

2nd LENSES E-DIALOGUE WEBINAR: SUSTAINABLE WATER MANAGEMENT IN SEMID-ARID AREAS

20 June 2023
h. 10:00 CET



COALA project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement No 870518



Smart Satellite-based service for low-impact irrigation management in Australia.

Operational tools developed in the context of the H2020

COALA project

<https://www.coalaproject.eu/>

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This project is part of the PRIMA programme supported by the European Union.
GA n° [2041] [LENSES] [Call 2020 Section 1 Nexus IA]

COALA aims at developing Copernicus-based services for...

...for supporting more sustainable use of water and nutrients in the advanced agricultural systems of Australia.

... sharing European knowledge and expertise in the field of EO-based applications for agriculture with Australian institutions

It will be a facilitator of new business experience between Europe and Australia



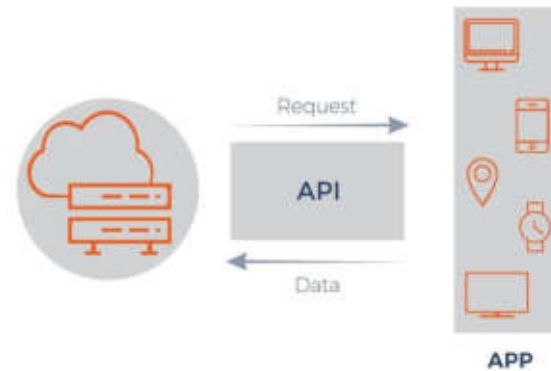
COALA will offer



- COALA services will be offered as **EO added value products** and services tailored for key agricultural processes and **needs of value chain stakeholders**
- COALA proposes Application program interface (**API**), allowing the partner's network to build upon the **custom application solution business cases**

EO added value products and services...

...tailored for key agricultural processes and needs of value chain stakeholders



COALA proposes Application program interface (API)



built upon the custom application **solution**

COALA Consortium

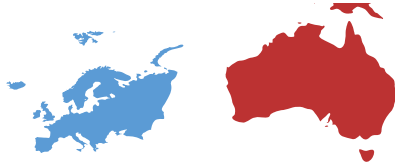
EU SMEs

EU & AU Research
institutions

EU End -Users

AU Business-Users

WHO



ARIES & **AGRISAT** bring innovative technology applications
WR will develop **market analysis** as well as **business modelling**

UCLM - R&D **Water** and **Nutrient** management Using EO.
BOKU - Solutions for **large-scale satellite data processing**
UOM - **agricultural sensing** and water modelling
UNSW applied research on natural **resource management**

ANBI and **JCRMO** will bring their **experience** as European **users** of support decisions making platform based on **EO data**.

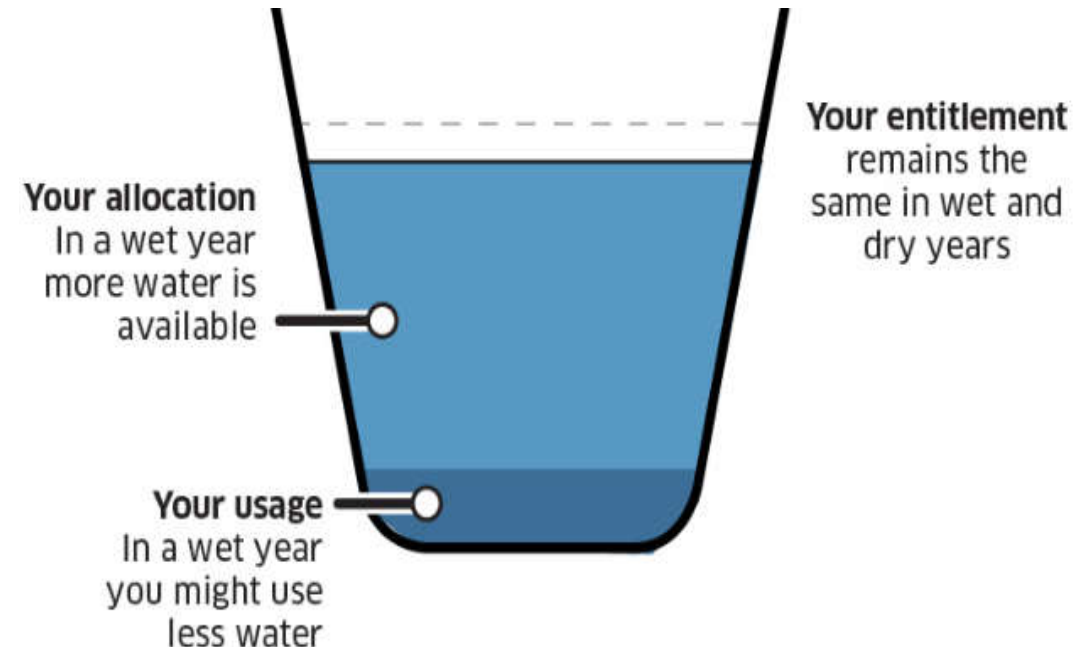
IREC - Irrigation Research and Extension Committee facilitates cross-industry collaboration
BCG - **Agricultural Consultancy** and Users engagement with their **community**

Water entitlements, allocations and usage (definitions)

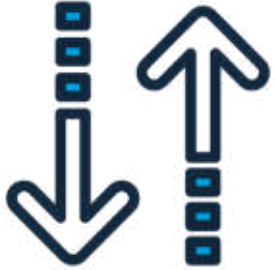
Water entitlements are rights to an ongoing share of water within a system.

Water allocations are the amount of water distributed to users (water entitlement holders) in a given year

Water usage is how much water is actually used from the water that is allocated.



Governance of Water Management



Water trading aims helping farmers to make more productive use of water and contributes to sustainable water management.

During the year, water is distributed (or 'allocated') against entitlements in response to factors such as rainfall and storage levels.



When water is allocated to an entitlement holder, they are able to use it as needed - this is their business decision to make.

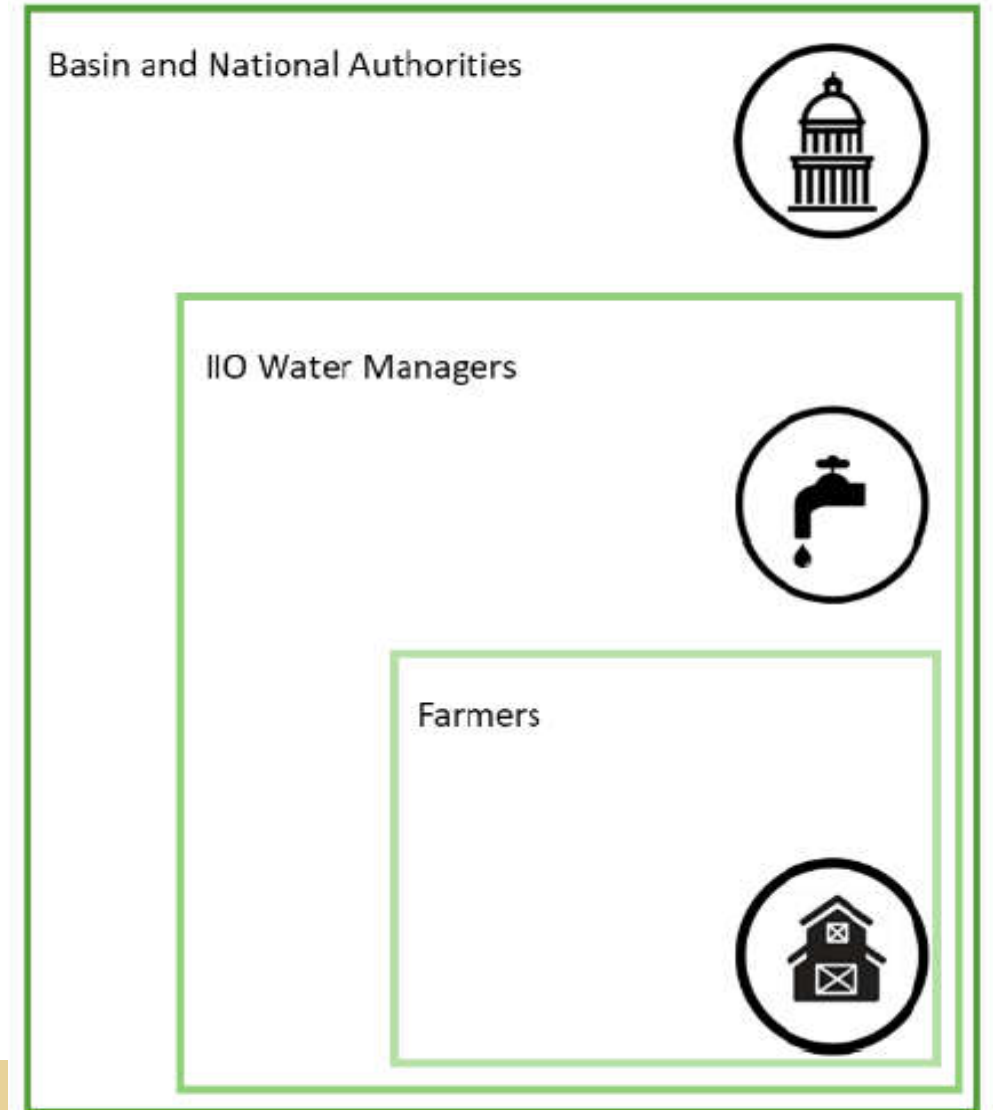
Governance of Water Management

Roles and responsibilities (actors)

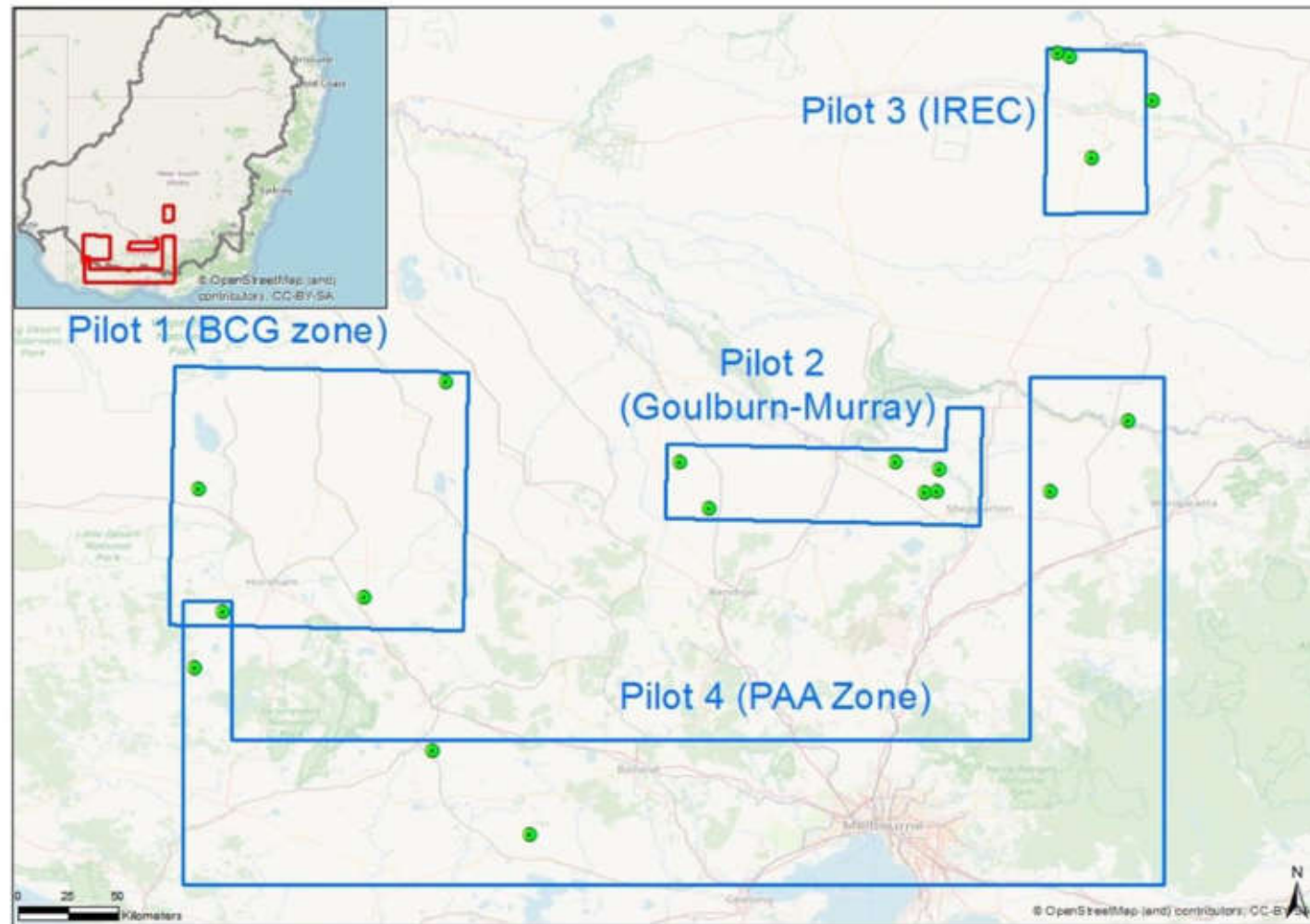
Irrigation Infrastructure Operators (IIOs) create and maintain trading rules within their irrigation network.

The Murray–Darling Basin Authority (MDBA) facilitates fair, consistent and transparent water trade across the Murray–Darling system.

The **Australian Competition and Consumer Commission (ACCC)** has monitoring, enforcement, advisory and price-setting roles (in some cases) for water market rules and water charge rules.



Pilots – Murray Darling Basin





What COALA provides?

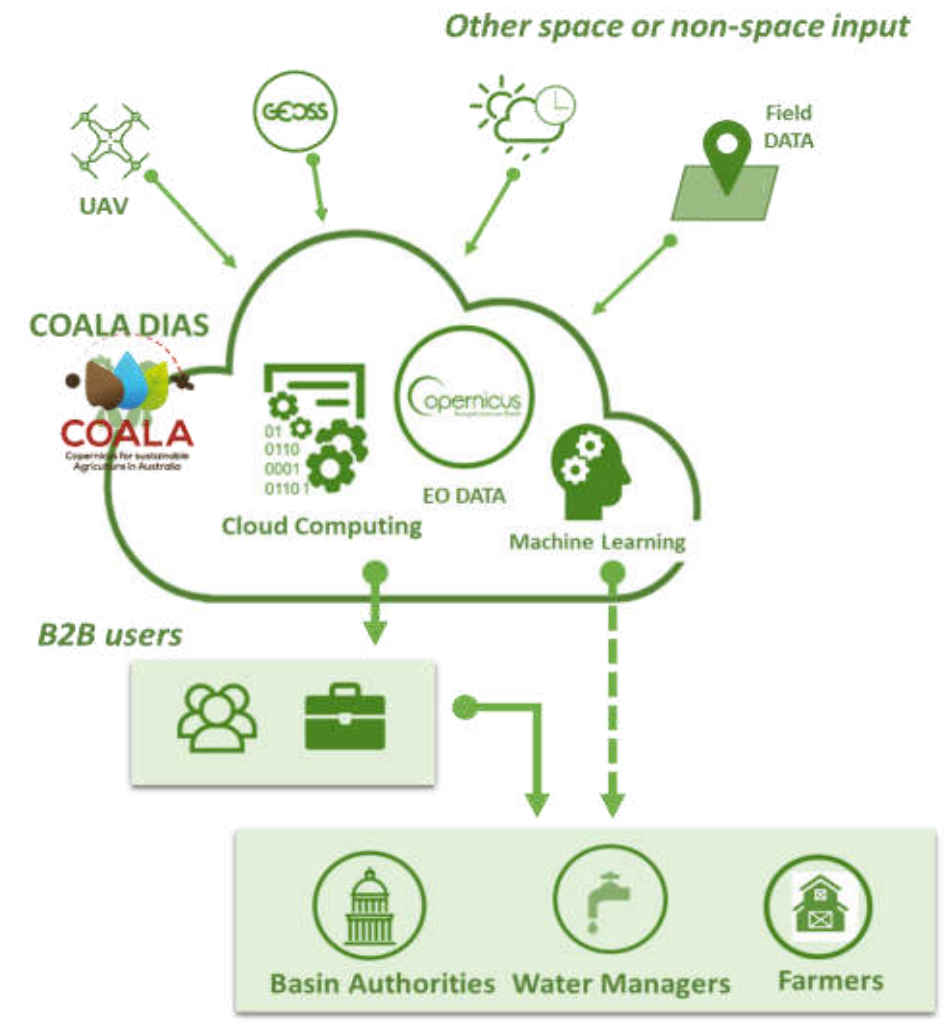


		Farmers	Water Managers (IIO)	Basin and National Authorities
EO Services	Services for water management And allocation procedure	<ul style="list-style-type: none"> ➤ Crop Evapotranspiration Map ➤ Crop Water Requirement Map ➤ Soil and Canopy Water Status (SCWS) 	<ul style="list-style-type: none"> ➤ Crop Evapotranspiration Map ➤ Crop Water Requirement Map ➤ Soil and Canopy Water Status (SCWS) ➤ Irrigated Area Map 	<ul style="list-style-type: none"> ➤ Crop Evapotranspiration Map ➤ Crop Water Requirement Map ➤ Soil and Canopy Water Status (SCWS) ➤ Irrigated Area Map
	Services for nutrient management	<ul style="list-style-type: none"> ➤ Nitrogen Nutrition Index Map ➤ Variable Rate Fertilization Map ➤ MZM 	<ul style="list-style-type: none"> ➤ Nitrogen Nutrition Index Map 	<ul style="list-style-type: none"> ➤ Nitrogen Nutrition Index Map
	Services to estimate Crop Development and Yield	<ul style="list-style-type: none"> ➤ Crop Yield Map; 	<ul style="list-style-type: none"> ➤ Crop Type Map 	<ul style="list-style-type: none"> ➤ Crop Type Map



How does COALA provide its services?

COALA proposes API (OGC compliant) allowing the partner network to built upon their existing application solution



How to access the data

- Via APIs
- Integration into existing platforms
webGIS,
app for farmer,
postman
- Integration into Qgis

Parametric Data processing is available at COALA platform

How to access the data – APIs documentation

The screenshot displays the SwaggerHub interface for the COALA APIs. The central pane shows the OpenAPI specification code, which includes the following details:

```

1 openapi: 3.0.0
2 info:
3   title: COALA APIs
4   version: "1"
5 servers:
6   - url: https://api.coalaproject.eu/api
7     description: BOKU server
8   # Added by API Auto Mocking Plugin
9   - description: SwaggerHub API Auto Mocking
10  url: https://virtserver.swaggerhub.com/zozlak/COALA/1
11 security:
12   - httpBasic: []
13   - token: []
14 paths:
15   /ameo/area:
16     post:
17       description: Upload new areas list in the geoJSON FeatureCollection format.
18       requestBody:
19         content:
20           application/json: {}
21           application/geo+json: {}
22       responses:
23         200:
24           description: Areas uploaded successfully
25           content:
26             application/json:
27               example:
28                 status: OK
29                 count: 398
30         400:
31           description: Bad request
32     put:
33       description:
34         Creates a single new feature.
35
36       Request payload must provide two properties - geometry containing a geoJSON geometry and
37       properties containing feature properties.
38       requestBody:
39         content:
40           application/json: {}
41           application/x-www-form-urlencoded: {}
42       responses:
43         200:
44           description: Feature created
  
```

The right pane shows the API endpoints for the COALA APIs, categorized by method:

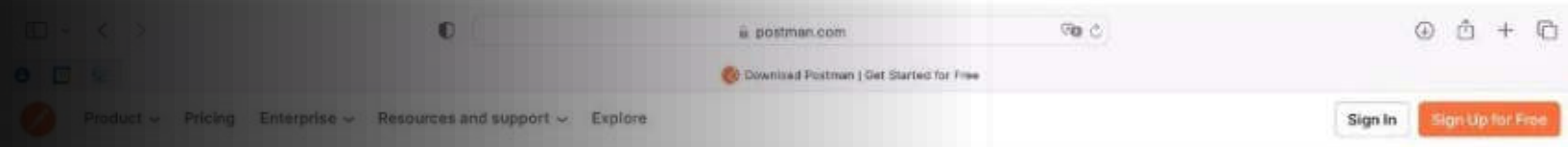
- POST** /ameo/area
- PUT** /ameo/area
- GET** /ameo/area
- DELETE** /ameo/area/{featureId}
- PUT** /ameo/area/{featureId}
- GET** /ameo/area/{featureId}
- DELETE** /ameo/area/{featureId}
- PUT** /ameo/area/{featureId}
- POST** /ameo/point
- PUT** /ameo/point

The interface also includes a sidebar with navigation options (Info, Tags, Servers) and a search bar. The top navigation bar shows the SwaggerHub logo and user options (Sign Up, Log In). The bottom status bar indicates the last saved time (3:16:45 pm - Mar 31, 2023) and a validity status (VALID).

Step 1. Download and Install Postman API Platform



[Postman download](#) (external link)



Download Postman

Download the app to get started using the Postman API Platform today. Or, if you prefer a browser experience, you can try the web version of Postman.

The Postman app

Download the app to get started with the Postman API Platform.



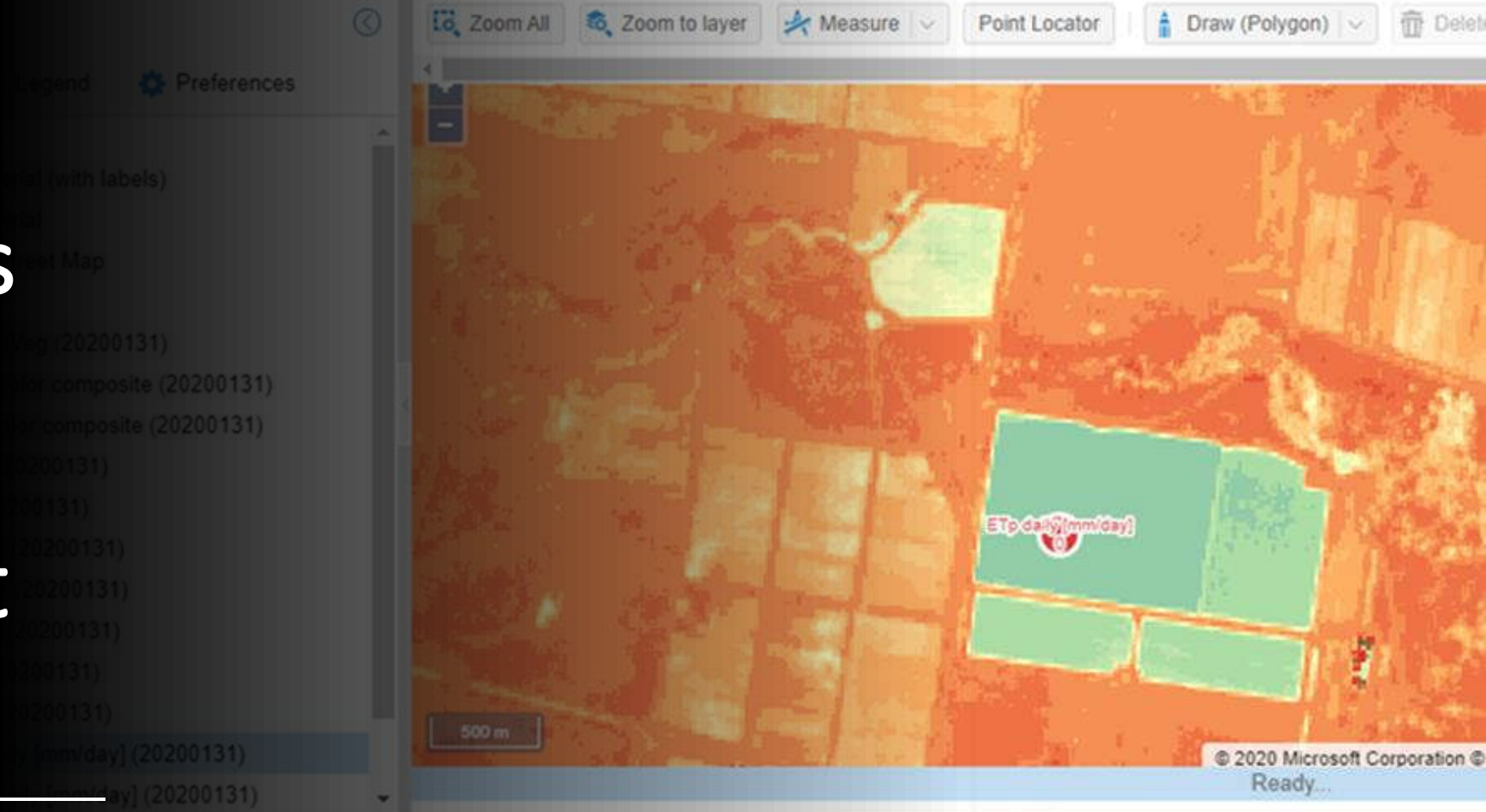
How to
access the data
- Postman

How to access the data – Qgis plugin

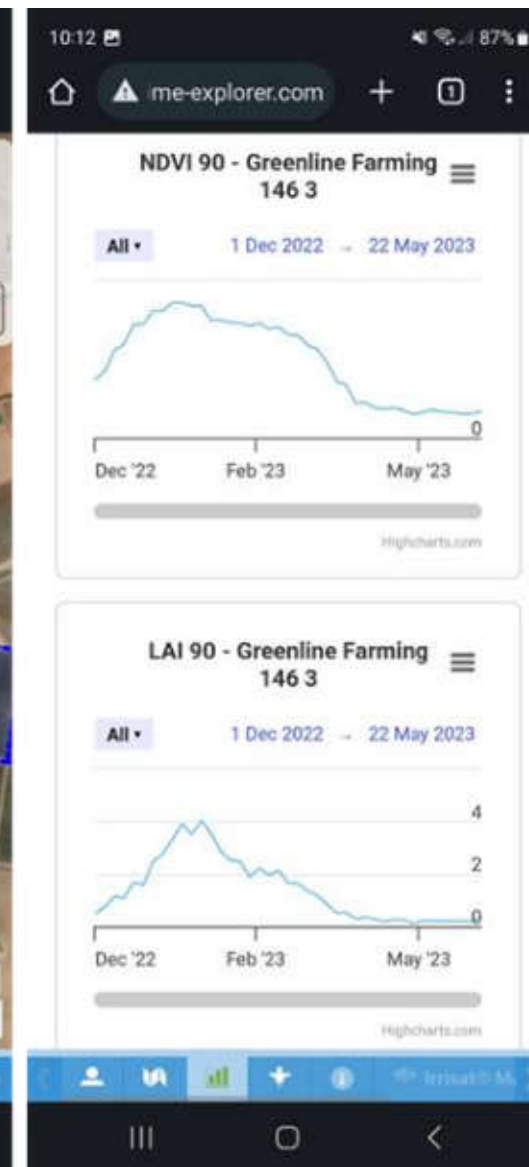
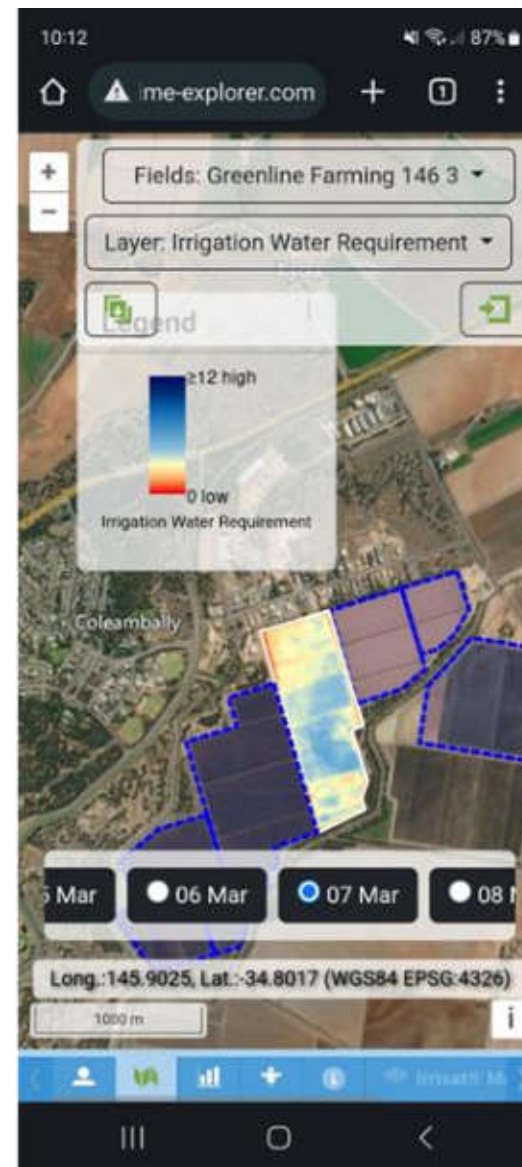
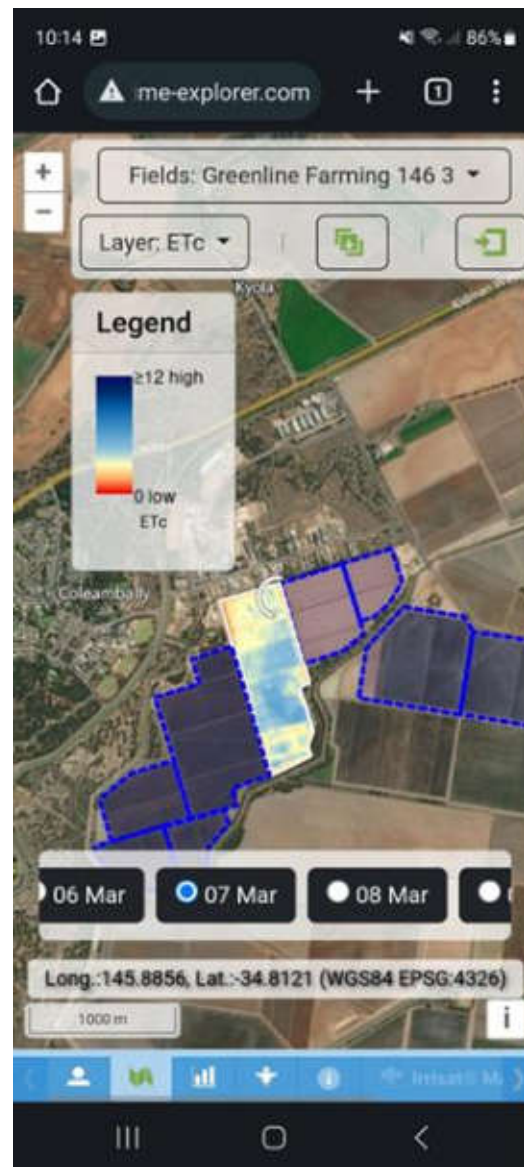
The screenshot shows the 'COALA Downloader' window in QGIS. The window title is 'COALA Downloader' with a close button. The main heading is 'Welcome to COALA Downloader'. Below this is the COALA logo, which consists of a stylized globe with a red dashed arc and the text 'COALA Copernicus for sustainable Agriculture in Australia'. The interface contains several input fields and buttons:

- 'Select a Polygon Layer': A dropdown menu with 'plots_broidal_2223' selected.
- 'Select a polygon': A dropdown menu with '(ID: 0) ,9,SICOT 606B3F | SICOT 714BRF3,Cotton,BROIDAL TERR' selected.
- 'Token': A text field filled with black dots, with a small 'x' icon to its right.
- 'Select an Indicator': A dropdown menu with 'cwr' selected.
- 'Get available dates': A button located below the indicator dropdown.
- 'Select a date': A dropdown menu with '2023-04-24' selected.
- 'Download tiff': A button located below the date dropdown.
- 'Chiudi': A button located at the bottom right of the window.

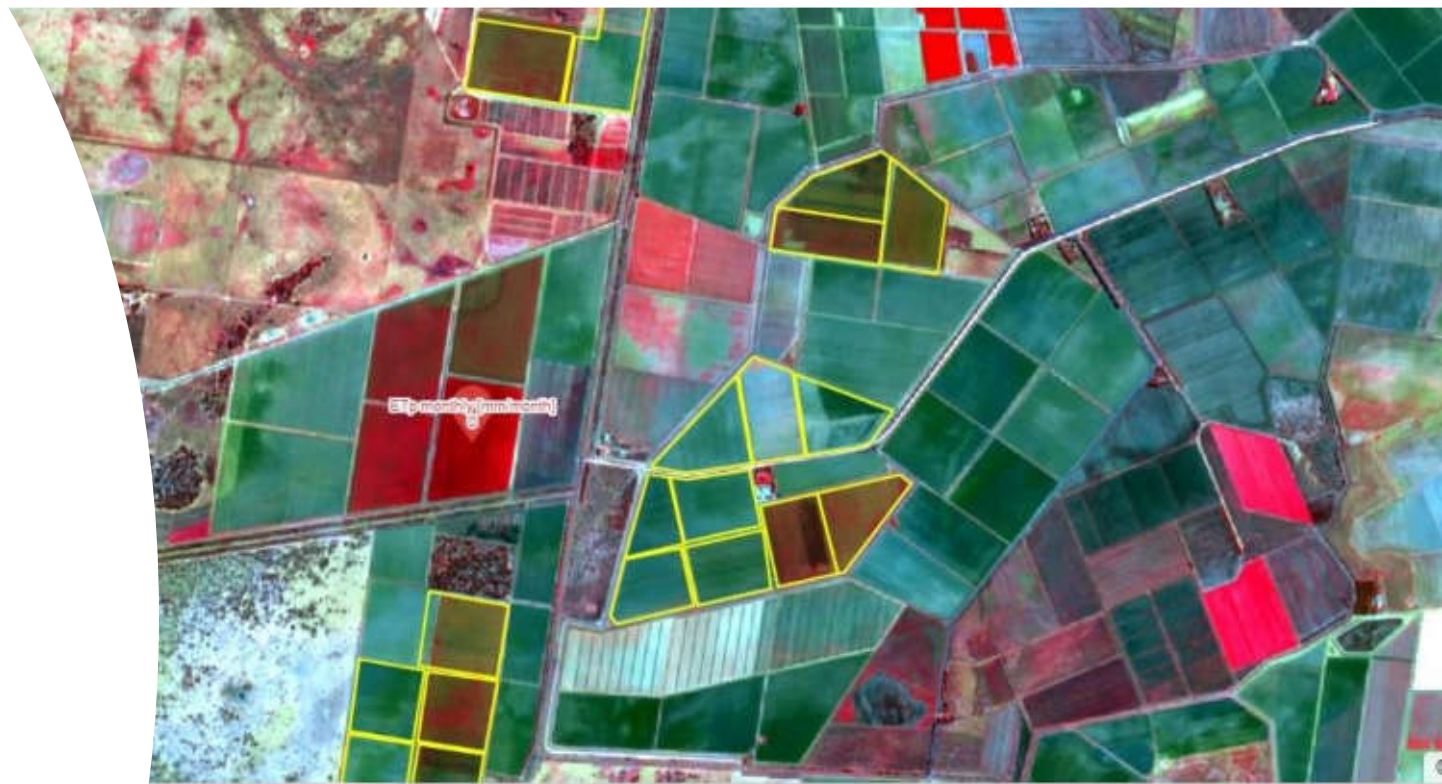
How to access the data – integration COALA product into WEB-GIS



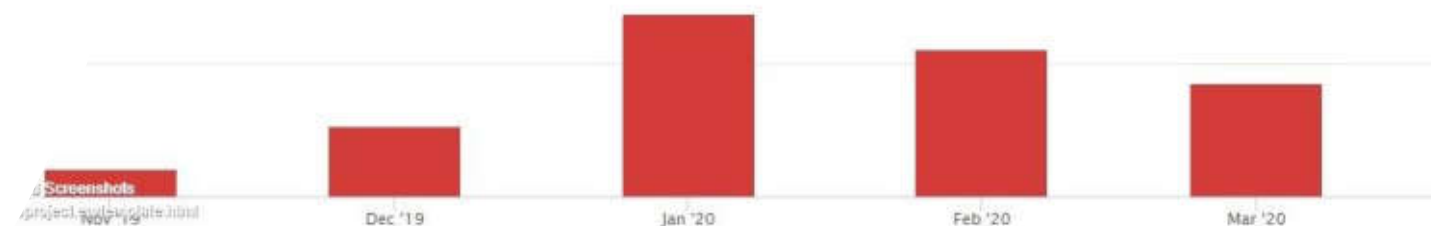
Tools for irrigation management at plot scale



Estimation of Irrigation Water usage from Paddock to District scale

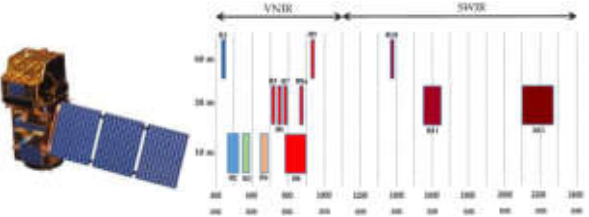
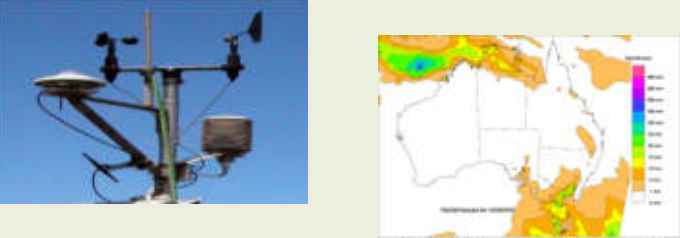
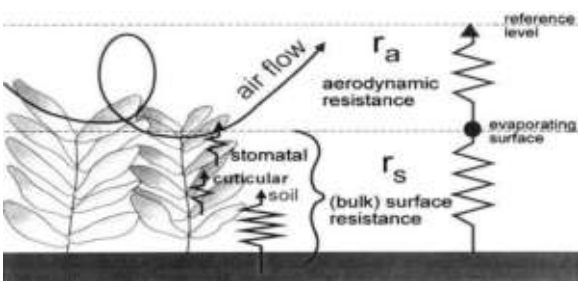



Irrigation Volume estimation based on modified PM-FAO56 approach can be aggregate from pixel up to large district area.

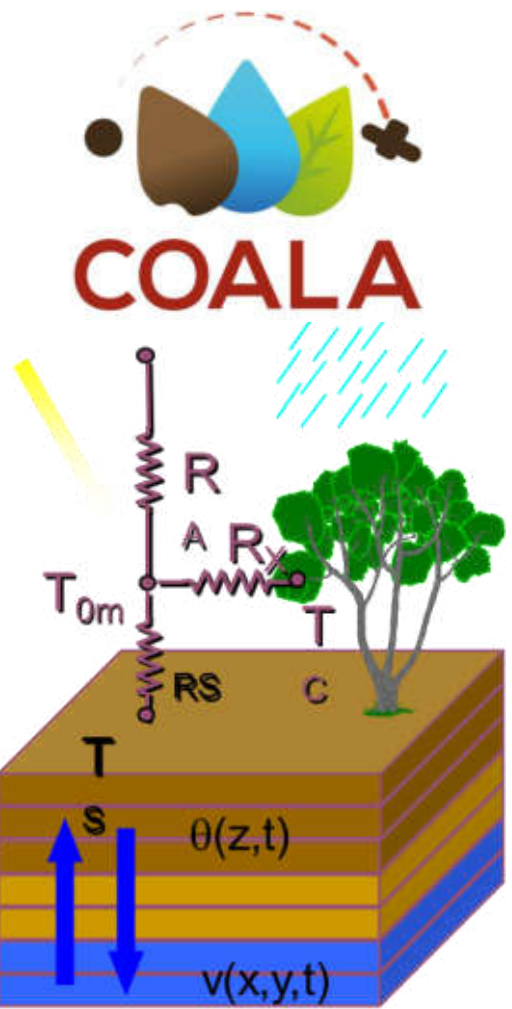


Technology behind COALA

Technology

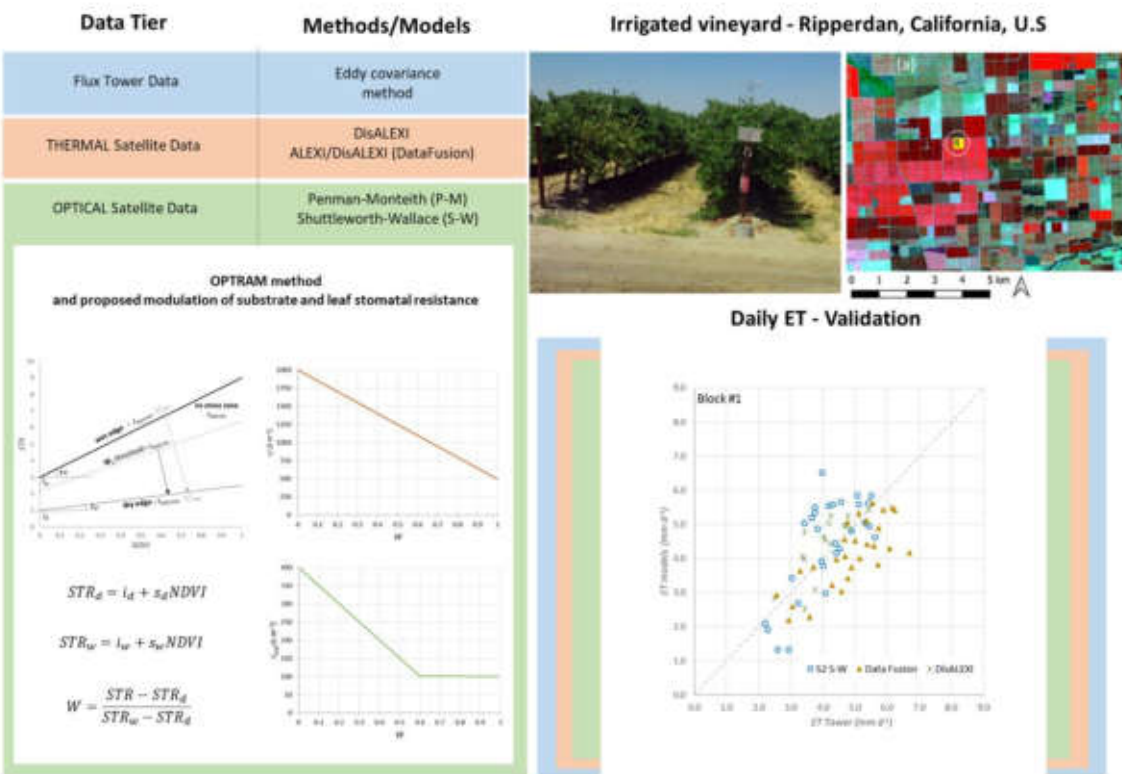
 <p>The image shows the Sentinel-2 satellite on the left. To its right are two bar charts representing spectral response curves. The first chart is labeled 'VNIR' (Visible Near-Infrared) and shows response curves for bands B01 through B08. The second chart is labeled 'SWIR' (Short-Wave Infrared) and shows response curves for bands B11 and B12. The x-axis represents wavelength in nanometers, and the y-axis represents relative spectral response.</p>	<p>Sentinel-2 High-resolution multispectral radiometric images from Sentinel-2. SWIR band (B12) are used for canopy water status estimation.</p>
 <p>The image contains two parts. On the left is a photograph of an agro-meteorological station with various sensors mounted on a tower. On the right is a map of the Mediterranean region showing a color-coded Numerical Weather Prediction (NWP) product, likely representing temperature or precipitation anomalies.</p>	<p>Agro-meteorological data from the stations (in-situ) or from selected Numerical Weather Prediction (NWP) products (up to days ahead).</p>
 <p>The diagram illustrates the Penman-Monteith equation's resistances. It shows a plant with leaves and a soil surface. Air flow is indicated by an arrow. The diagram labels 'reference level' at the top, 'evaporating surface' at the plant canopy, and 'soil' at the bottom. Resistances are shown as vertical zig-zag lines: r_a (aerodynamic resistance) between the reference level and the evaporating surface, and r_s (bulk) surface resistance between the evaporating surface and the soil. Within the plant canopy, 'stomatal' and 'cuticular' resistances are also indicated.</p>	<p>Standard FAO-56 procedures Direct calculation of Potential Evapotranspiration by the Penman-Monteith equation by combining in-situ agro-meteorological variables, satellite data. Water Balance modeling.</p>

Feature	Systems based only on crop water balance	COALA
Actual irrigated area	Input data to be provided to the system based on historical, statistical data	 <p>Retrieved from Satellite time series data</p>
Irrigated Crop map	Not supplied	
Crop Water Development	Based on standard crop coefficients, it is necessary to provide the list of crops, presumed sowing and harvesting period	
Crop Water Requirement, Irrigation water requirement	Based on standard crop coefficients & statistics	
Aggregation of Results	At the scale of the calculation framework. Generally, it is not possible to disaggregate the data	<p>Temporal and spatial aggregation is always available</p>





How we take into account canopy-soil water status



Determining Evapotranspiration by Using Combination Equation Models with Sentinel-2 Data and Comparison with Thermal-Based Energy Balance in a California Irrigated Vineyard

by [Guido D'Urso](#)^{1,*}, [Salvatore Falanga Bolognesi](#)², [William P. Kustas](#)³, [Kyle R. Knipper](#)⁴,
[Martha C. Anderson](#)³, [Maria M. Alsina](#)⁵, [Christopher R. Hain](#)⁶, [Joseph G. Alfieri](#)³,
[John H. Prueger](#)⁷, [Feng Gao](#)³, [Lynn G. McKee](#)³, [Carlo De Michele](#)²,
[Andrew J. McElrone](#)⁸, [Nicolas Bambach](#)⁹, [Luis Sanchez](#)⁵ and [Oscar Rosario Belfiore](#)¹

...by exploiting the SWIR band (B12) from Sentinel-2 to correct the estimation of the evapotranspiration taking into account the canopy-soil water status.

THANKS FOR YOUR ATTENTION!



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