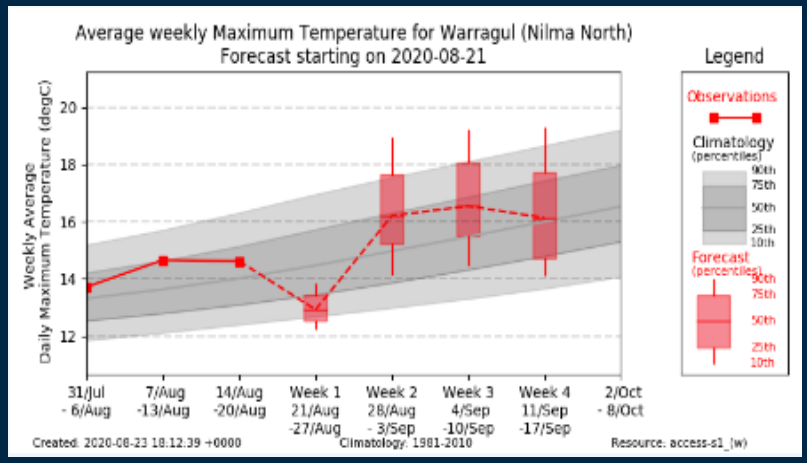
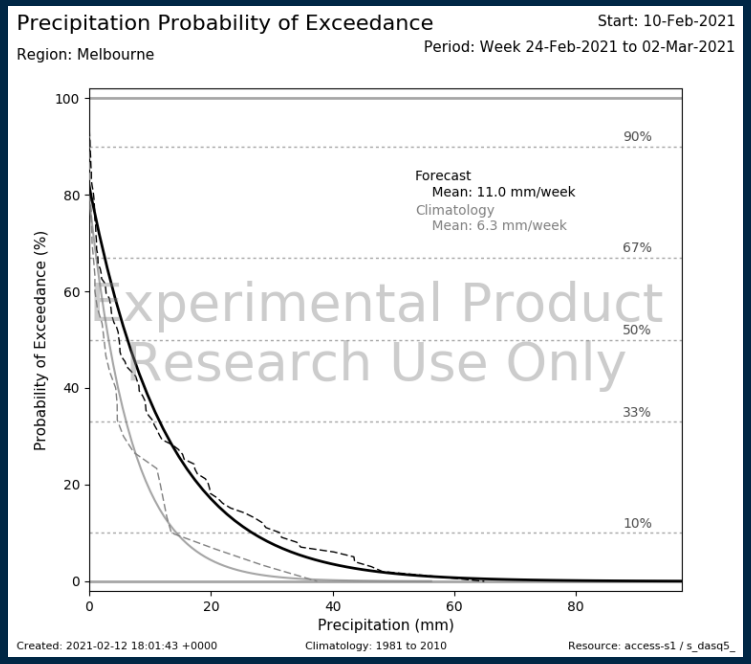
What's next for the products?

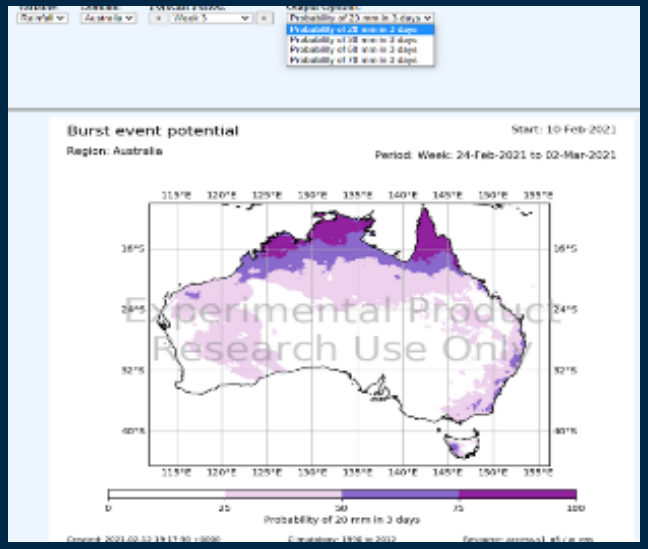
- Product #3 goes live end March 2022. User feedback for proposed operational version underway
- Operational design of products #4, #5 being initiated, going live end May 2022



#3 – Location based weekly/monthly time series of rainfall/temperature outlooks (Climagrams)



#4 Location based rainfall probability of exceedance chart



#5 Maps showing heightened probability of rainfall burst (3-day accumulations)

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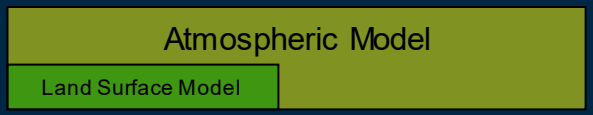
What's next for modelling?

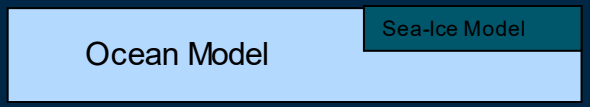
Seamless global coupled modelling

Global weather forecast model



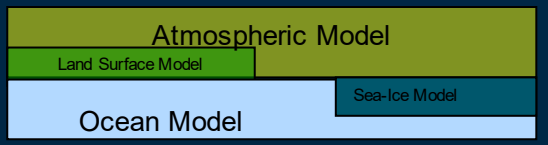
ACCESS-G; ACCESS-GE

Global ocean forecast model



OceanMAPS

Multi-week/seasonal forecast model

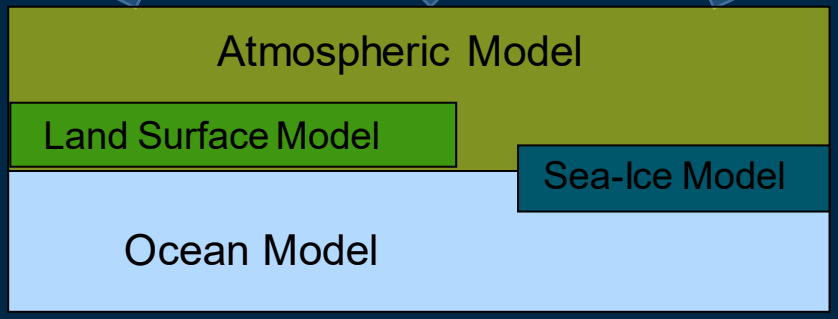


ACCESS-S

NOW

FUTURE

- Seamless and consistent forecasts across timescales and domains (days to seasons; atmosphere and ocean)
- Development (jointly with UKMO) of seamless coupled earth system modelling framework
- Ocean-atmosphere interactions are also important on shorter timescales, for both weather and ocean prediction
- UKMO: operational coupled global NWP forecasts Feb 2022
- BOM starting to investigate coupled NWP and extension into the sub-seasonal



Future global weather, ocean and seasonal forecast model

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Thank you

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Research Program