



UNGEONOW 2025
第二届联合国地信周

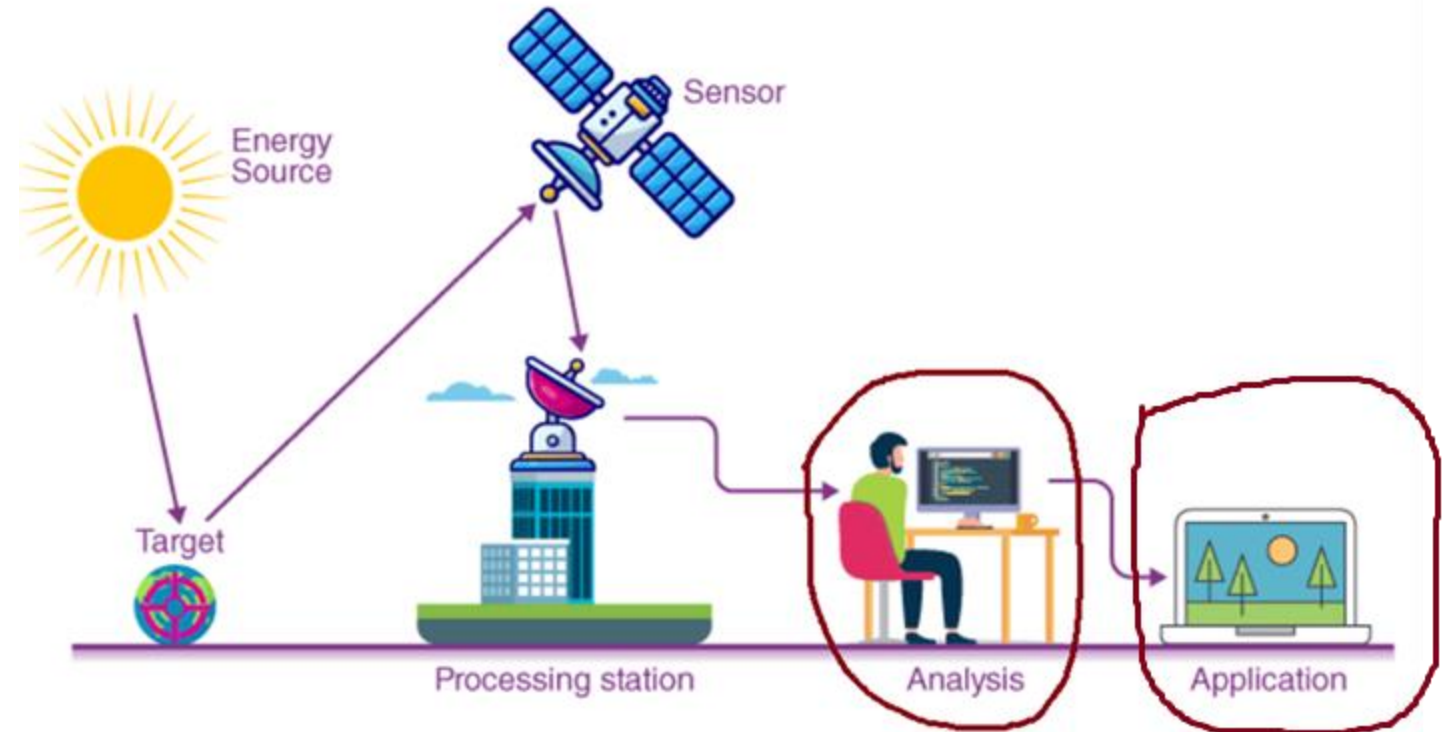


FAO Geo-spatial Platforms contribute to Healthy Earth

Pengyu Hao
FAO, UN

Satellite Observations Data Processing Flow

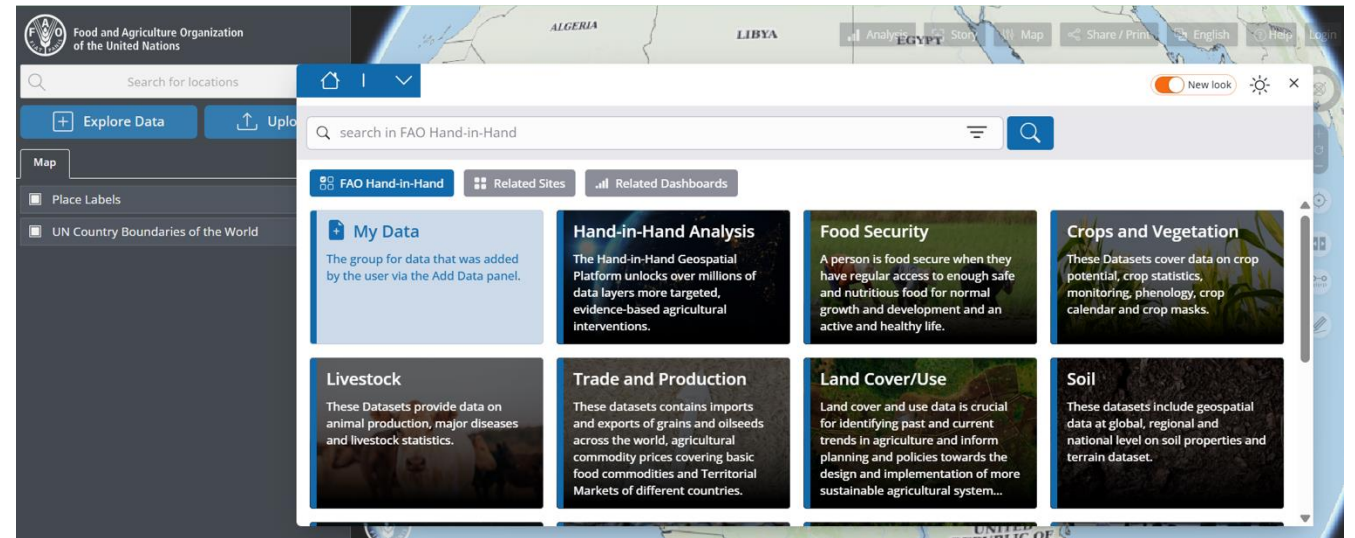
- Satellites equipped with sensors observing land surface.
- Processing station receive signals from satellite and generate raw image.
- Satellite data process and analysis and generate land surface products.
- GIS analysis and applications.



Bridging the gap between data provider and end user

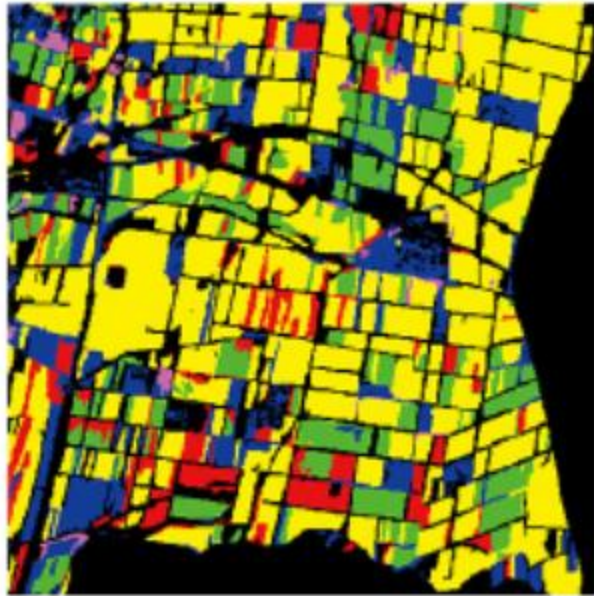
FAO Geo-spatial Platforms

- On behalf of UN SDGs and FAO “Four Betters” (Better production ; Better nutrition ; Better environment ; Better life), FAO have launched a series of data platforms, portals, toolboxes and chatbots.
- FAO Agro-Informatics Platform (AIP) aims to show all available digital capabilities on the ground and provide basic analysis tools to simplify user experience
- FAO Digital Services Portfolio (DSP), FAO Global Animal Disease Information System (EMPRES-i), The Climate Risk ToolBox (CRTB), Global Information and Early Warning System on Food and Agriculture (GIEWS), WaPOR Portal, etc.



End User Requirements

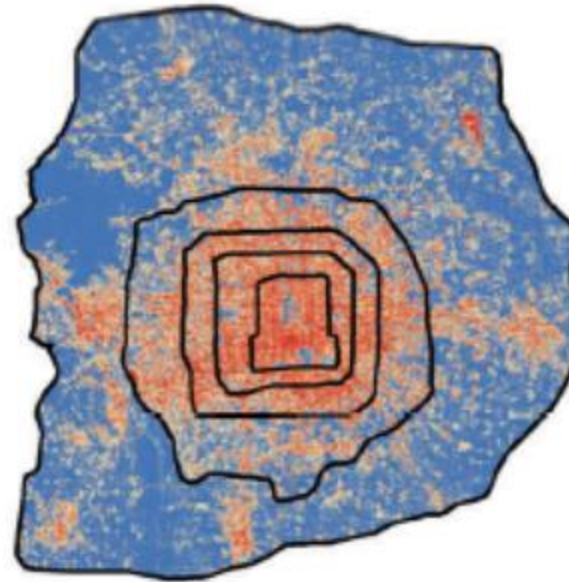
- Topic of the data and spatial/temporal resolution, update frequency, definition
- Data Accuracy and Uncertainty
- Data Accessibility



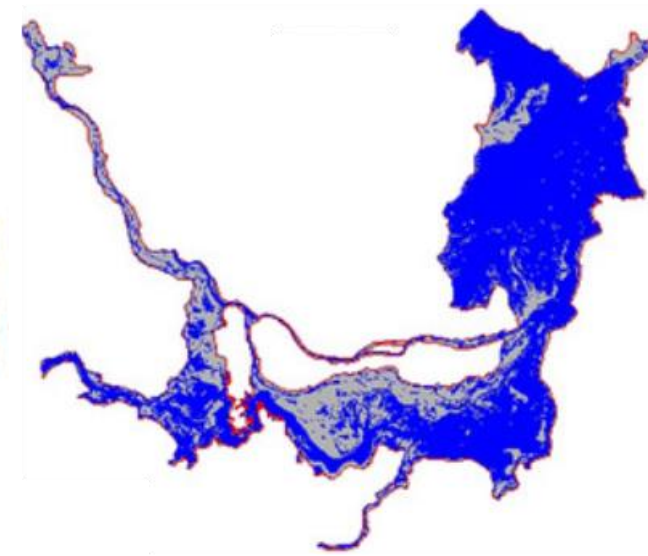
Cropland



Forest



Urban



Aquatic

Topic & spatial/temporal resolution

➤ Data definition

Data definition matches user's requirement

6610	Agricultural land	Land used for cultivation of crops and animal husbandry. The total of areas under "Cropland" and "Permanent meadows and pastures."
6620	Cropland	Land used for cultivation of crops. The total of areas under "Arable land" and "Permanent crops".
6621	Arable land	The total of areas under temporary crops, temporary meadows and pastures, and land with temporary fallow. Arable land does not include land that is potentially cultivable but is not normally cultivated.
6630	Land under temporary crops	Land used for crops with a less-than-one-year growing cycle, which must be newly sown after the harvest. Some crops that remain in the field for more than one year are temporary crops e.g., asparagus, strawberries, pineapples, bananas and sugar cane. Multi-cropping is not included.
6633	Land under temporary meadows and pastures	Land temporarily cultivated with herbaceous forage crops for mowing or pasture. A periodic fallow is used to differentiate between temporary and permanent meadows and pastures.
6640	Land with temporary fallow	Land that is not seeded for one or more growing seasons. The maximum idle period is usually 1 year. Land may be in the form of green manure for the exclusive production of green manure. Land remains in this class until it acquires characteristics requiring it to be reclassified, as for instance permanent meadows and pastures, grazing or haying.
6650	Land under permanent crops	Land cultivated with long-term crops which do not have to be replanted for several years, such as orchards, vineyards, rubber plantations, and plantations of trees and shrubs producing flowers (such as roses and jasmine), and nurseries (which should be classified under "Forestry"). Permanent meadows and pastures are excluded from permanent crops.

Cropland Definitions of FAO STAT

Product	Temporal cropland	Woody crop	Cultivated Pasture	Fallow land	Greenhouse
FROM-GLC	○	✗	○	○	○
GLC-FCS30	○	○	✗	✗	✗
Globeland30	○	○	○	✗	○
WorldCover	○	✗	✗	✗	✗
ESRI LC	○	✗	○	○	✗
WorldCereal	○	✗	✗	✗	✗
GFSAD30	○	○	○	○	✗
GLAD	○	✗	○	○	✗

Cropland Definitions of existing cropland products

Topic & spatial/temporal resolution

➤ Data product resolution

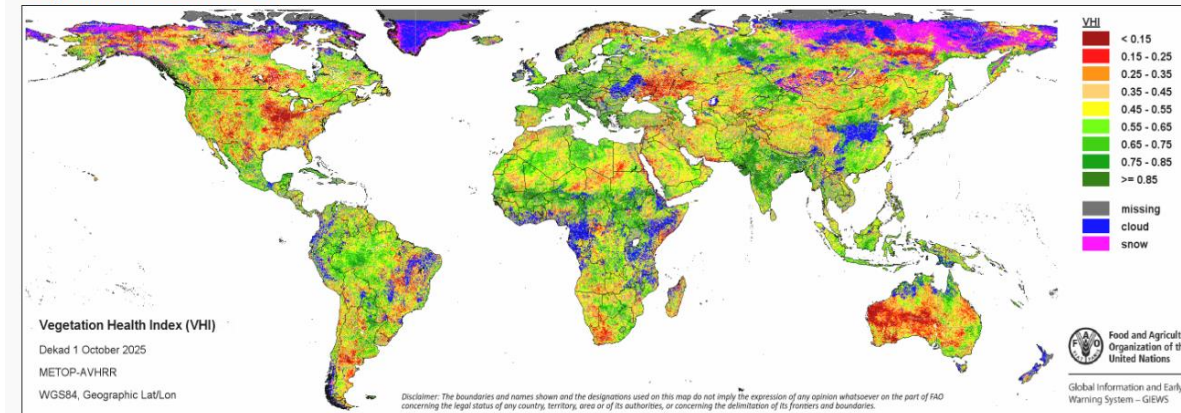


Shrimp Ponds Boundary

Very High Resolution (VHR) pond boundary

Global

Vegetation Health Index



Global Level Crop Growth Monitor

Low spatial resolution but high temporal frequency

Latest Update: **Dekad 1 Oct 2025**

Seasonal Global Indicators

Agricultural Stress Index

Drought Intensity

Global Indicators

NDVI Anomaly

Vegetation Condition Index

Vegetation Health Index

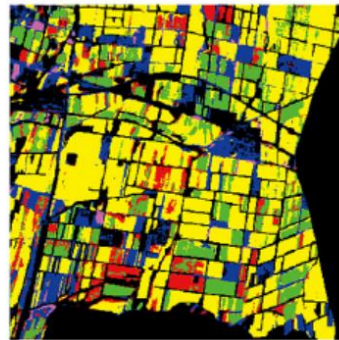
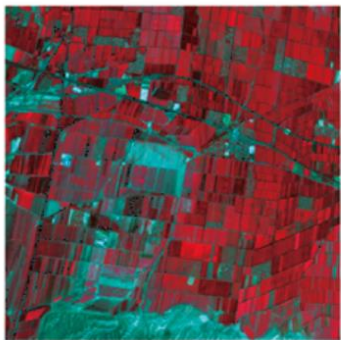
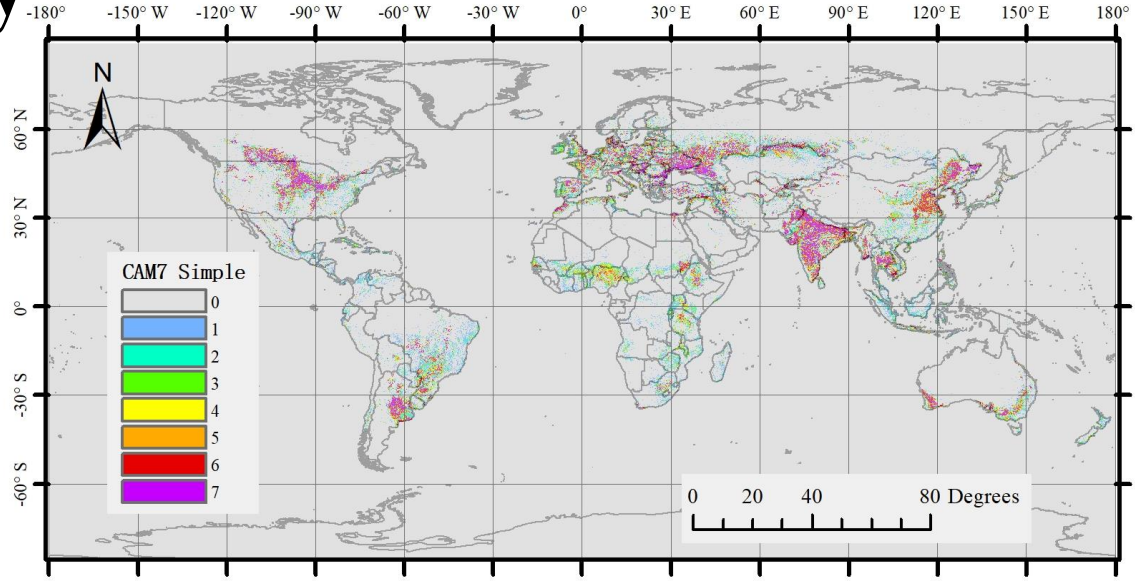
Estimated Precipitation

Precipitation Anomaly

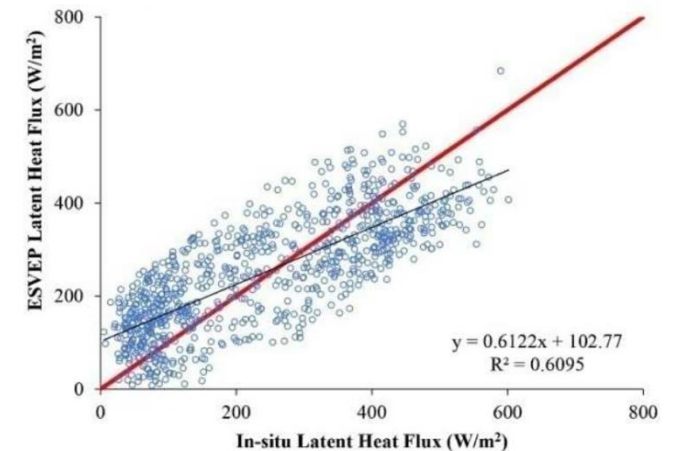
Proper spatial/temporal resolution matches user's request

Data Accuracy and Uncertainty

- **Classification/Quantitative accuracy**
 - **Boundary geometry accuracy**
 - **Data agreement and classification accuracy**
 - **Wall-to-wall comparison**
 - **Correlation between satellite observation and reference data**



		Actual Class		
		Positive	Negative	
Actual Class	Positive	True Positive (TP)	False Negative (FN) Type II Error	Sensitivity $\frac{TP}{(TP + FN)}$
	Negative	False Positive (FP) Type I Error	True Negative (TN)	Specificity $\frac{TN}{(TN + FP)}$
		Precision $\frac{TP}{(TP + FP)}$	Negative Predictive Value $\frac{TN}{(TN + FN)}$	Accuracy $\frac{TP + TN}{(TP + TN + FP + FN)}$





Data Accessibility

The screenshot shows the Zenodo search results for the query 'cropland'. It displays three datasets with their respective metadata, including version numbers, dates, and authors. The datasets are: 1) 'Cropland area database by country circa 2020' by Tubiello et al., 2) 'LS-500: Global 500m-resolution Cropland Suitability' by Yuki Ishikawa and Dai Yamazaki, and 3) 'NECCPB-1: The first cropland parcel boundary dataset from meter-level imagery of Northeast China' by Zheng et al.

The screenshot shows the NASA EarthData search interface. It displays search results for 'cropland' with 10,752 matching collections. The results are sorted by usage and shown in a list view. The top results include: 1) 'Aqua AIRS-MODIS 1-km Matchup Indexes V1 (Aqua_AIRS_MODIS1km_IND) at GES_DISC' with 1,657,164 granules, 2) 'OMPS/NPP PCA SO2 Total Column 1-Orbit L2 Swath 50x50km V2 (OMPS_NPP_NMSO2_PCA_L2) at GES DISC' with 67,277 granules, and 3) 'TOMS/N7 Near UV Aerosol Index and LER 1-Orbit L2 50x50 km'.

NASA EarthData

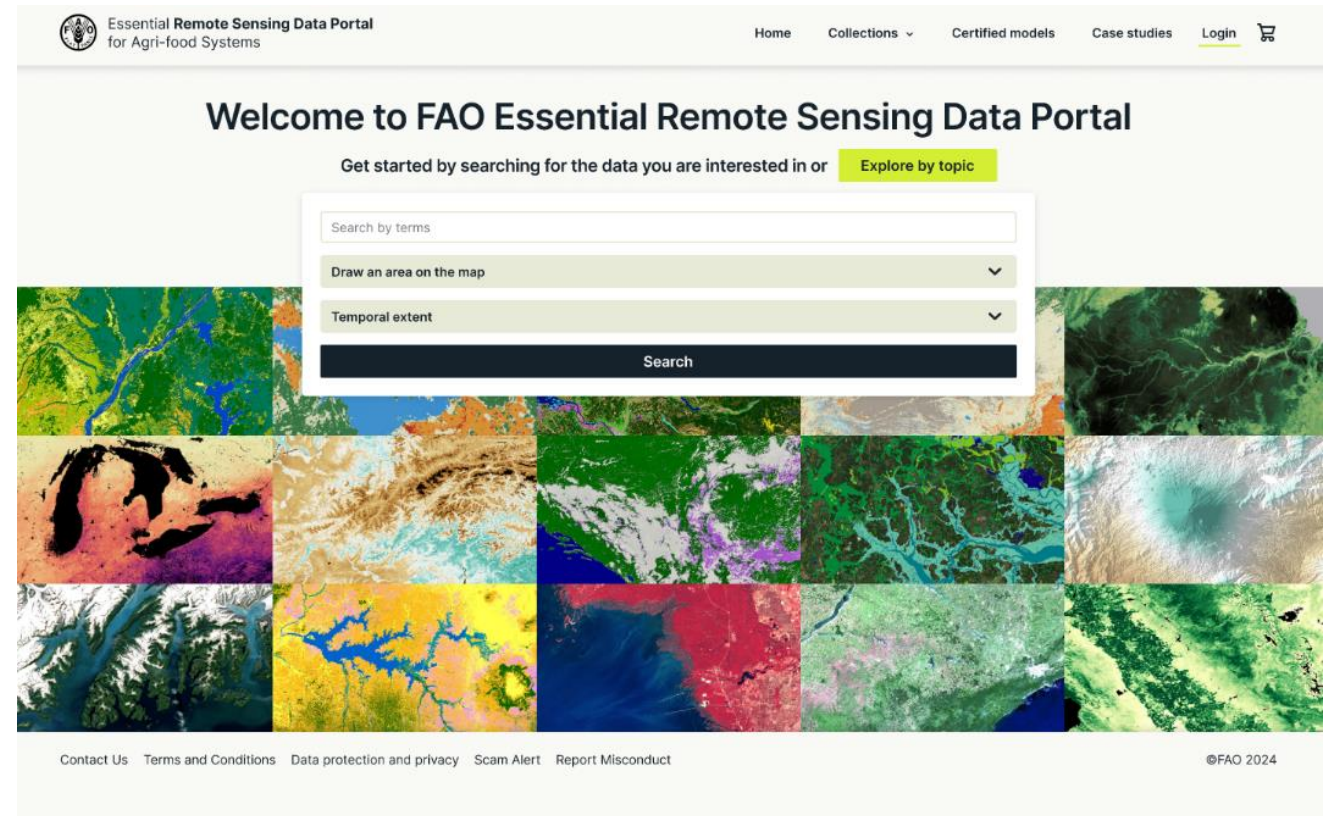
Third-party data repository, like Zenodo

The screenshot shows the Google Earth Engine interface. It displays a script named 'LandsatCharting.js' in the Scripts editor. The script defines three points (park, farm, urban) and plots the TOA band values for Landsat 8 bands B1 through B7 at these points. The output is shown in the Inspector panel, which contains two line charts: 'Landsat 8 TOA band values at three points near...' and 'Landsat 8 TOA spectra at three points near Mexi...'. The charts show reflectance values for each band across the three points.

Google Earth Engine

FAO Essential Remote Sensing Data Product Portal

- **Scope:** Subset of FAO AIP, provide **certified** up-to-date and ready-to-analysis datasets.
- **Target User:** FAO internal users, member countries and external users with data analysis requirements.
- **Data Accessibility:** Data search/download and STAC
- **Data Policy:** Open access with data citation.

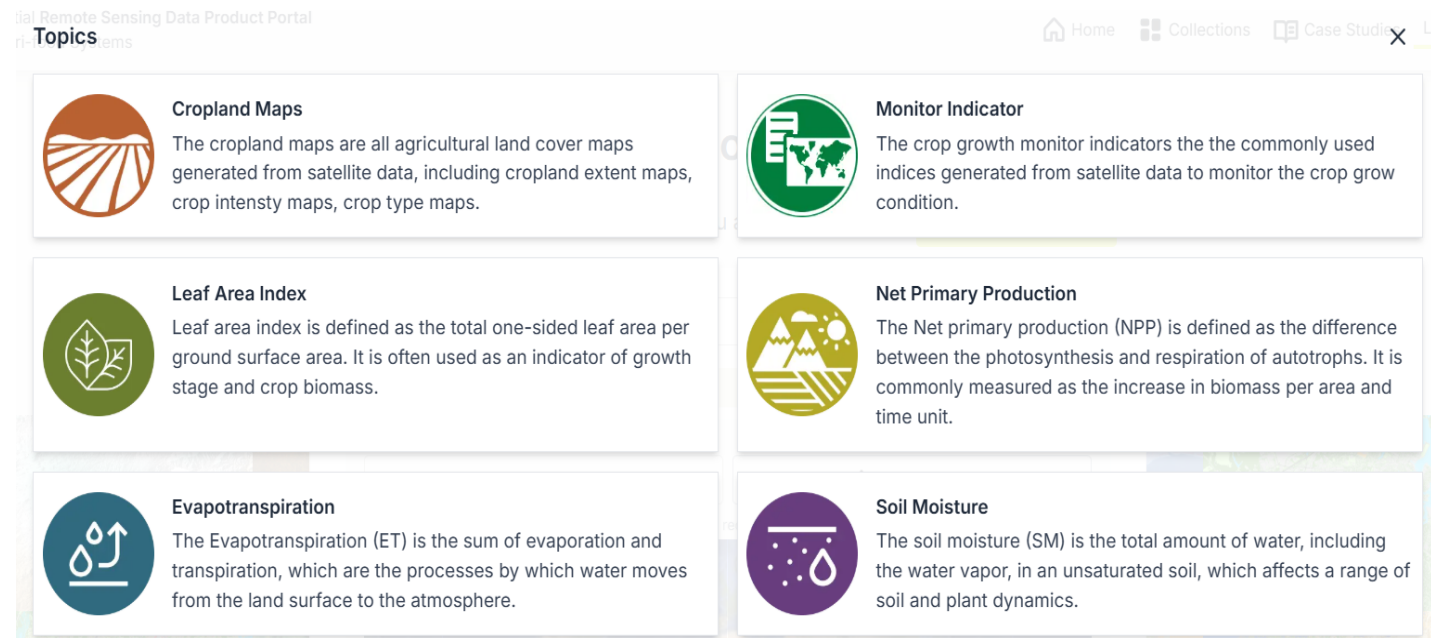


<https://data.review.fao.org/remote-sensing-portal>

Data Category and Selection

➤ Based on the request of end users, we currently selected around **30 data collections** covering **8 topics**. Including Cropland maps, monitor indicators, leaf area index, net primary production, forest biomass, soil moisture, evapotranspiration, land surface phenology.

➤ All global level remote sensing product **generated by FAO** and several **selected external product** are included.



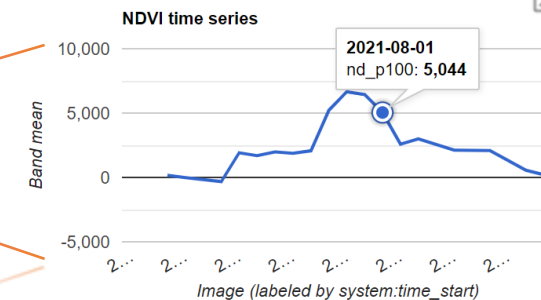
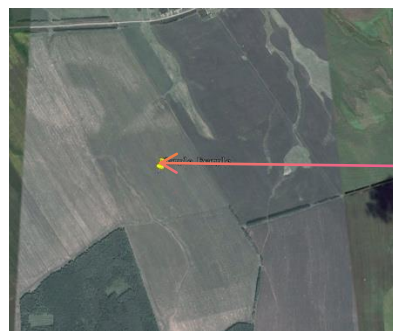
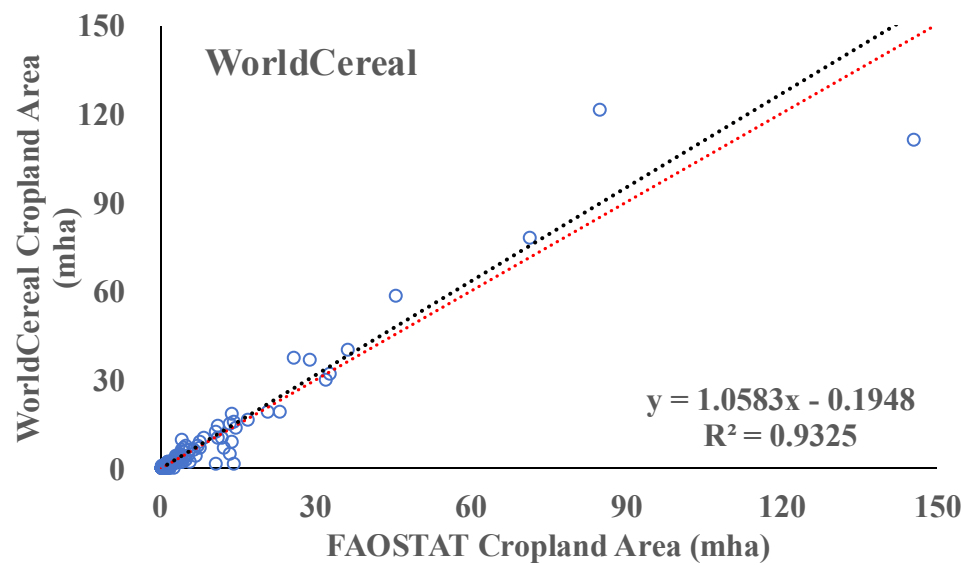
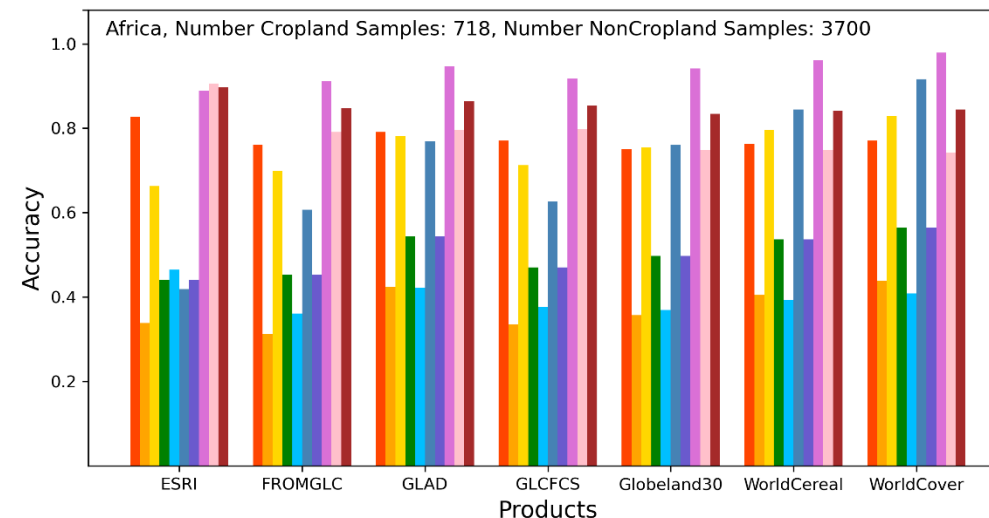
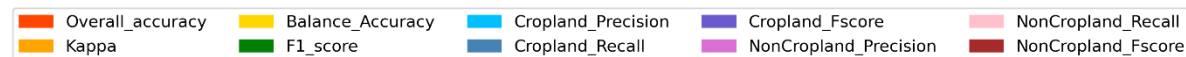
The screenshot shows the 'Global Remote Sensing Data Product Portal' with a 'Topics' section. It features eight data collection topics, each with an icon and a brief description:

- Cropland Maps**: The cropland maps are all agricultural land cover maps generated from satellite data, including cropland extent maps, crop intensity maps, crop type maps.
- Monitor Indicator**: The crop growth monitor indicators are the commonly used indices generated from satellite data to monitor the crop growth condition.
- Leaf Area Index**: Leaf area index is defined as the total one-sided leaf area per ground surface area. It is often used as an indicator of growth stage and crop biomass.
- Net Primary Production**: The Net primary production (NPP) is defined as the difference between the photosynthesis and respiration of autotrophs. It is commonly measured as the increase in biomass per area and time unit.
- Evapotranspiration**: The Evapotranspiration (ET) is the sum of evaporation and transpiration, which are the processes by which water moves from the land surface to the atmosphere.
- Soil Moisture**: The soil moisture (SM) is the total amount of water, including the water vapor, in an unsaturated soil, which affects a range of soil and plant dynamics.

Third-Party Data Validation

➤ Third-party validation case 1

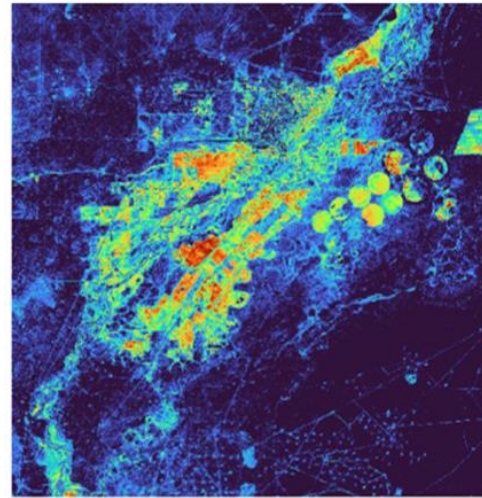
Using “Temporary Crops” definition, validation with 30,000 samples showed that WorldCereal has the best accuracy (OA = 87.24%), and all included data tend to over-estimate cropland area



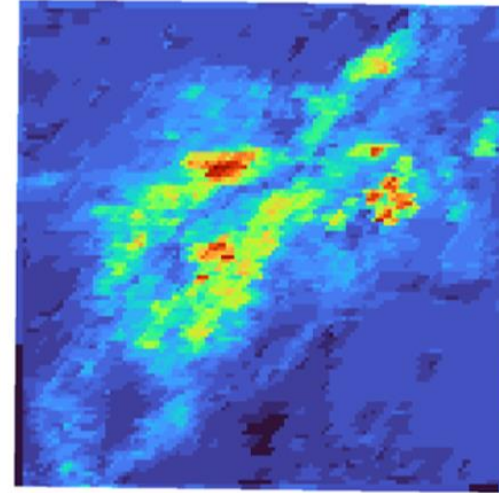
Third-Party Data Validation

➤ Third-party validation case 2

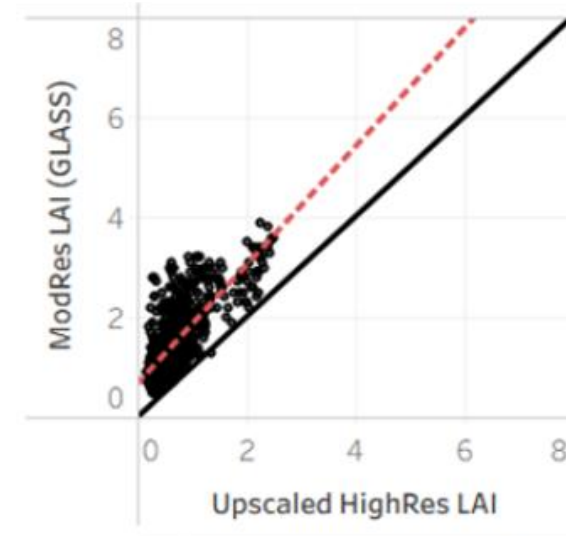
Long time series, correlation analysis and wall-to-wall comparison showed that GLASS LAI have better accuracy for LAI calculation.



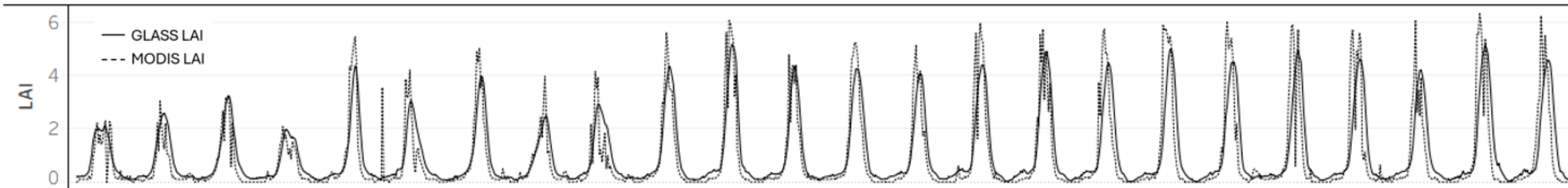
Reference LAI map



GLASS LAI map



R^2	0.57
RMSE	0.94



Take-home message

- FAO geospatial data platforms, portals, toolbox and chatbots have contributed to UN SDGs and FAO “Hand-in-hand” and “Four Betters” initiatives.
- FAO Essential Remote Sensing Data Product Portal aims to provide certified high-quality and ready-to-use remote sensing products and allow user to easily access data for free. We intend to launch portal **by the end of Nov 2025**.





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THANKS
谢谢