



Department of  
Primary Industries and  
Regional Development

Protect  
Grow  
Innovate

# 'weatherOz': A unified interface to access and source Australian climate data

Data systems, sensors and technology  
for improved decision making



**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

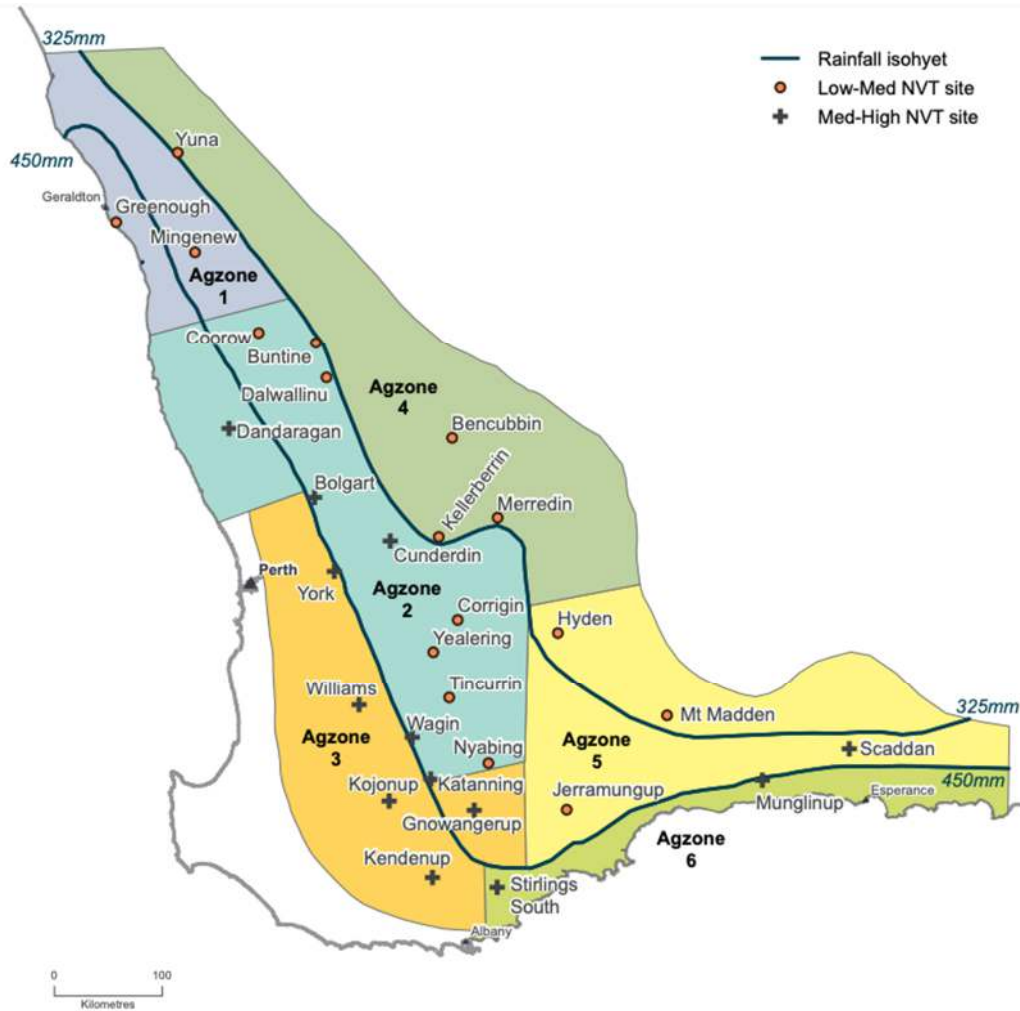
Applications/current use

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

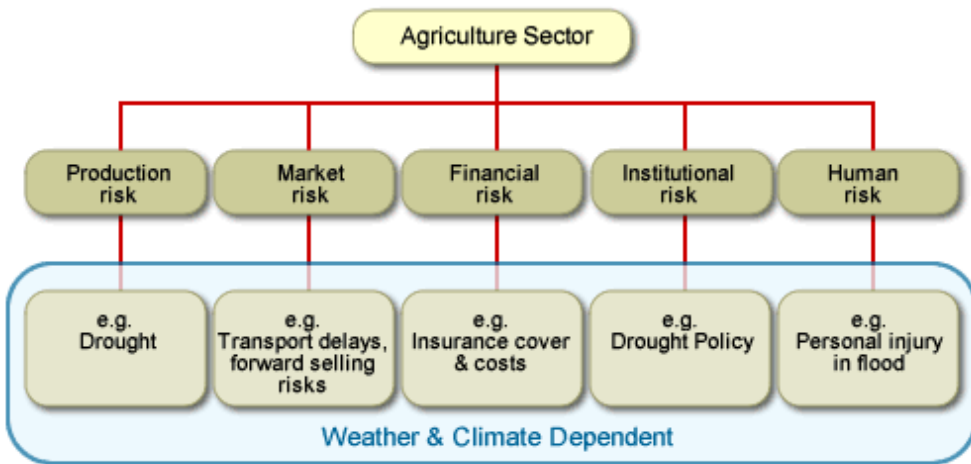
## Lupin agronomy guide

### 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

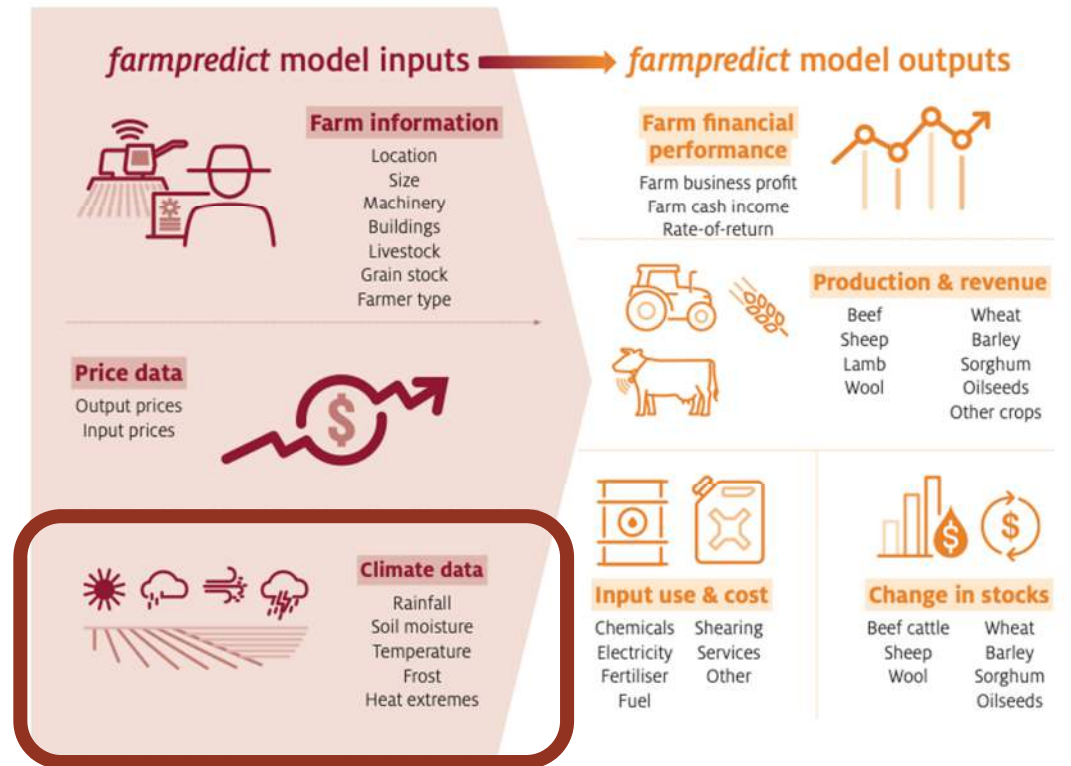
# Weather data

## Risk in the Agriculture Sector



<http://www.bom.gov.au/wat/about-weather-and-climate/risk/>

FIGURE 13 An overview of *farmpredict*: ABARES broadacre farm microsimulation model



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



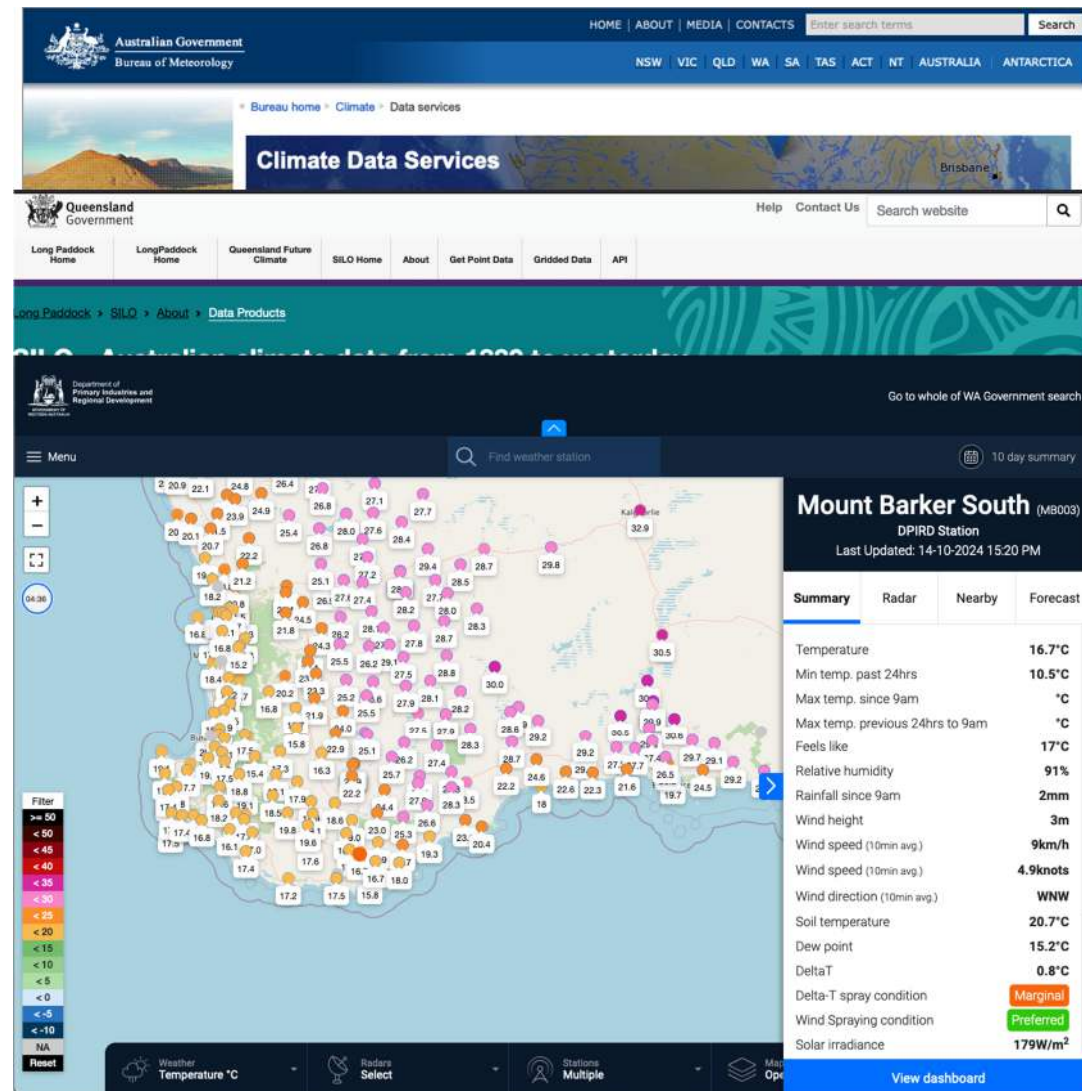
# Data access

## 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

Request point climate data from 1889 to yesterday

Point datasets can be requested at station or grid cell locations. Select a station

Date range: 01/01/2010

Search on station name, station number or decimal latitude/longitude e.g. -27.63,152.71

Australian Government Bureau of Meteorology

Home | About | Media | Contacts

Enter search terms Search

NSW VIC QLD WA SA TAS ACT NT AUSTRALIA ANTARCTICA

IDW65176

### Agricultural Observations Bulletin for Western Australia

Latest 9 am Observations

Issued at 11:15 am WST Monday 14 October 2024

[About Agricultural Observations](#) | [About this table](#)

Station Name	Date/Time WST	Max Temp °C	Min Temp °C	Terr Min °C	Delta-T °C	Rain to 9 am mm	Evaporation mm	Wind Run km	Sunshine hours	Solar Radiation MJ/mq m	Soil Temperatures °C				
											5cm	10cm	20cm	50cm	1m
Beverley	14/09:00	29.4	12.8	-	4.2	-	-	-	-	24.0	-	-	-	-	
Brookton	14/09:00	28.4	10.3	-	3.6	0.0	-	-	-	23.3	-	-	-	-	
Broome	14/09:00	35.0	22.8	-	7.0	0.0	-	-	-	27.1	-	-	-	-	
Carnamah	14/09:00	34.5	10.5	-	4.0	-	-	-	-	22.7	-	-	-	-	
Carnarvon	14/09:00	24.7	17.1	-	5.5	0.0	-	-	-	26.1	-	-	-	-	
Corrigin	14/09:00	32.0	10.5	-	1.5	-	-	-	-	24.6	-	-	-	-	
Donnybrook	14/09:00	22.8	15.4	-	1.7	-	-	-	-	25.1	-	-	-	-	
Emu Creek	14/09:00	35.4	16.7	-	6.0	0.0	-	-	-	27.1	-	-	-	-	
Esperance	14/09:00	18.0	11.2	-	1.6	0.0	-	-	-	9.1	-	-	-	-	
Eucla	14/09:00	24.1	12.9	-	2.7	0.0	-	-	-	25.6	-	-	-	-	
Geraldton Airport	14/09:00	23.5	17.2	-	5.6	0.0	-	213	-	21.5	23.4	22.6	22.8	22.7	21.6
Goomalling	14/09:00	33.5	11.5	-	4.0	-	-	-	-	24.2	-	-	-	-	
Hopetoun North	14/09:00	19.0	11.8	-	2.7	0.0	-	-	-	14.7	-	-	-	-	
Jarrahwood	14/09:00	24.0	9.0	-	2.5	0.0	-	-	-	25.1	-	-	-	-	
Kalgoorlie-Boulder	14/09:00	31.3	17.0	-	6.6	0.0	-	-	-	24.9	-	-	-	-	
Lake Grace Post Office	14/09:00	26.9	11.0	-	3.7	0.0	-	-	-	23.1	-	-	-	-	
Learnmonth	14/09:00	36.9	16.7	-	6.6	0.0	-	-	-	27.0	-	-	-	-	
Leonora Airport	14/09:00	36.6	17.1	-	10.4	-	-	-	-	25.0	-	-	-	-	
Manjimup	14/09:00	24.9	11.8	-	2.7	0.0	-	-	-	25.0	-	-	-	-	
Meekatharra	14/09:00	35.6	16.4	-	6.2	0.0	-	-	-	26.6	-	-	-	-	
Merredin	14/09:00	31.0	13.0	-	1.5	0.0	9.2	-	-	23.9	-	22.0	22.0	22.5	21.0
Munglinup West	14/09:00	21.8	12.6	-	2.8	0.0	-	-	-	14.7	-	-	-	-	

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?

# {weatherOz}: An API Client for Australian Weather and Climate Data Resources



{weatherOz} facilitates access to and download of weather and climate data for Australia from Australian data sources. Data are sourced from from the [Western Australia Department of Primary Industries and Regional Development \(DPIRD\)](#) and the [Scientific Information for Land Owners \(SILO\) API](#) endpoints and the Australian Government Bureau of Meteorology's (BOM) [FTP server](#).

The package queries the APIs or an FTP server and returns data as a data frame or radar and satellite imagery in your R session. Observation data from DPIRD's weather station network are available via the [Weather 2.0](#) Open API initiative. SILO data is available from Queensland's Long Paddock initiative (Jeffery *et al.* 2001) and are spatially and temporally complete, covering all Australia and few nearby islands (112 to 154 degrees longitude, -10 to -44 degrees latitude), with resolution 0.05° longitude by 0.05° latitude (approximately 5 km × 5 km). Visit the [SILO website](#) for more details about how the data is prepared and which climate data are available. Agriculture bulletins, radar imagery, satellite imagery and seven-day forecasts are available from the Bureau of Meteorology (BOM) via an anonymous FTP server.

Access to DPIRD API requires an API key. Apply for an API key by submitting the [DPIRD API registration form](#). Access to the SILO API is conditioned to supplying a valid email address with the user query. Follow the API Terms and Conditions for the [DPIRD](#) and [SILO](#) APIs.

Observation data from the DPIRD's weather station network is also available via a [web interface](#). The data available is a mirror of the DPIRD Weather 2.0 API endpoints. Rainfall estimates are also available at virtual stations (*i.e.*, where no observational data is present) and is sourced from the Doppler radar service provided by the Australian Government Bureau of Meteorology (BOM) under license.

## Installation instructions

You can install the stable version of {weatherOz} from [CRAN](#) like so:

```
install.packages("weatherOz")
```

You can install the development version of {weatherOz} like so:

```
install.packages("weatherOz", repos = "https://ropensci.r-universe.dev")
```

## Links

[View on CRAN](#)

[Browse source code](#)

[Report a bug](#)

## License

[Full license](#)

GPL (>= 3)

## Community

[Contributing guide](#)

## Citation

[Citing weatherOz](#)

## Developers

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Adam H. Sparks

Author

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)



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

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

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DOI: [10.21105/joss.06717](https://doi.org/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 & Hiltunen, 2009). Other uses of weather data include mapping potential cropland areas, and

# 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

LICENSE.md x MD NEWS.md x MD README.md x weatherOz.Rmd x Untitled11\* x

Go to file/function Addins weatherOz

```
1 # Load weatherOz
2 library(weatherOz)
3
4 # Get help for the function (arguments, valid values, etc)
5 ?find_nearby_stations
6
7 # Find weather stations around 50km radius from Albany, WA
8 # Albany coordinates are 117.8163 (lon) and -34.9418 (lat)
9 Albany <-
10   find_nearby_stations(
11     longitude = 117.8163,
12     latitude = -34.9418,
13     which_api = "dpird",
14     distance_km = 50
15   )
16
17 # Check results
18 print(Albany)
19
20 # Get data for one station (Narrikup, NA003)
21 # Last 5 years of daily data for air temo, rainfall
22 MB_daily <- get_dpird_summaries(
23   station_code = "MB",
24   start_date = "2019-01-01",
25   end_date = "2024-01-01",
26   interval = "daily",
27   values = c("airTemperature",
28             "rainfall")
29 )
30
31 # Create a plot
32 library(ggplot2)
33 ggplot(subset(MB_daily, year == 2023),
34        aes(x = date, y = rainfall)) +
```

2:19 (Top Level) R Script

Console Terminal Background Jobs

R 4.3.1 · ~/Documents/DPIRD/Git/weatherOz/

> |

Files Plots Packages Help Build Viewer Presentation

Zoom Export

Environment History Connections Git Tutorial

# 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



## 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	10 Jun
50% spores released - blackspot risk medium	62% spores released - blackspot risk low	71% spores released - blackspot risk low
Do not sow	Sow - do not sow dry	Sow - do not sow dry

## 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 Jun
15% spores released - blackspot risk high	25% spores released - blackspot risk high	41% spores released - blackspot risk high
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	10 Jun
50% spores released - blackspot risk medium	62% spores released - blackspot risk low	71% spores released - blackspot risk low
Sow - do not sow dry	Sow - do not sow dry	Sow - do not sow dry

## 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

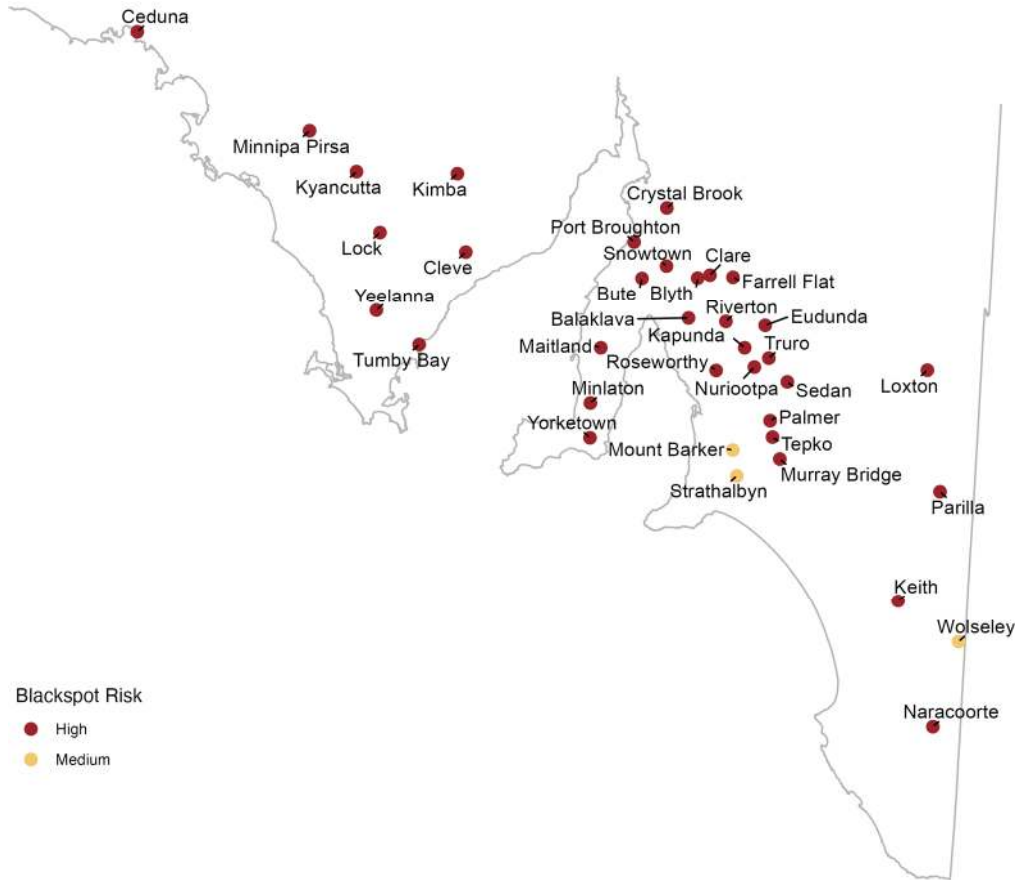
Last date used for prediction: 26 May 2024

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

# 27<sup>th</sup> May forecast - SA



# 27<sup>th</sup> 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>

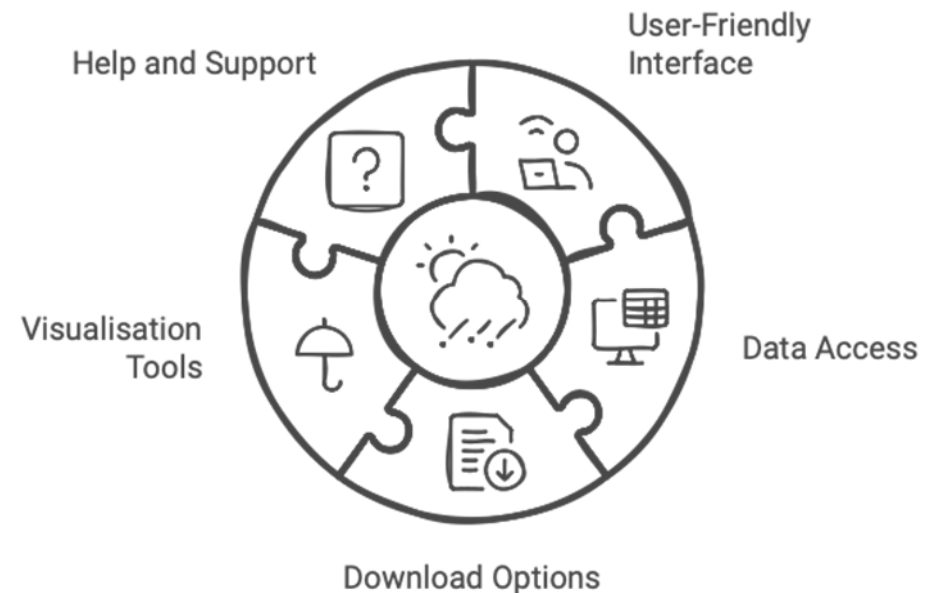
# Applications & use

## Interactive data access

User-friendly dashboards for easy data retrieval

Selection of multiple stations and custom variables

Download data for further analysis





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Crops

Livestock & animals

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Home > Climate, land & water > Crops > Grains > Western Australian Farming Systems project



Crops

Grains

Wheat

Barley

Canola

Lupins

Oats

Pulses

Grains Research & Development

Genetic modification

## 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.



### Western Australian Farming Systems project

- 1. [Background](#)
- 2. [Regional Innovation Groups](#)
- 3. [Project activities](#)
- 4. [Extension activities](#)
- 5. [Acknowledgments](#)

[View on one page](#)

### Documents

[WAFS Field Trials Report 2023.pdf](#)

### Regions

- > [Great Southern](#)
- > [Mid West](#)

# AgriClimate Insights



Department of  
Primary Industries and  
Regional Development

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

Department of Primary Industries and Regional Development  
 Agriculture and Food

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Go to where you want

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Tools & support > Newsletters

## Tools & support

### Tools & support

Initiatives

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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

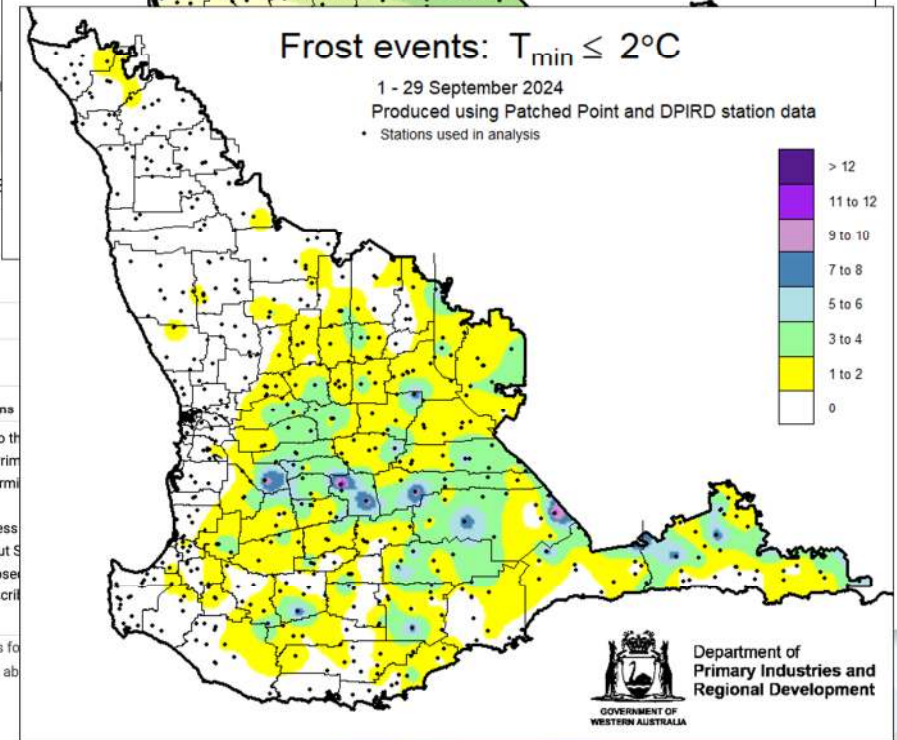
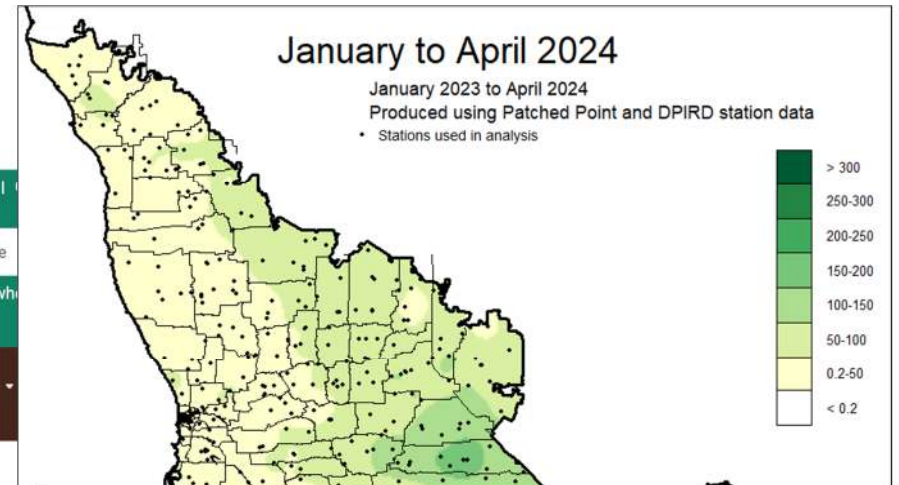
Seasonal Climate Outlook September 2024

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...



Seasonal Climate Outlook

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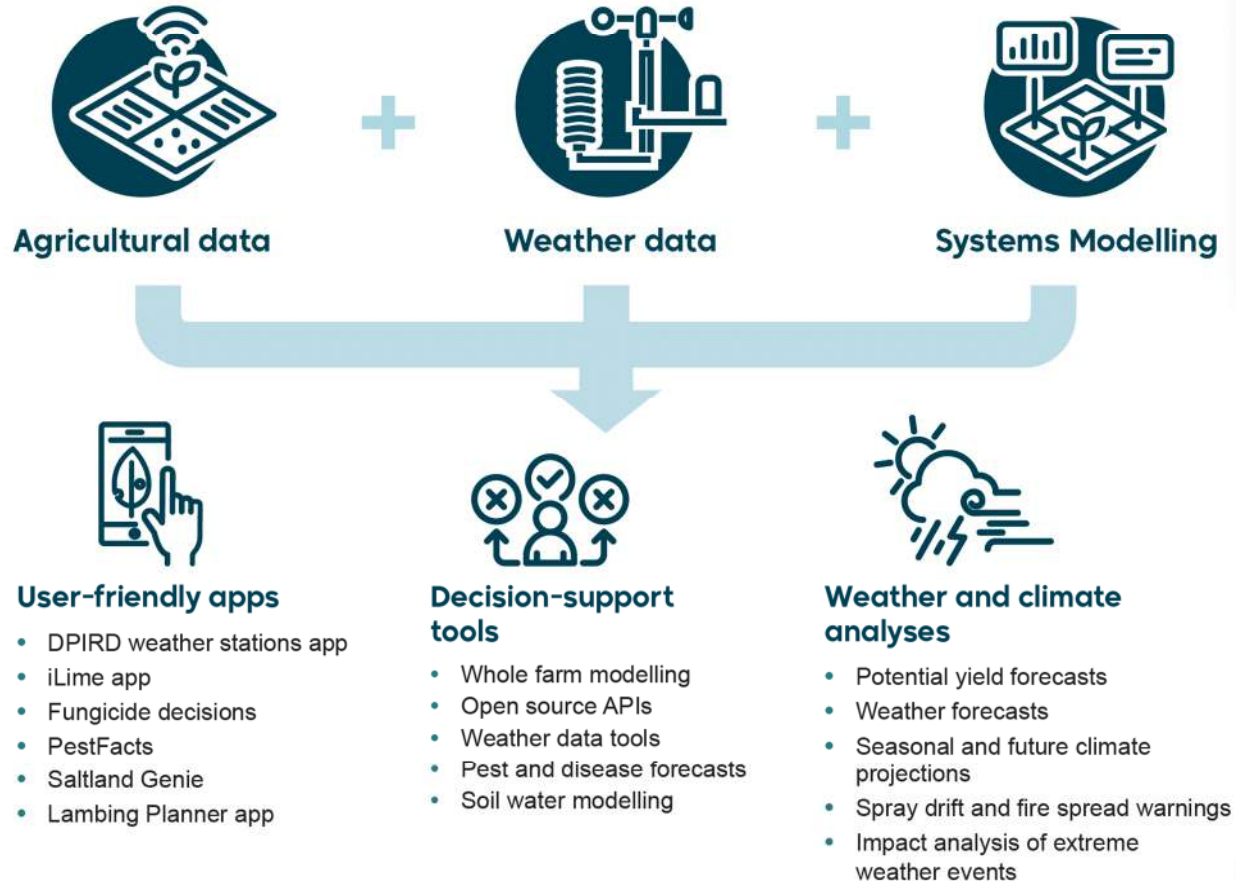
Subscribe

# Benefit and impact



## Farming Systems Innovation Directorate: Systems Modelling Branch

Research, develop and extend decision-support tools, whole-farm modelling and climate insights to guide farm management and regional development.

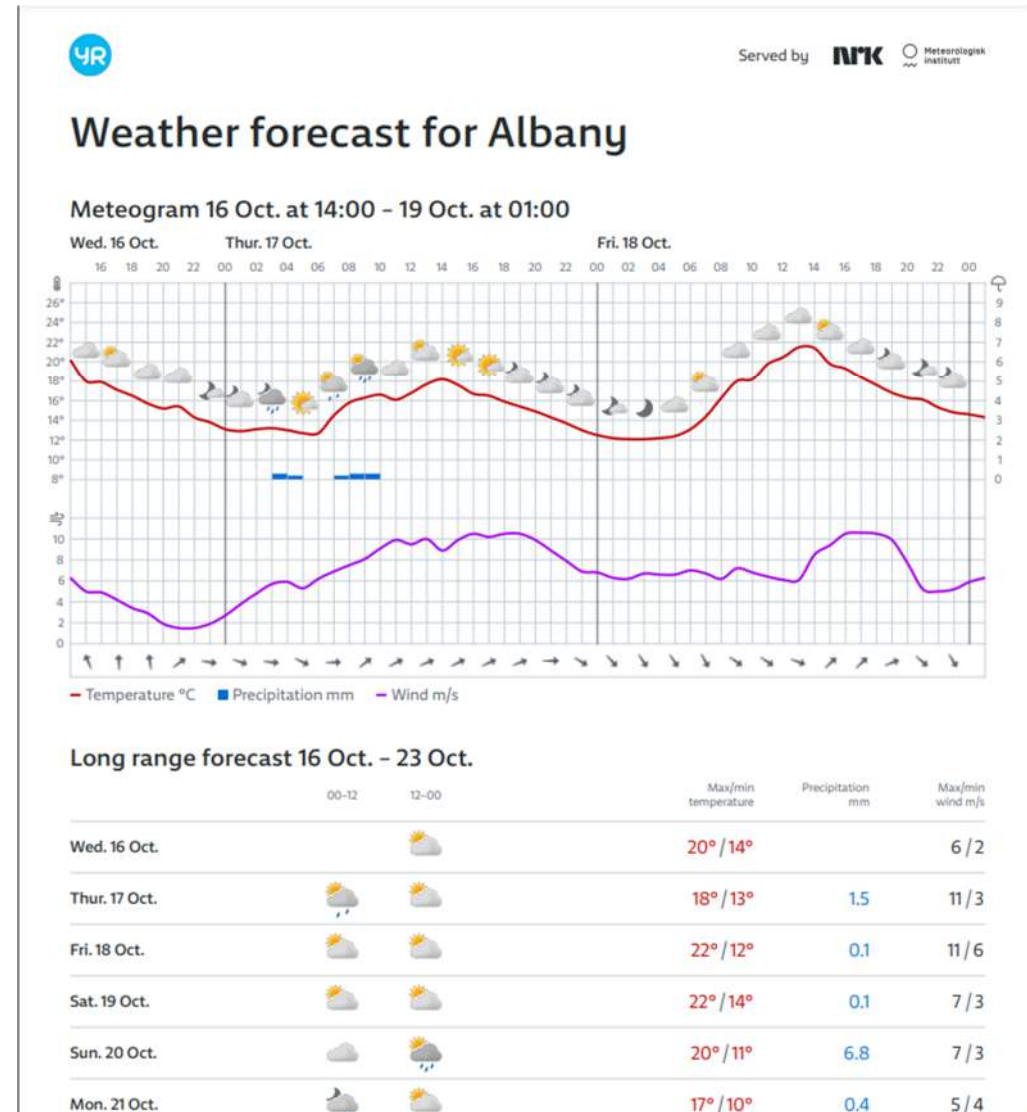


# Future directions

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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Dean Marchiori

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DPIRD FSI Climate Team

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James Goldie

Mark Pagdam

Paul Melloy

Rebecca O'Leary

Steve Collins



Department of  
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# 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](mailto:rodrigo.pires@dpird.wa.gov.au)  
weatherOz website: <https://docs.ropensci.org/weatherOz/>

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# 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>