AgroSat

Open Big Data and Precision Agriculture

Framework Partnership Agreement for Copernicus User Uptake

"Monitoring Soil Moisture with Earth Observation", 14-15 July 2020

The Copernicus User Uptake project is financed by the European Commission under the FPA no.: 275/G/GRO/COPE/17/10042"

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Dipartimento di Scienze Bio-Agroalimentari
Istituto per la BioEconomia

By **2021**, **Italy** must achieve the goal of managing **10%** of the national agriculture land through Precision Agriculture (UE) – in **2017** only **1%**

But a recent study has shown that the sector is in **full growth**, registering a turnover increase of 22% compared to 2018 and over 400 Italian start-ups dealing with Precision Agriculture

Create a community

A collaboration platform that allows end-users to access, share, consult data – info – knowledge and plan actions

AgroSat

full **free open source platform** born to boost the wide spread of **Precision Agriculture** through Earth Observation **satellites**

Developed by a **public research institute**

National Research Council
Institute of BioEconomy

Idea & Concept -> *2016-2017*

Release

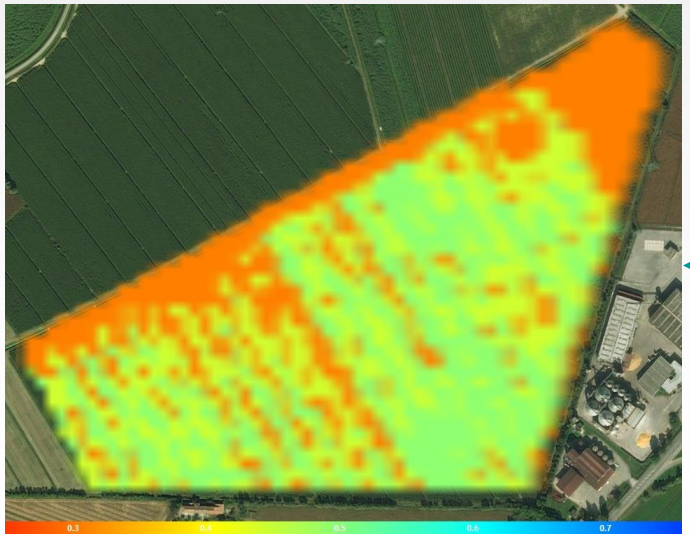
AgroSat — 4 regions — -> ***late 2017***

AgroSat v2.0 — Italy (v2.0) — -> ***2018***

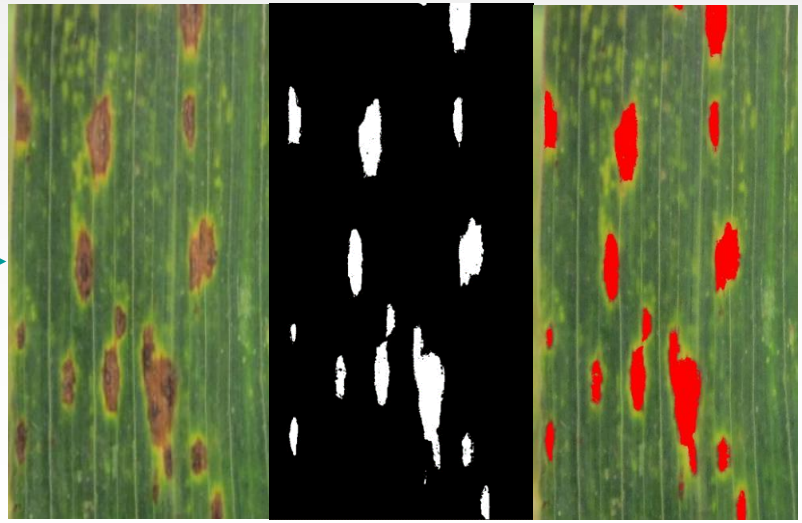
AgroSat Studio — "Studio" package — -> ***2019***

AgroSat v3.0 — v3.0 — -> ***2020***

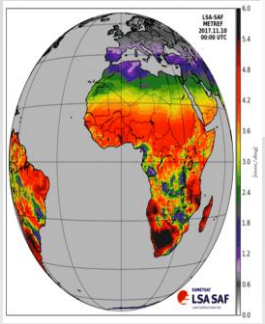
Cereals, Pastures and Horticulture



Soil Moisture Content



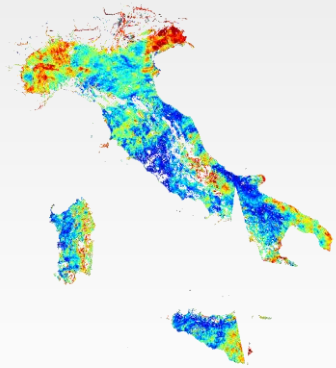
Plant disease automatic recognition (ongoing…)



To calculate the real **ET** and crop irrigation use

To retrieve **Sentinel** 2-A /2-B data

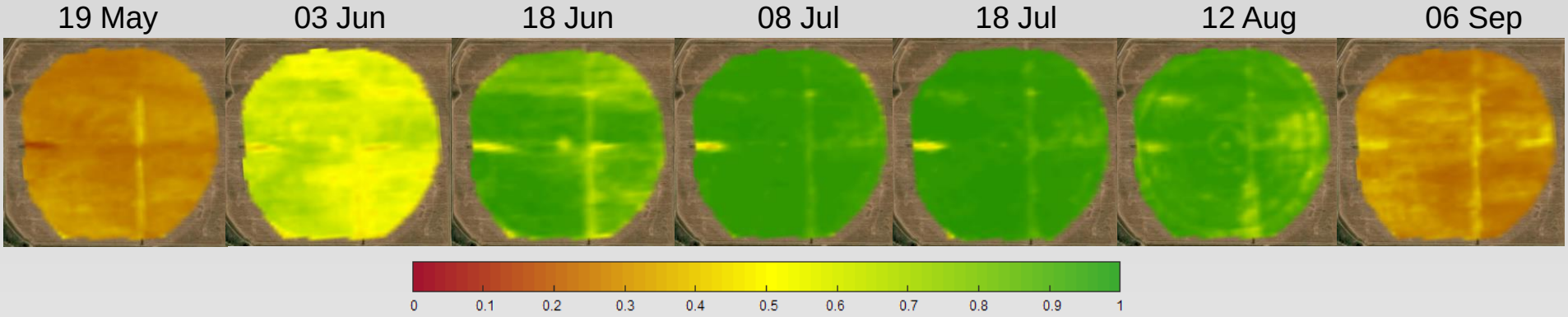
For historical **weather data** and for seasonal weather forecast

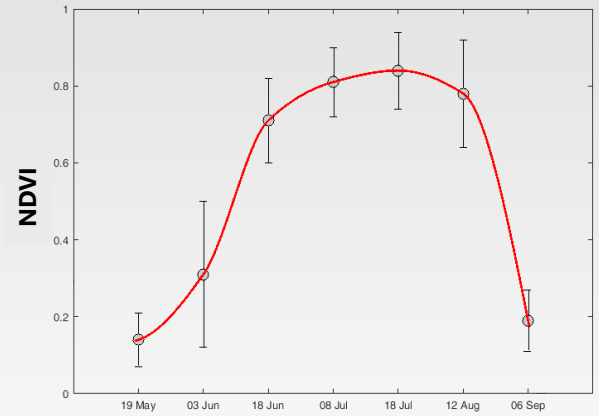


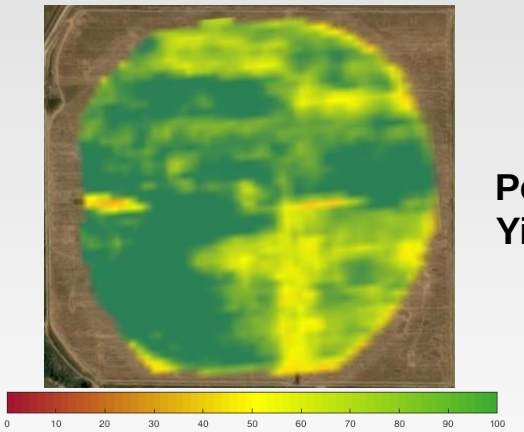
To calculate high spatial and temporal resolution **drought index**

WRF-**model** for weather forecast

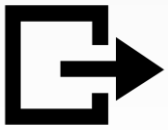
Regional weather stations network to retrieve **weather observations**



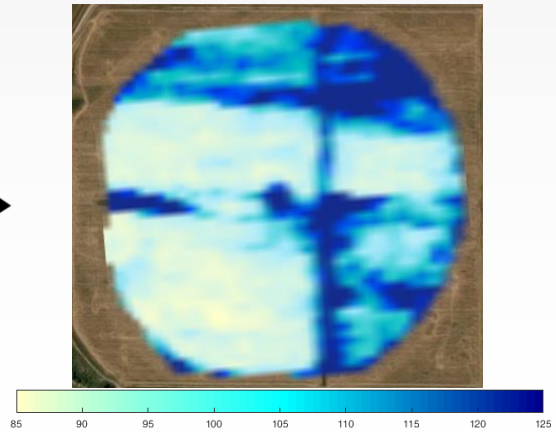




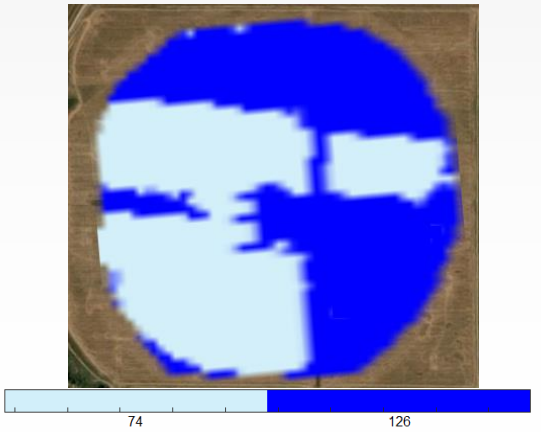
Potential Yield (%)

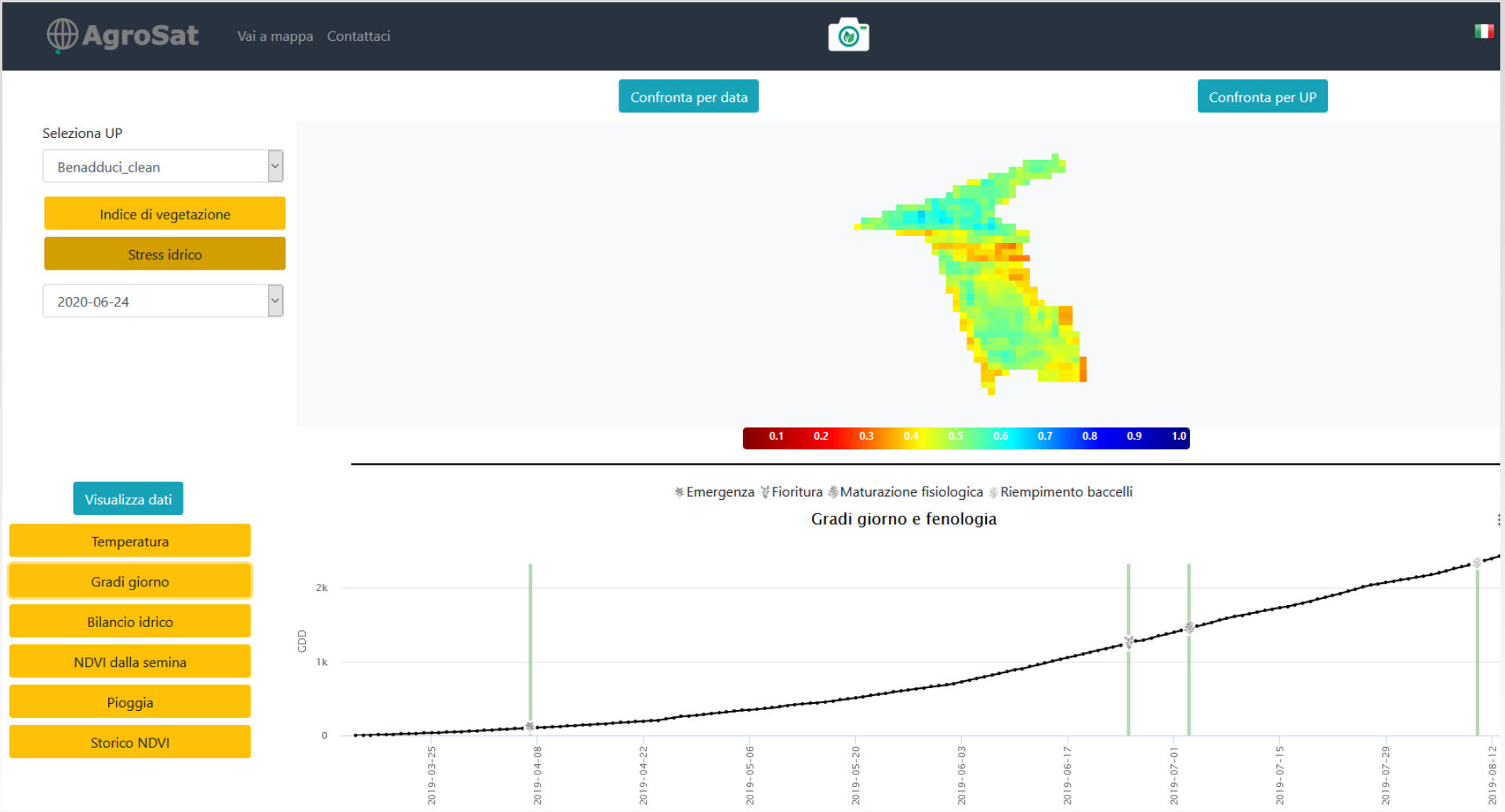


Precision Fertilization (unit)

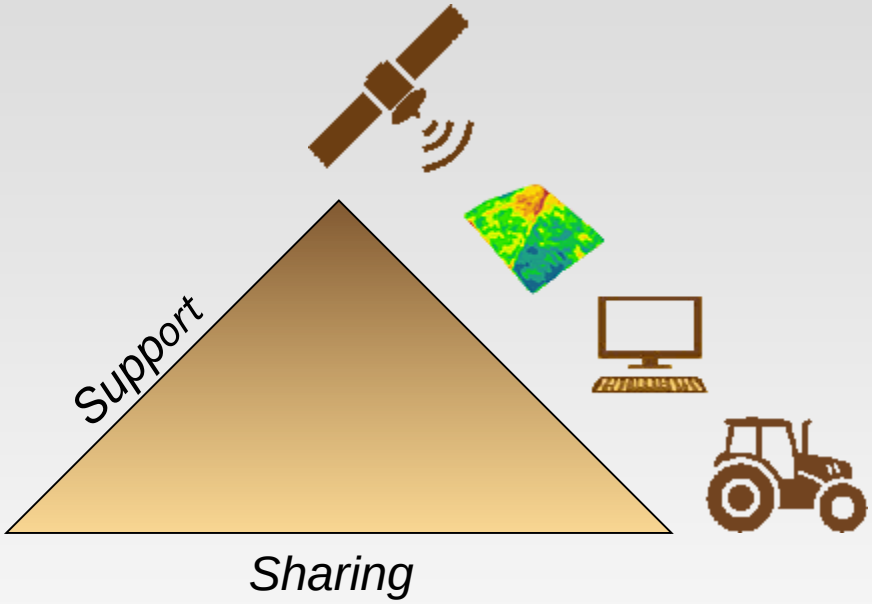


Map Classification





Users can manage **multi farming unit**, view 5 days **weather forecast** and local **weather observation** for their units. They can also report on their **agronomic techniques**, accessing a **block chain geo-traceability** service for supply chain.



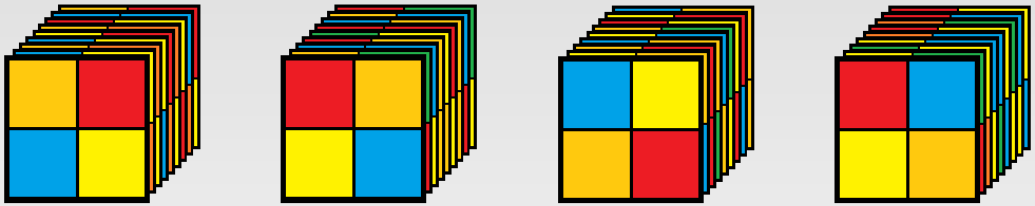
Free and open data redistribution: fast, safe, flexible and inclusive

On-The-Fly Processing of data streams!

in less than 5 seconds

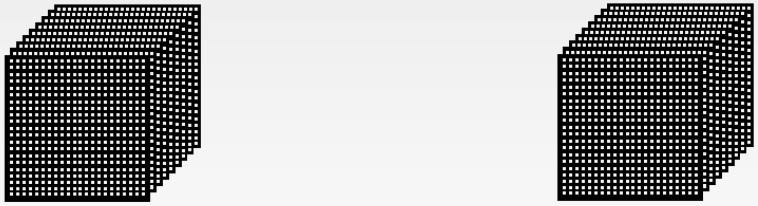
2018: water crop condition exploiting both Sentinel-2 and CGLS products

Low spatial resolution – High temporal resolution



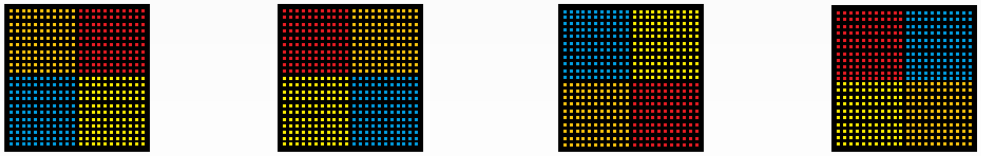
➢ Daily Soil Water Index (**SWI**) – ~12km Different T-values (time lengths 001 – 100)

High spatial resolution – Low temporal resolution



➢ No cloud **Sentinel-2** scene – 10/20 m multi-spectral

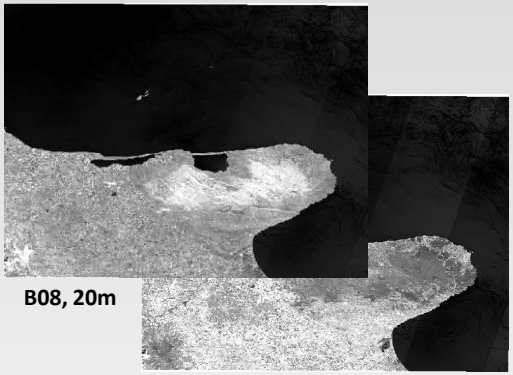
High spatial resolution – High temporal resolution



➢ Daily Crop Water Condition – 20m **qualitative index** (low – medium – high)

2018: water crop condition exploiting both Sentinel-2 and CGLS products

SENTINEL2



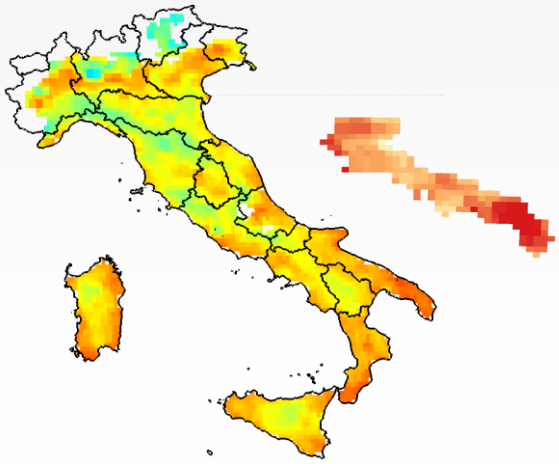
B08, 20m

B11, 20m

Normalized Difference Water Index (Gao, 1996)
The index values increase with increasing water content.
Applications: stressed vegetation detection.

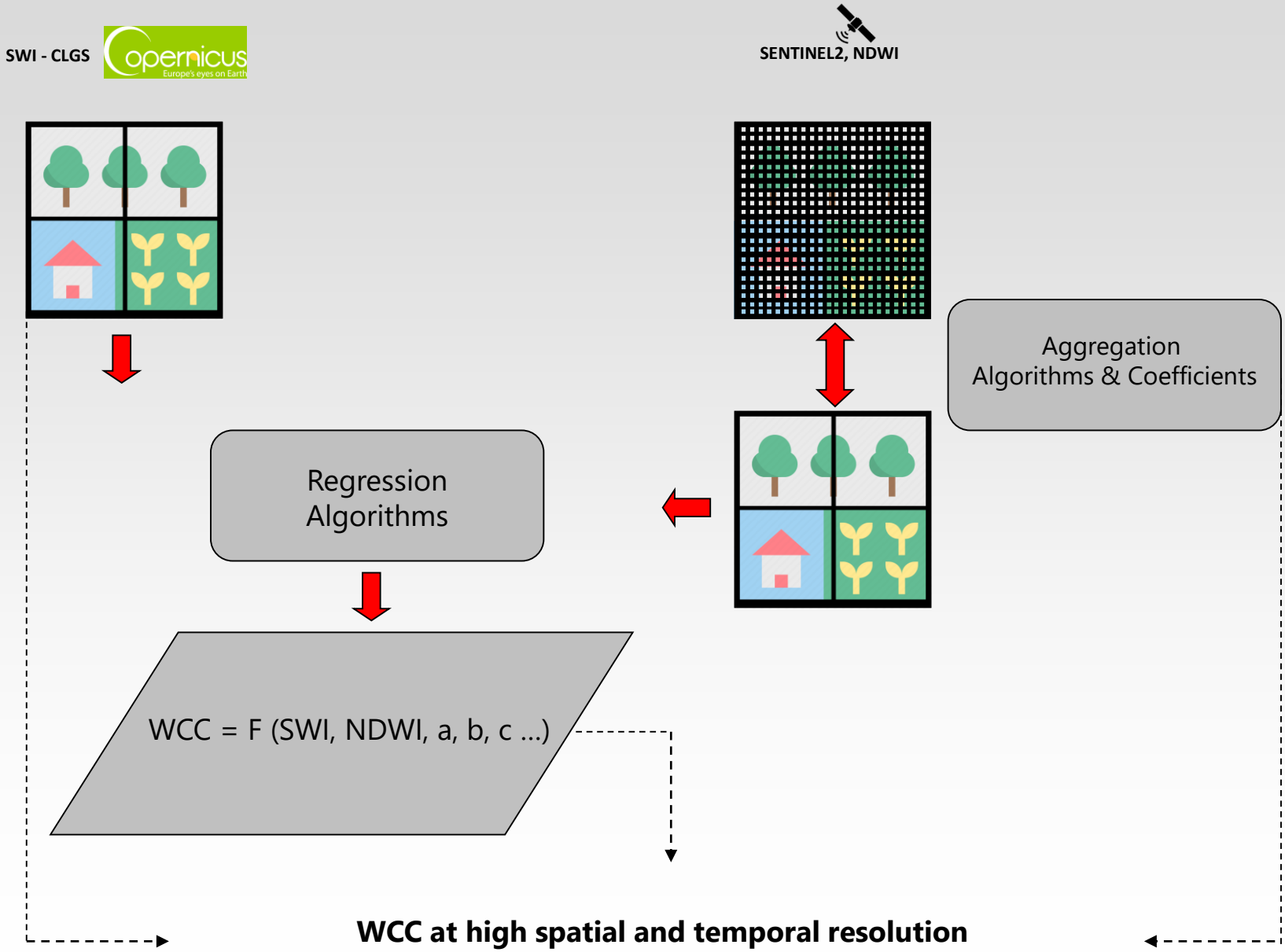
20 m

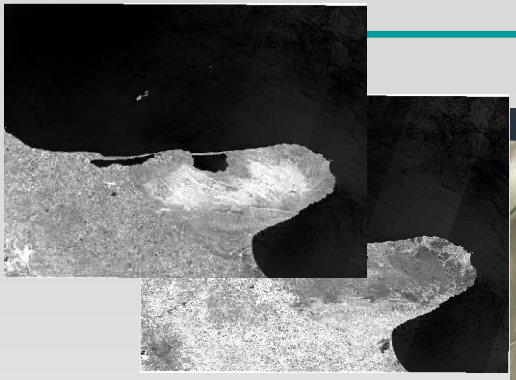
SWI - CLGS

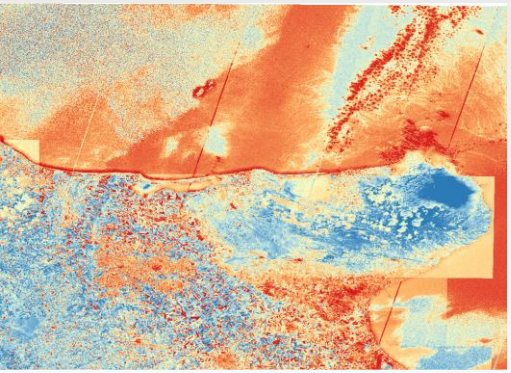


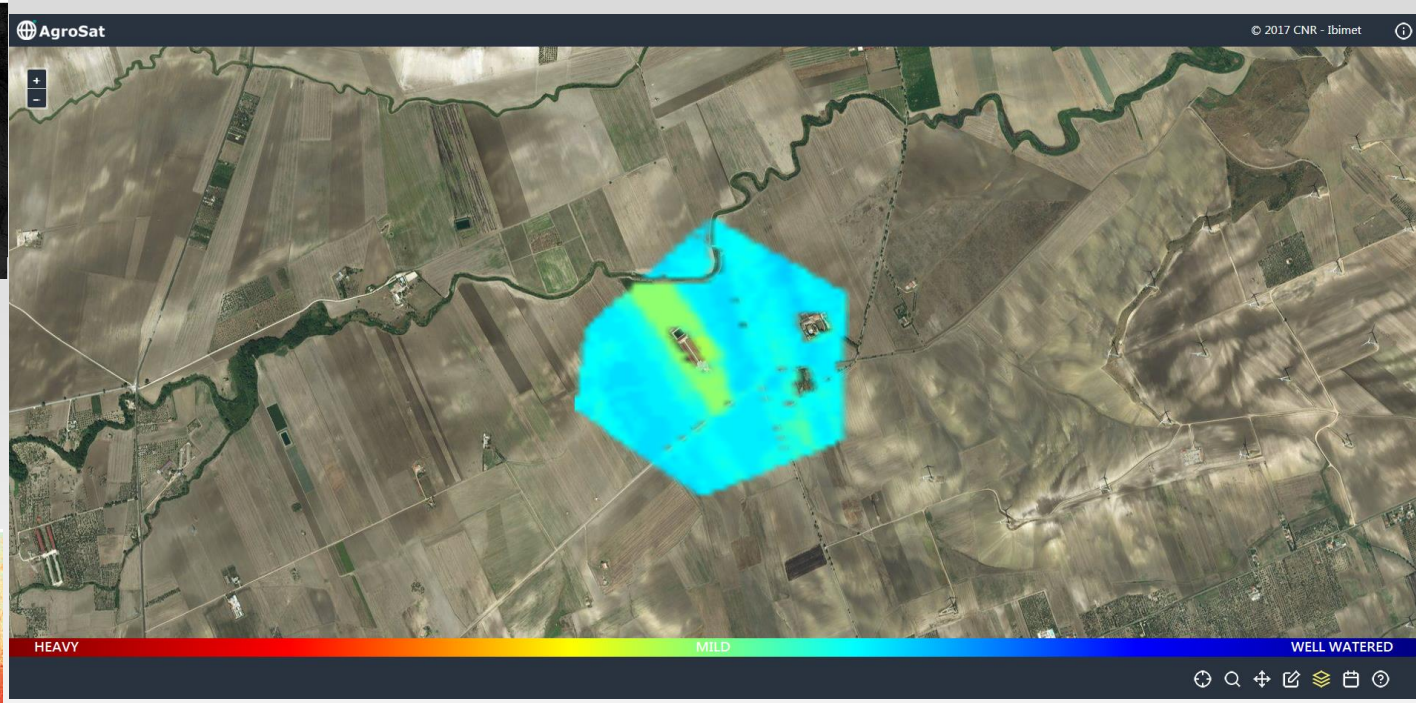
The **Soil Water Index** quantifies the moisture condition at various depths in the soil.

0.1 deg ~ **12km**


SWI - CLGS
opernicus
Europe's eyes on Earth
SENTINEL2, NDWI
Aggregation
Algorithms & Coefficients
Regression
Algorithms
WCC = F (SWI, NDWI, a, b, c ...)
WCC at high spatial and temporal resolution







Farmers

Researchers

Pros: higher temporal & spatial

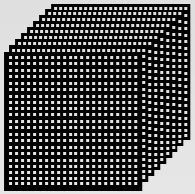
ABANDONED

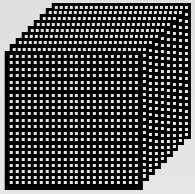
Cons: very expensive procedure (time) [illegible] ne), high spatial "qualitative information", failing when S-2 scenes are not available for a long period (> 2 weeks)

Non Linear Optical Trapezoid Model (OPTRAM) driven by Copernicus Sentinel-2 data

High spatial resolution – Low temporal resolution

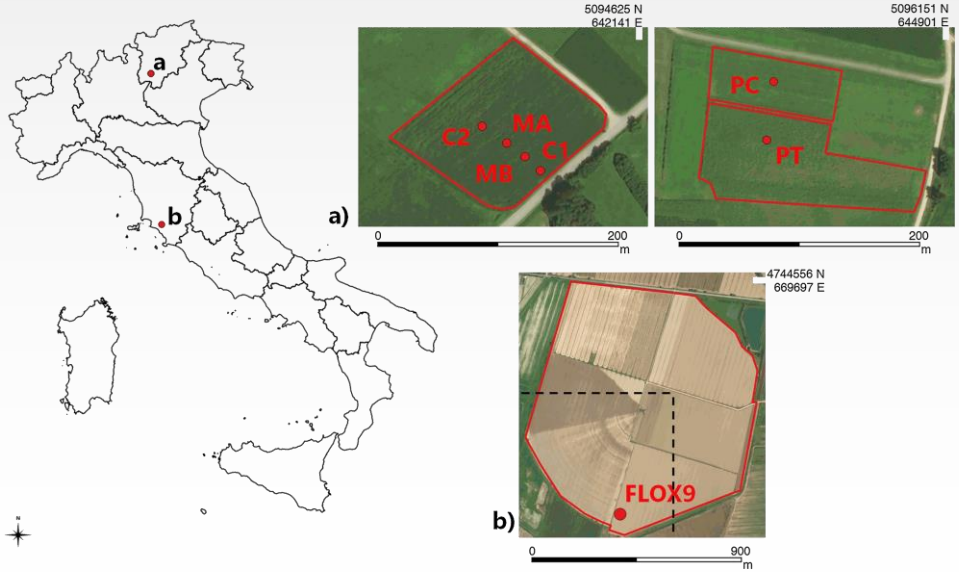
2020





No cloud **Sentinel-2** scene – **10 m** multi-spectral

- preserving native resolution
- decreasing procedure timing
- providing moisture values and not a qualitative index



Field samples

Rainfed and irrigated crops

Literature -> Linear OPTRAM

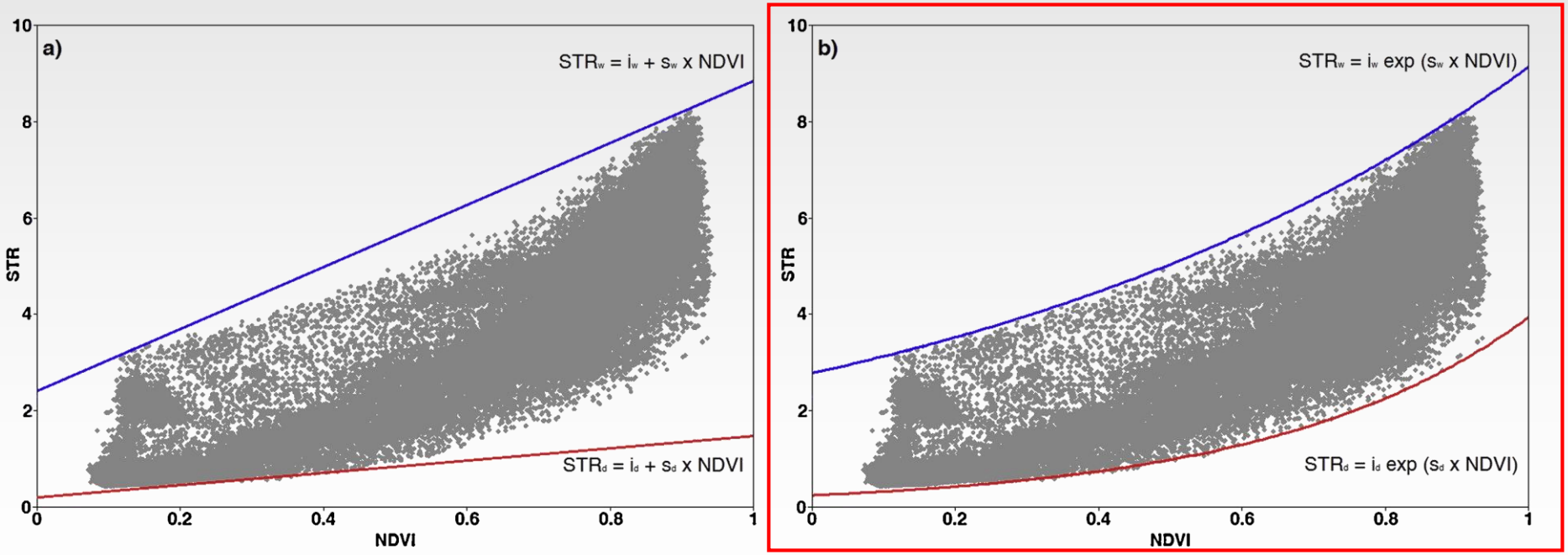
Non Linear Optical Trapezoid Model (OPTRAM) driven by Copernicus Sentinel-2 data

Data input (S-2 B4, B8, B12)

NDVI

STR

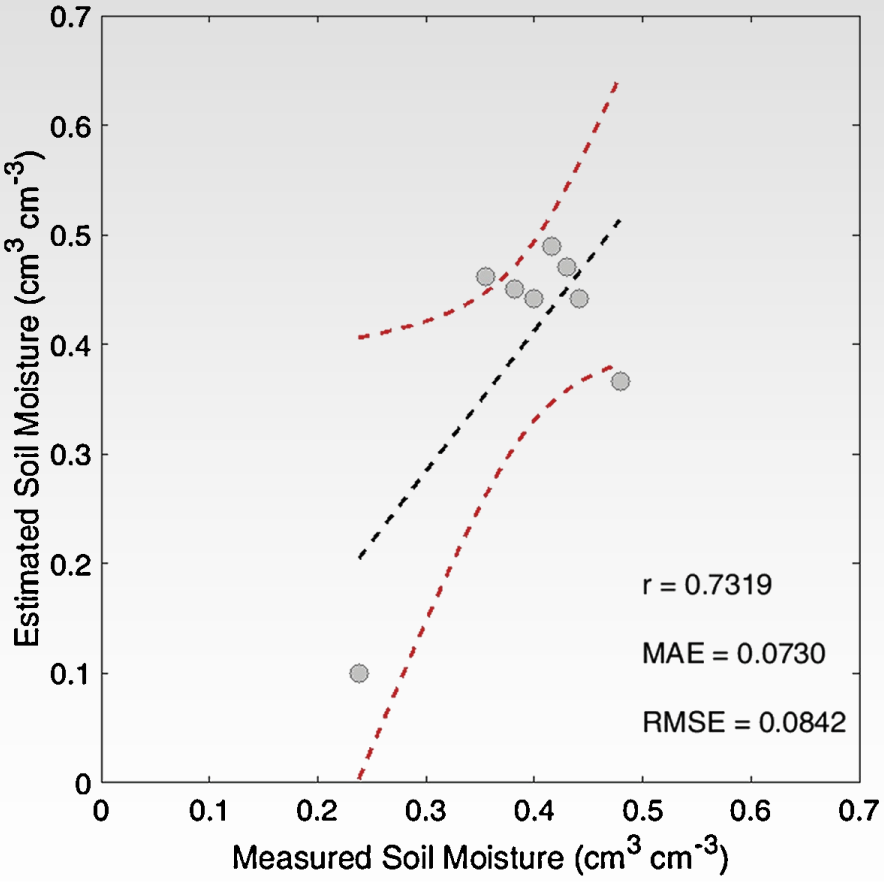
Model parametrization (linear and **nonlinear**)



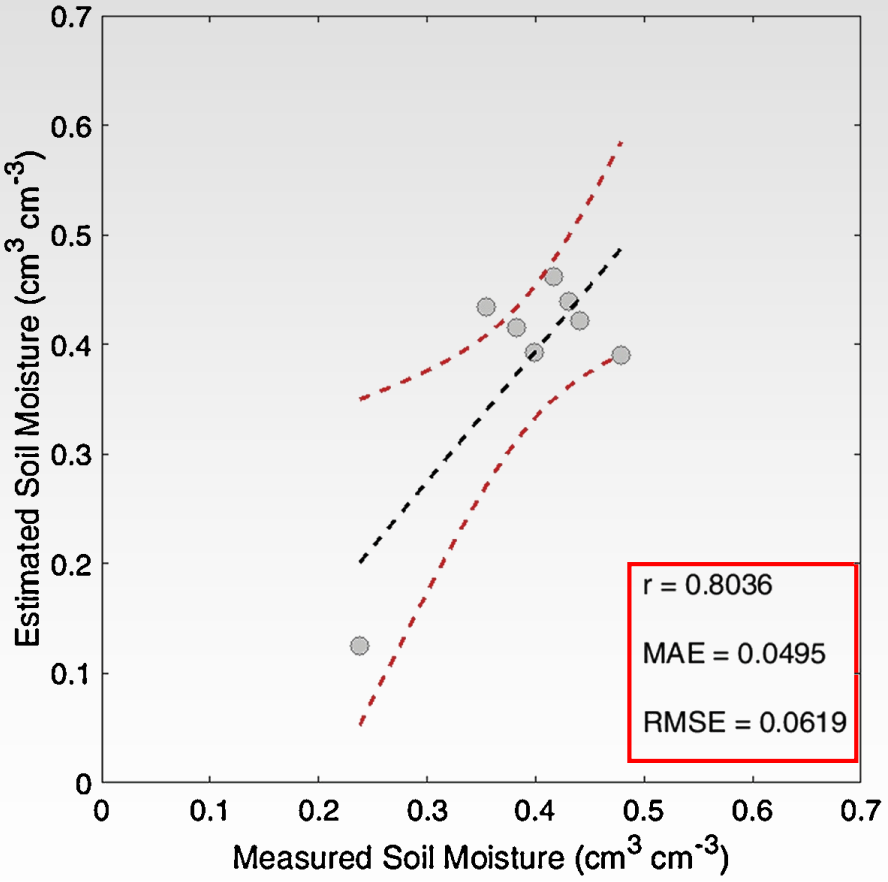
$$W = \frac{i_d \exp(s_d \times NDVI) - STR}{i_d \exp(s_d \times NDVI) - i_w \exp(s_w \times NDVI)}$$

Non Linear Optical Trapezoid Model (OPTRAM) driven by Copernicus Sentinel-2 data

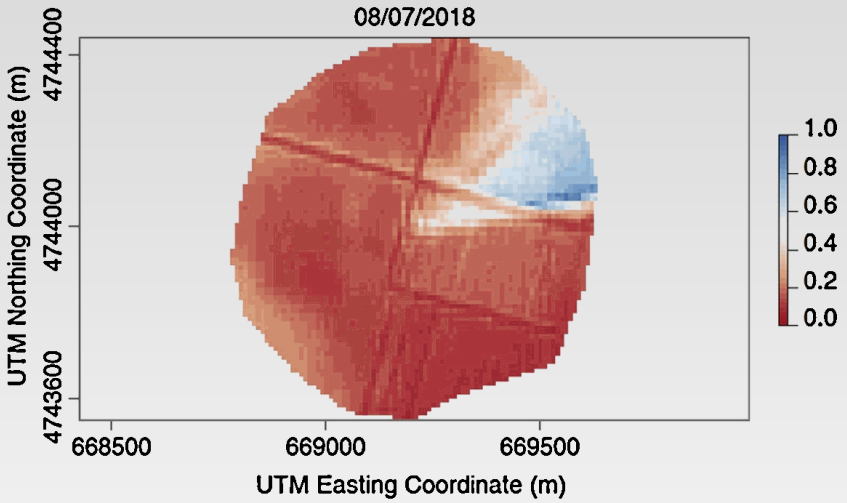
Linear

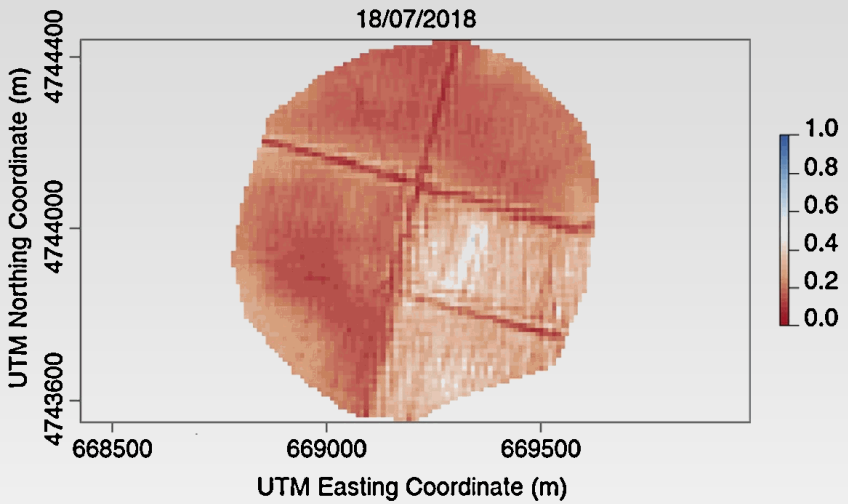


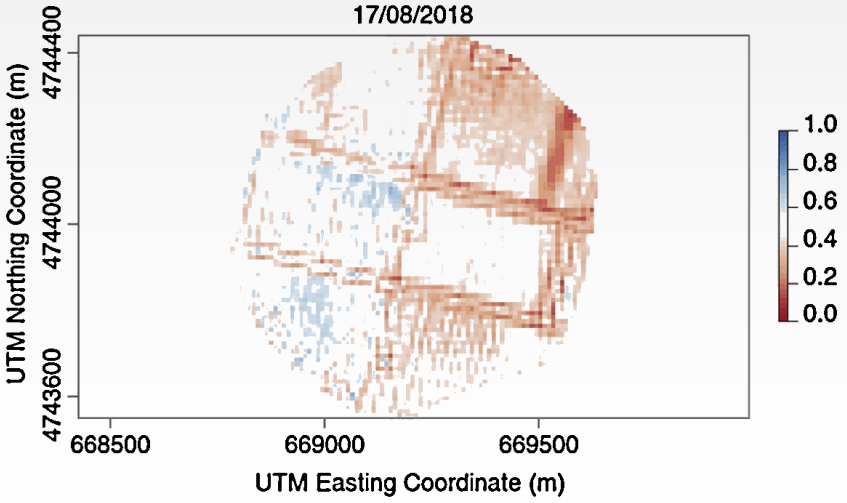
Nonlinear

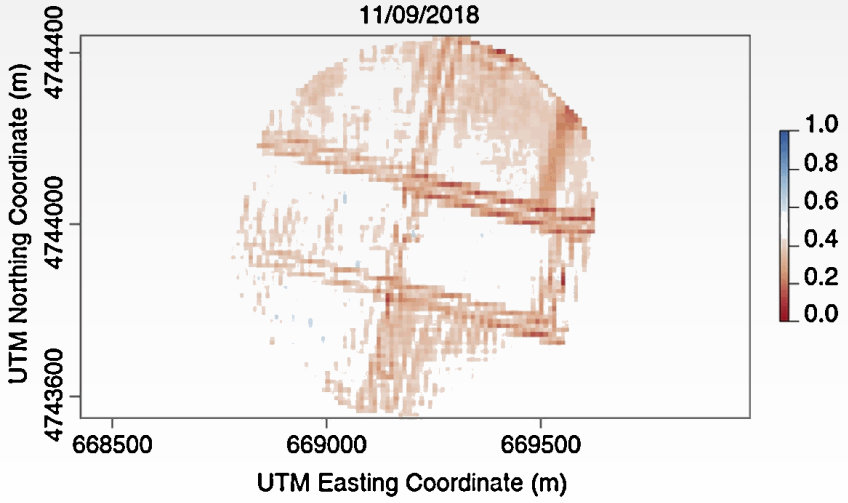


Non Linear Optical Trapezoid Model (OPTRAM) driven by Copernicus Sentinel-2 data

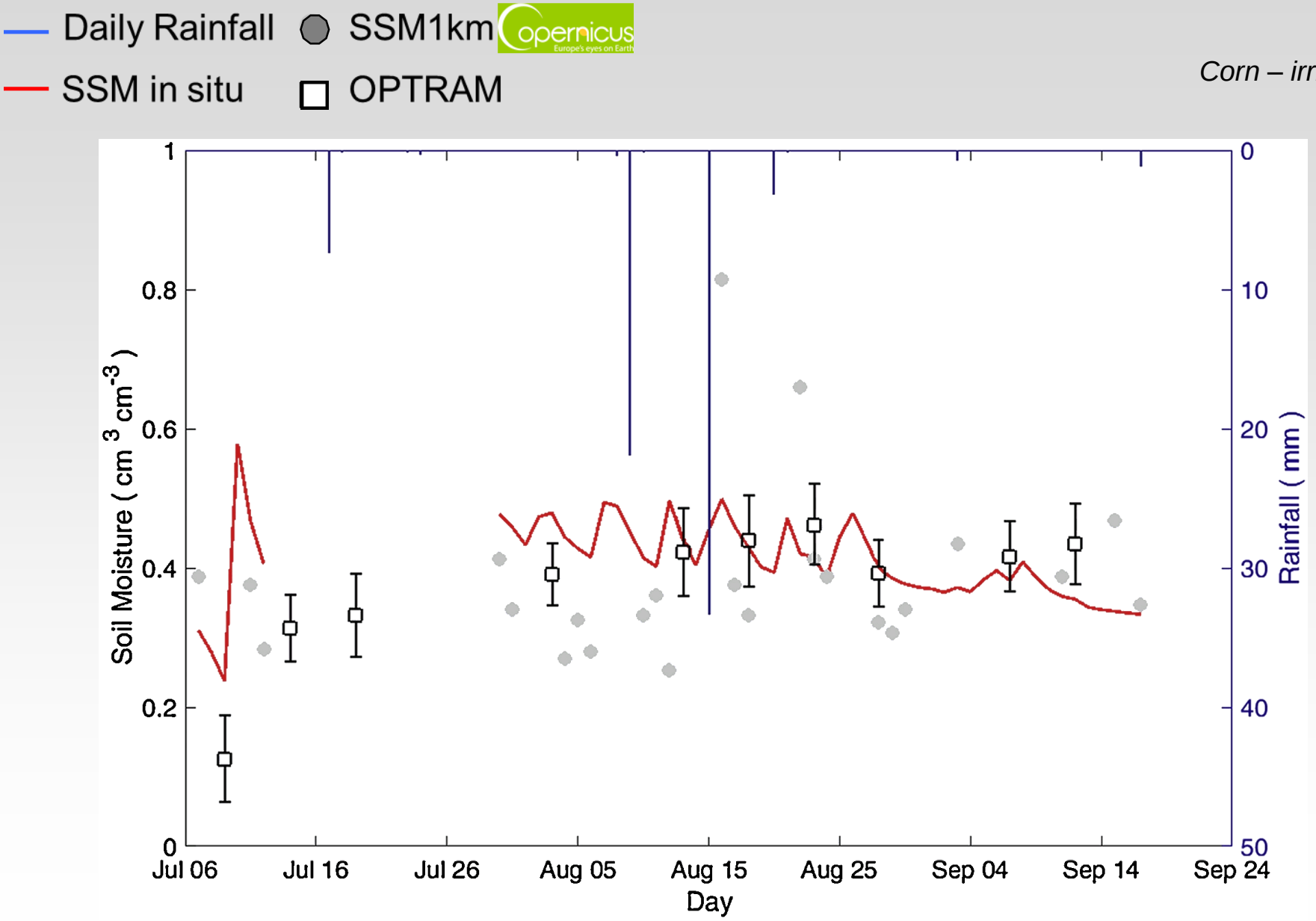


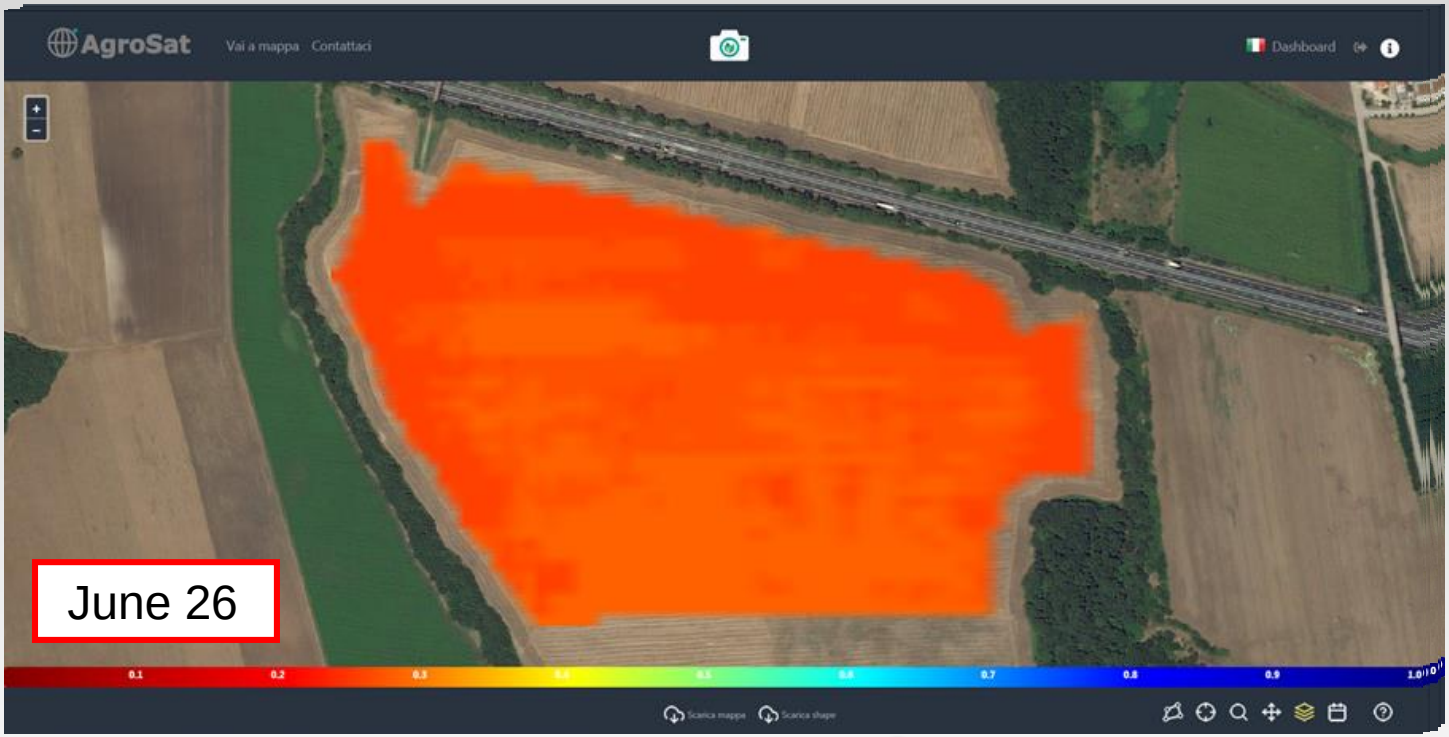


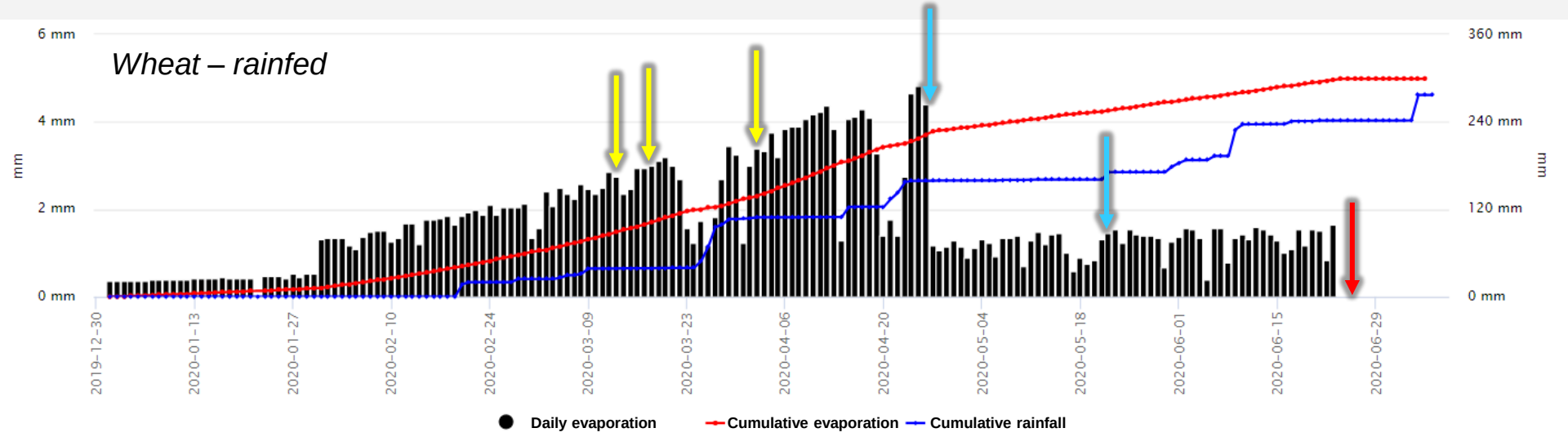




Corn – irrigated


Daily Rainfall
SSM1km
SSM in situ
OPTRAM
Corn – irrigated
Soil Moisture (cm 3 cm-3)
Rainfall (mm)
Day
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50
Jul 06
Jul 16
Jul 26
Aug 05
Aug 15
Aug 25
Sep 04
Sep 14
Sep 24


AgroSat
Vai a mappa
Contattaci
Dashboard
June 26


Wheat – rainfed
6 mm
4 mm
2 mm
0 mm
mm
360 mm
240 mm
120 mm
0 mm
mm
2019-12-30
2020-01-13
2020-01-27
2020-02-10
2020-02-24
2020-03-09
2020-03-23
2020-04-06
2020-04-20
2020-05-04
2020-05-18
2020-06-01
2020-06-15
2020-06-29
Daily evaporation
Cumulative evaporation
Cumulative rainfall

Thanks!

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