

Mitigating the effects of severe fires, floods and heatwaves through the improvements of land dryness measures and forecasts.

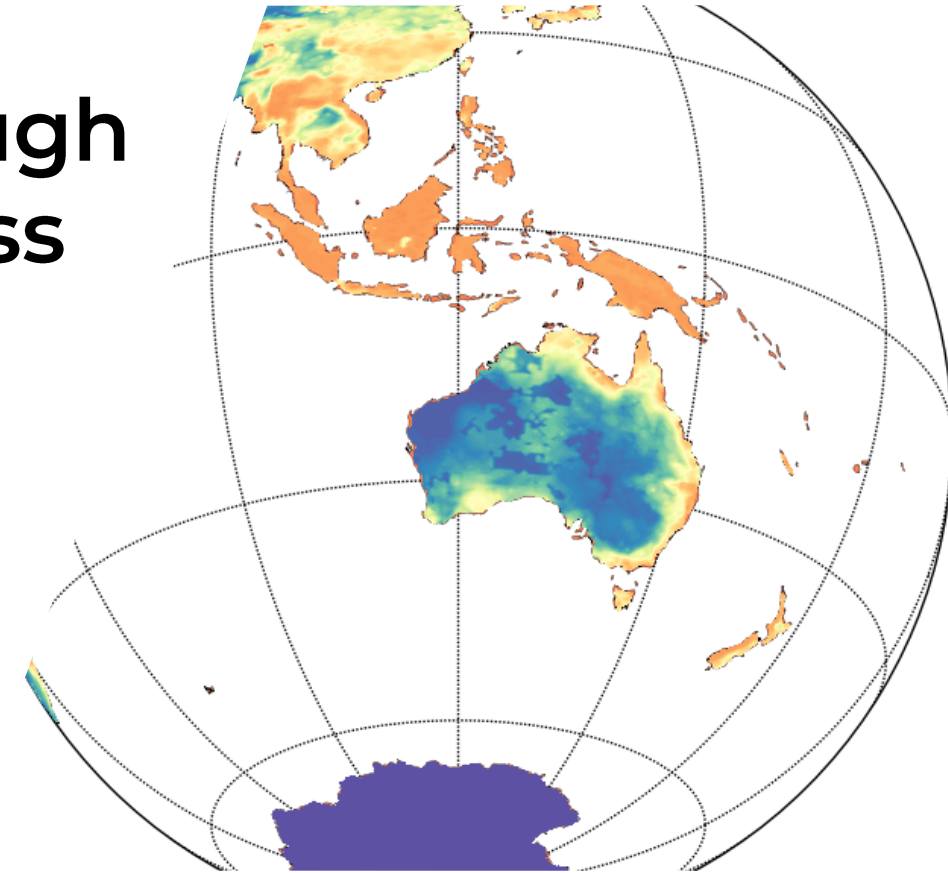
Research Advisory Forum / **2018**

Dr Paul Fox-Hughes / Bureau of Meteorology

Dr Vinod Kumar / Bureau of Meteorology

Dr Imtiaz Dharssi / Bureau of Meteorology

 @bnhcrc  @bnhcrc

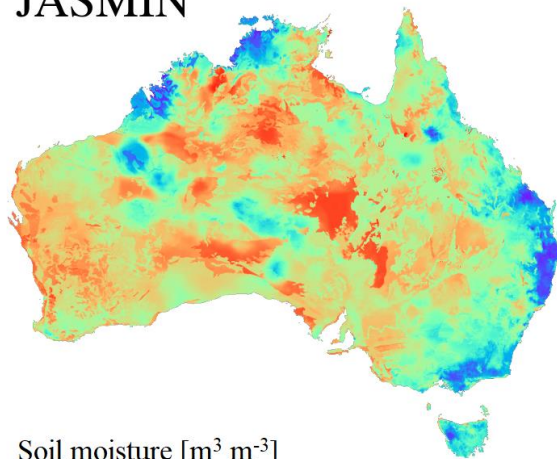


Calibration of JASMIN

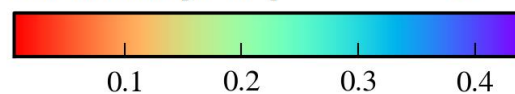
For easier utilization of JASMIN

- Utilization of JASMIN in existing operational frameworks.
- Moisture content (Kg m^{-2}) \rightarrow moisture deficit (0 – 200 mm).
- The calibration methods applied here are:
 - minimum-maximum (MM) matching,
 - mean-sd ($\mu-\sigma$) matching, and
 - cumulative distribution function (CDF) matching

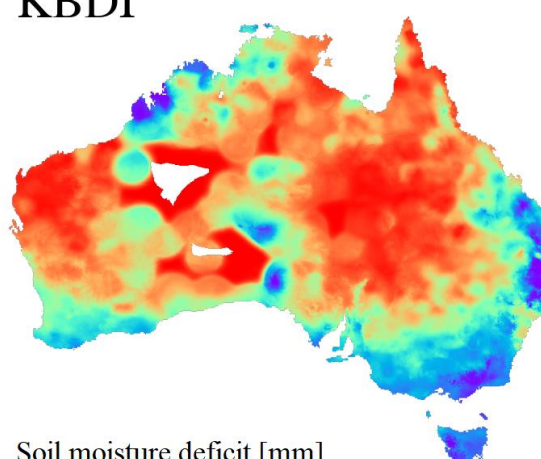
JASMIN



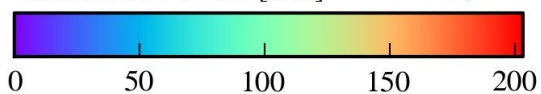
Soil moisture [$\text{m}^3 \text{m}^{-3}$]



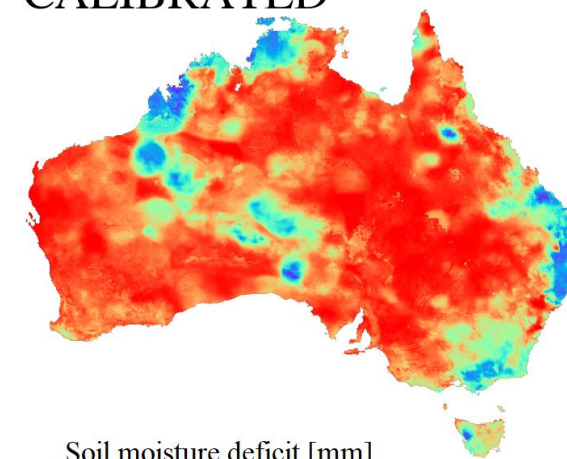
KBDI



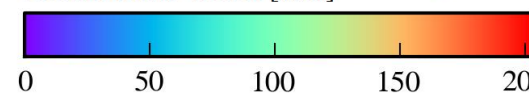
Soil moisture deficit [mm]



CALIBRATED

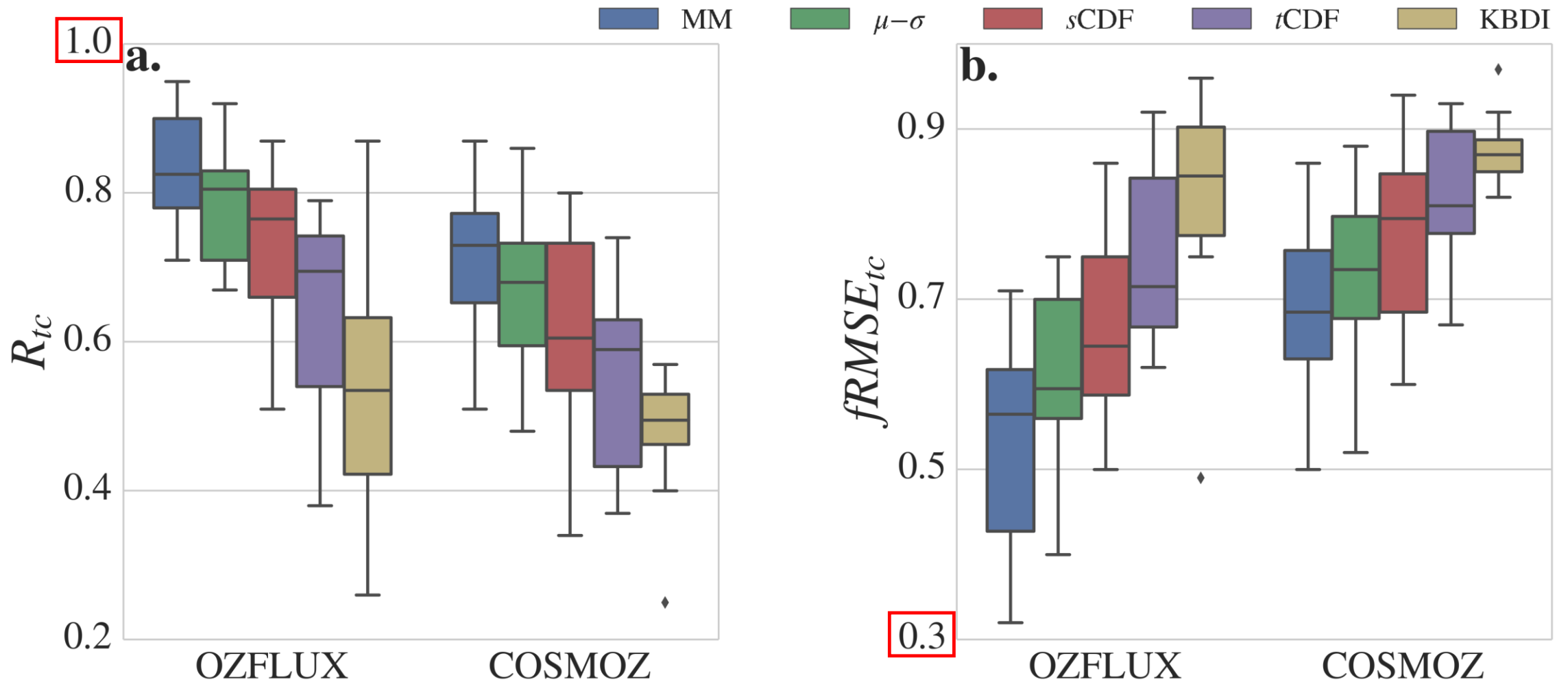


Soil moisture deficit [mm]



Verification of calibrated products

Min-Max (MM) approach give better skills.



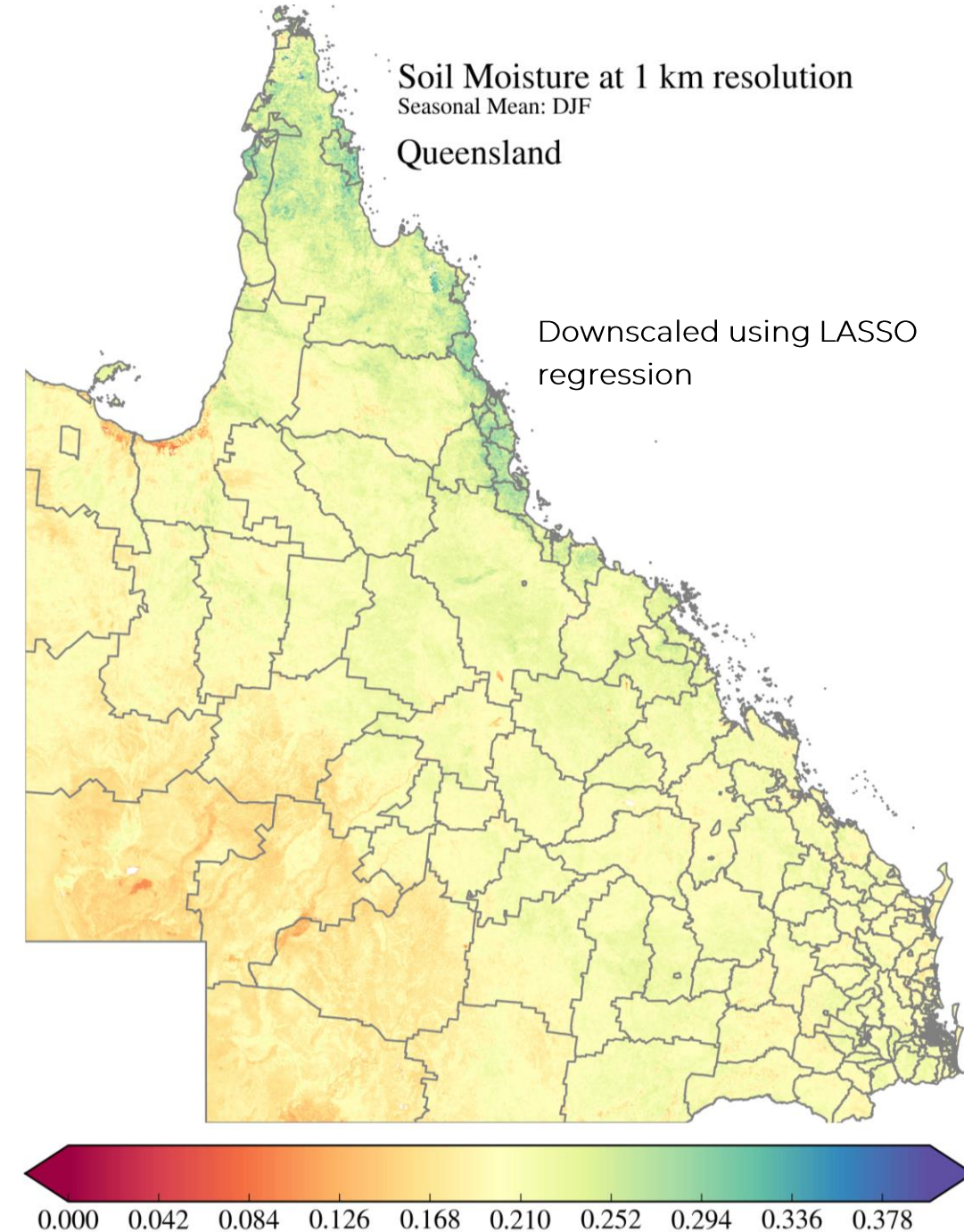
CDF = Cumulative Distribution Function

MM = Min-Max | $\mu-\sigma$ = Mean-SD | tCDF = temporal CDF | sCDF = spatial CDF

Downscaling

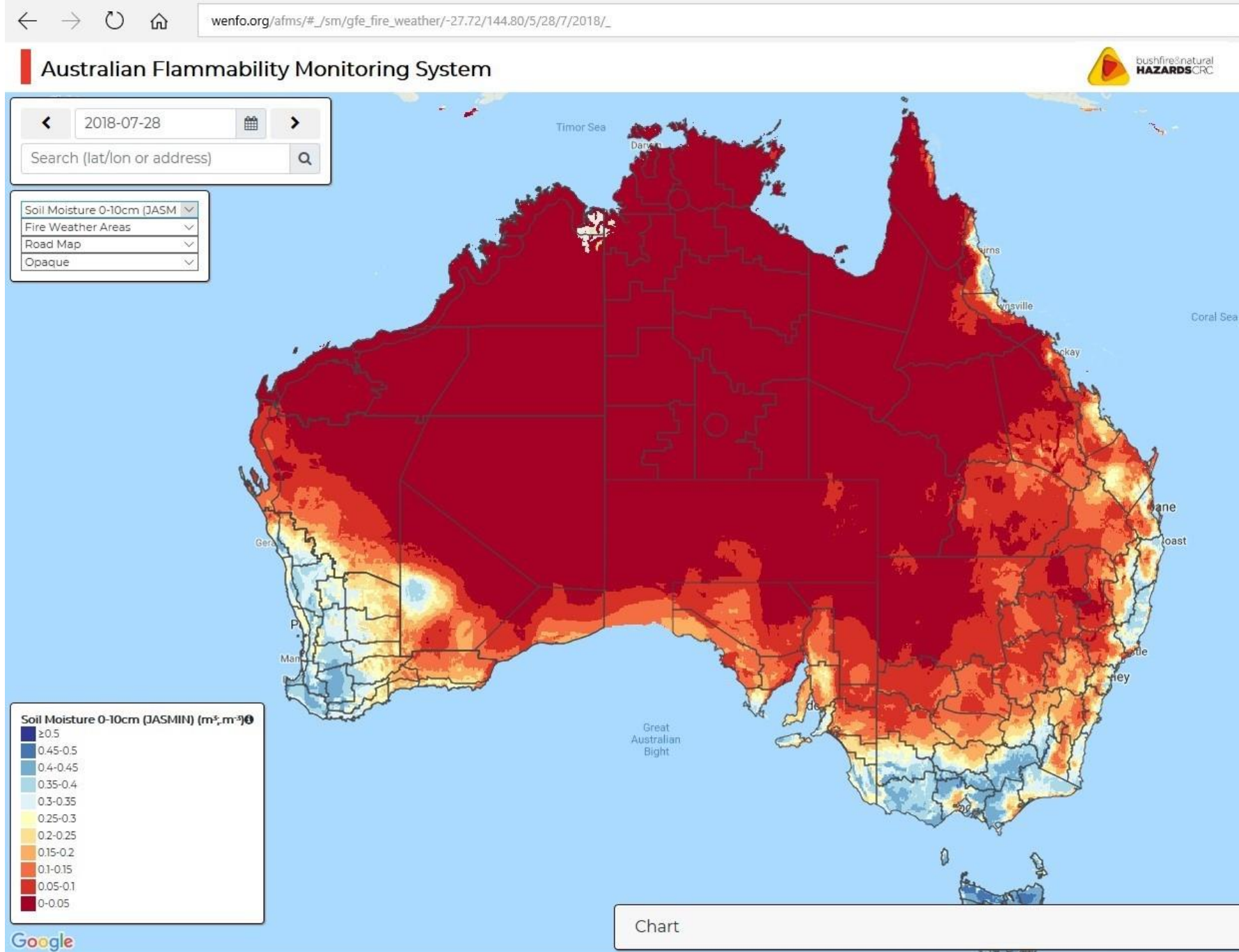
Work still in progress!

- Potentially two approaches:
 - T_s -VI space
 - Pros – auxiliary data readily available.
 - Cons – IR based data not weather proof.
 - Geo-spatial statistics
 - Pros – all weather proof.
 - Cons – Need fine scale auxiliary information.
- Starting with T_s -VI space approach
- A few different methods within the T_s -VI space approach:
 - Regression
 - DisPATCH
- Two regression methodologies attempted:
 - Multiple linear regression
 - LASSO regression
- Temporal skill not good as expected.
- Currently analysing the reasons.
- Verification is another challenge!



JASMIN on AFMS

- ▣ Volumetric soil moisture.
- ▣ 4 day interval
- ▣ Top two model soil layers.
 - 0–10 cm;
 - 10–35 cm;



BoM THREDDDS

- Downloadable annual netCDF cubes
- Reasonably up to date
- Full JASMIN dataset:
 - Native
 - soil moisture
 - volumetric units
 - 4 layers
 - Calibrated
 - soil dryness
 - all 4 calibration methods
 - 0 – 200 mm
 - based on JASMIN soil layers:
 - 0-35 cm (layer 1 - 2), &
 - 0 - 100 cm (layer 1-3)


Link



http://opendap.bom.gov.au:8080/thredds/catalog/c35ee8d2a475e10ea06d0ad53b46ce2a/JASMIN_land_dryness/catalog.html

opendap.bom.gov.au:8080/thredds/ncss/grid/c35ee8d2a475e10ea06d0ad53b46ce2a/JASMIN_land_dryness/native/jasmin.vol.smc.2018.nc/dataset.html

Thredds Data Server



unidata

NetCDF Subset Service for Grids

Dataset: /thredds/ncss/grid/c35ee8d2a475e10ea06d0ad53b46ce2a/JASMIN_land_dryness/native/jasmin.vol.smc.2018.nc

Base Time: 2018-01-01T00:00:00Z

[Gridded Dataset Description](#)
[As Point Dataset](#)

Select Variable(s):

with Vertical Levels (level) : 0.10000000149011612 0.25 0.6499999761581421 2.0 /level
 sm

Choose Spatial Subset:

All
 Bounding Box (decimal degrees):

North
-10.5500

West 113.1500 153.6499 East
-43.9500

South

Choose Time Subset:

All
 Time Range:

Starting: 2018-01-01T00:00:00Z
Ending: 2018-10-05T00:00:00Z

Horizontal Stride:

Add Lat/Lon to file
 Add Lat/Lon variables

Submit Reset

[NetCDF Subset Service Documentation](#)

Summary

JASMIN

- Utilization strategy.
- Addresses immediate requirement for more accurate soil dryness product.
- Simple, faster and cost-effective.

- High-resolution
- Better skill than traditional indices
- Can address gaps in existing methods (e.g., multiple soil layers).

Calibration of JASMIN

Future plans

- JASMIN in the prototype National Fire Danger Rating System.
- Downscale JASMIN product to 1 km.
- JASMIN within NASA's Land Information System (LIS) framework.

Thank you

Acknowledgements

- BNHCRC
- All end-users.
- Peter Steinle, Chun-Hsu Su, Nathan Eizenberg.
- Monash University & University of Melbourne for OzNet.
- CSIRO for CosmOz.
- TERN for OzFlux.

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JASMIN

JULES based Australian Soil Moisture Information

■ JULES: Joint UK Land Environment Simulator

- Physics based land surface model.
- Used in BoM's weather and seasonal forecasting models.
- In active development

■ JASMIN

- High resolution (5 km).
- Daily (valid at 00 UTC).
- 4 soil layers.
- 0–10; 10–35; 35–100; 100–300 (in cm)
- Data from 2010 onwards.
- Can assimilate satellite data.

JASMIN: A prototype high resolution soil moisture analysis system for Australia

Intiaz Dharssi and Vinodkumar
October 2017



Skill break-up

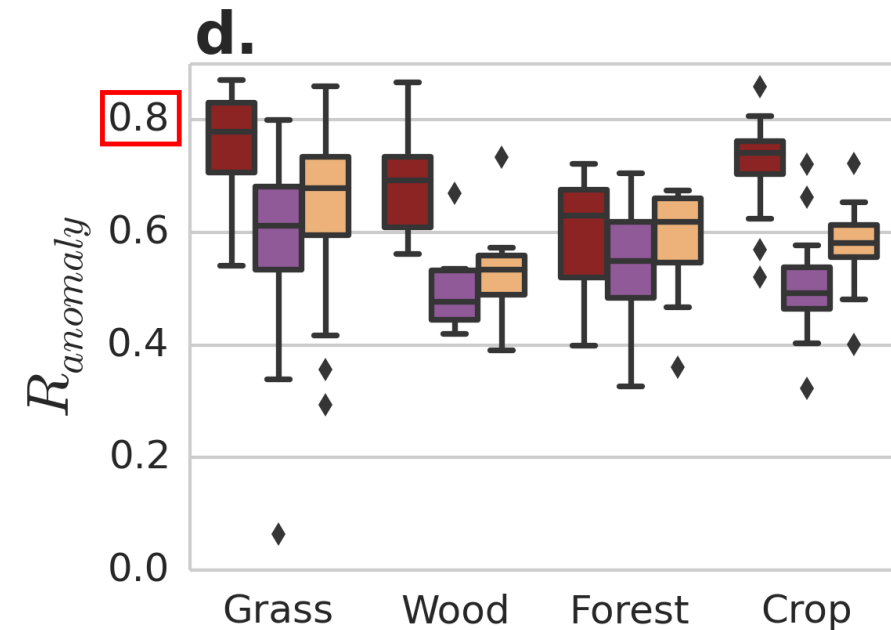
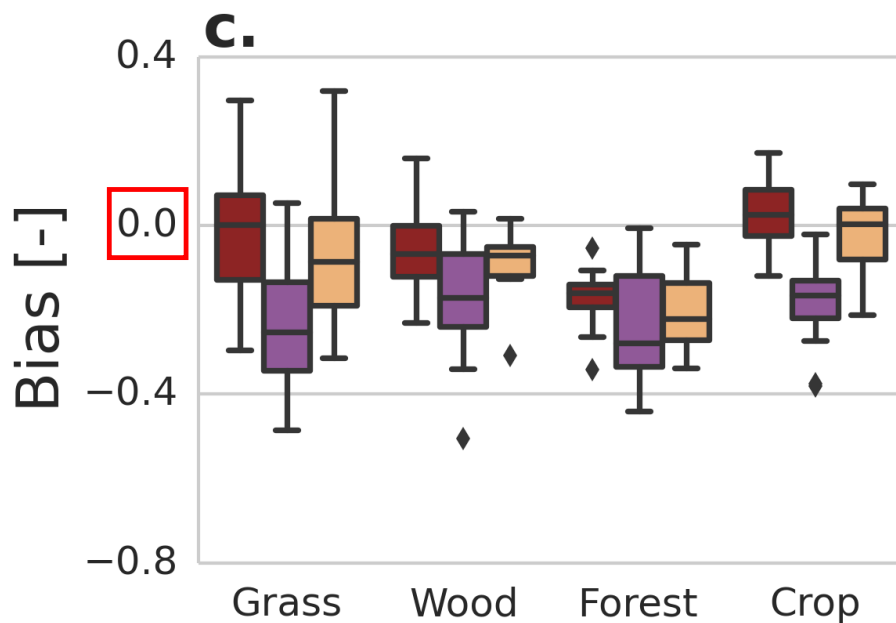
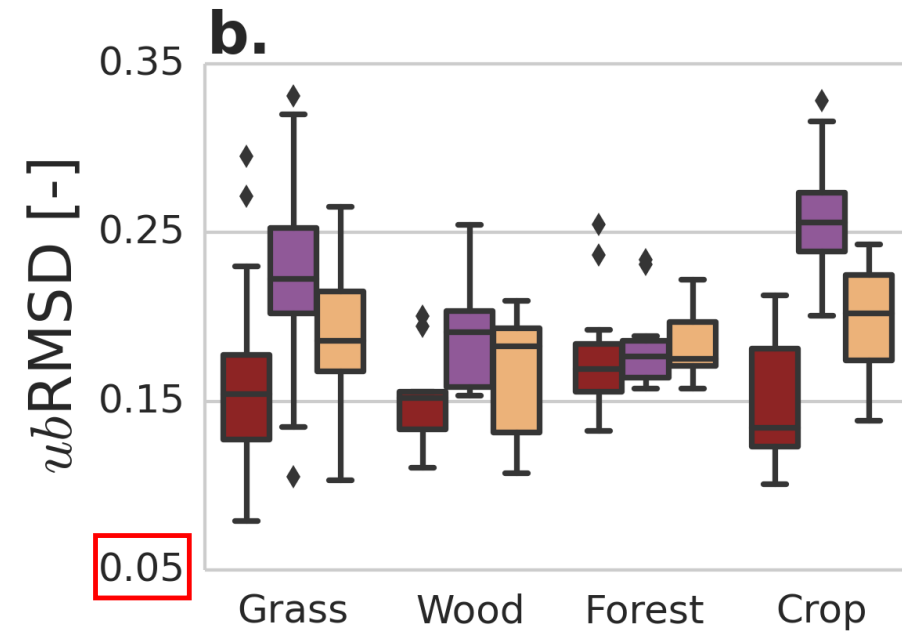
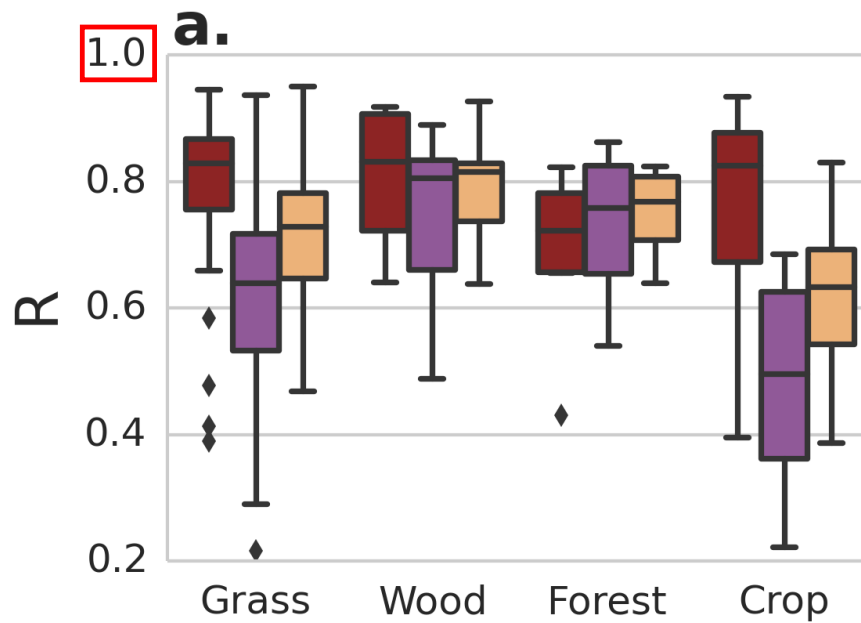
JASMIN consistently good!

Number of sites under:

- Cropland = 12,
- Forest = 12,
- Woodland = 9,
- Grassland = 27

JASMIN
KBDI
SDI

Bias:
-ve = wet bias
+ve = dry bias



More on:


- calibration methods
- verification
- evaluation
- FFDI sensitivity


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Volume 264, 15 January 2019, Pages 27-39



Evaluation and calibration of a high-resolution soil moisture product for wildfire prediction and management

Vinodkumar ^{a, b} ✉, Imtiaz Dharssi ^a

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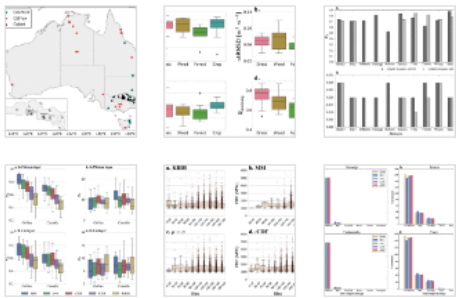
<https://doi.org/10.1016/j.agrformet.2018.09.012> [Get rights and content](#)

Outline

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- 3. Methodology
- 4. Results
- 5. Discussion
- 6. Conclusions
- Code and data availability
- Author contribution
- Acknowledgements
- References

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Figures (7)



<https://www.sciencedirect.com/science/journal/01681923>

Highlights

- Utilization of soil moisture from a land surface model for wildfire applications.
- Robust performance by the new product against ground observations.
- Calibration of the soil moisture product for use in operational practices.
- Improvements to existing drought indices used in operations.

Abstract

Soil moisture deficit is a key variable used in operational fire prediction and management

