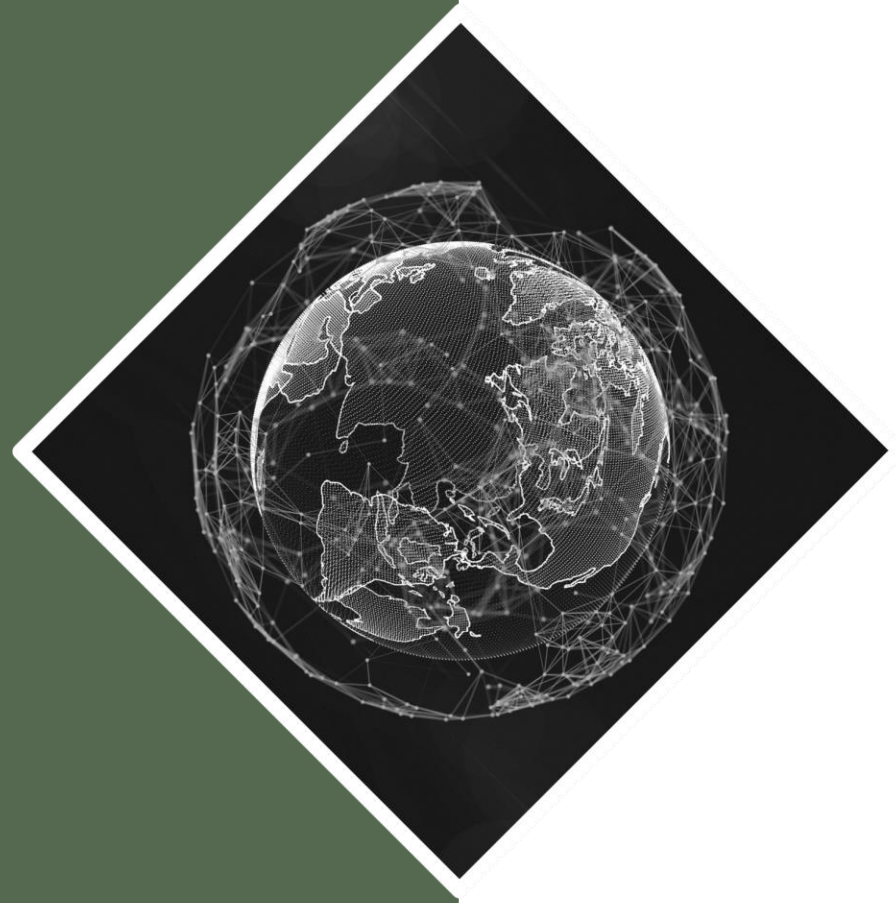
Anomaly hotSpots of Agricultural Production (ASAP)



- Hervé Kerdiles

European Commission, Joint Research Centre, Ispra, Italy

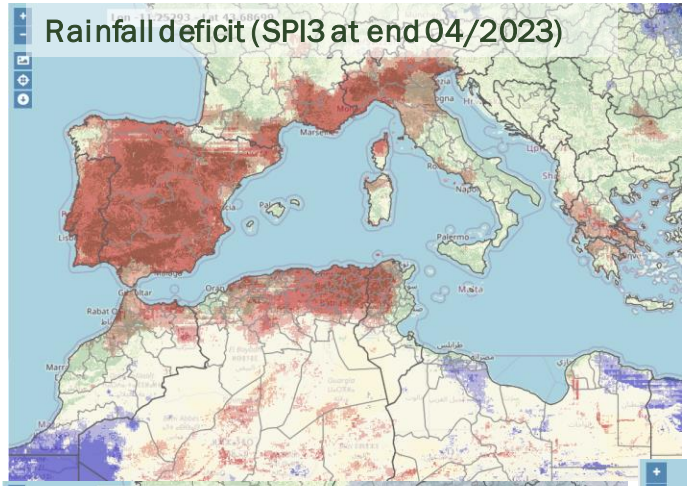
16 June 2023, Geneva, Switzerland

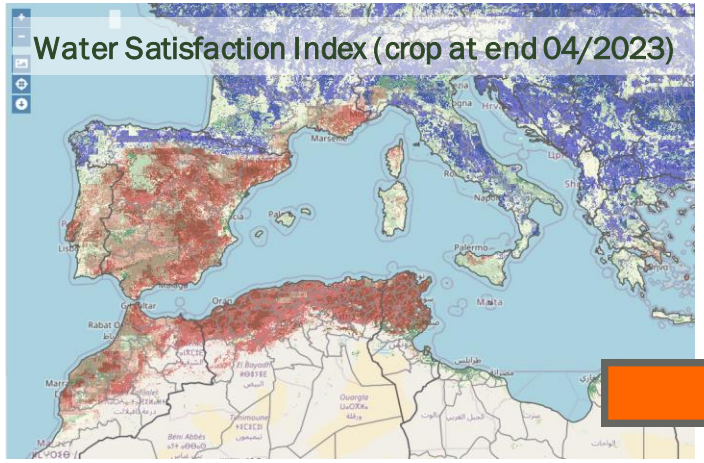
GEO Open Data Knowledge Workshop

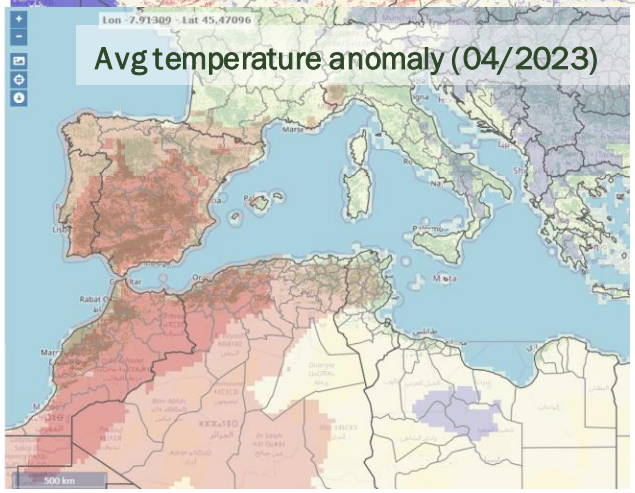
ASAP, a global early warning system…

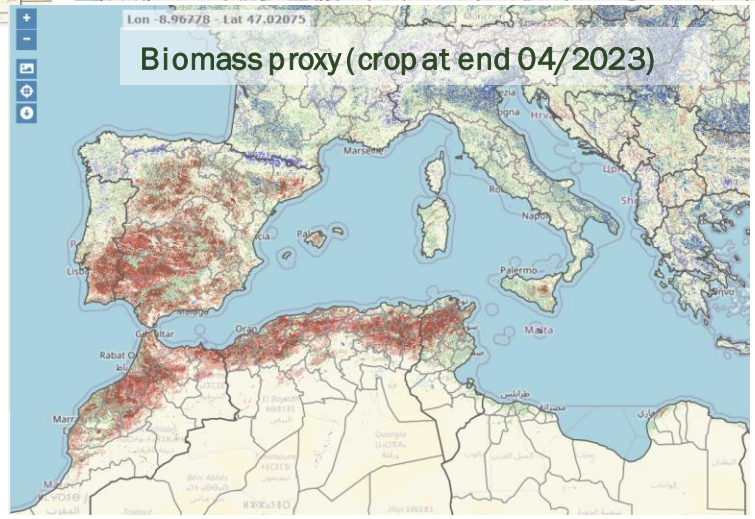
*… to identify **crop production deficits** mainly due to **drought***

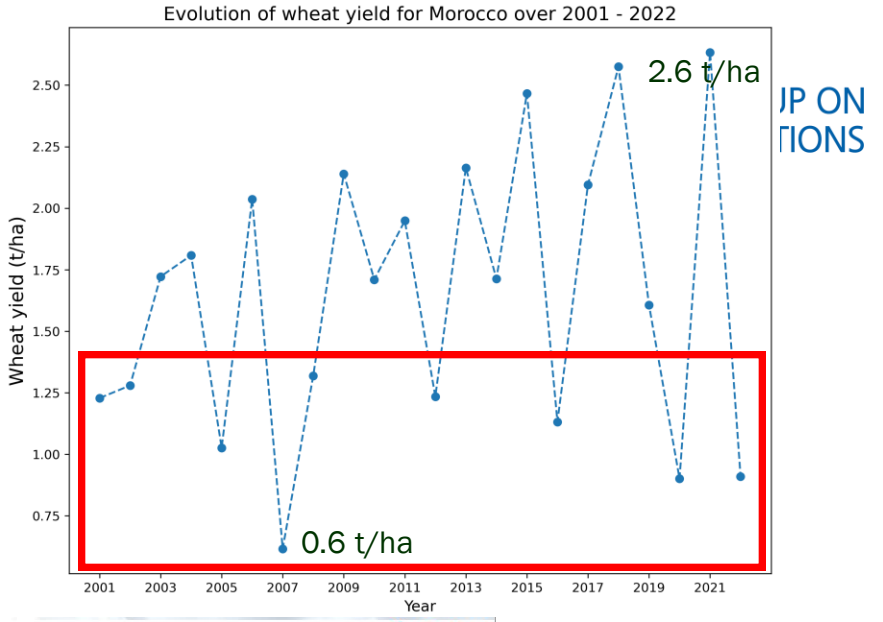
using satellite and agro-meteo data

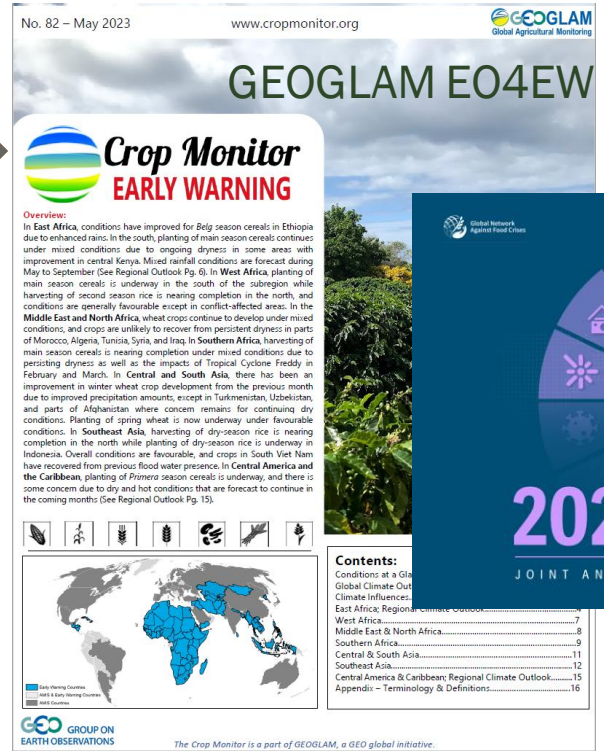


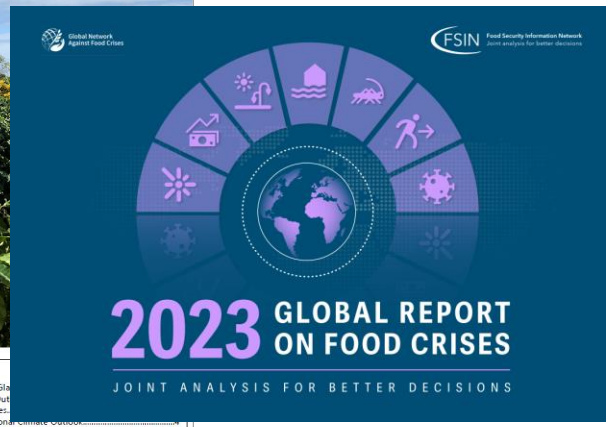




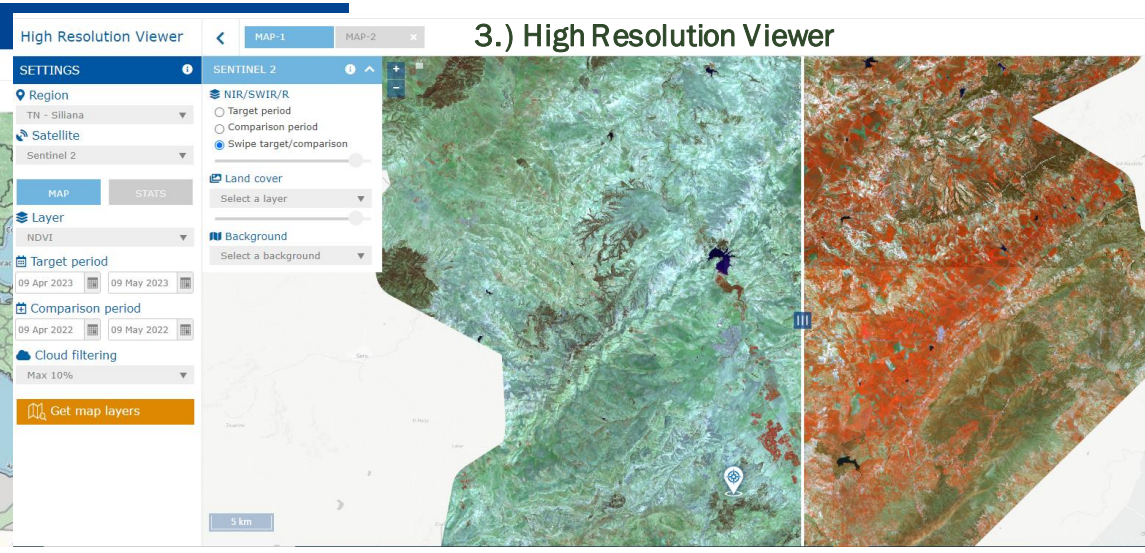








ASAP information levels



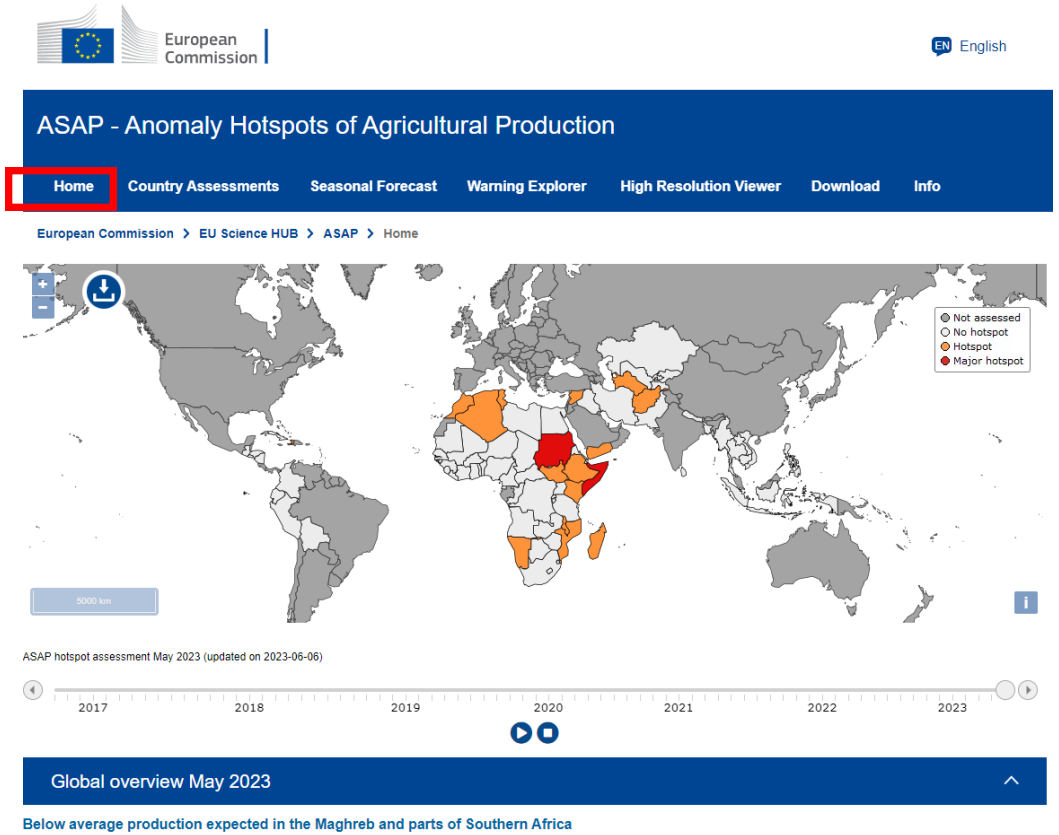
Information level	Information provided	Targeted audience
Country Assessment	Monthly summary for 81 food insecure countries	Decision makers, policy analysts
GAUL 1 region with the Warning Explorer	Explore meteo & RS (low resolution) indicators & automatic warnings at region level every 10 days	Agricultural analysts
Field level with High Resolution Viewer	Explore field level with 10m Sentinel imagery	Agricultural analysts with RS knowledge

+ Seasonal Forecast of rainfall (monthly timestep for next 6 months) at continental level

Info level 1: Hotspot analysis

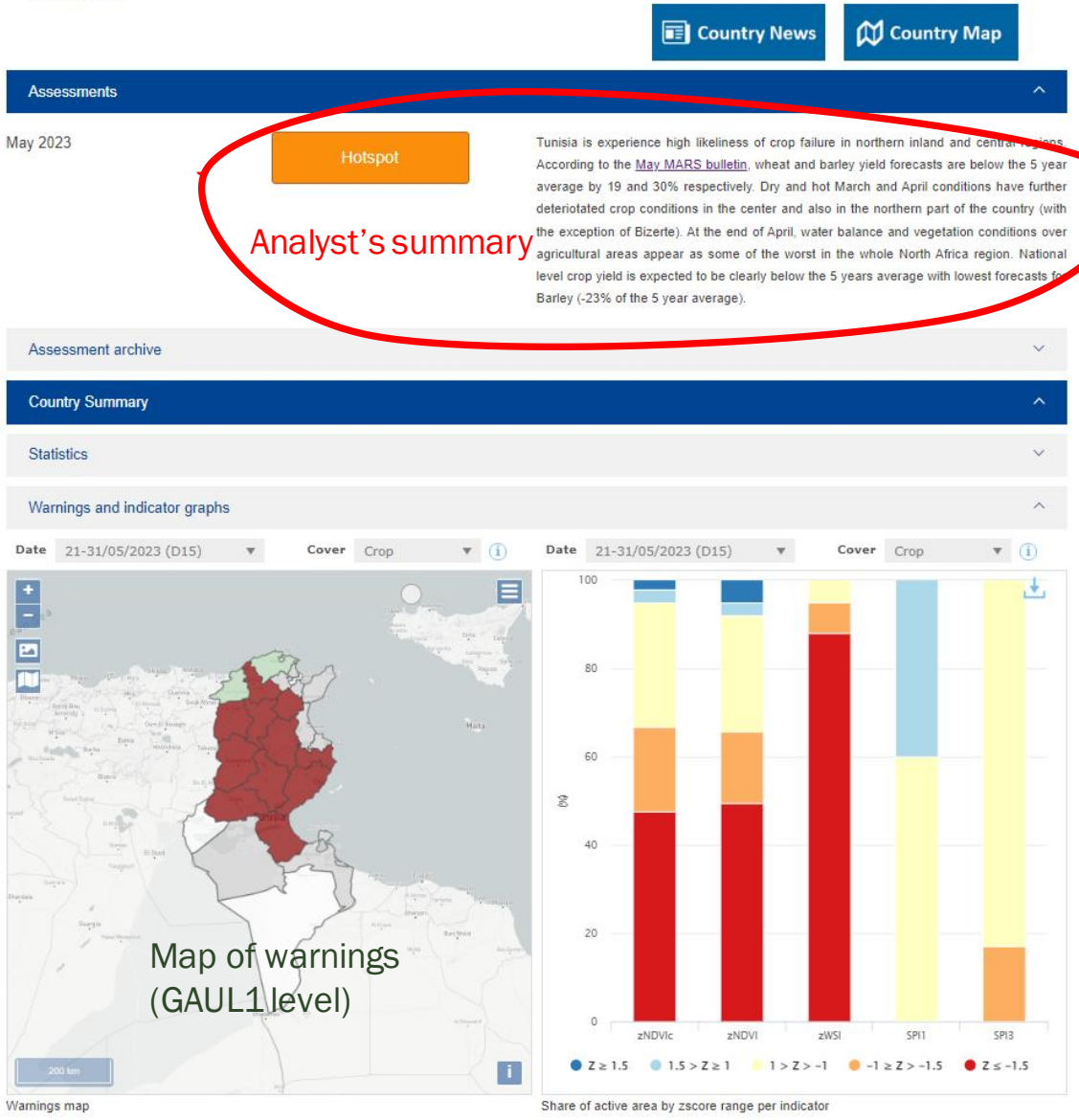
GROUP ON EARTH OBSERVATIONS

Global overview



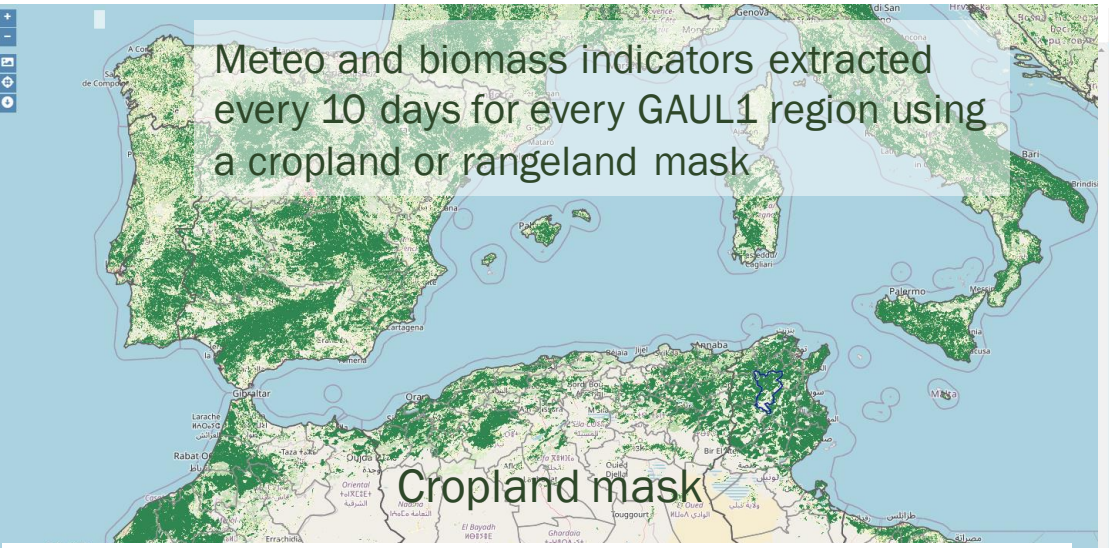
Summary per large region (e.g. East Africa, Southern Africa…)

Monthly Country assessment



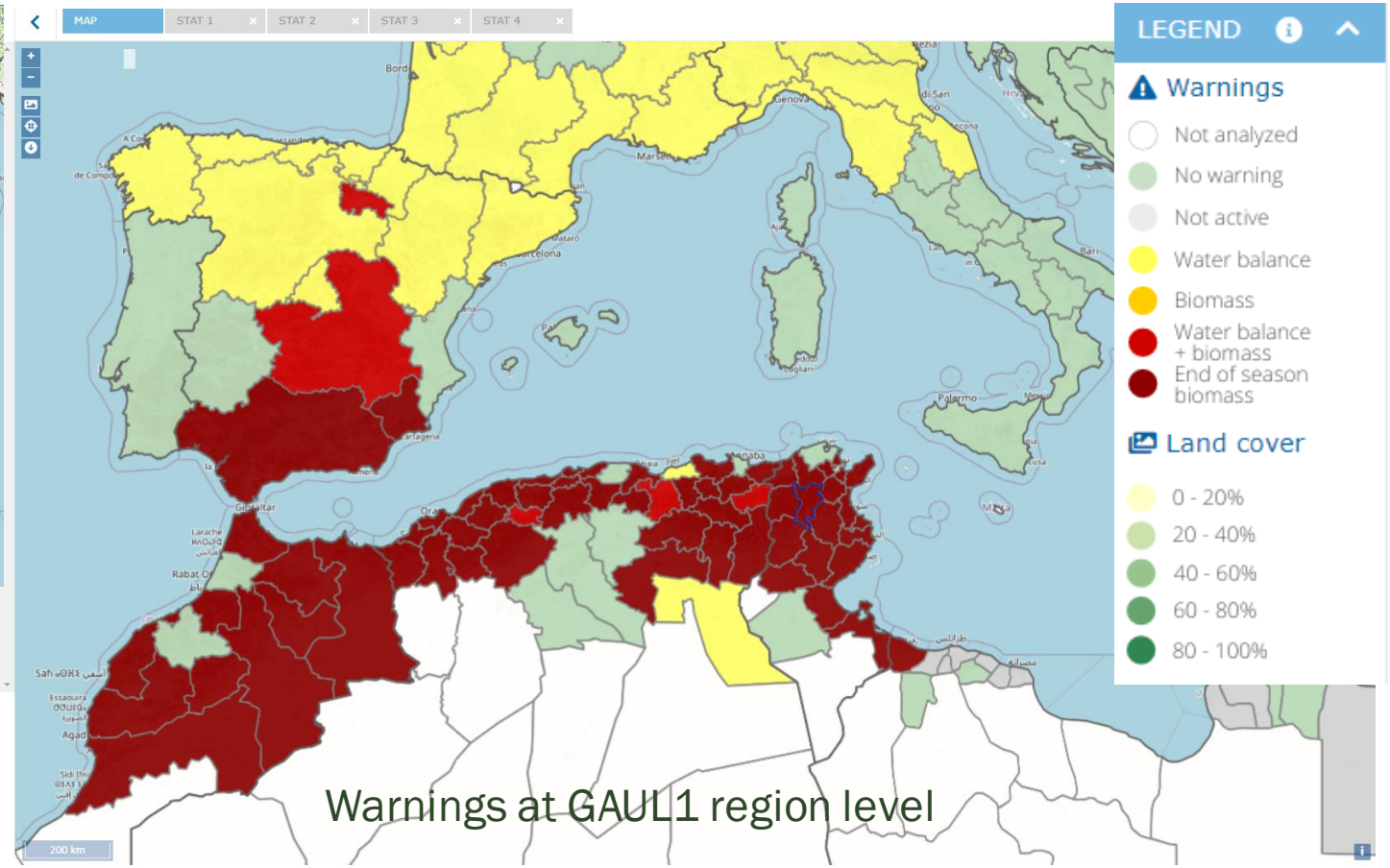
Info level 2: Warning Explorer

- Every 10 days, ASAP assigns warnings automatically to GAUL1 regions using indicators of biomass or water deficit (low resolution data - 1 km to 0.25 deg, non crop specific, mean phenology)



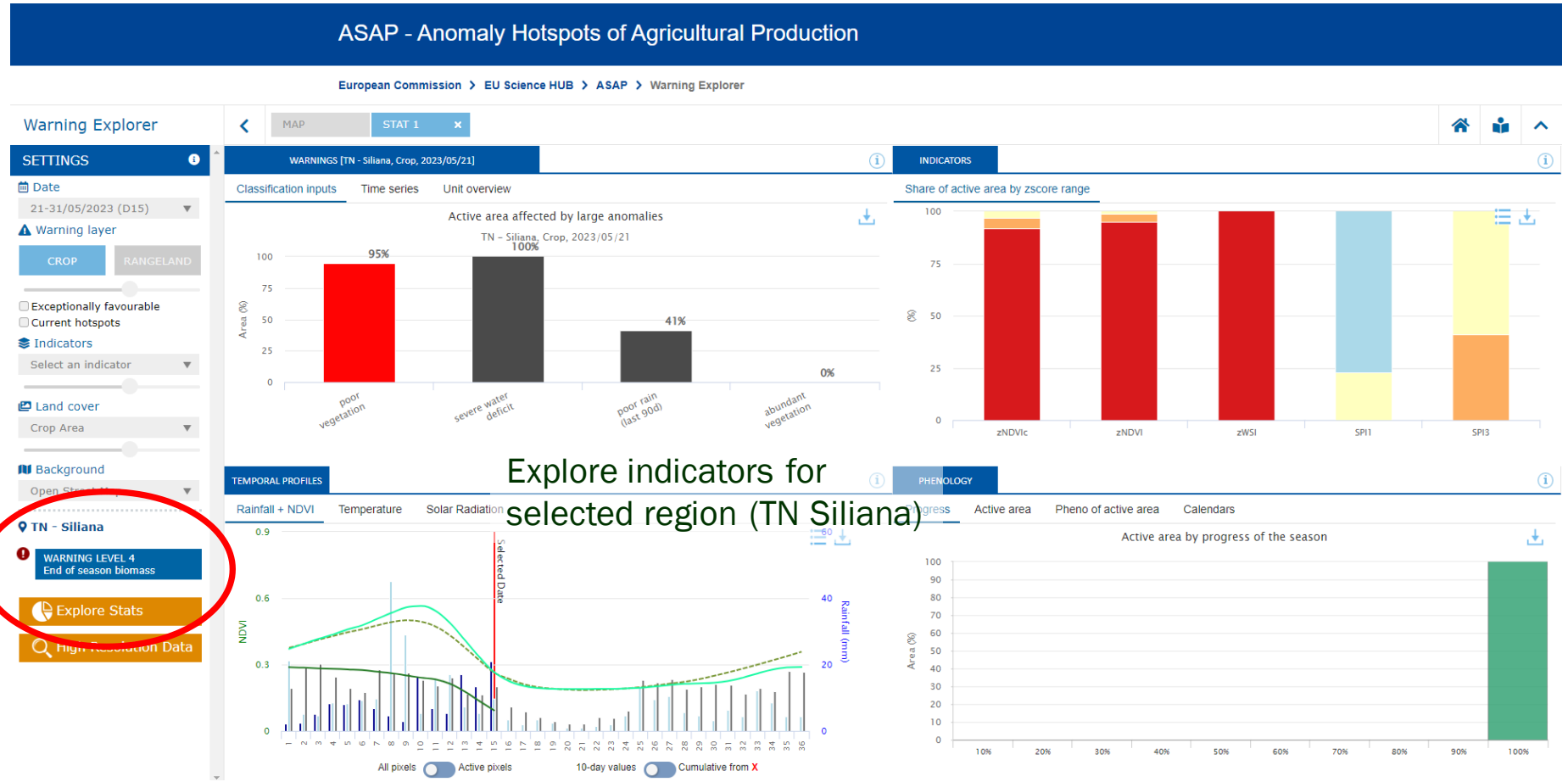
Classification rule

	Indicator with CAF>25%			Phenological phase: Expansion, maturation	Phenological phase: Senescence
Water deficit possibly evolving into poor growth					
Meteo-based (Water-balance)	zWSI			1	-
Meteo-based (Rainfall)		SPI3			
Meteo-based	zWSI	SPI3		1+	-
Evidence of poor growth					
NDVI-based			zNDVIc	2	4
Poor growth & negative prospects					
Meteo & NDVI	zWSI		zNDVIc	3	4
Meteo & NDVI		SPI3	zNDVIc		
Meteo & NDVI	zWSI	SPI3	zNDVIc	3+	4



Info level 2: Warning Explorer

- Analyst can explore meteo & biomass indicators (for cropland or rangeland) of GAUL 1 regions to decide if the country should be classified as hotspot



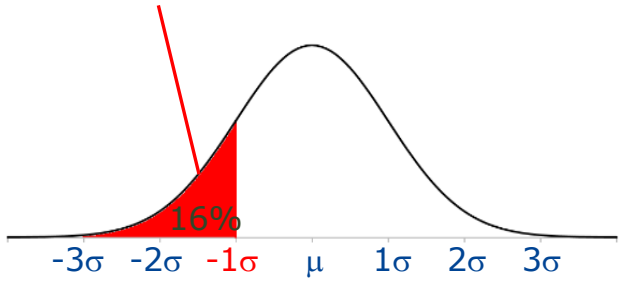
Explore indicators for selected region (TN Siliana)

Warnings based on z-score

$$zX_t = \frac{X_t - \bar{X}_t}{\sigma_{X_t}}$$

with t time of observation
X: biomass proxy, water satisfaction index, 3-month rainfall

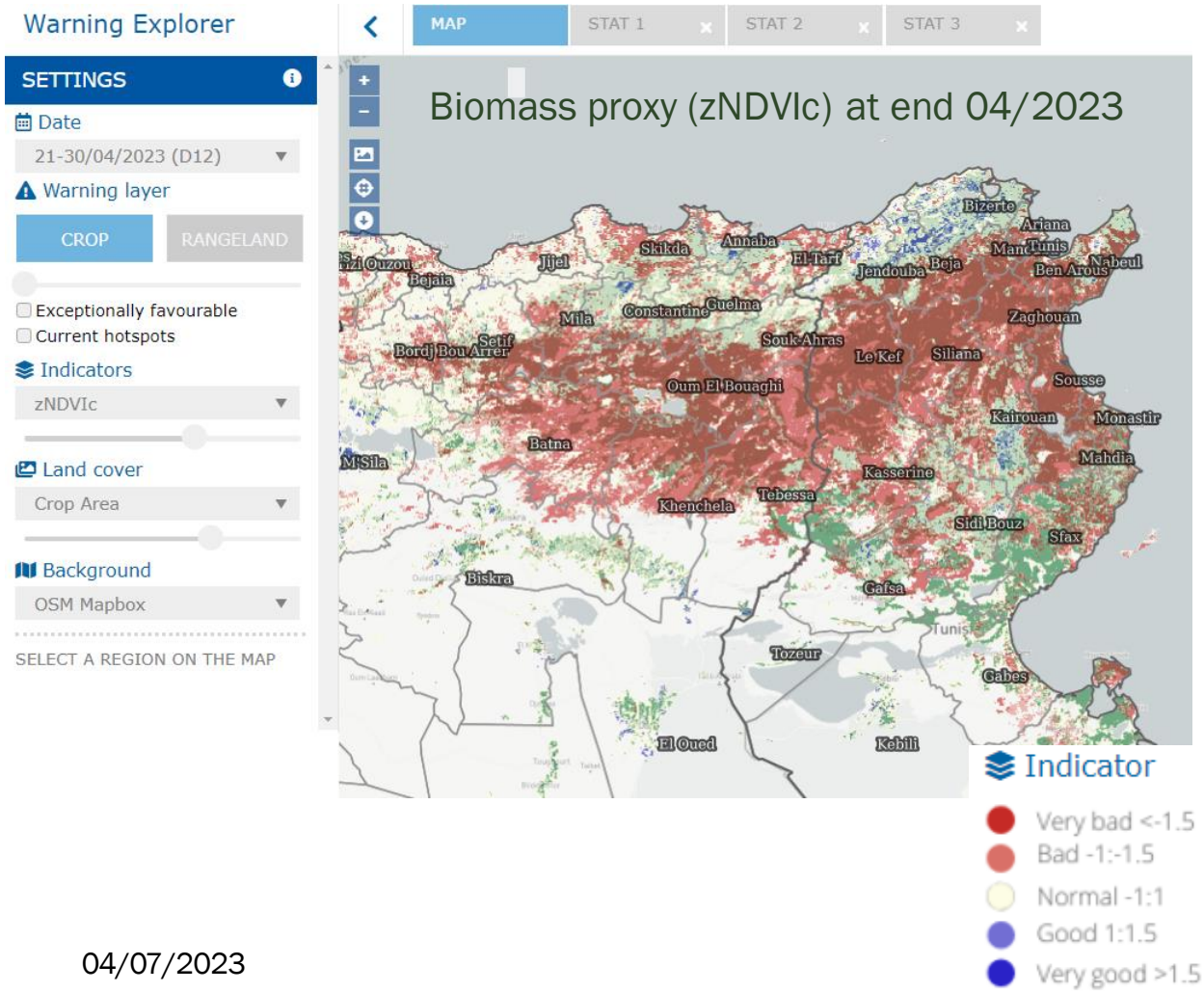
Pixel critical if $zX_t < -1$

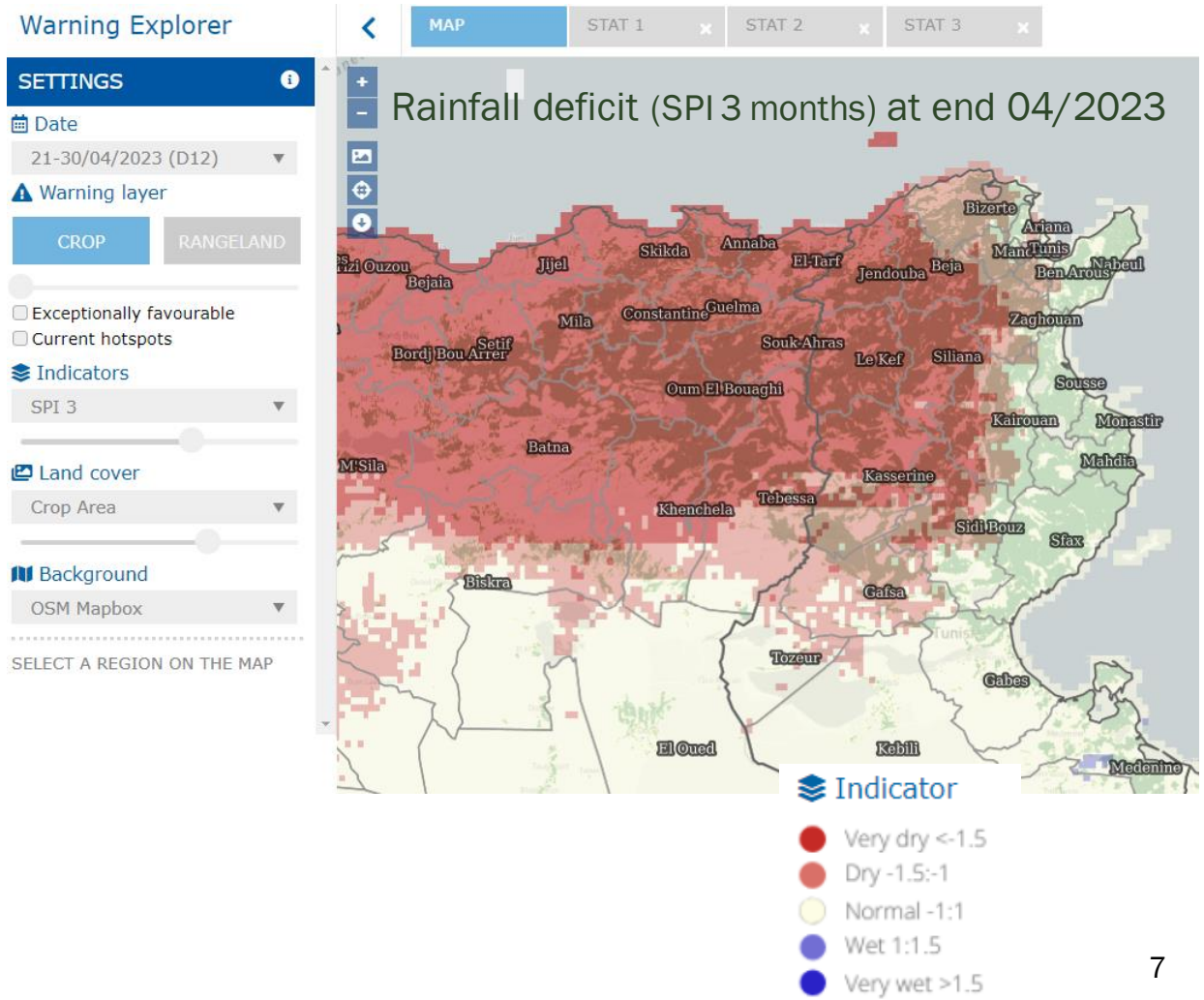


Warning assigned if critical cropland (or rangeland) area >25% of (active) cropland area

Info level 2: Warning Explorer

- Analysis of maps of the various indicators

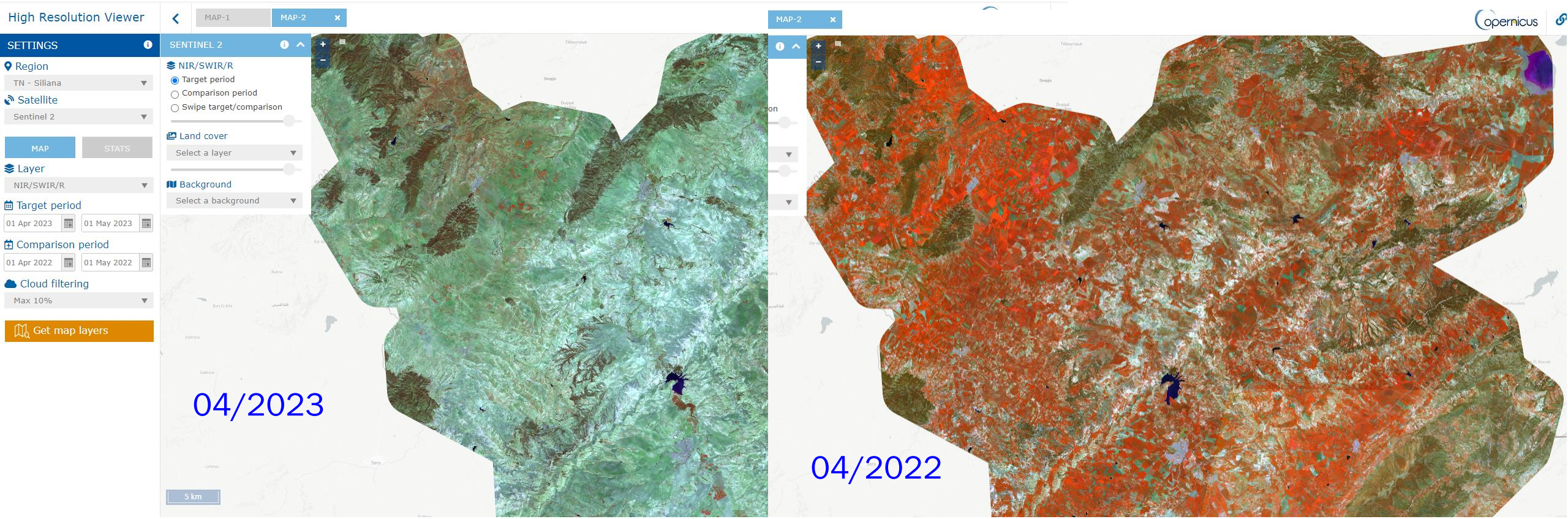




Info level 3: High Resolution Viewer

Possibility to zoom in to field level (10 m resolution) anywhere on the globe (data on the cloud)

Allows detecting poor biomass, flooding, burning, clearing, snow presence etc…

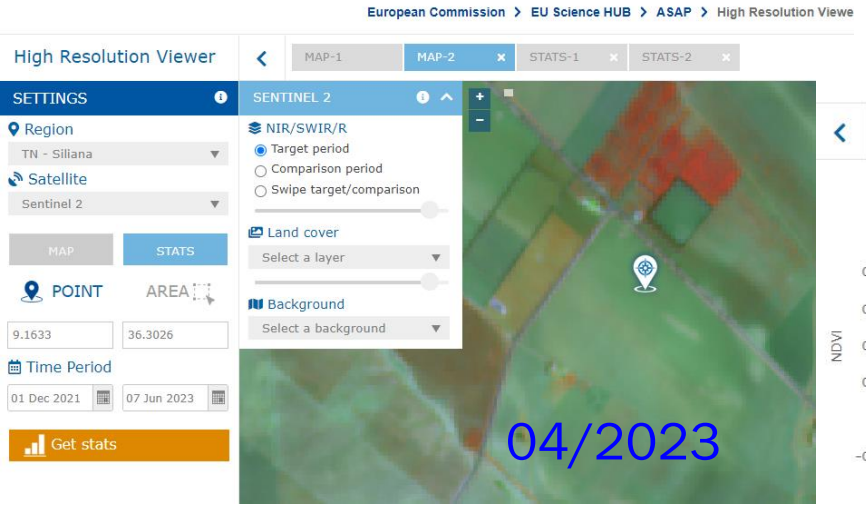


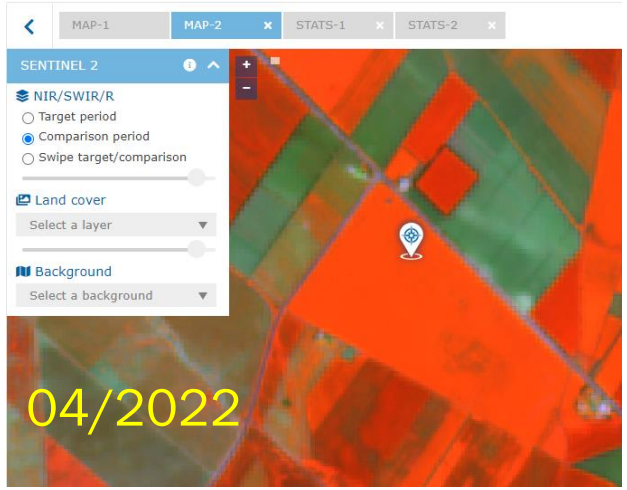
Field level monitoring for any point on Earth with revisit frequency of 5, 8 or 12 days (S2, Landsat 8&9, S1 resp.)

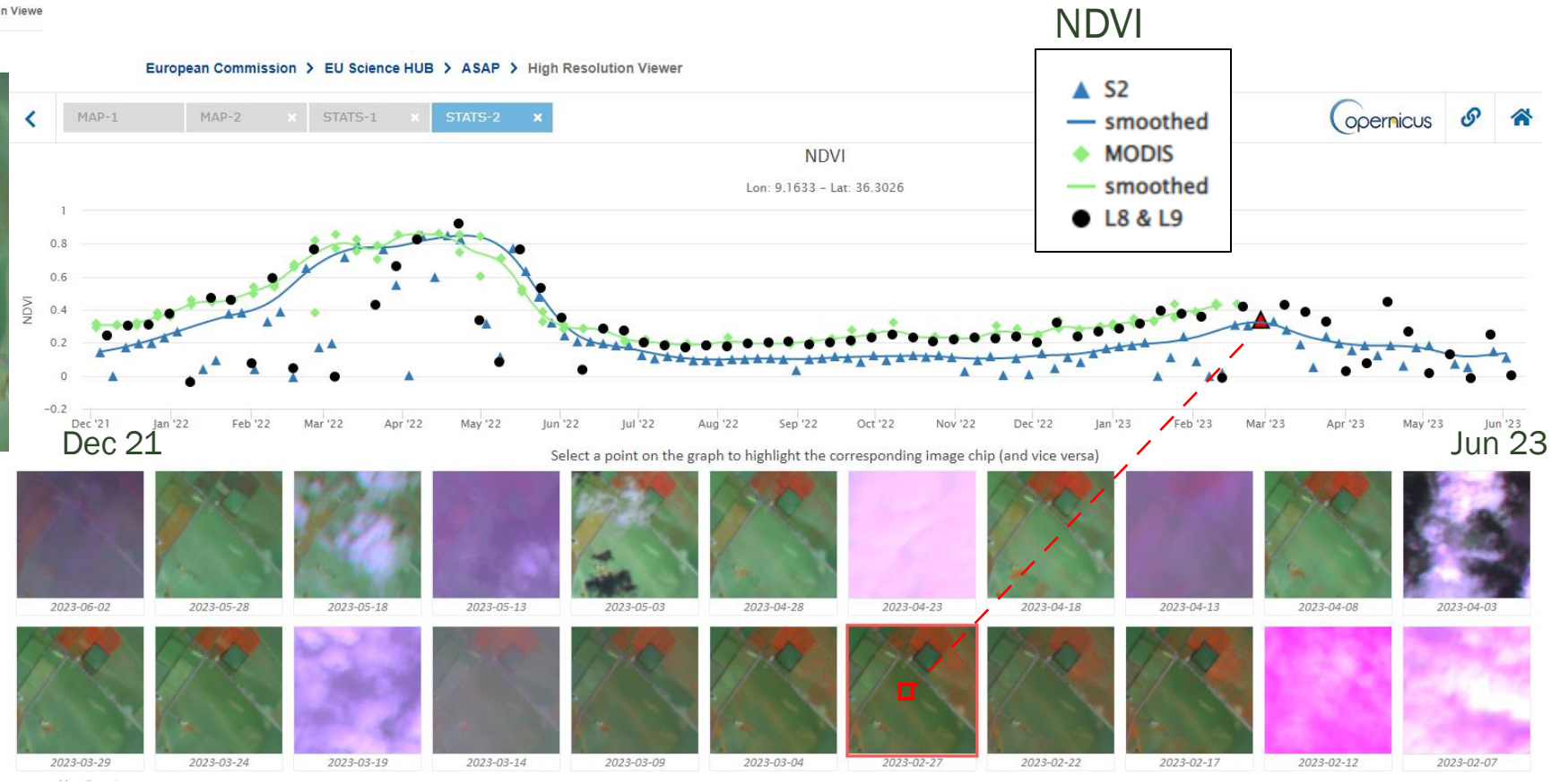
Powered by Google Earth Engine

Info level 3: High Resolution Viewer

And to obtain the S2, L8 & MODIS NDVI time profile of a point (40m x 40m)





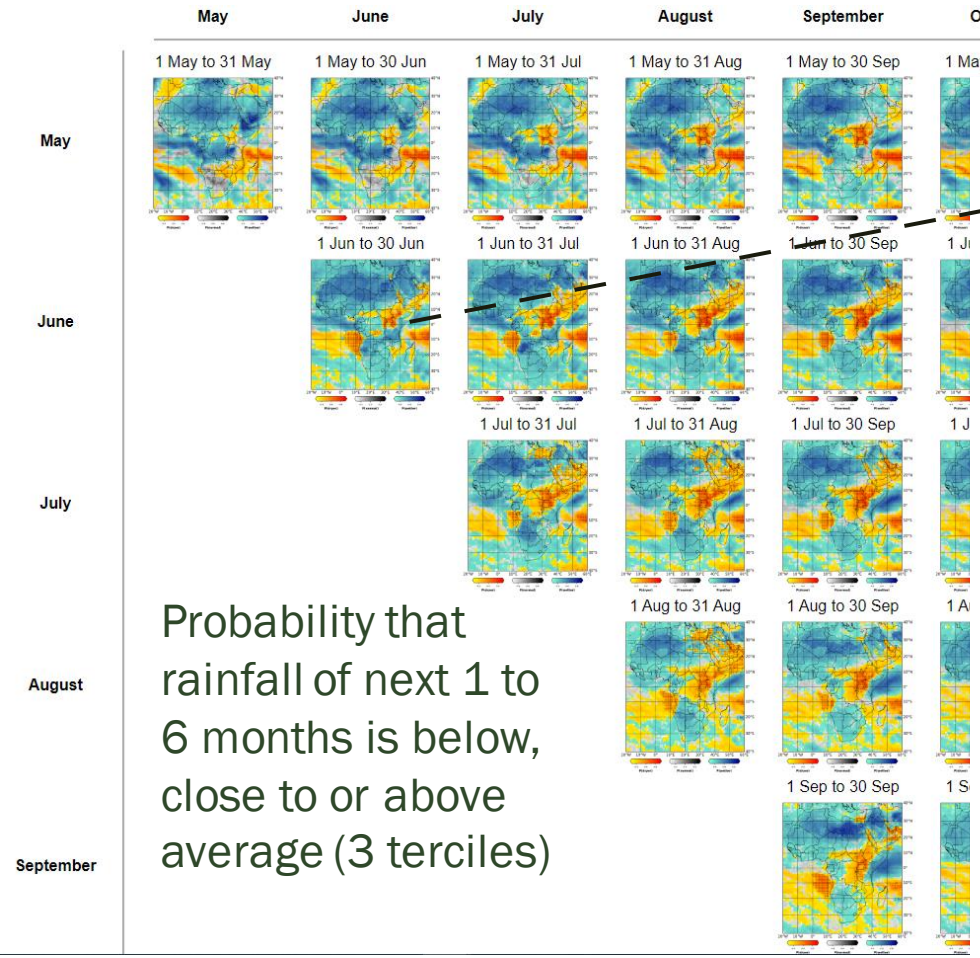


Field level monitoring (crop specific)

Mainly for agriculture analysts with basic remote sensing knowledge

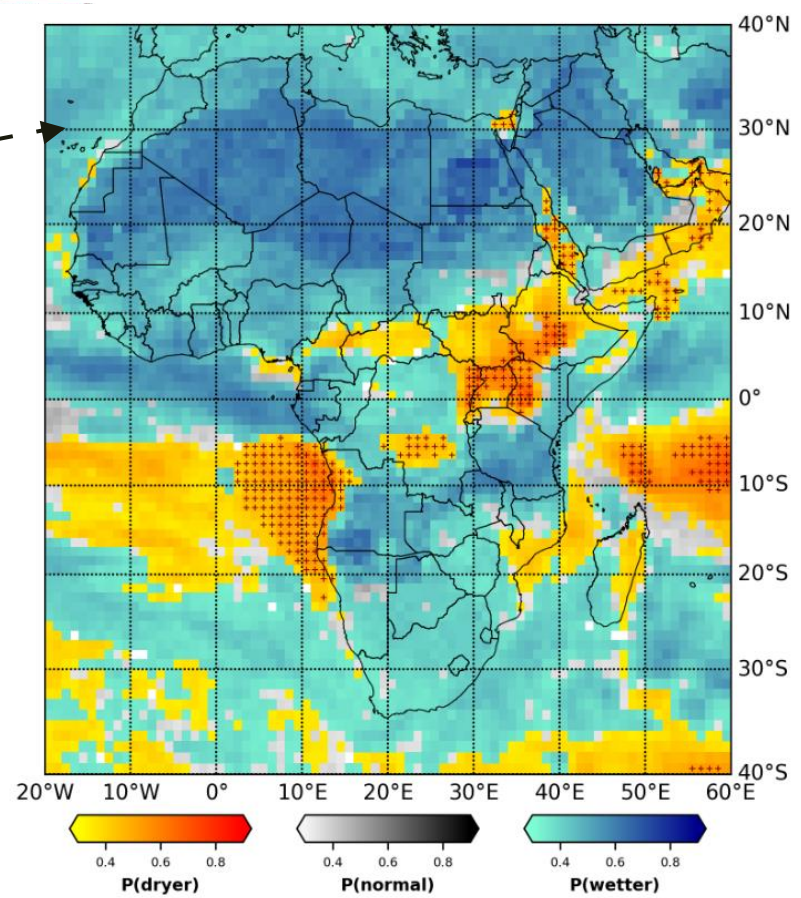
Seasonal rainfall forecast

Rainfall forecast for the next 6 months from 6 models from Copernicus Climate Change Service (C3S)

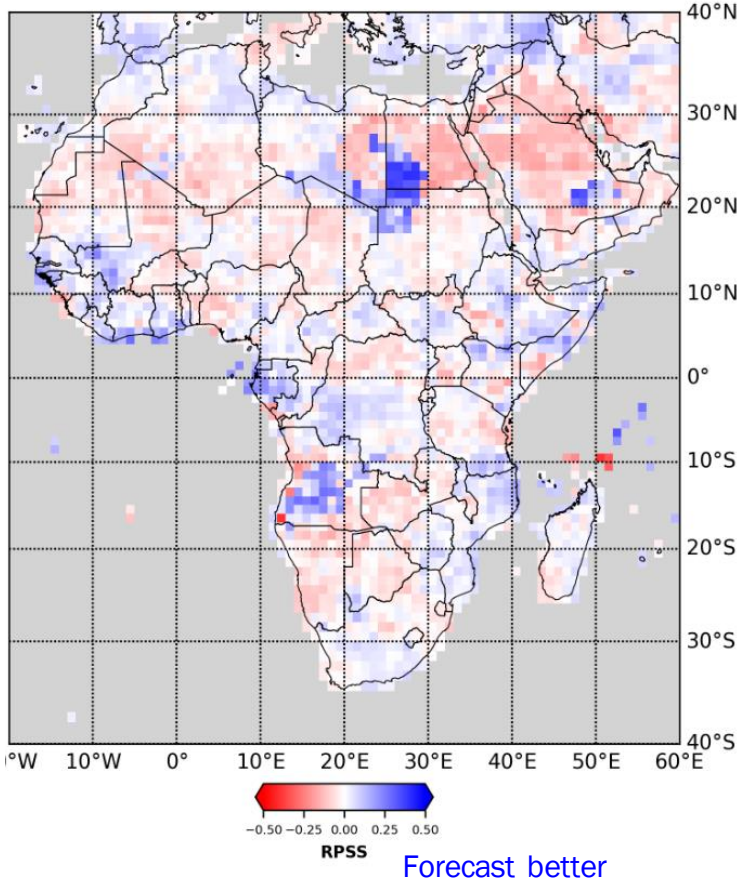


Probability that rainfall of next 1 to 6 months is below, close to or above average (3 terciles)

Forecast rainfall 1-30 June 2023



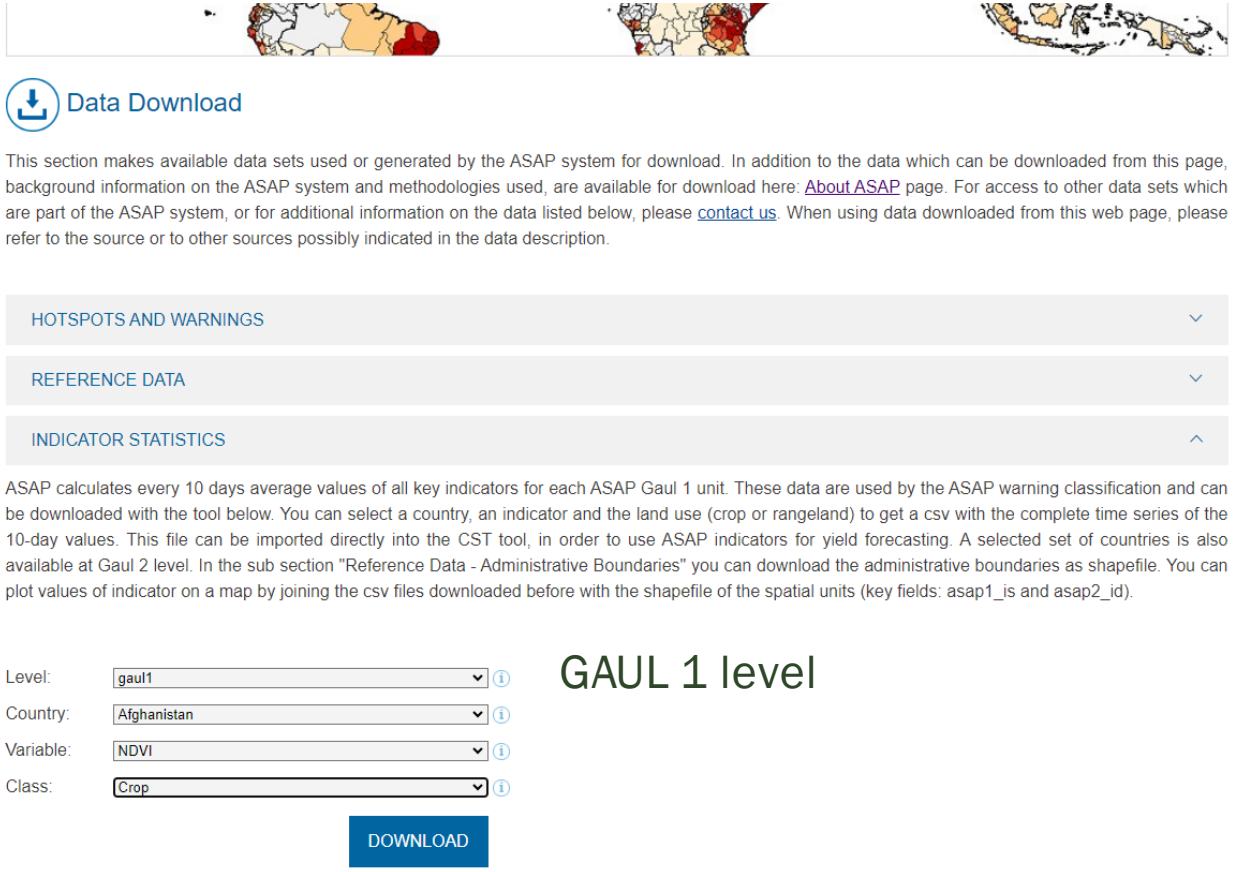
Rank Probability Skill Score comparing forecast to CHIRPS rainfall climatology



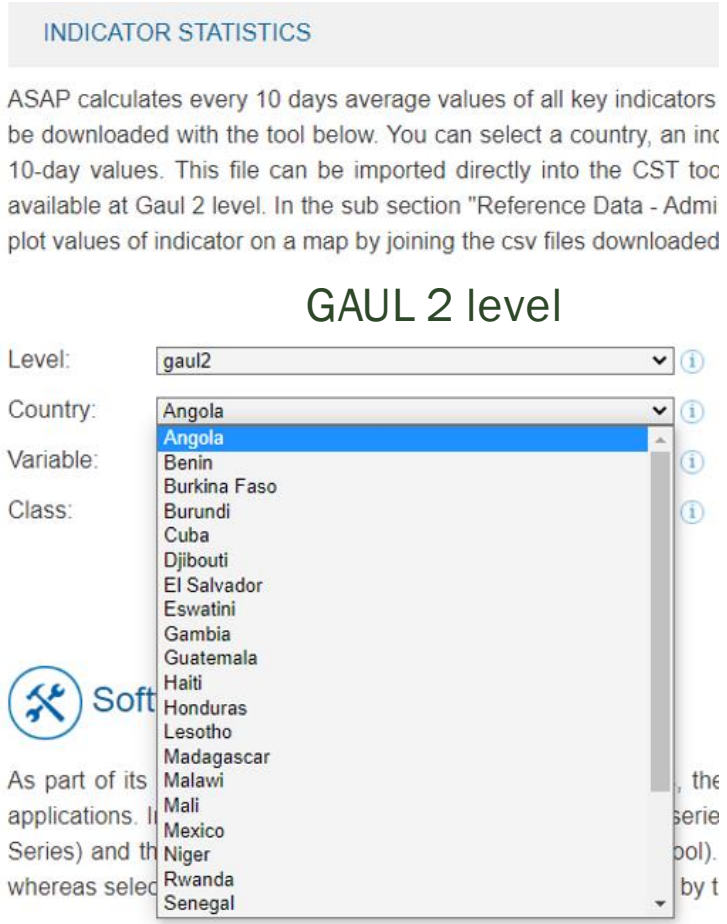
Forecast better than climatology

Data for download

- Indicators (NDVI, Rainfall, zNDVIc, SPI-3, Mean air temperature, WSI, global radiation) at GAUL1 level; GAUL2 level for 26 countries subject of food security (IPC) analysis.
- Warnings & reference data (GAUL limits, cropland / rangeland masks, mean ASAP phenology)



GAUL 1 level



GAUL 2 level

Tunisia 2023: analysis with ASAP Warning Explorer

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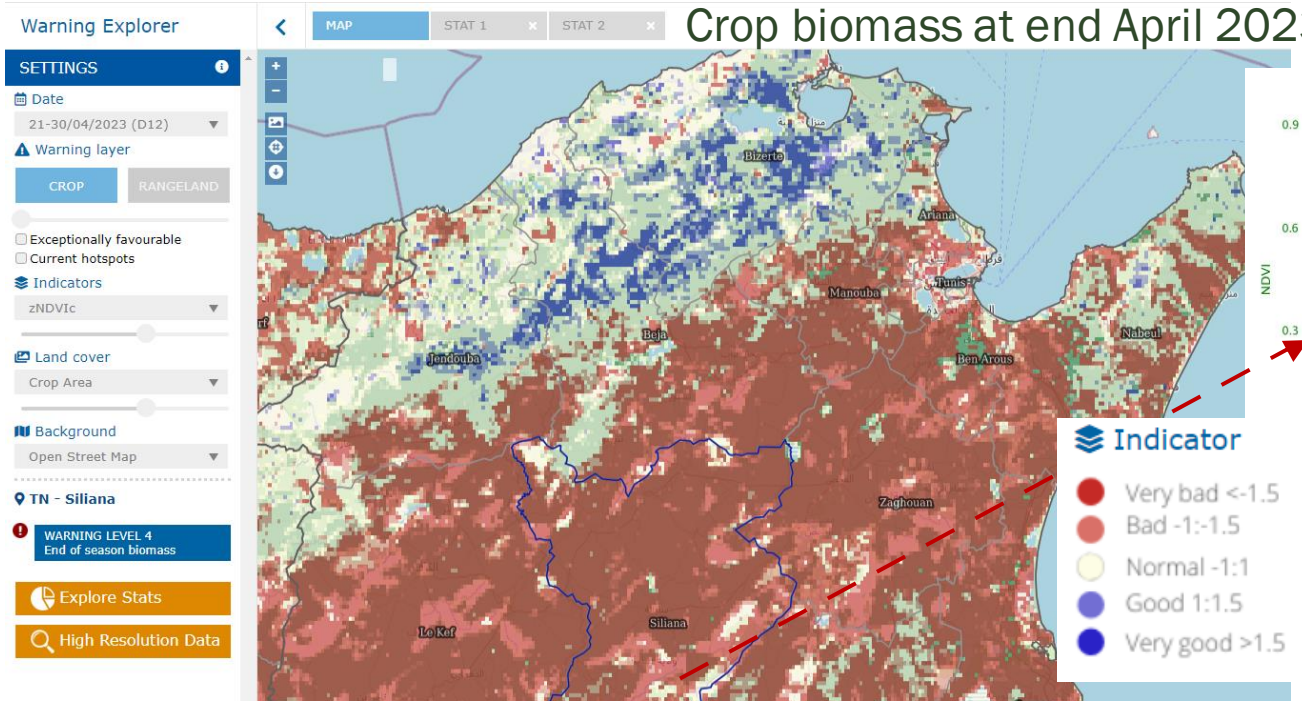
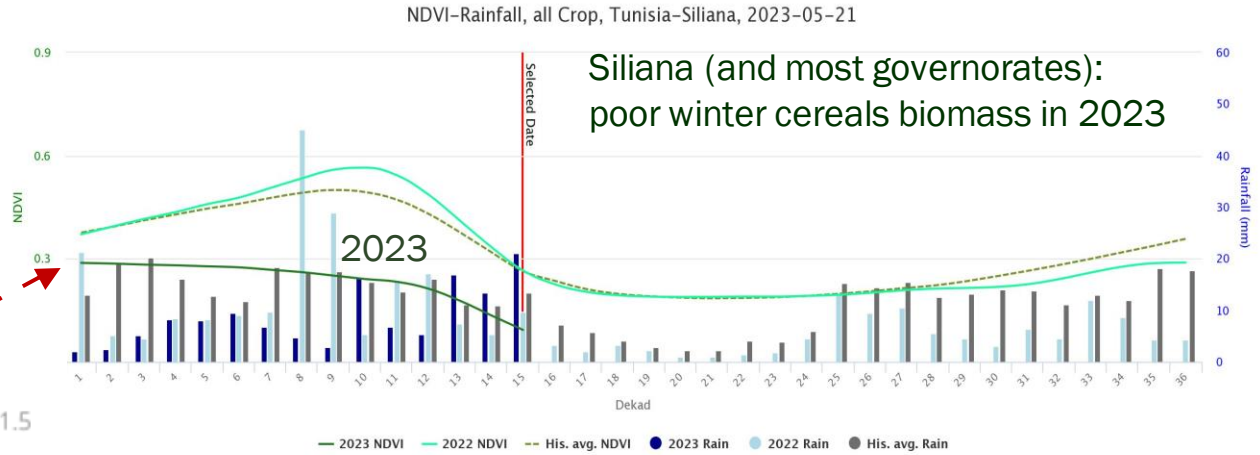
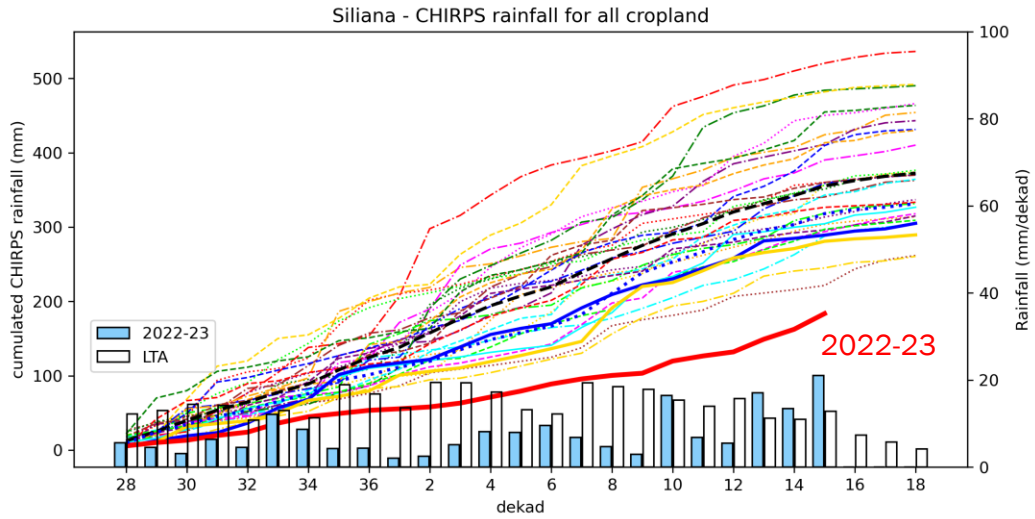
Crop biomass at end April 2023

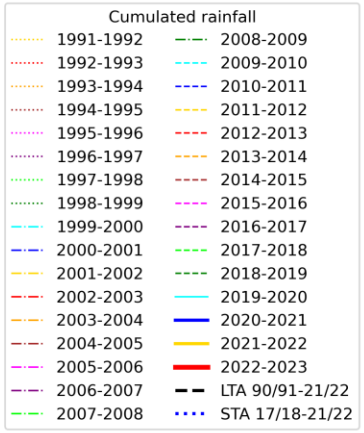


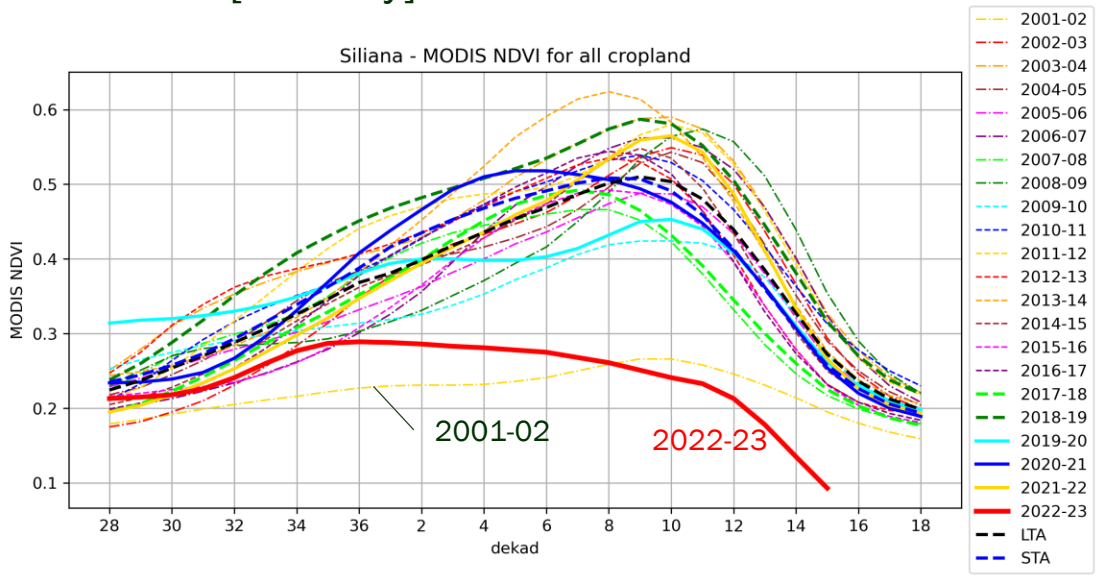


Siliana (and most governorates): poor winter cereals biomass in 2023

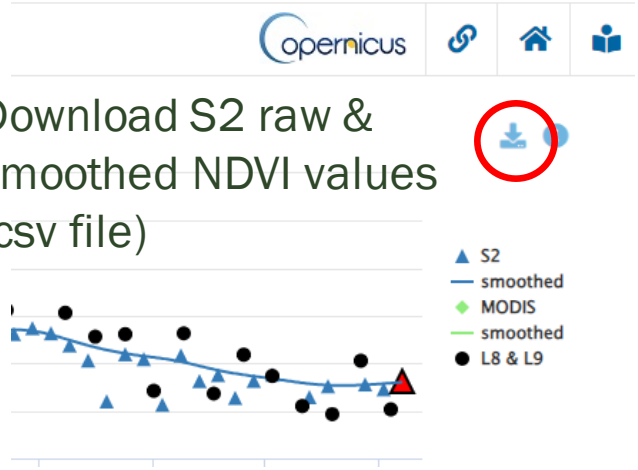
2023 driest [Oct-May] season since 1991-1992

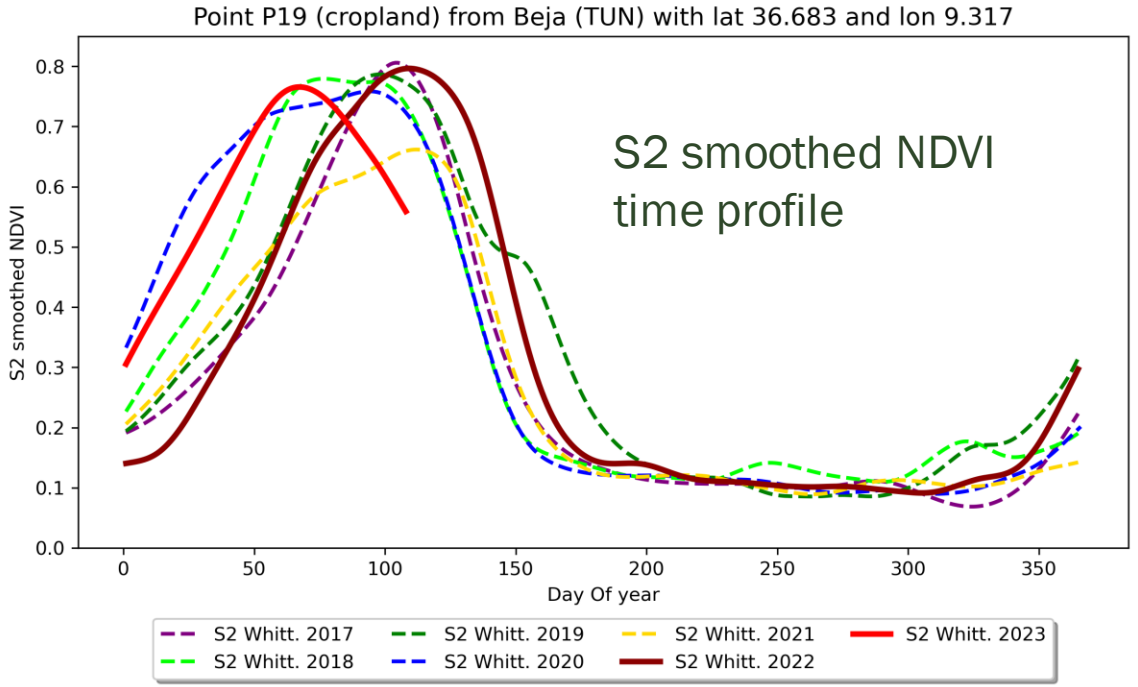


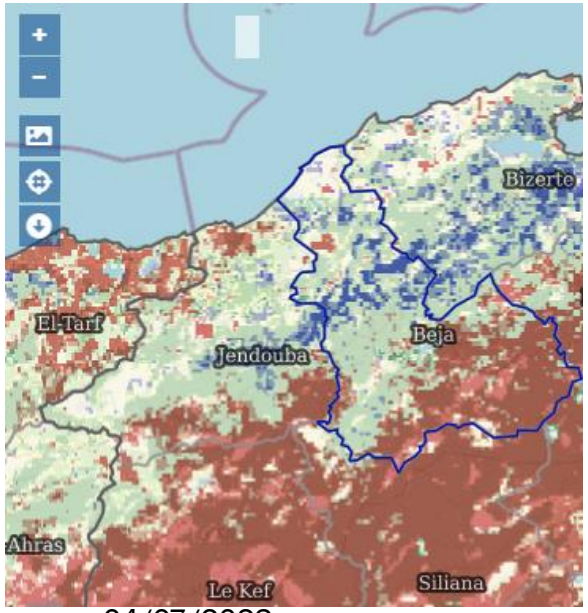


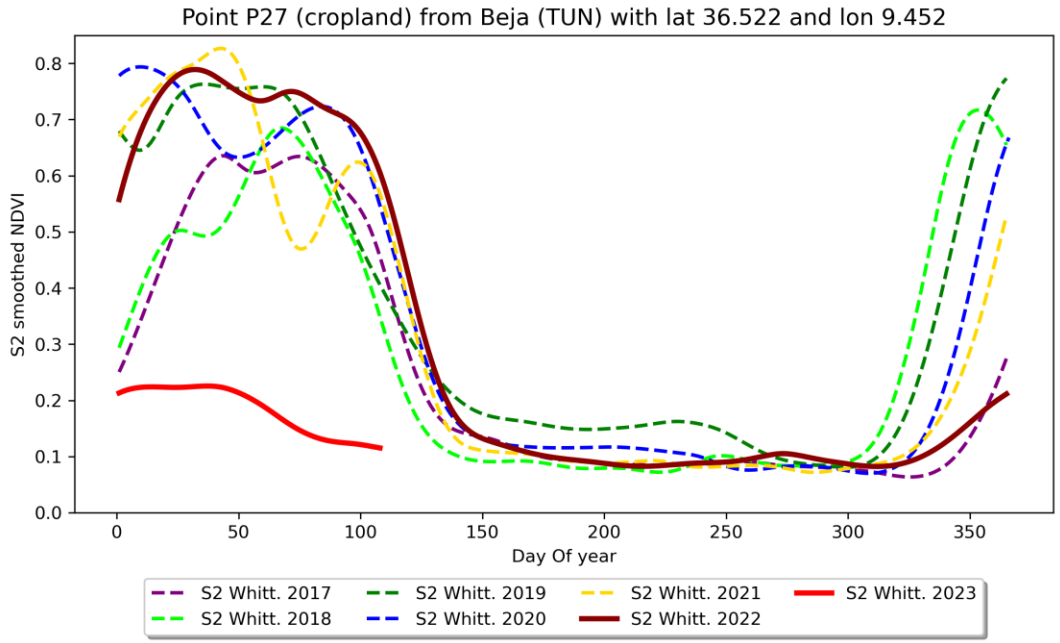


Zoom in to field level









Rice seasons with S2 NDVI profiles

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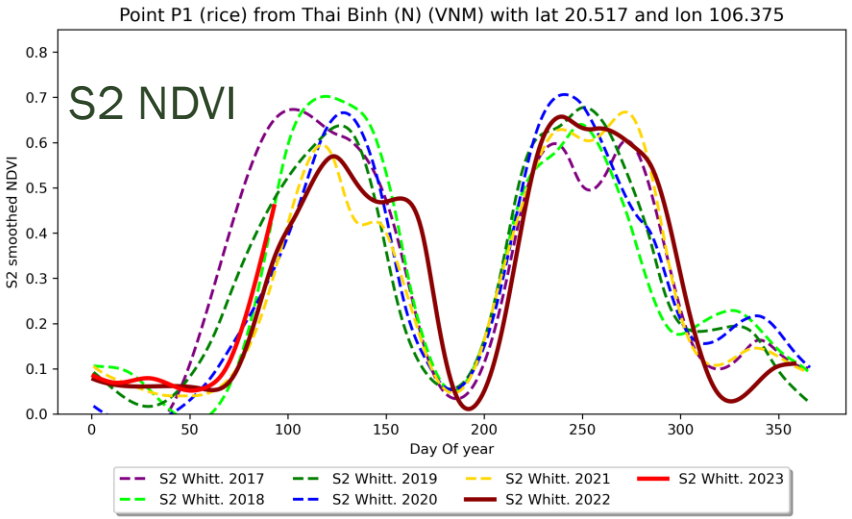
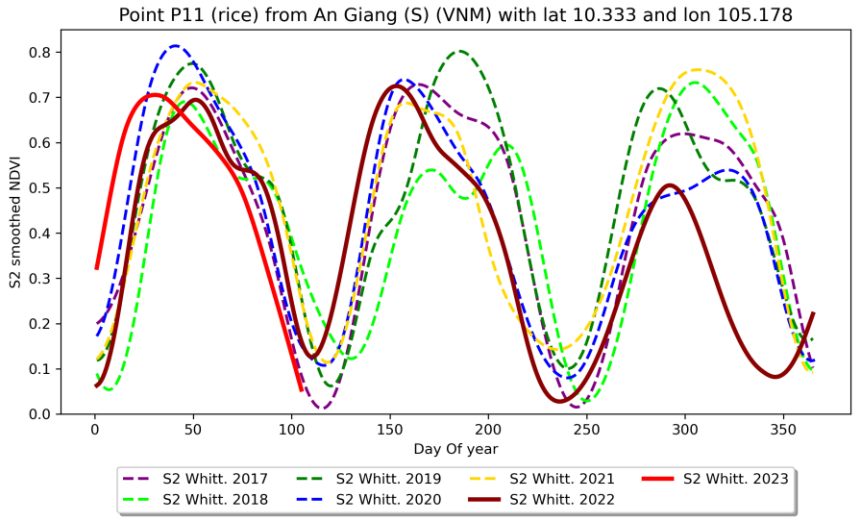
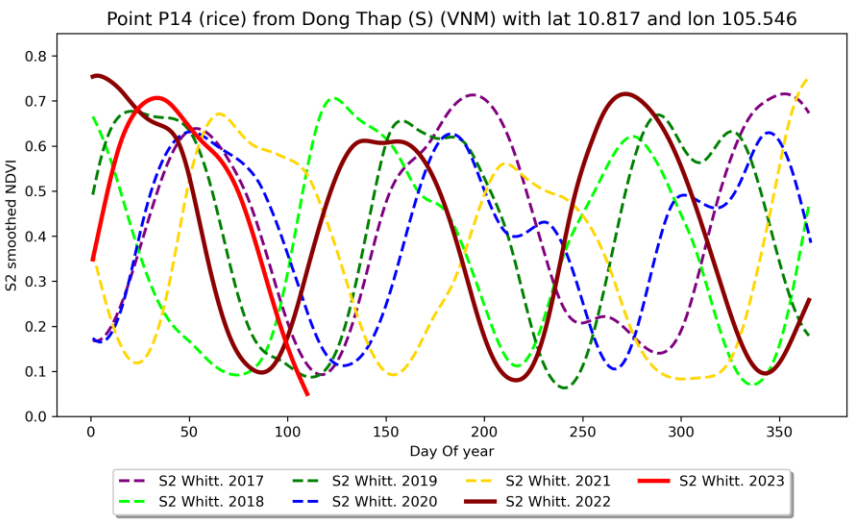
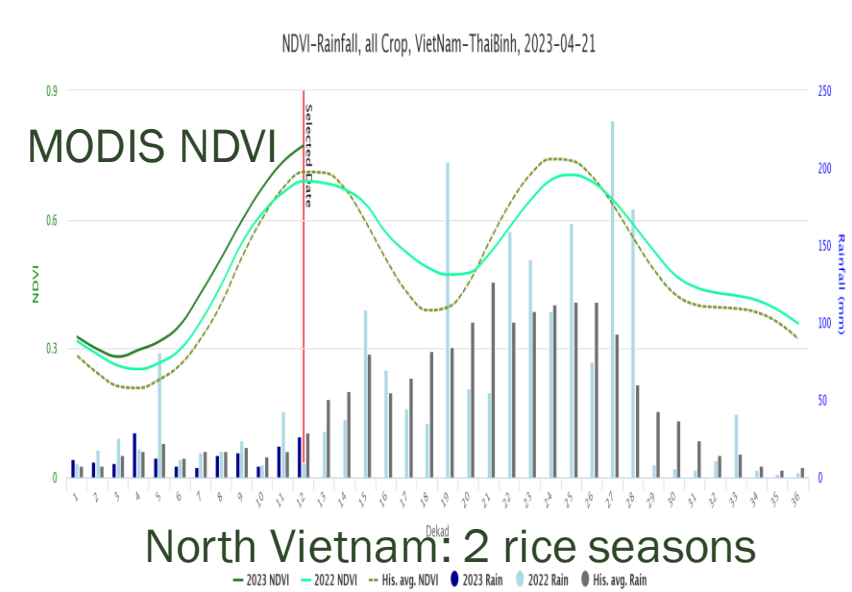
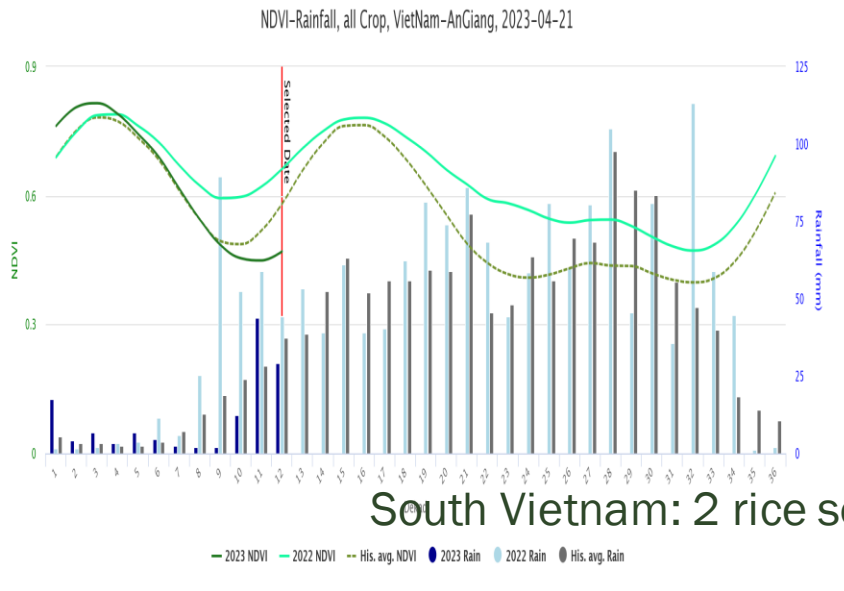


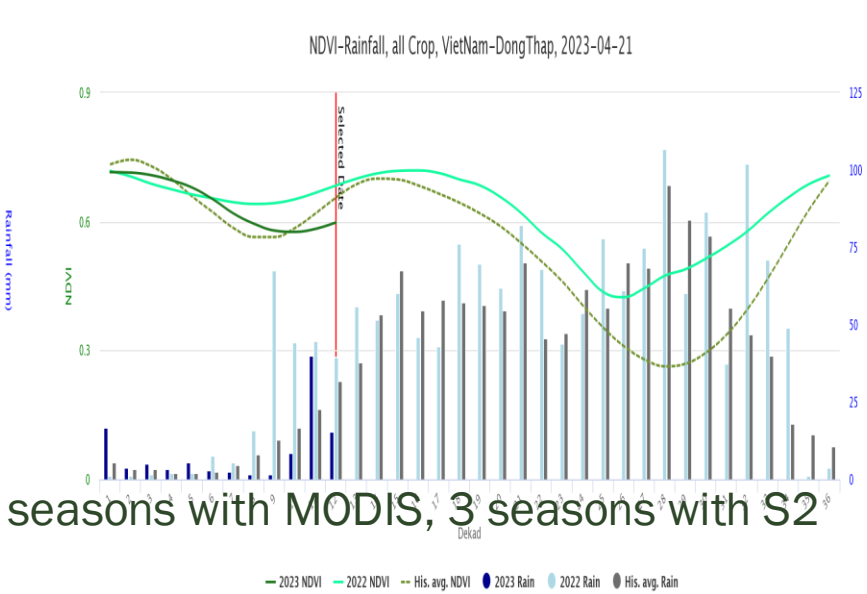






North Vietnam: 2 rice seasons





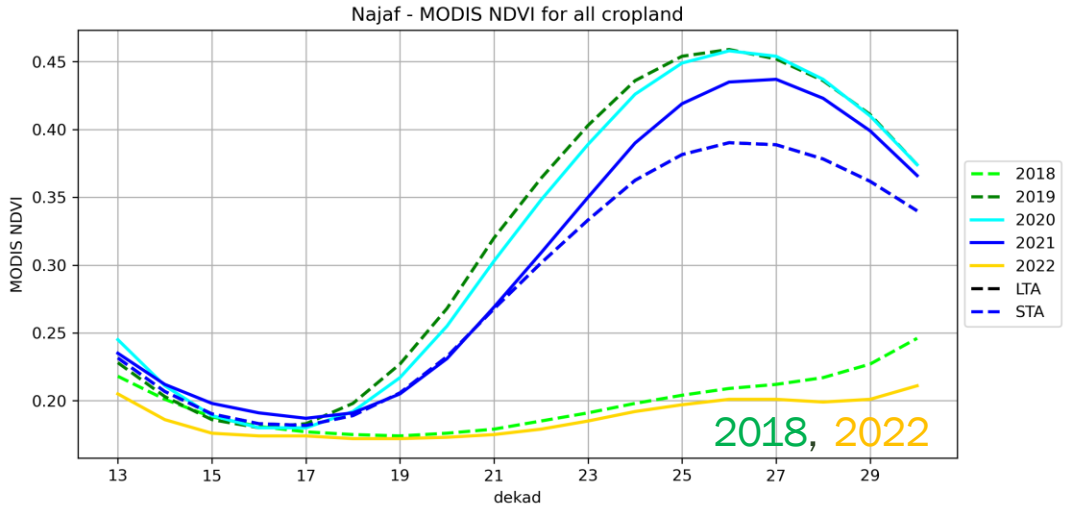
South Vietnam: 2 rice seasons with MODIS, 3 seasons with S2

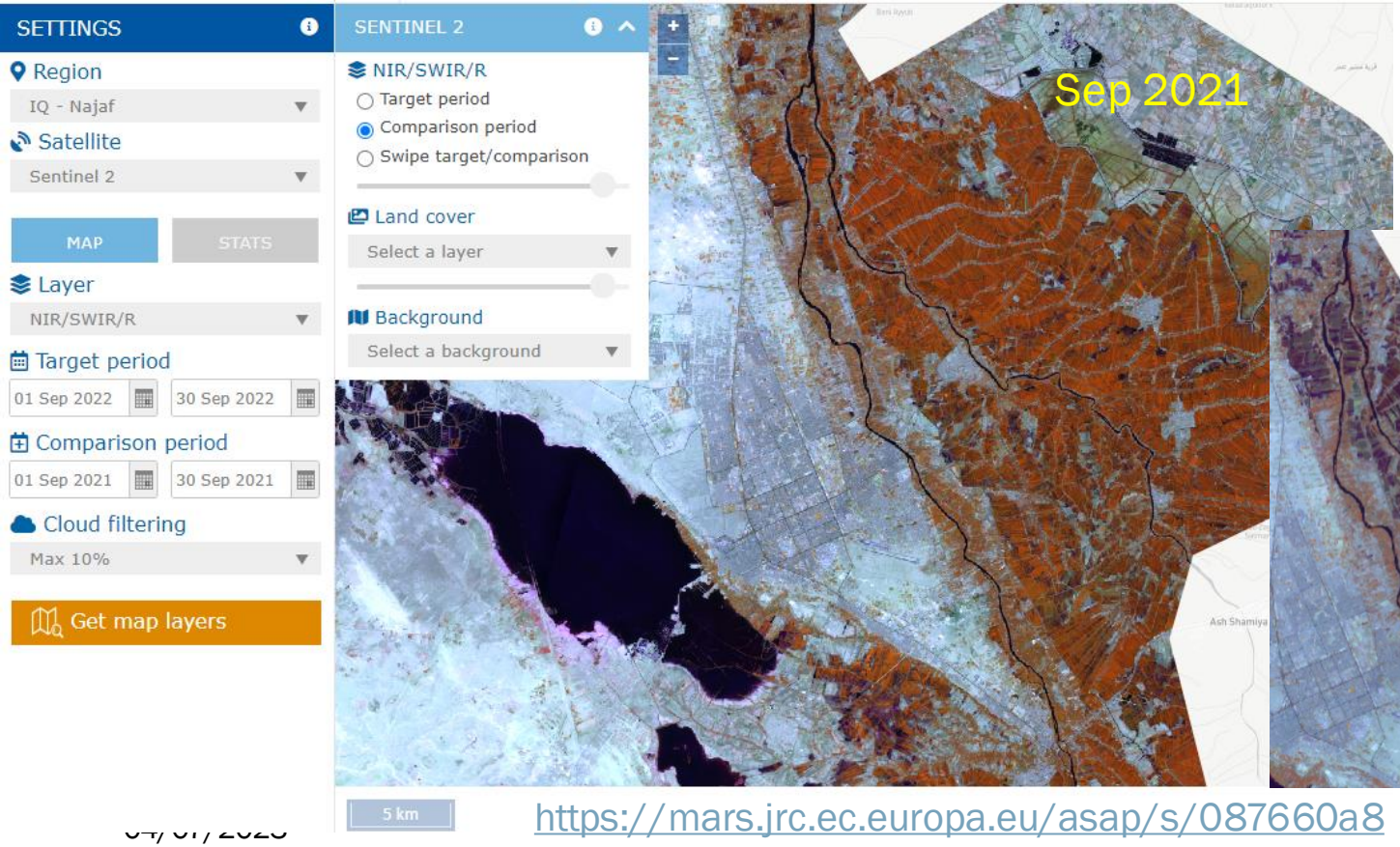
Biomass anomaly

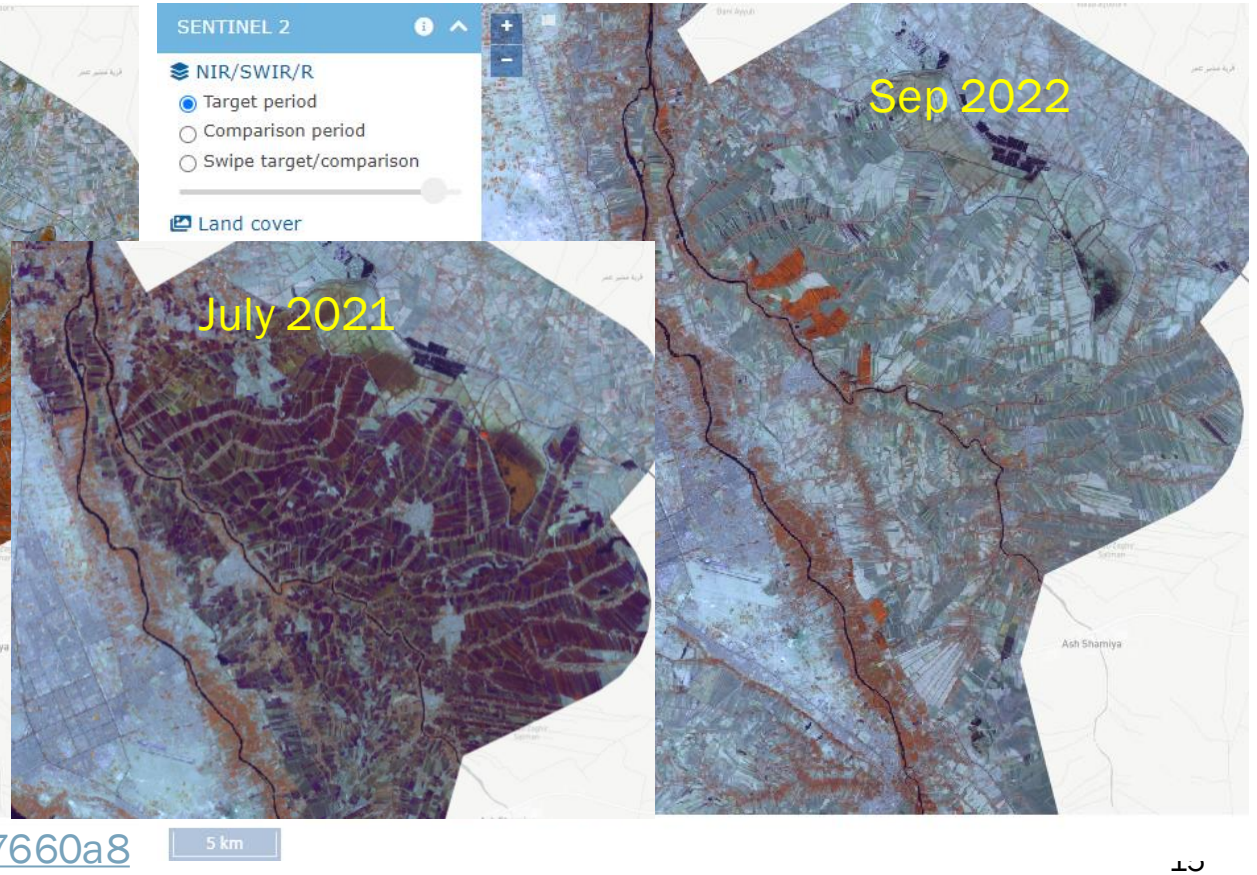
- Iraq Najaf: very low NDVI in 2022 and 2018

due to ban on summer crops (rice)

cf. https://english.alarabiya.net/features/2018/07/05/Iraq-bans-farming-summer-crops-as-water-crisis-grows-dire







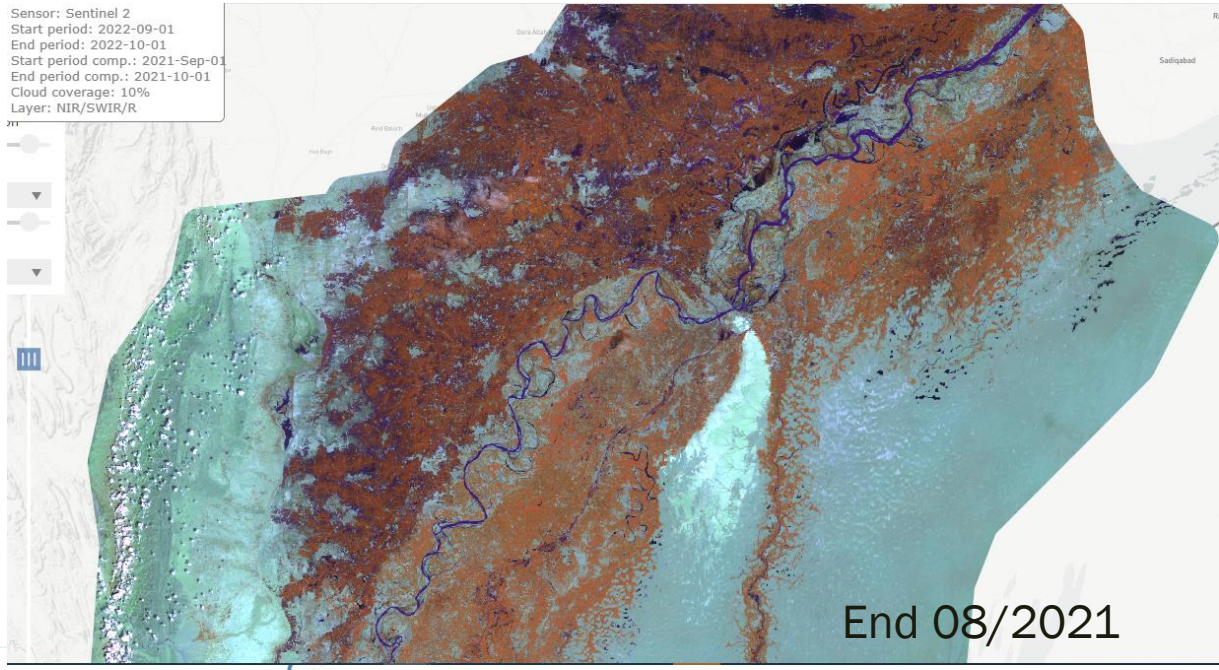
https://mars.jrc.ec.europa.eu/asap/s/087660a8

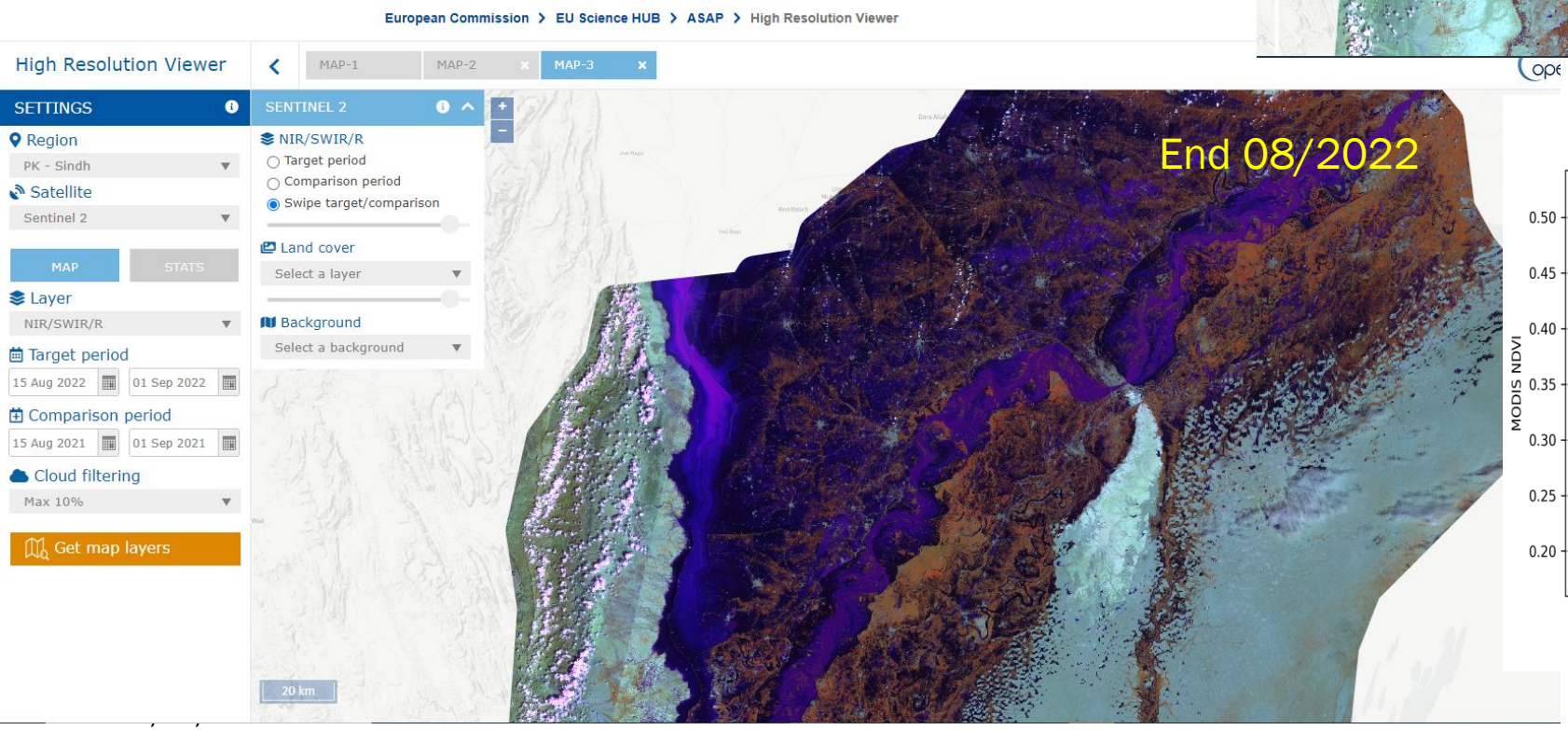
Flood extent assessment

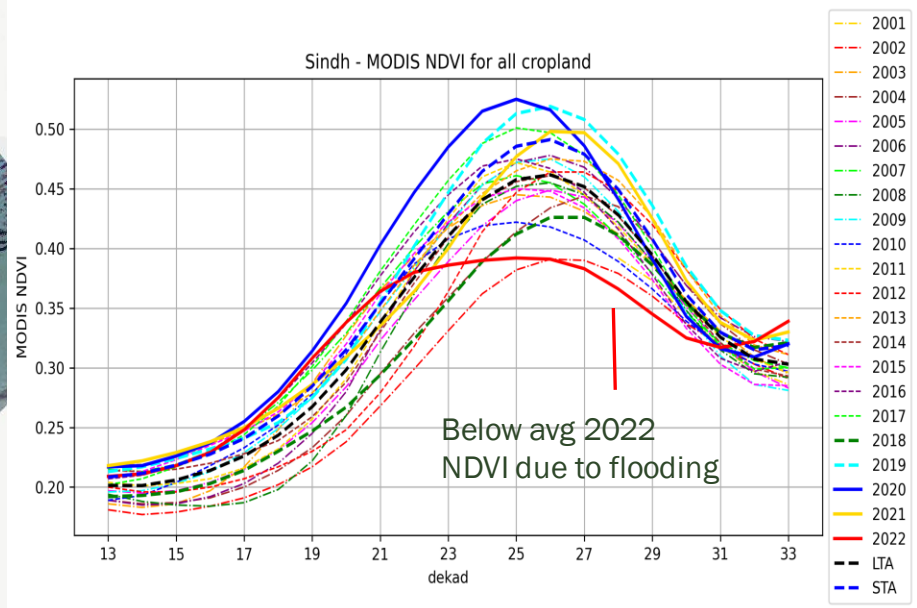
Pakistan Sindh: summer-autumn 2022

https://mars.jrc.ec.europa.eu/asap/s/760bee82

Floods detected if large and water remains for >1 week







Flood extent assessment with SAR

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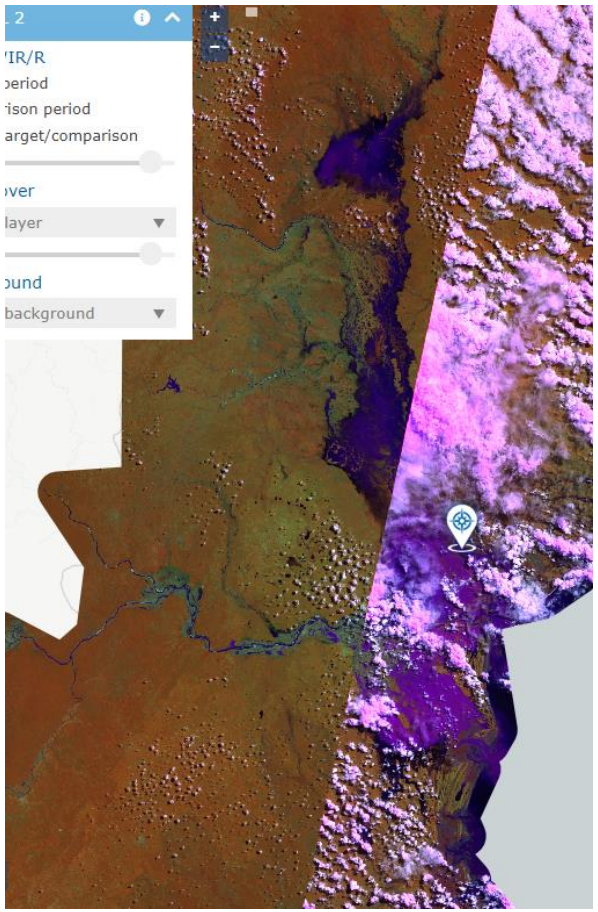
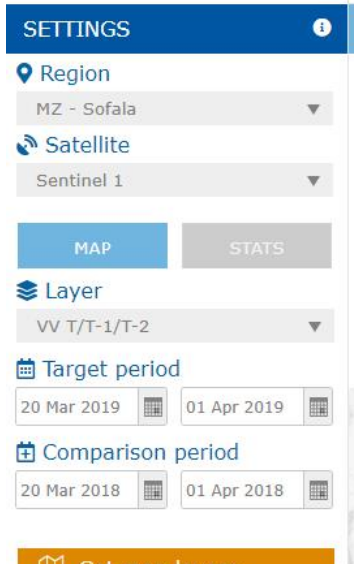
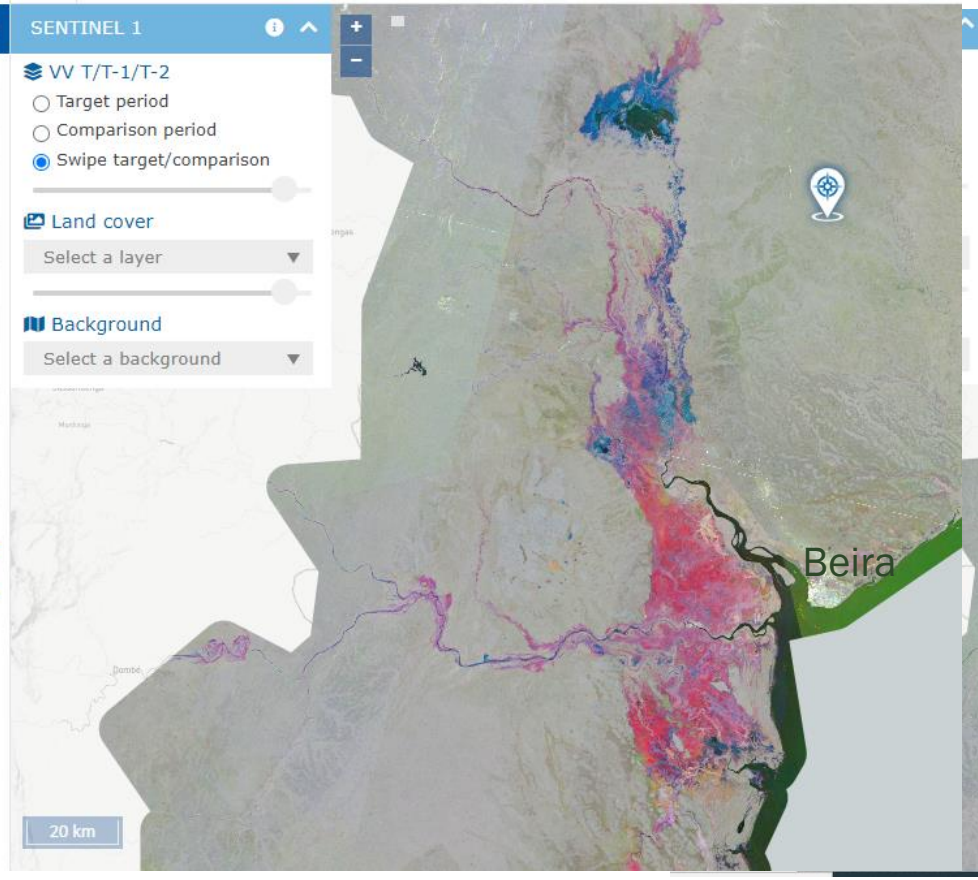
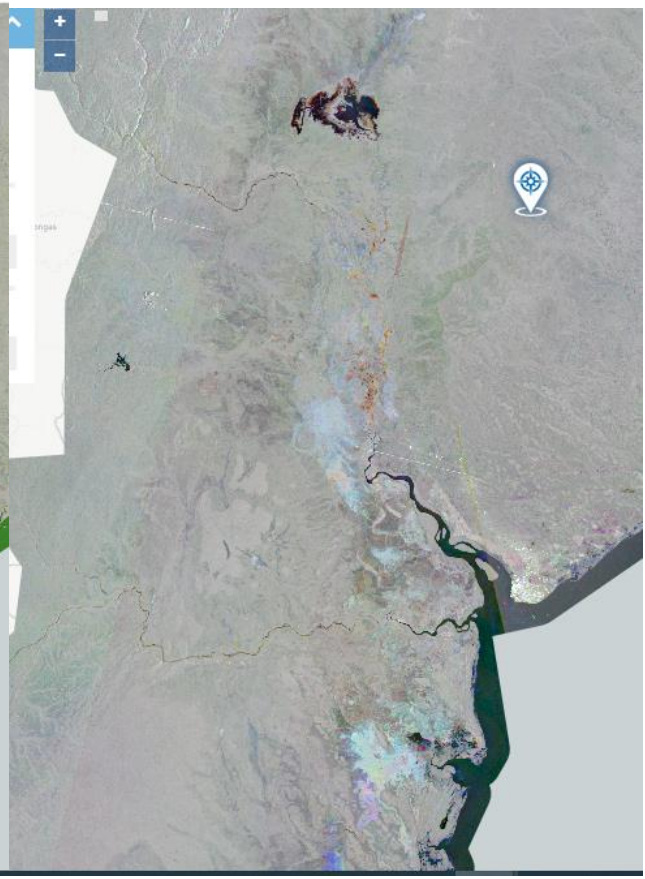
Mozambique: Idai tropical storm in 03/2019

Interest of SAR S1 data for floods occurring during the rainy (cloudy) season









S1 data: VV Sigma0 at end March/mid March/early March in R/G/B
https://mars.jrc.ec.europa.eu/asap/s/63edae1d

Take home message

- **Open access to a global online Early Warning System**
- Easy **access to EO data**, in particular high resolution **S2, S1, Landsat data**, on the cloud; open access to indicator and reference data
- Growing users community and collaboration with partners (FAO, WB, USDA, ICPAC, OSS etc…) including limited adaptations for regional centres (ICPAC: https://agriculturehotspots.icpac.net/, OSS: http://guetcrop.oss-online.org/)
- New data (e.g. soil moisture, fAPAR) and functionalities depending on results of ongoing research projects e.g. yield forecasting based on FAOSTAT country level data with Machine Learning (with Univ. of Valencia)
- -> We are OPEN to collaborations with (food insecure) countries on yield forecasting at GAUL1 region level using ASAP indicators and countries yield stats

CONTACT DETAILS

ASAP: https://mars.jrc.ec.europa.eu/asap/

EMAIL ADDRESS

Herve.kerdiles@ec.europa.eu

PHONE NUMBER