Department of Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Protect
Grow
Innovate

‘weatherOz’: A unified interface to access and source Australian climate data

Data systems, sensors and technology for improved decision making

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AUSTRALIAN AGRONOMY CONFERENCE
Adaptive agronomy for a resilient future

Rodrigo Pires
Primary Industries Development
Farming Systems Innovation
System Modelling

Outline

Weather data and access challenge

What is weatherOz

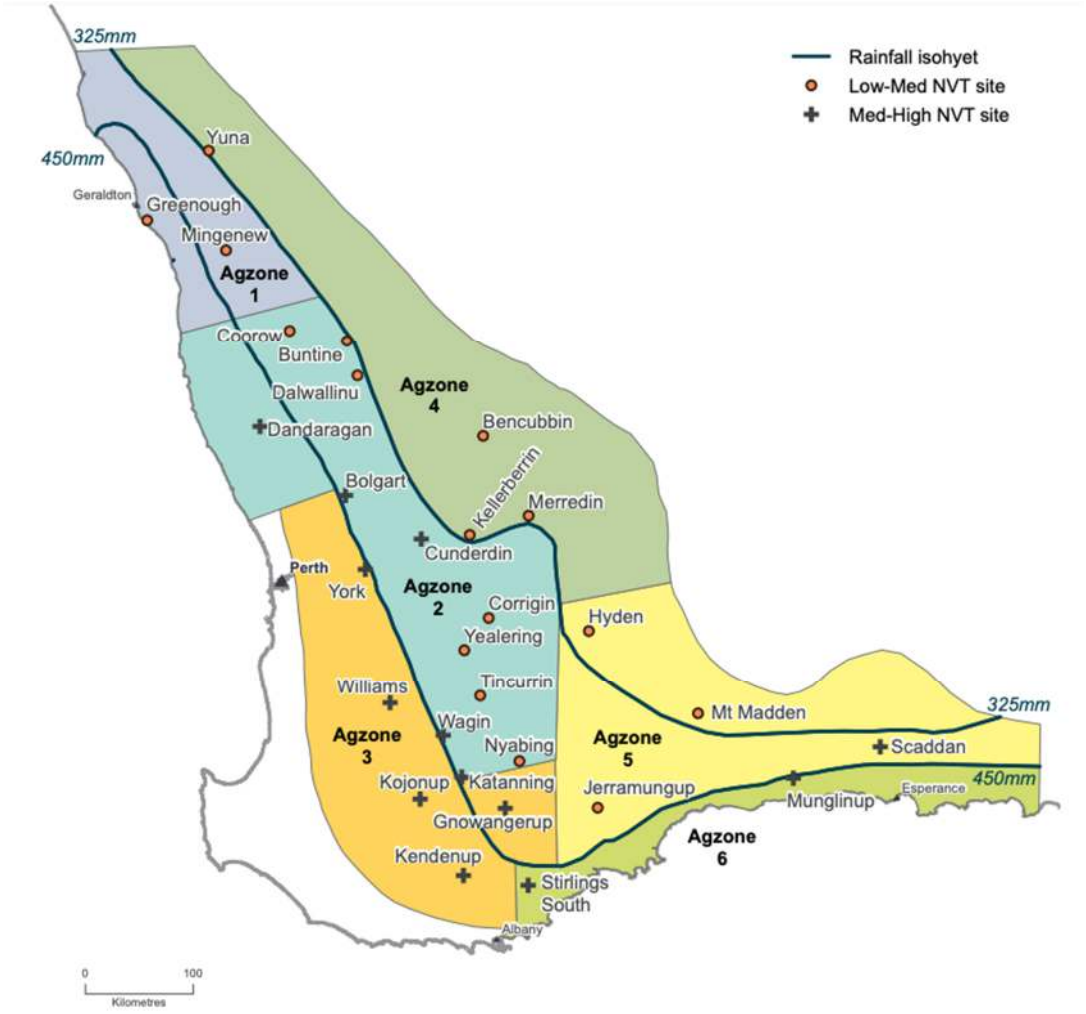
Key features and capabilities

Applications/current use

Benefits and impact

Future directions

Weather data



Location of Low-Med Rainfall and Med-High Rainfall canola NVT across Western Australian agzones. 2024 WA Australian Crop Sowing Guide.

2024 Western Australian Crop Sowing Guide 211

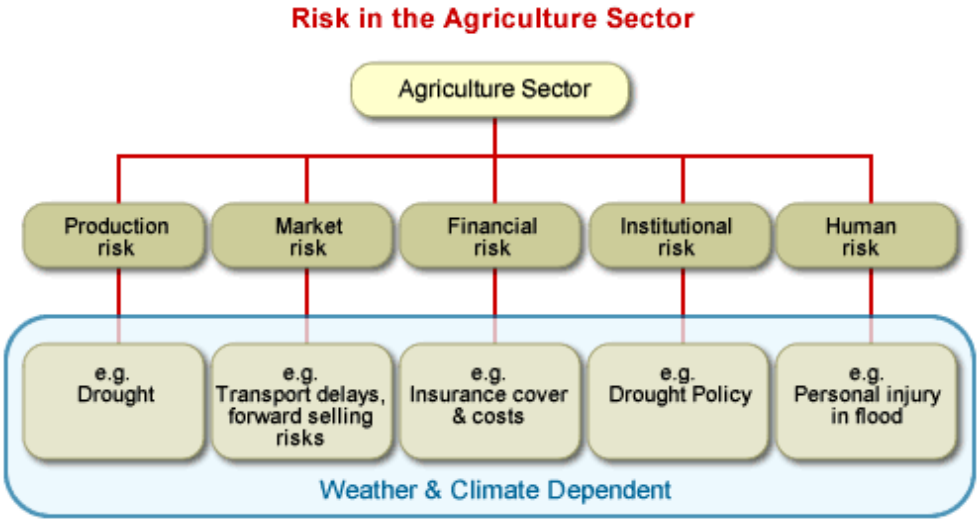
Lupin agronomy guide

Sowing window

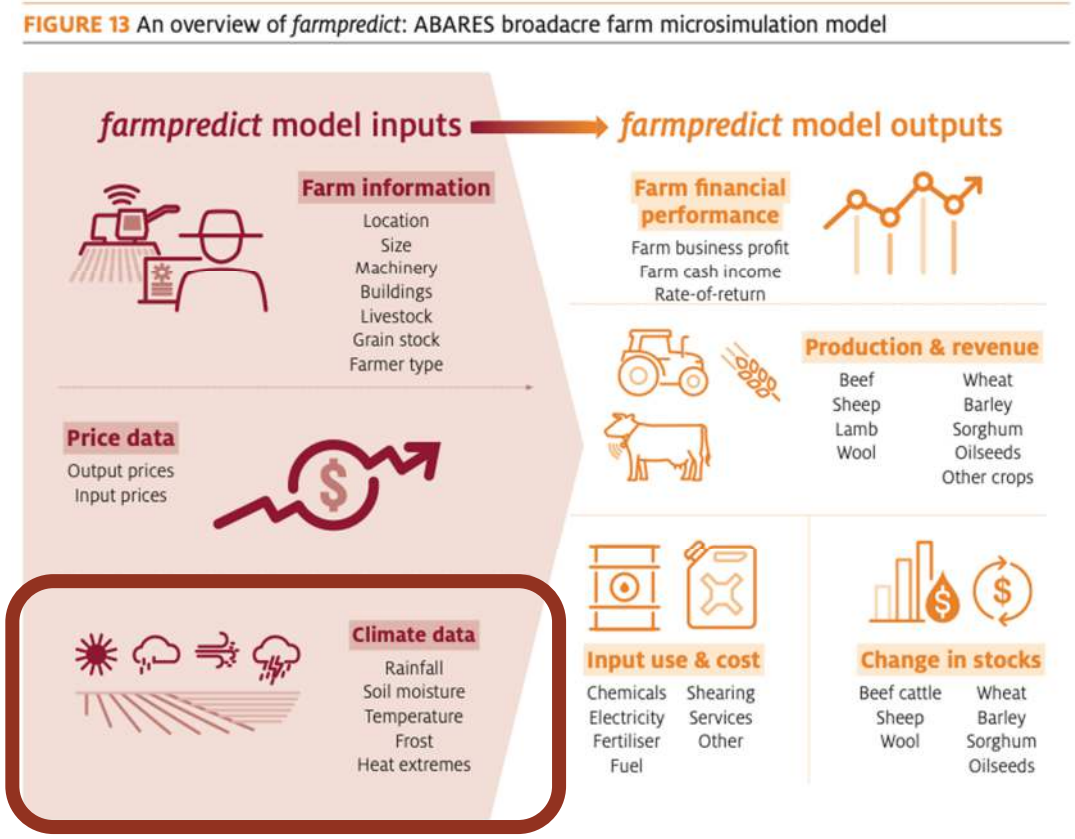
Agzone	Rainfall	Suggested sowing date
Agzone 1	High	Late April to early June
	Medium	Late April to mid-May
Agzone 2	High	Late April to early June
	Medium	Late April to mid-May
Agzone 3	High	Early May to early June
Agzone 4	Low	Late April to mid-May
Agzone 5	Low-Medium	Late April to mid-May
Agzone 6	High	Late April to early June

2024 Western Australian Crop Sowing Guide. B Shackley, S Power, B Paynter, G Troup, M Seymour and H Dhammu (DPIRD)

Weather data



http://www.bom.gov.au/watl/about-weather-and-climate/risk/



Hughes, 2021, Analysis of climate change impacts and adaptation on Australian farms. https://doi.org/10.25814/589v-7662

Weather data

Drives key decisions: sowing, nutrient and pest/disease management, harvest

Enables **data-driven** decision-making

Improves crop management and resource optimisation

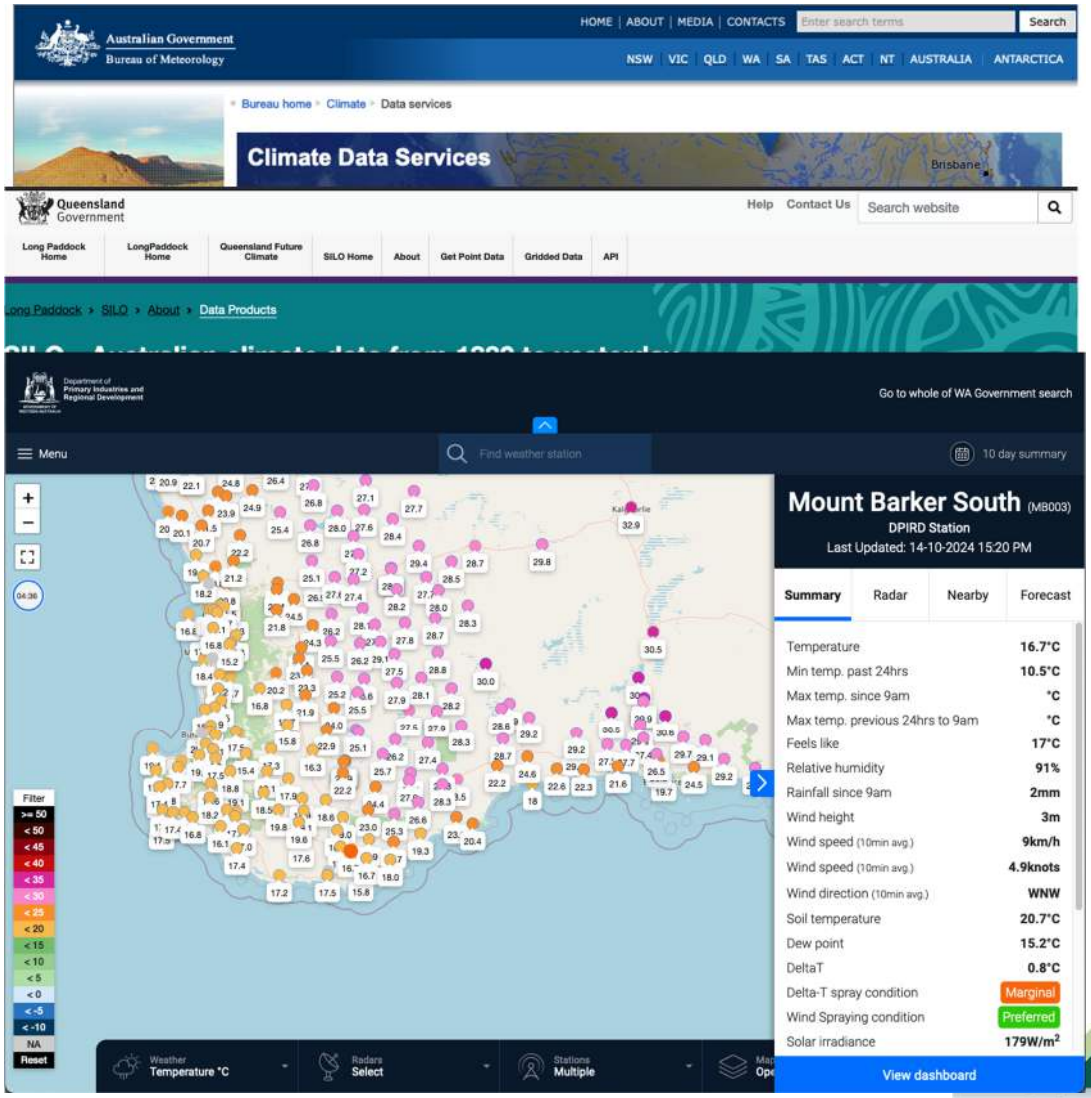
Data access

Fragmented data sources

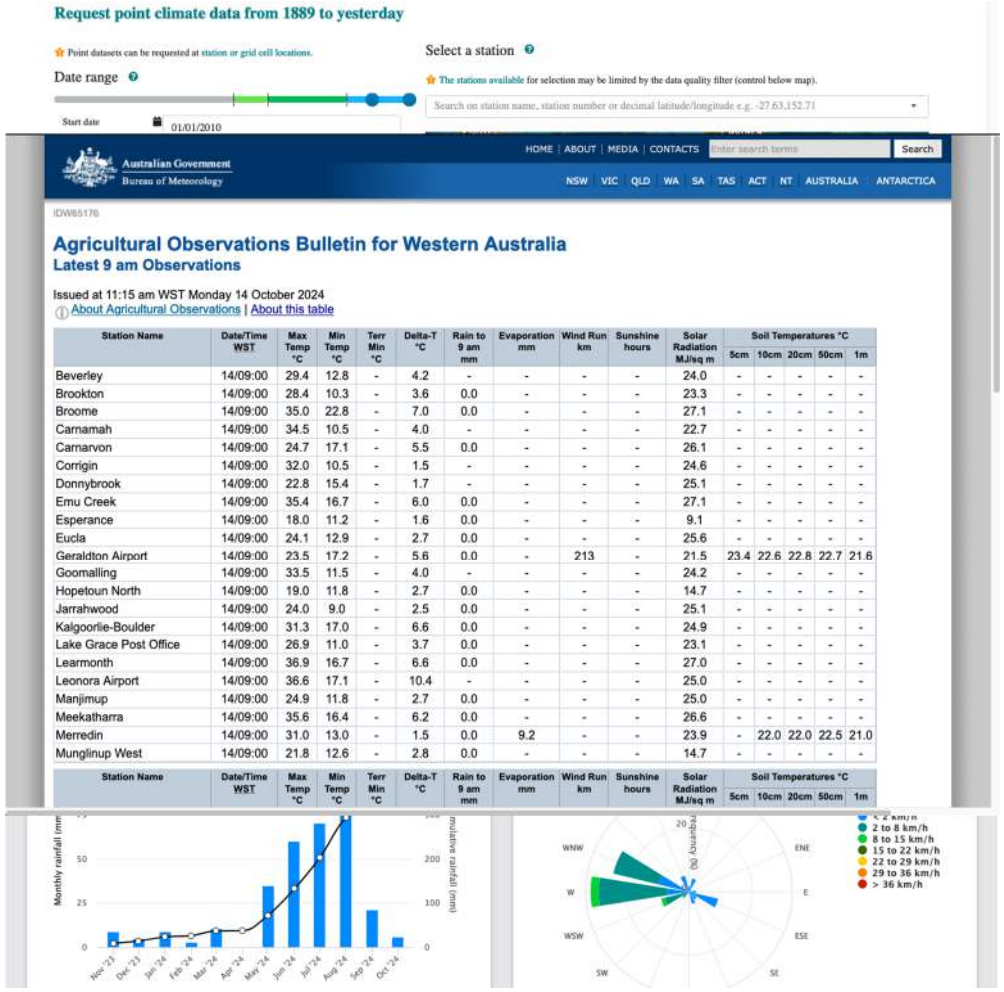
Multiple data sources (BOM, SILO, DPIRD) with different formats and access methods

Challenges in accessing, integrating, and analysing data efficiently

Lack of streamlined programmatic access for repeated use and standardised output



Data access



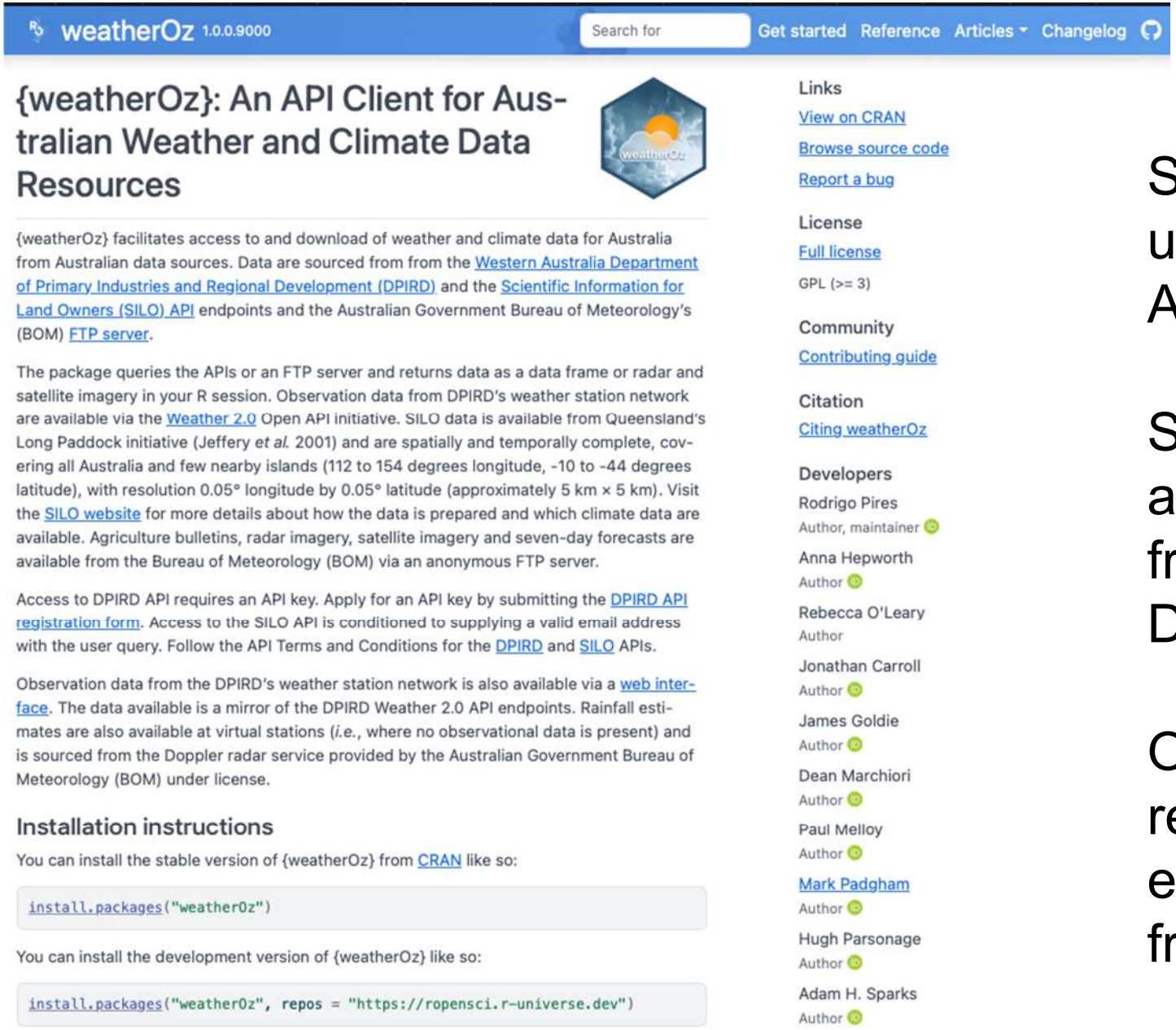
What if I want..

.. weather data for stations in a given area regardless of the source?

.. weather data since the start of the records?

.. download weather data for one or multiple stations and save locally for further analysis?

.. fill data gaps for custom date/time interval?



Software providing a unified interface to Australian climate data

Standardised data access and retrieval from BOM/SILO, and DPIRD

Open-source, peer-reviewed, built for extensibility and user-friendliness

weatherOz

Integrated historical functionalities from DPIRD codebase

Leveraged and updated features from the *bomrang* R package

Developed a robust API client interface

Rich documentation and usage examples

Comprehensive station metadata

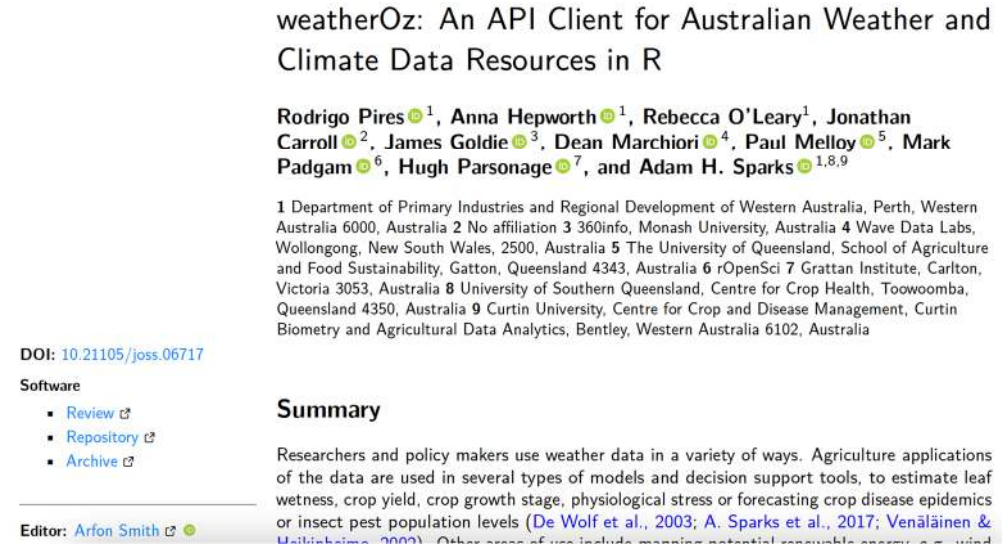
weatherOz - key features

Access to near-live weather observations and historical climate data (stations and gridded)

Access to Bureau of Meteorology forecasts (précis & coastal) and agriculture bulletin data

Download and visualisation of radar and satellite imagery (BOM ftp server)

Metadata information for all DPIRD and BOM stations (~3885)



JOSS
The Journal of Open Source Software

weatherOz: An API Client for Australian Weather and Climate Data Resources in R

Rodrigo Pires[1], Anna Hepworth[1], Rebecca O'Leary[1], Jonathan Carroll[2], James Goldie[3], Dean Marchiori[4], Paul Melloy[5], Mark Padgam[6], Hugh Parsonage[7], and Adam H. Sparks[1,8,9]

1 Department of Primary Industries and Regional Development of Western Australia, Perth, Western Australia 6000, Australia 2 No affiliation 3 360info, Monash University, Australia 4 Wave Data Labs, Wollongong, New South Wales, 2500, Australia 5 The University of Queensland, School of Agriculture and Food Sustainability, Gatton, Queensland 4343, Australia 6 rOpenSci 7 Grattan Institute, Carlton, Victoria 3053, Australia 8 University of Southern Queensland, Centre for Crop Health, Toowoomba, Queensland 4350, Australia 9 Curtin University, Centre for Crop and Disease Management, Curtin Biometry and Agricultural Data Analytics, Bentley, Western Australia 6102, Australia

DOI: 10.21105/joss.06717

Software

- Review
- Repository
- Archive

Editor: Arfon Smith

Summary

Researchers and policy makers use weather data in a variety of ways. Agriculture applications of the data are used in several types of models and decision support tools, to estimate leaf wetness, crop yield, crop growth stage, physiological stress or forecasting crop disease epidemics or insect pest population levels (De Wolf et al., 2003; A. Sparks et al., 2017; Venäläinen &

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weatherOz - Key features

Example 3: Get Data Drill APSIM-ready Data

For APSIM users, SILO provides an endpoint that serves APSIM formatted data ready for use in this modelling framework. The `get_data_drill_apsim()` function works just as `get_data_drill()`, it just returns an object that is an {[apsimx]} `met` class rather than a `data.table` and there is no need to specify values as those are predetermined by the API endpoint. The [write_apsim_met()] function is reexported from {apsimx} for convenience in saving .met files.

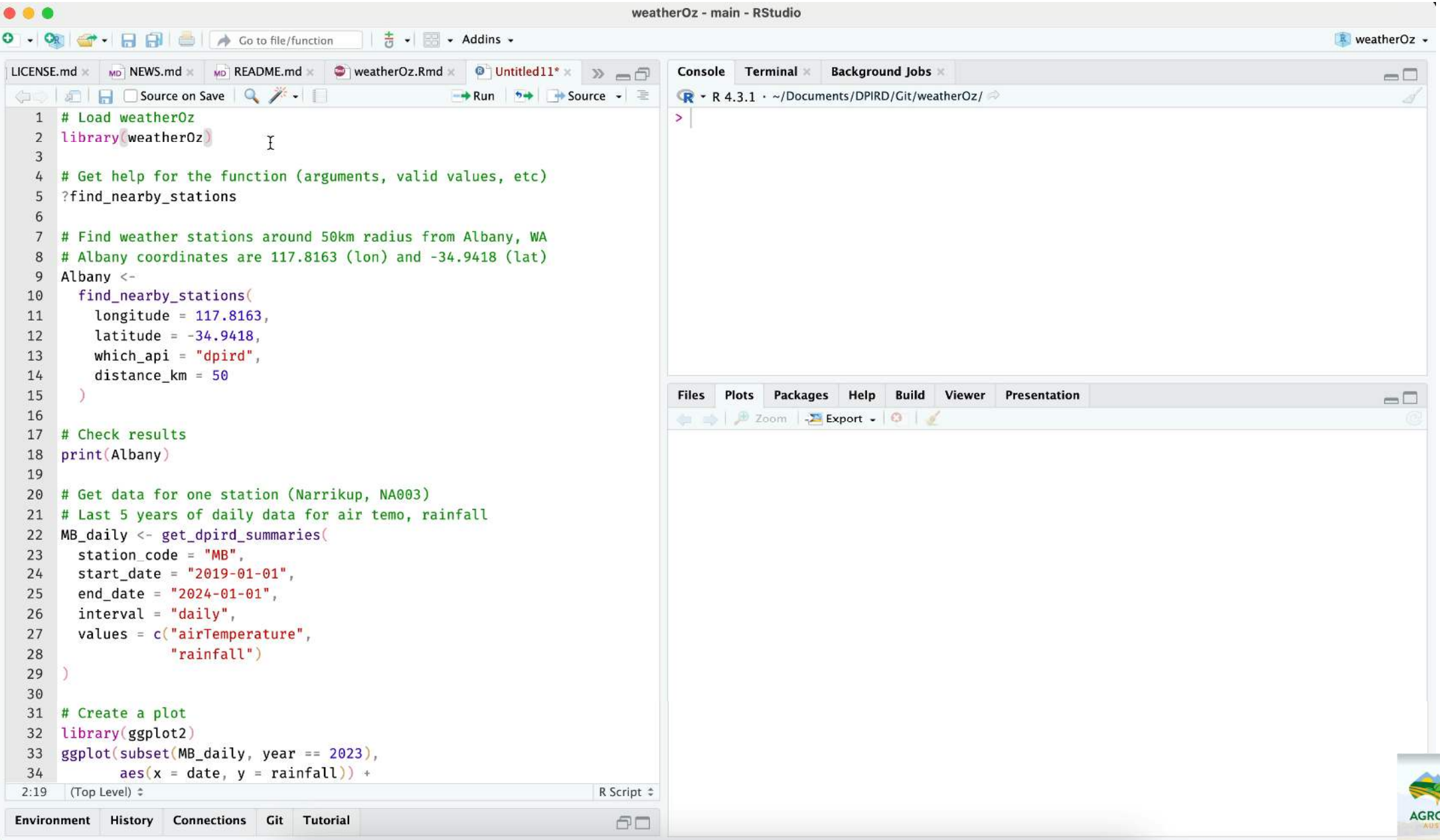
```
library(weatherOz)

(
  southwood_apsim <- get_data_drill_apsim(
    latitude = -27.85,
    longitude = 150.05,
    start_date = "20230101",
    end_date = "20231231"
  )
)
#> weather.met.weather
#> site =
#> latitude = -27.85  (DECIMAL DEGREES)
#> longitude = 150.05  (DECIMAL DEGREES)
#> tav = 20.8006868131868 (oC) ! calculated annual average ambient temperature 2
#> amp = 14.85 !calculated with the apsimx R package: 2024-08-03 15:44:33.655
#> year day radn maxt mint rain evap vp code
#> () () (MJ/m^2) (oC) (oC) (mm) (mm) (hPa) ()
#>   year day radn maxt mint rain evap   vp   code
#> 1 2023   2 30.4 35.3 19.6  0.0  8.2 17.0 422222
#> 2 2023   3 22.7 36.6 20.6  0.0  6.1 18.2 422222
#> 3 2023   4 22.0 39.1 20.9  0.0  8.5 21.0 422222
#> 4 2023   5 12.1 31.4 21.4  3.6  6.5 18.1 422222
#> 5 2023   6 30.1 34.4 16.4  0.0  6.7 17.1 422222
#> 6 2023   7 27.6 33.4 19.8  0.0  5.7 15.7 422222
```

Daily data from BOM/SILO stations and minute to yearly data from DPIRD, supporting custom variable selection

Extreme weather indicators from DPIRD Weather API (erosion, frost and heat conditions)

Ability to export data in several formats, including for use in APSIM simulations (.met files)


weatherOz - main - RStudio
Go to file/function
Addins
weatherOz
LICENSE.md
NEWS.md
README.md
weatherOz.Rmd
Untitled11*
Source on Save
Run
Source
# Load weatherOz
library(weatherOz)
# Get help for the function (arguments, valid values, etc)
?find_nearby_stations
Find weather stations around 50km radius from Albany, WA
Albany coordinates are 117.8163 (lon) and -34.9418 (lat)
Albany <-
find_nearby_stations(
longitude = 117.8163,
latitude = -34.9418,
which_api = "dpird",
distance_km = 50
)
# Check results
print(Albany)
# Get data for one station (Narrikup, NA003)
# Last 5 years of daily data for air temo, rainfall
MB_daily <- get_dpird_summaries(
station_code = "MB",
start_date = "2019-01-01",
end_date = "2024-01-01",
interval = "daily",
values = c("airTemperature",
"rainfall")
)
# Create a plot
library(ggplot2)
ggplot(subset(MB_daily, year == 2023),
aes(x = date, y = rainfall)) +
2:19
(Top Level)
R Script
Environment
History
Connections
Git
Tutorial
Console
Terminal
Background Jobs
R 4.3.1 · ~/Documents/DPIRD/Git/weatherOz/
Files
Plots
Packages
Help
Build
Viewer
Presentation
Zoom
Export

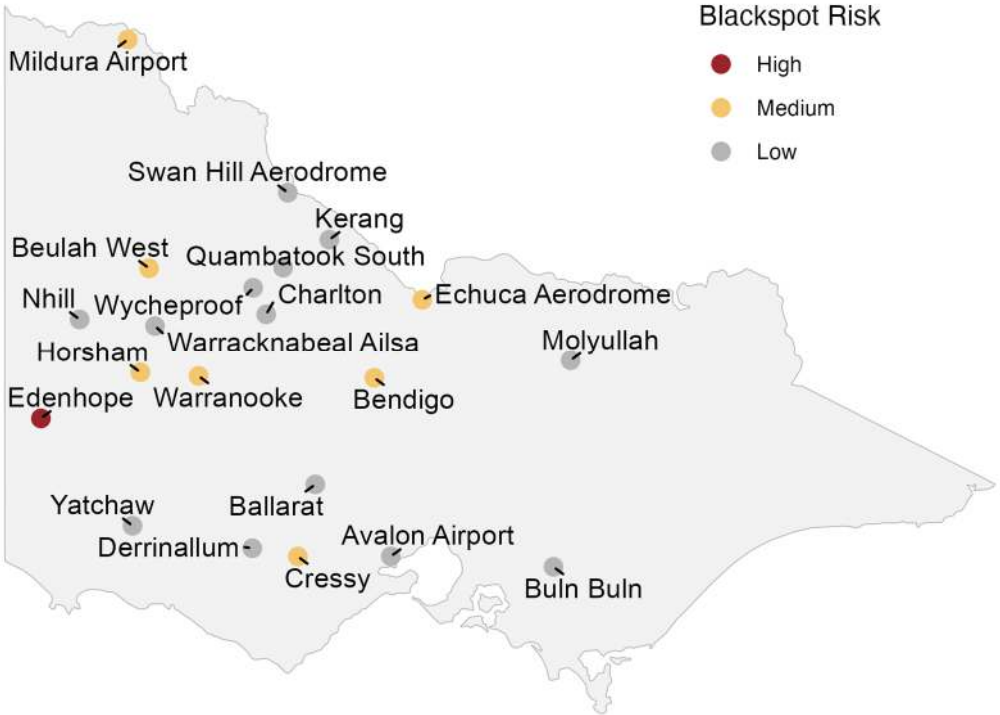
Applications & use

Near real-time advice

Weekly risk forecasts and summaries for subscribers (April-June)

Blackspot forecasts in field peas (WA, NSW, SA and VIC) and Blackleg forecasts in canola (WA)

Location-specific agronomic recommendations



DPIRD 2024. https://www.agric.wa.gov.au/field-peas/blackspot-field-peas-disease-forecast

Mt Barker

Last date used for prediction: 26 May 2024
Rainfall to date: 65.7 mm
Days with significant stubble moisture: 45

27 May	3 Jun	1(
50% spores released - blackspot risk medium	62% spores released - blackspot risk low	7 bl
Do not sow	Sow - do not sow dry	S

Mullewa

Last date used for prediction: 26 May 2024
Rainfall to date: 50 mm
Days with significant stubble moisture: 22

27 May	3 Jun	10 J
15% spores released - blackspot risk high	25% spores released - blackspot risk high	41% blac
Do not sow	Do not sow	Sow

Munglinup

Last date used for prediction: 26 May 2024
Rainfall to date: 77.4 mm
Days with significant stubble moisture: 45

27 May	3 Jun	1(
50% spores released - blackspot risk medium	62% spores released - blackspot risk low	7 bl
Sow - do not sow dry	Sow - do not sow dry	S

Minnipa PIRSA

Last date used for prediction: 26 May 2024
Rainfall to date: 27.4 mm
Days with significant stubble moisture: 14

Forecast for crops sown on	27 May	3 Jun
Spores released	1%	3%
Blackspot risk	High	High

Mt Barker

Last date used for prediction: 26 May 2024
Rainfall to date: 95.2 mm
Days with significant stubble moisture: 47

Forecast for crops sown on	27 May	3 Jun
Spores released	59%	70%
Blackspot risk	Medium	Low

Murray Bridge

Last date used for prediction: 26 May 2024
Rainfall to date: 54.4 mm
Days with significant stubble moisture: 34

Forecast for crops sown on	27 May	3 Jun
Spores released	29%	41%
Blackspot risk	High	Medium

Griffith

Last date used for prediction: 26 May 2024
Rainfall to date: 245.6 mm
Days with significant stubble moisture: 66

Forecast for crops sown on	27 May	3 Jun	10 Jun
Sowing guide (based on agronomic suitability)	OK to sow	Getting too late to sow - after 9th June	Too late to sow after 16th June
Blackspot risk	Low	Low	Low

Temora

Last date used for prediction: 26 May 2024
Rainfall to date: 239.2 mm
Days with significant stubble moisture: 79

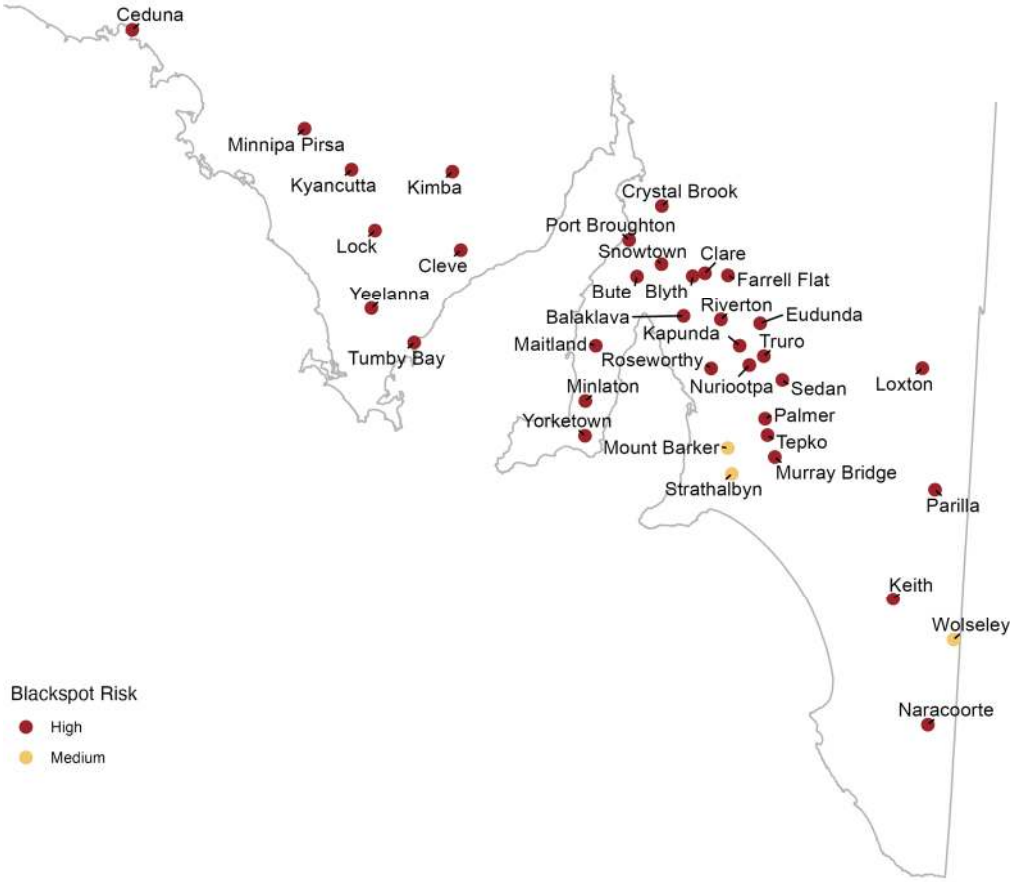
Forecast for crops sown on	27 May	3 Jun	10 Jun
Sowing guide (based on agronomic suitability)	OK to sow	OK to sow	Getting too late to sow - after 16th June
Blackspot risk	Low	Low	Low

Wagga Wagga AMO

Last date used for prediction: 26 May 2024
Rainfall to date: 161 mm
Days with significant stubble moisture: 52

Forecast for crops sown on	27 May	3 Jun	10 Jun
Sowing guide (based on agronomic suitability)	OK to sow	OK to sow	OK to sow
Blackspot risk	Low	Low	Low

27th May forecast - SA



27th May forecast - VIC

https://www.agric.wa.gov.au/field-peas/field-pea-blackspot-management-guide-south-australia-27-may-2024
https://www.agric.wa.gov.au/crop-diseases/field-pea-blackspot-management-guide-victoria-27-may-2024

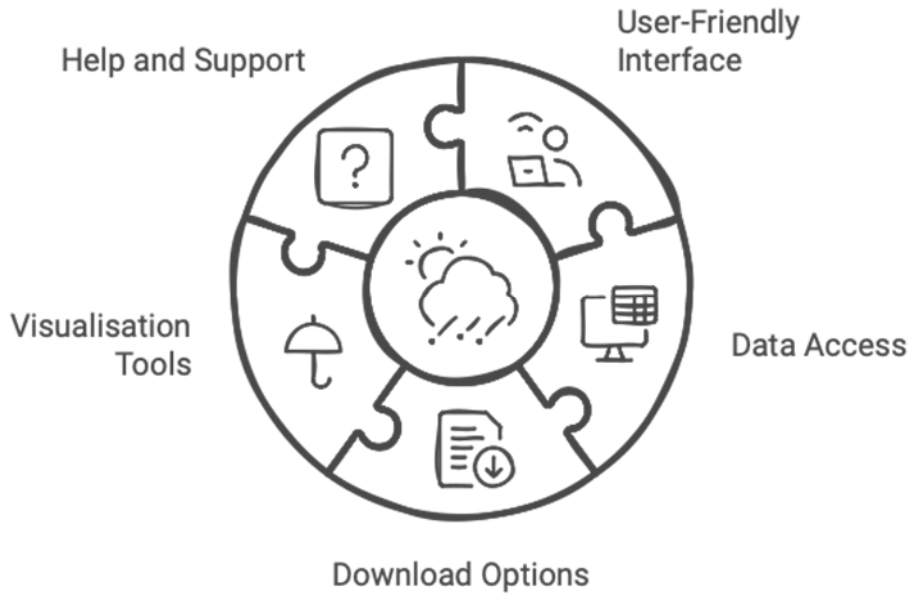
Applications & use

Interactive data access

User-friendly dashboards for easy data retrieval

Selection of multiple stations and custom variables

Download data for further analysis

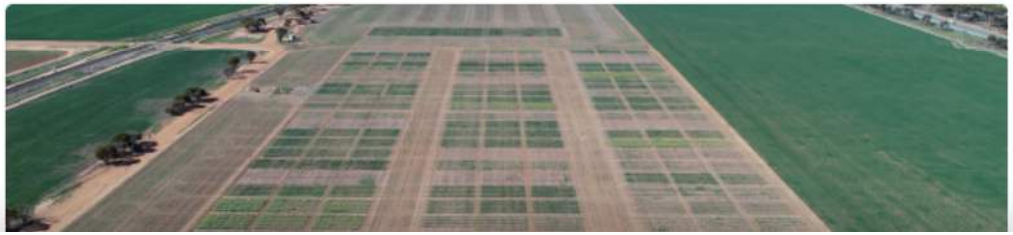


Western Australian Farming Systems project

Page last updated: Tuesday, 2 April 2024 - 7:48am

The Western Australian Farming Systems project is a 5 year co-investment by the Department of Primary Industries and Regional Development (DPIRD) and the Grains Research and Development Corporation (GRDC), undertaking farming systems research and development (R&D) in the medium and low rainfall regions of WA.

The project aims to increase adoption and integration of agronomic and systems innovations which support increased whole farm profitability through managing enterprise mix and rotations.



Documents

WAFS Field Trials Report 2023.pdf

Regions

- Great Southern
- Mid West

Home | Current Climate | Future Climate

AgriClimate Insights

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An Interactive Climate Analysis for Australian Grain Growers and Researchers

This web application provides an easy-to-use platform for analysing climate data tailored for growers and researchers in Australia. It simplifies decision-making around sowing by making complex data accessible without the need for advanced computing skills.

Getting Started

What interests you?

- **Current** (1950s-Now) or **Future** (Now-2100s)
  - Want an overall understanding? Check out the **Summary**
  - Explore a detailed understanding of your local **Sowing Opportunity**
  - Understand the changes surrounding **Extremes**

Please ensure to;

- Register with a valid email for full data access as per SILO's policy.
- Submit your data and click 'Submit' to view or update results.
- Download reports or data directly from each page.

Need help? Visit our **FAQ** section or contact us via email.

FAQ

- ▶ **Understanding a Sowing Opportunity**
- ▶ **Exploring Multiple Sowing Opportunities**
- ▶ **Where is the historic climate data coming from?**

Applications & use

Site map | Accessibility |

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Tools & support › Newsletters

Tools & support

- Tools & support
  - Initiatives
  - Newsletters
    - AgMemo
    - Fit to trade
    - Agribusiness, Food & Trade
    - Ovine observer
    - PestFacts WA
    - Grains Convo
    - Protecting WA crops
    - **Seasonal climate outlook**
    - Sheep industry business innovation
    - WA Livestock disease outlook
    - Wine industry newsletter

Seasonal Climate Outlook

The Seasonal Climate Outlook (SCO) is a monthly newsletter that summarises national and international climate outlooks for the next three months for the South West Land Division. It provides a review of recent climate indicators, including ENSO (El Niño Southern Oscillation), the Indian Ocean Dipole, the Southern Annular Mode, as well as local sea surface temperature and pressures systems.

October 2024

Seasonal Climate Outlook October 2024

The current rainfall outlook for the South West Land Division (SWLD) from October to December has the majority of models indicating neutral chances of exceeding median rainfall. It's important to understand that a neutral outlook does not imply average rainfall but rather reflects normal...

September 2024

Seasonal Climate Outlook September 2024

The current rainfall outlook for the South West Land Division (SWLD) from September to November is mixed, with most models indicating either neutral chances of exceeding median rainfall or predicting above-median rainfall. Near-normal maximum temperatures and warmer-than-normal minimum...

August 2024

Seasonal Climate Outlook August 2024

The current rainfall outlook for the South West Land Division (SWLD) from August to October indicates neutral chances of exceeding median rainfall, with an equal likelihood of below or above median rainfall. Near-normal maximum temperatures, and warmer

Seaso

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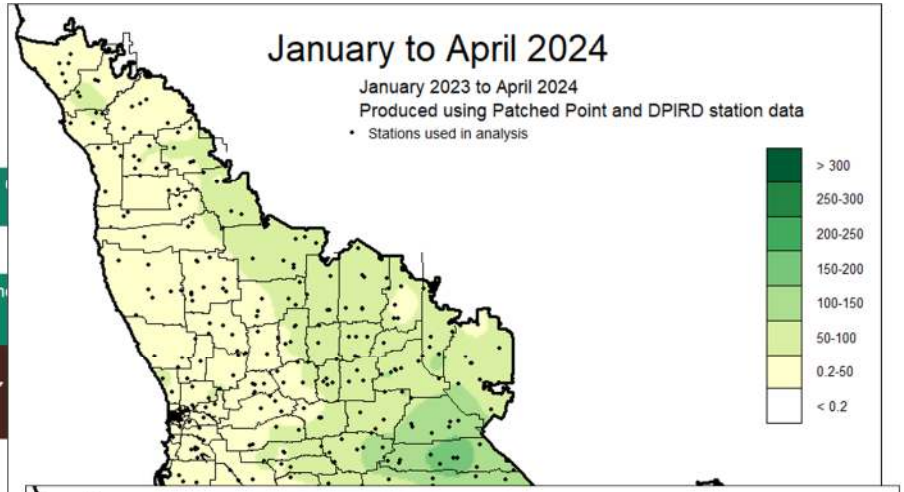

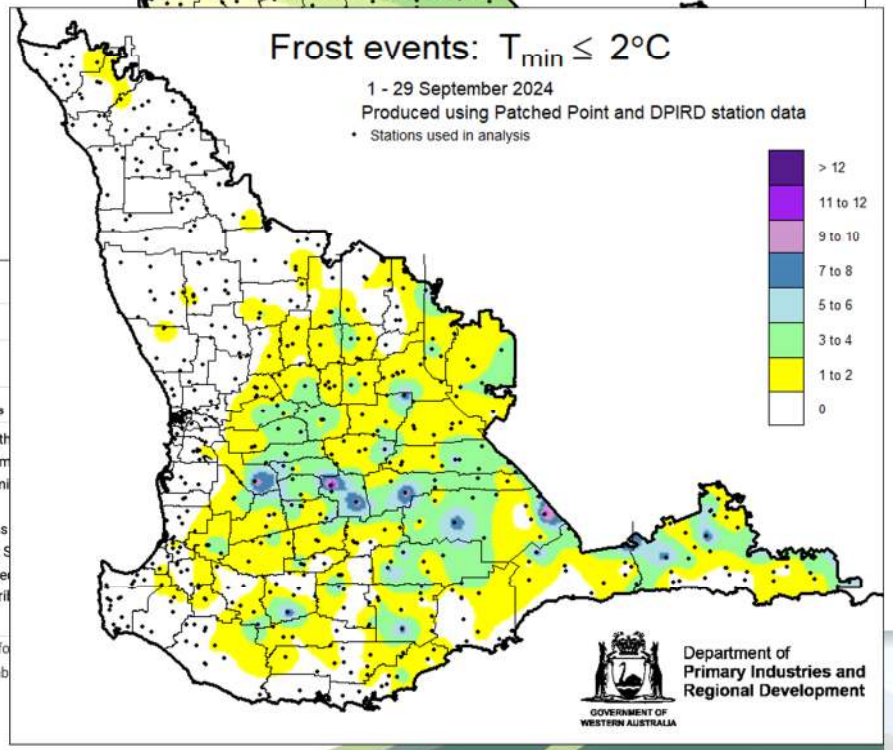

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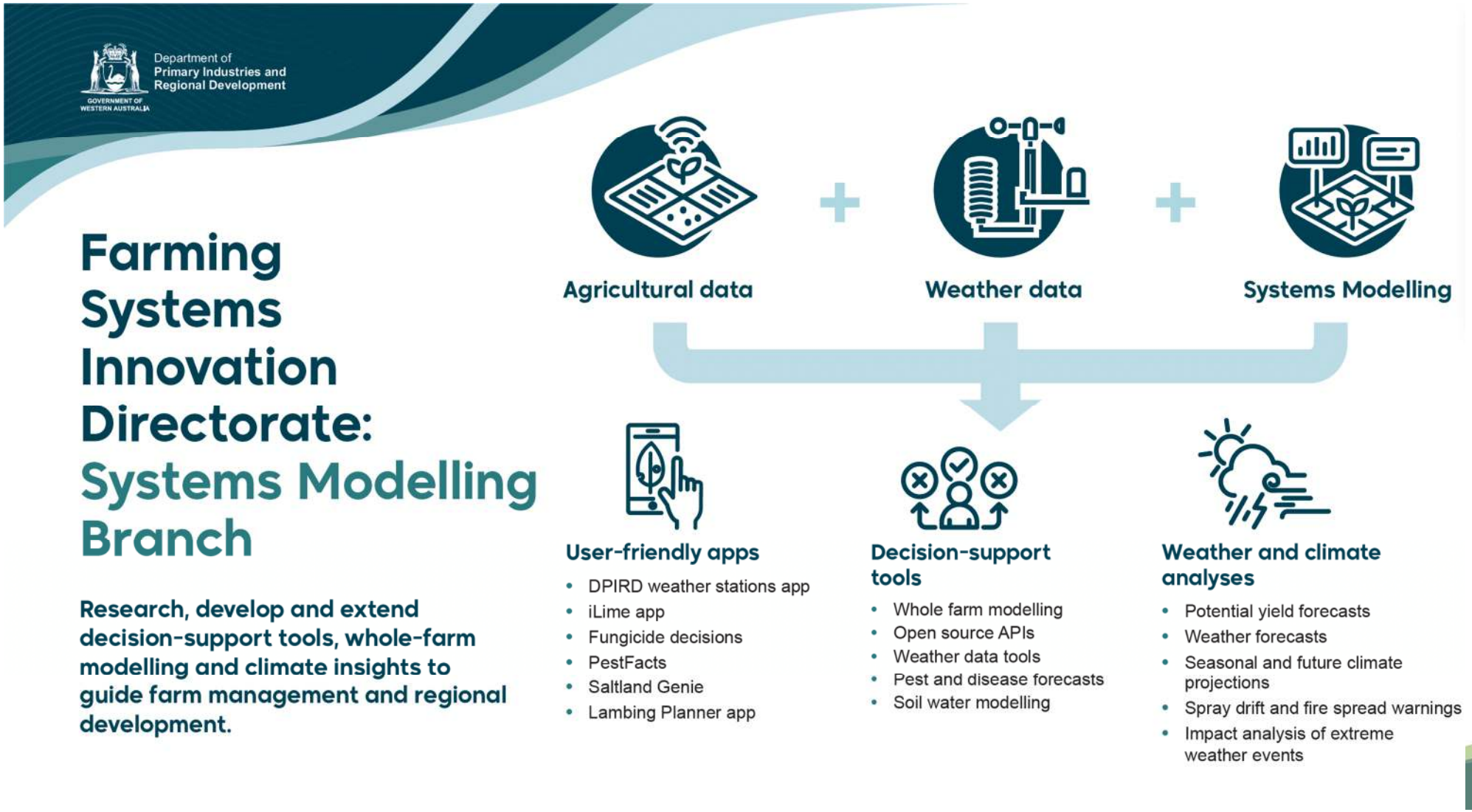
Benefit and impact

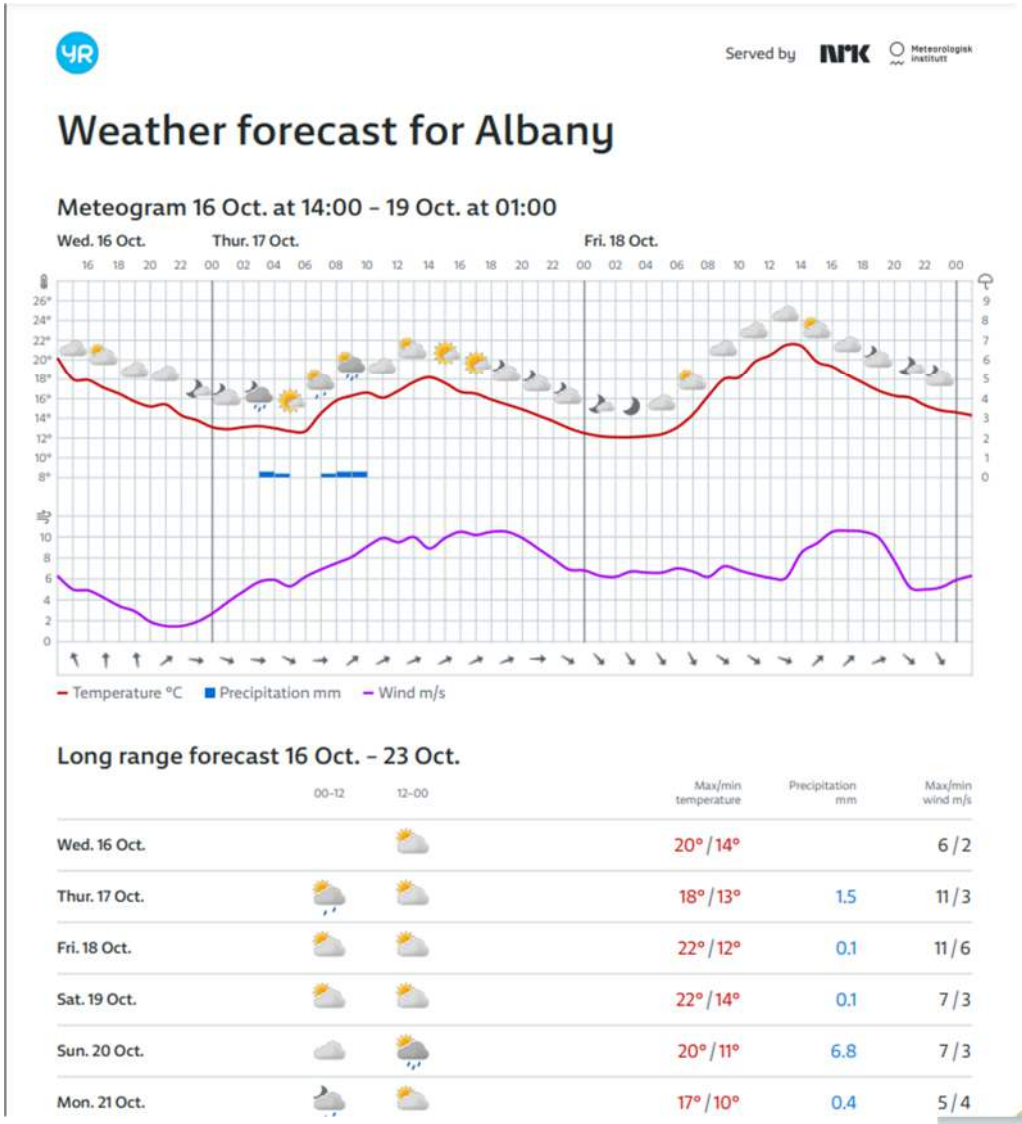


Future directions

Encouraging community contributions and collaborations

Additional functionality to access weather forecasts

Expand capacity to source gridded datasets



Take-home messages

Unified access to Australian climate data (DPIRD and BOM/SILO)

Comprehensive metadata information with reliable and standardised data outputs

Foundation for developing new tools and applications

Explore *weatherOz* and provide feedback/contribute!

Acknowledgements and thanks

Adam Sparks
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DPIRD FSI Climate Team
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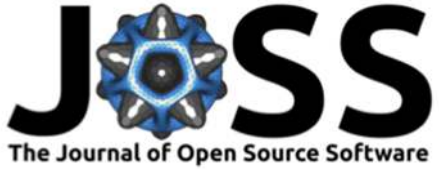
Paul Melloy
Rebecca O'Leary
Steve Collins

Department of
Primary Industries and
Regional Development



University of
Southern
Queensland

Thank you

dpird.wa.gov.au

Dr Rodrigo Pires | Research scientist @ecophysplants on X
Primary Industries Development | Farming Systems Innovation | System Modelling
Email: rodrigo.pires@dpird.wa.gov.au
weatherOz website: https://docs.ropensci.org/weatherOz/

References

- Pires et al., (2024). weatherOz: An API Client for Australian Weather and Climate Data Resources in R. Journal of Open Source Software, 9(98), 6717, https://doi.org/10.21105/joss.06717
- weatherOz GitHub repository - https://github.com/ropensci/weatherOz
- weatherOz webpage and documentation - https://docs.ropensci.org/weatherOz/
- weatherOz rOpenSci software peer-view - https://github.com/ropensci/software-review/issues/598
- DPIRD Sporacle Blackspot Manager (WA, VIC, NSW, SA) - https://www.agric.wa.gov.au/field-peas/blackspot-field-peas-disease-forecas
- DPIRD Sporacle Blackleg spore maturity forecast (WA) - https://www.agric.wa.gov.au/canola/canola-blackleg-spore-maturity-forecast-western-australia-0
- DPIRD AgriClimate Insights dashboard - https://aci.dpird.app
- DPIRD Seasonal Climate Outlook newsletter - https://www.agric.wa.gov.au/newsletters/sco
- DPIRD Mobile App Centre webpage - https://www.agric.wa.gov.au/appcentre
- SILO, Australian climate data from 1889 to yesterday - https://www.longpaddock.qld.gov.au/silo/
- BOM Weather Data Services - http://www.bom.gov.au/catalogue/data-feeds.shtml
- Weather forecast, The Norwegian Meteorological Institute - https://www.yr.no/en