

living planet symposium

BONN
23–27 May
2022

TAKING THE PULSE
OF OUR PLANET FROM SPACE



Assimilation of biophysical parameters of vegetation in digital twins of irrigated plots for quantifying and forecasting crop water requirements at the lower Ter River basin

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25.05.2022

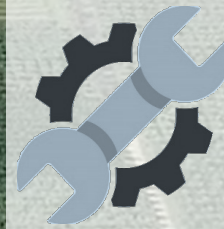
It is forecast that by 2050, 40% of world's population will be experiencing severe water stress if we do not make supply and efficiency improvements

Many irrigation areas have low water use efficiency. On average, only 40% of the water diverted for irrigation is actually used by crops.

Distribution savings

Scheduling savings

Application savings



Real-time systems capable to quantify and to forecast crop's water demands to enhance the productivity and sustainability of irrigated agriculture

Irrigation District managers

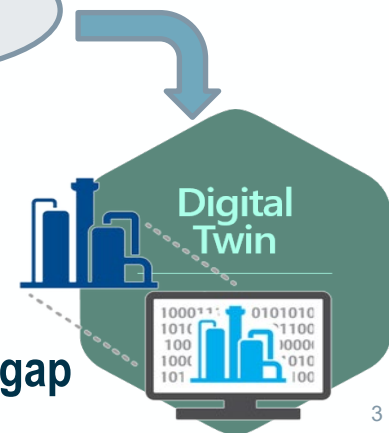


- How much water is available in the reservoirs now
 - Will I have enough water for the entire irrigation campaign
-
- What is crop water demand this week
 - What's the potential crop water demand throughout the growing season
 - In case I know I don't have water, what is the most appropriate crop phenological stage to impose deficit without affecting productivity
 - Or ... what crops should farmers grow in years with a limited water allocation

SUPPLIES

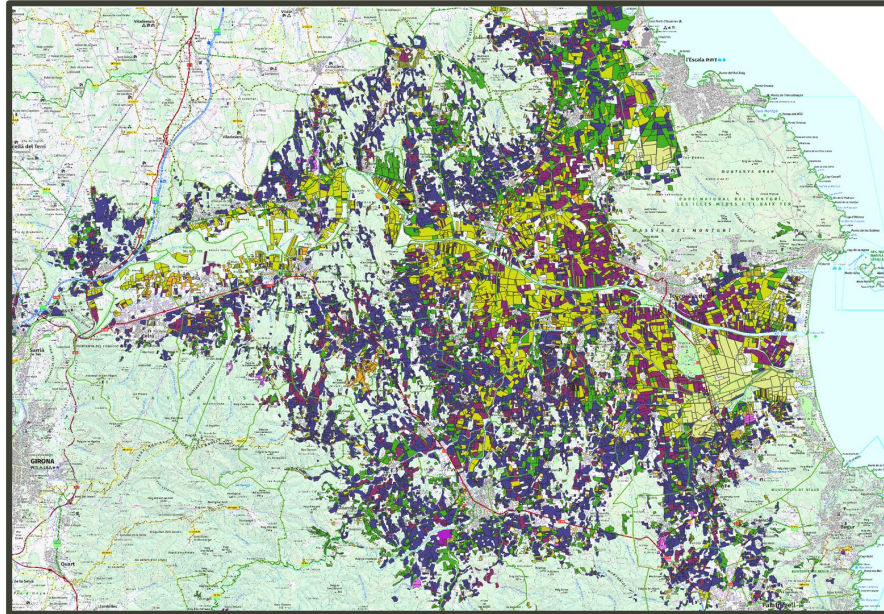


DEMAND



Close the water supply-demand gap

Lower Ter river Basin



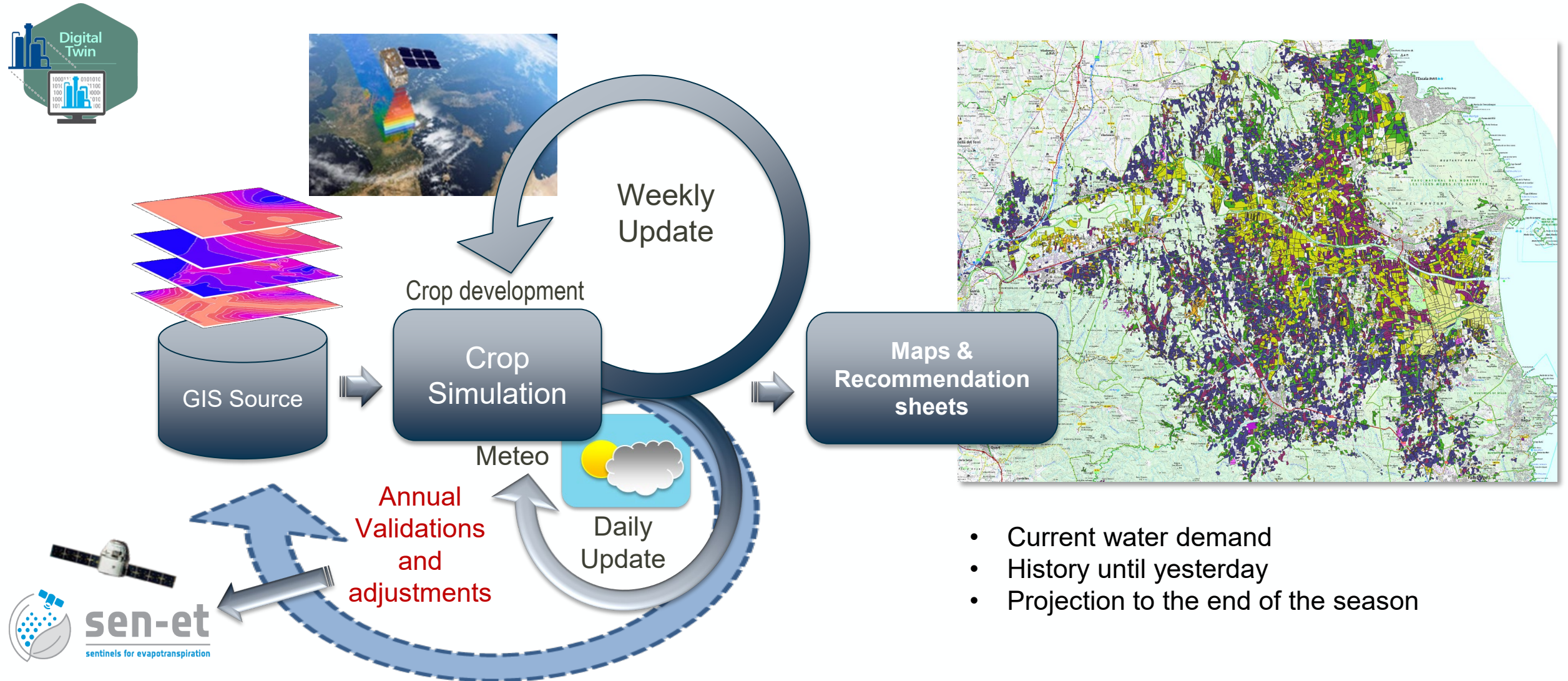
High competition for water resources in the area:

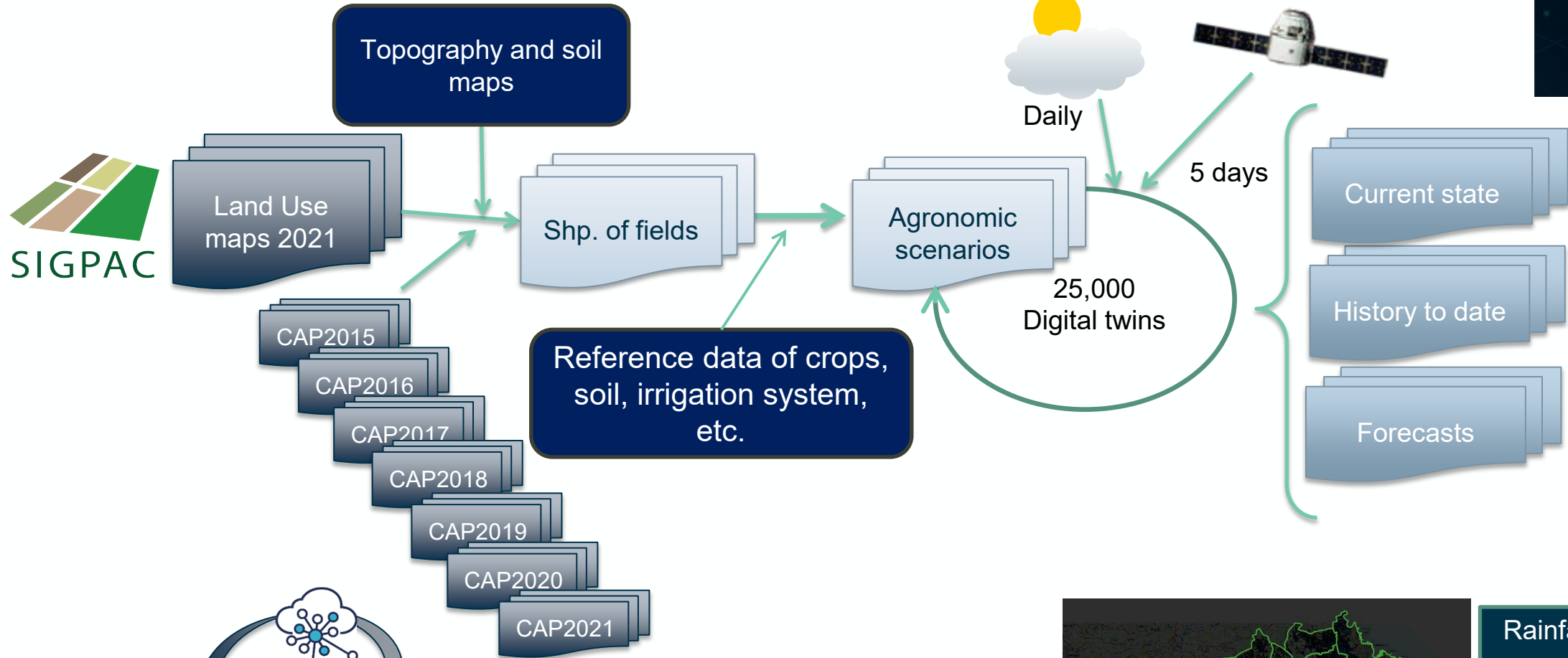
- Drinking water (> 2 million people)
- Industry
- Tourism
- Agriculture
- Environment & biodiversity

Small fields -> limitation to estimate ETa with the current TIR satellites

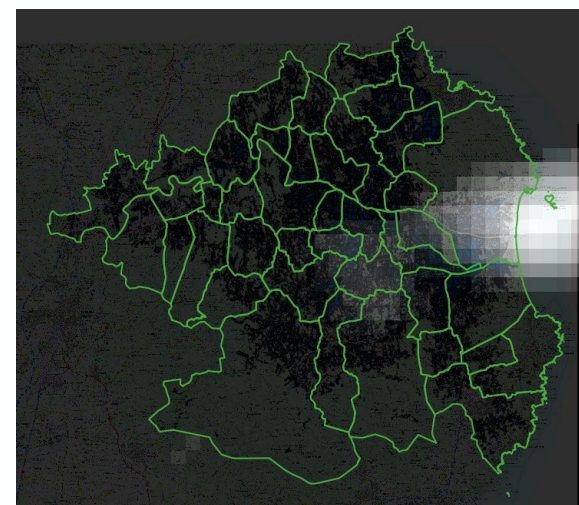
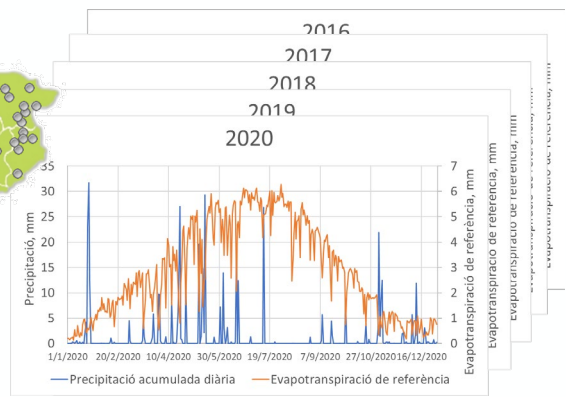
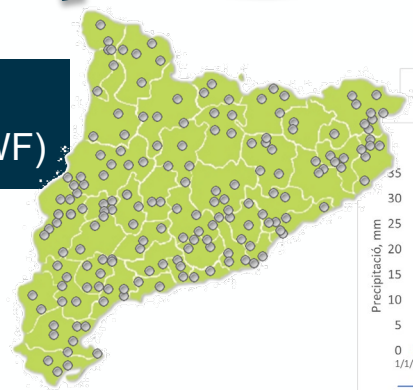


Dynamic simulations of the crop and soil-water balance in real-time, adjusted to each field through remote sensing





Daily meteo (2010-2021)
Local meteo stations (or ECMWF)

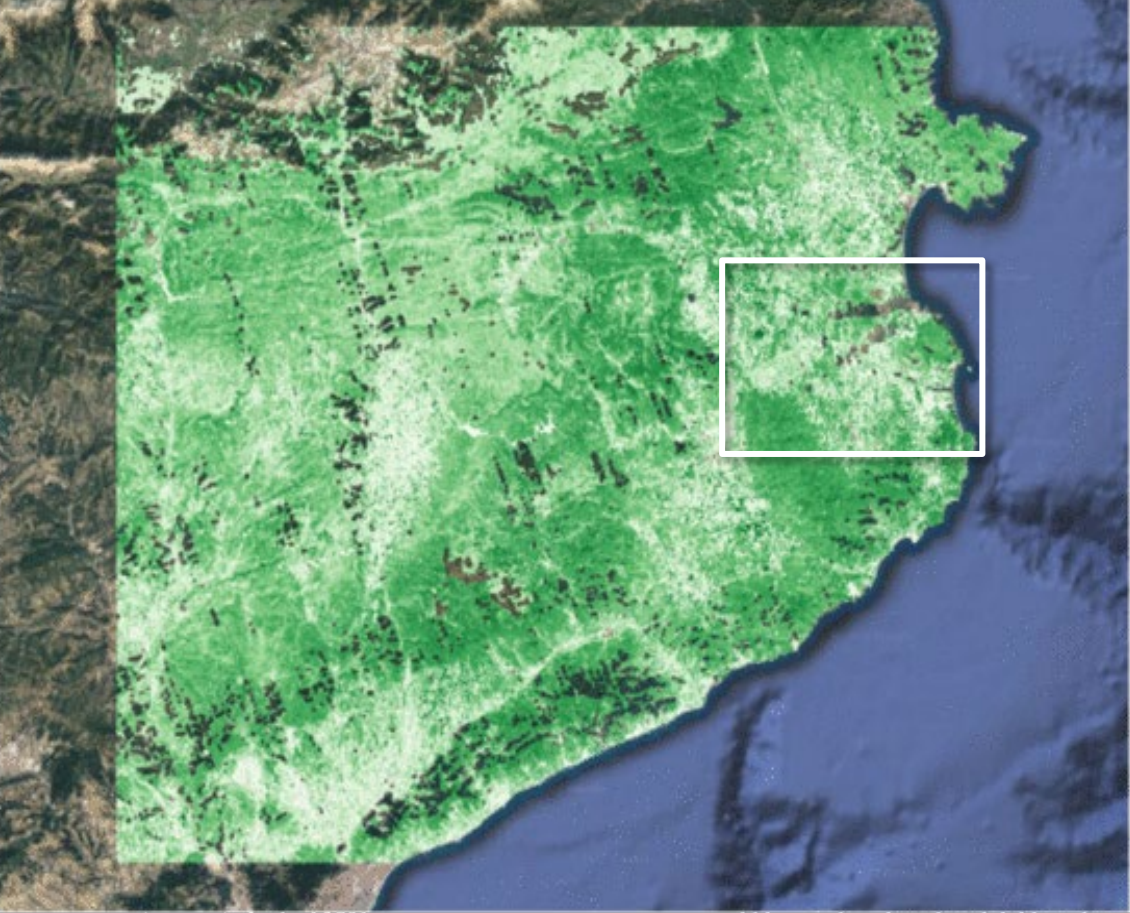


Rainfall maps at 1 Km
2020-2021

Time-series of the biophysical parameters from Sentinel-2



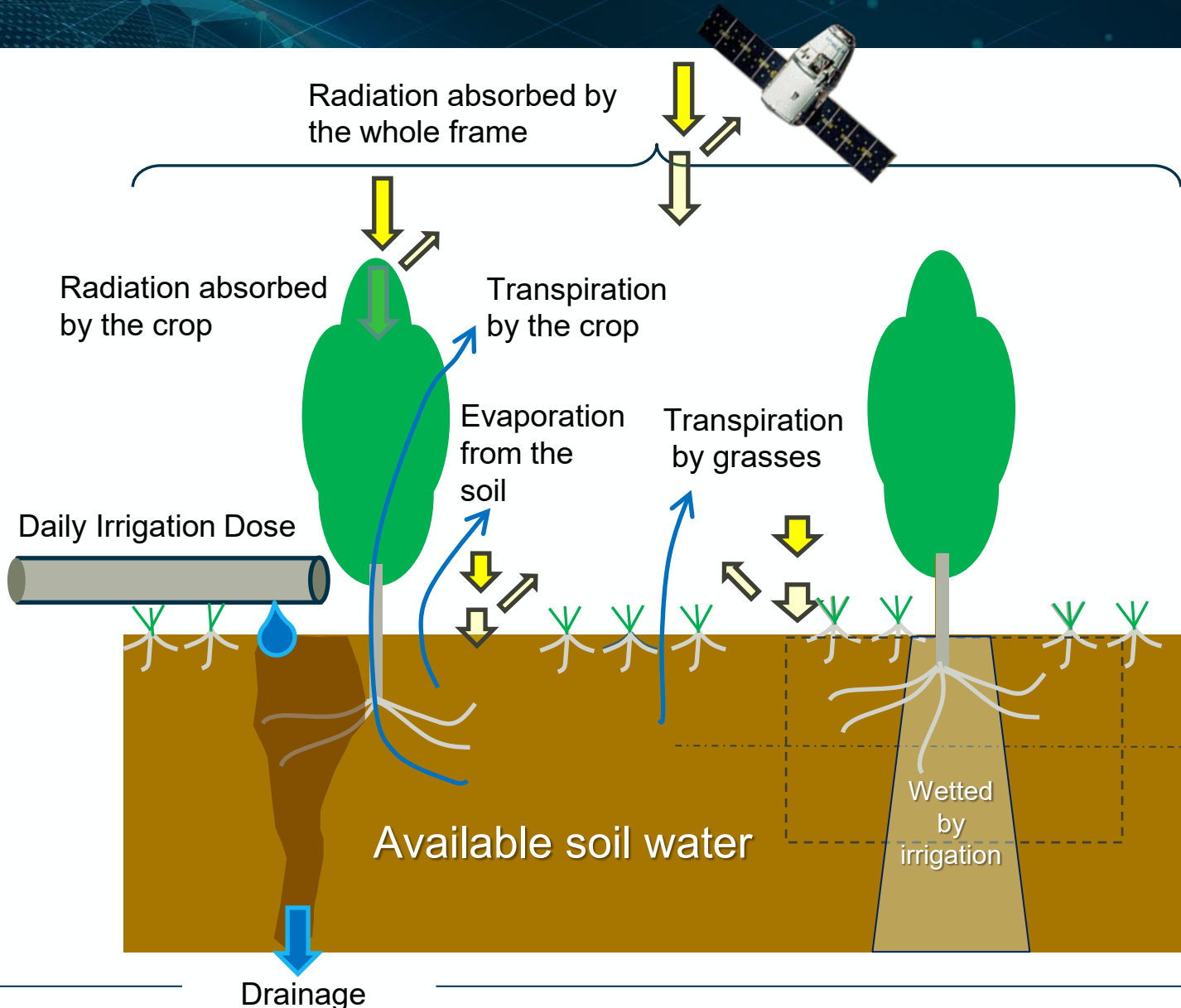
FAPAR from Sentinel-2 (20-m) at the Baix Ter river basin (Catalonia)



11 Feb 2019



Components of the continuum soil-water balance model



1. Dataset

OFFICIAL_VERSION

2. Year

2021 (current year)

3. Variable

Daily

Accumulated

Pending (min. estimate)

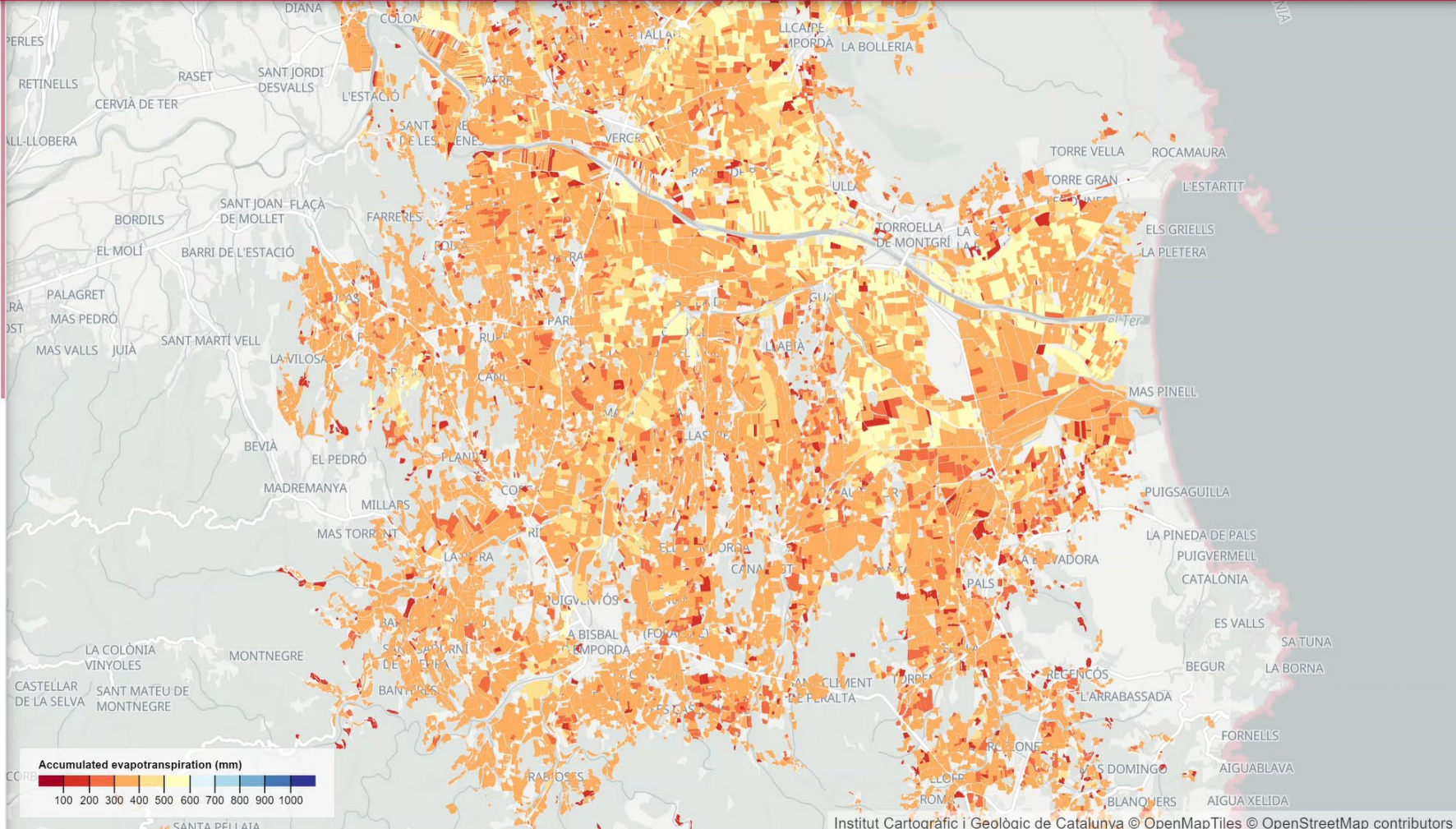
Pending (max. estimate)

Other variables...

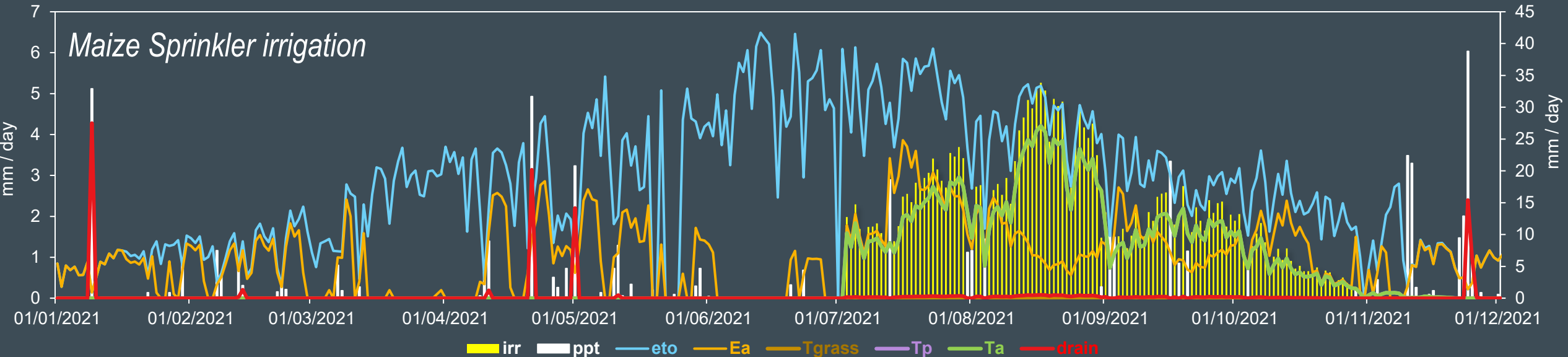
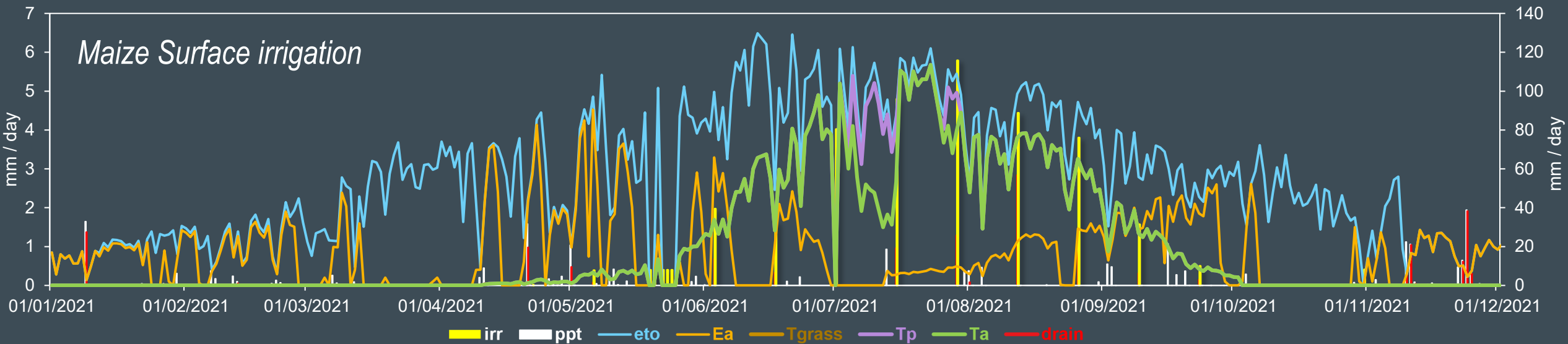
G Girona, regió sensible a l'aigua

Unió Europea Fons europeu de desenvolupament regional Generalitat de Catalunya

Diputació de Girona geomatico



Example of simulations in maize



Exportable to any GIS via GeoServer

The screenshot shows the GeoServer web interface. At the top, there is a navigation bar with the GeoServer logo and a search bar. Below the navigation bar, there is a sidebar with a menu containing 'Servidor', 'Dades', and 'Demos'. The main content area displays a modal window titled 'Vista prèvia de les capes' (Preview of layers). This modal window contains a description, a search bar, and a table of layers. The table has columns for 'Tipus', 'Títol', 'Nom', 'Formats habituals', and 'Tots els formats'. Three layers are listed: 'Parcel·les', 'Irrigació actual', and 'Cultius'. Each layer has a dropdown menu for selecting a format.

Tipus	Títol	Nom	Formats habituals	Tots els formats
	Parcel·les	irriter:plot	OpenLayers GML KML	Escolliu-ne una
	Irrigació actual	irriter:plotstate	OpenLayers GML KML	Escolliu-ne una
	Cultius	irriter:plotversion	OpenLayers GML KML	Escolliu-ne una

Therefore, interoperability with other GIS

p.ex. SCADA : hydraulic management network

water consumption forecast by zones allows optimization (reserves, pumping ...)

Experiments 'in-silico': What would happen if ?



IRTA Institut de Recerca i Tecnologia Agroalimentàries

IRRITER - Sistema d'Informació per al reg de precisió al Baix Ter

Català

1. Dataset

OFFICIAL_VERSION

projection 2030

3. actualDate Sel·lecció de variable

Aquesta setmana

Acumulat fins avui

Min previsible fins el final

Max previsible fins el final

Estil Mapa Base

Positron Full Dark OSM Hibrid Bright

Girona, regió sensible a l'aigua

Unió Europea Fons europeu de desenvolupament regional Generalitat de Catalunya Diputació de Girona geomatico

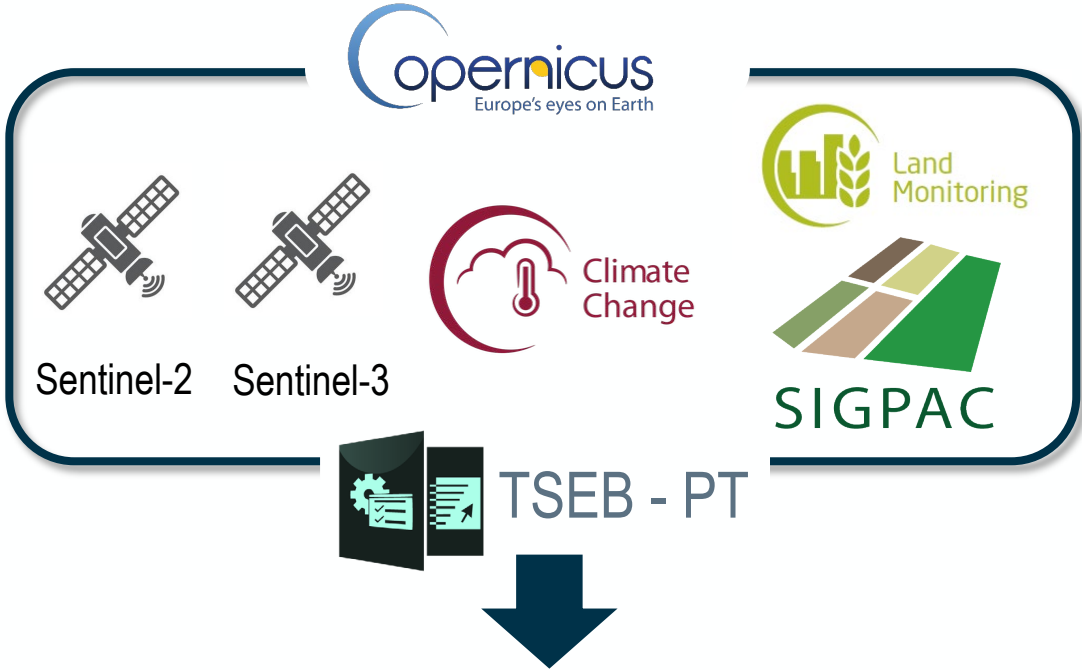
Evapotranspiració acumulada (mm)

Prospection of alternative choices

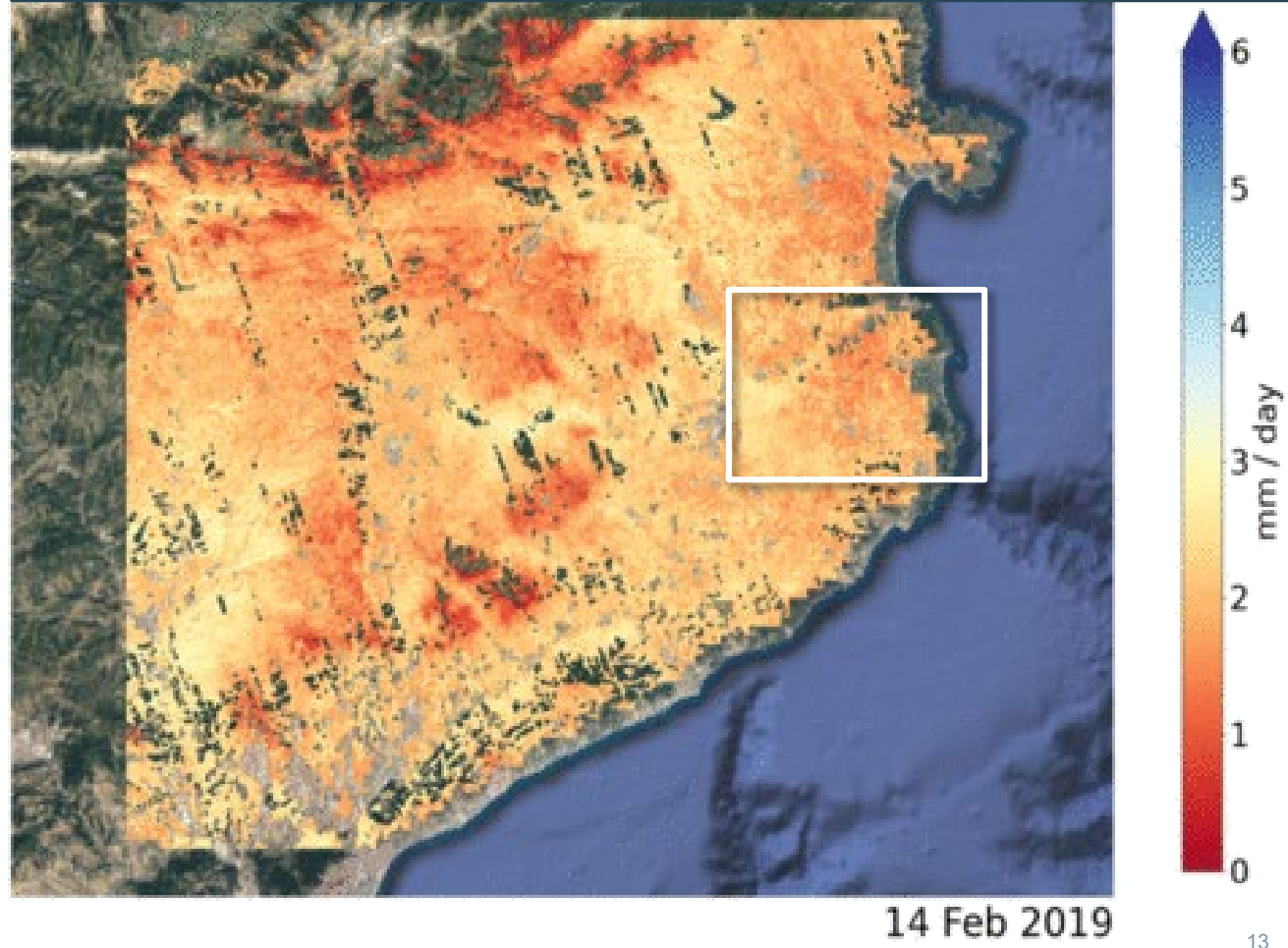
Institut Cartogràfic i Geològic de Catalunya © OpenMapTiles © OpenStreetMap contributors | 2



Validations and adjustments



Actual crop evapotranspiration (ETa) with TSEB using Copernicus based inputs at Baix Ter river basin (Catalonia)



This system allows to see a dynamic representation of crop water requirements in almost real-time and a temporal perspective (forward & backward)

Support for making hypothetical scenarios perspectives

We are currently working on the feedback of growers and irrigation district managers

NEXT STEPS:

- ❑ Case studies: connectivity with automatic systems that controls water flows through gates based on IoT systems -> **Close the water supply-demand gap**
- ❑ Portability to other locations: Use of ECMWF meteo data, field delineation from CAP, use of global soil database

Thanks for your attention !

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