

Collaboration of Space Research Institute NASU-SSAU with EC JRC on satellite monitoring for food security: background and prospects

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Context of cooperation - GEO related projects



- **GEOGLAM**

GEO Global Agricultural Monitoring Initiative



- **JECAM**

Joint Experiment on Crop Assessment and Monitoring

JECAM

- **SIGMA**

SIGMA – FP7 Project “Stimulating Innovation for Global Monitoring of Agriculture”

SIGMA |

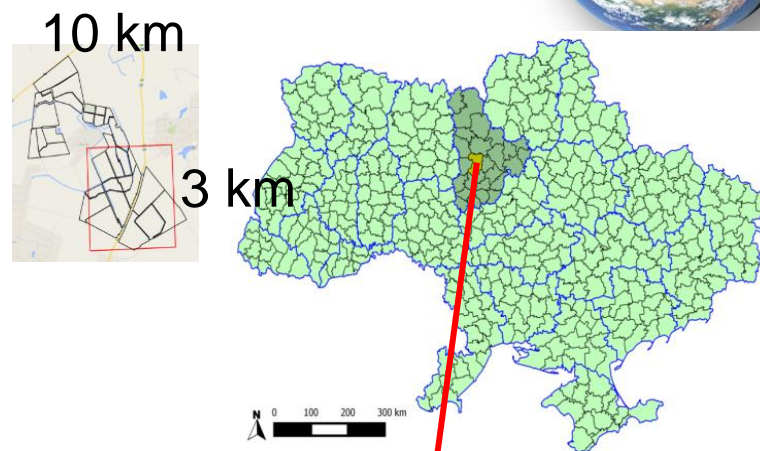
- **ERA-PLANET**

Horizon 2020 project on European Research Area in Earth Observations

JECAM-Ukraine site description



- **Location:** Ukraine (Kyiv oblast with area 28,000 km²; intensive observation sub-site of 25x15 km²). Centroid: lat: 50.35° N, long: 30.71° E
- Intensive agriculture area. Main crop types: **winter wheat, winter rapeseed, spring barley, maize, soybeans, sunflower, sugar beet, and vegetables**
- Field size: **from 30 to 250 ha**
- Crop calendar: **Winter: September – July;**
Summer: April – October
- Cloud coverage can be very frequent during the growing season
- Topography: mostly flat, slope: 0% to 2%
- Soils: different kinds of **chernozems**
- Soil drainage is ranging from poor to well-drained. Irrigation infrastructure is limited
- Climate and weather: **humid continental**



Kyiv oblast & Vasylkiv district

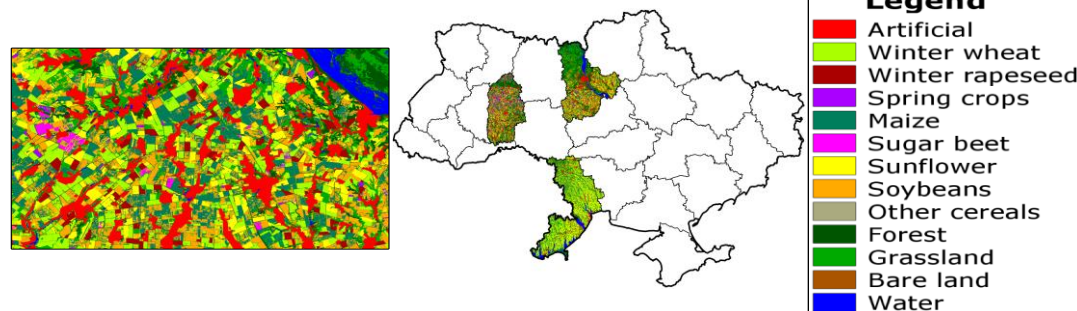


Map of intensive observation sub-site

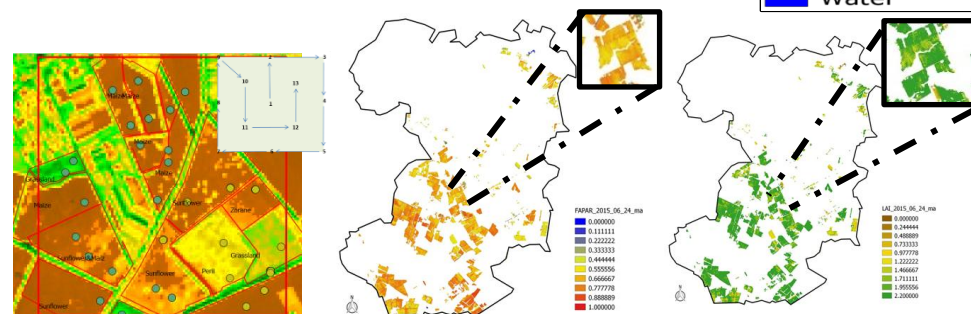
Main directions of cooperation with JRC



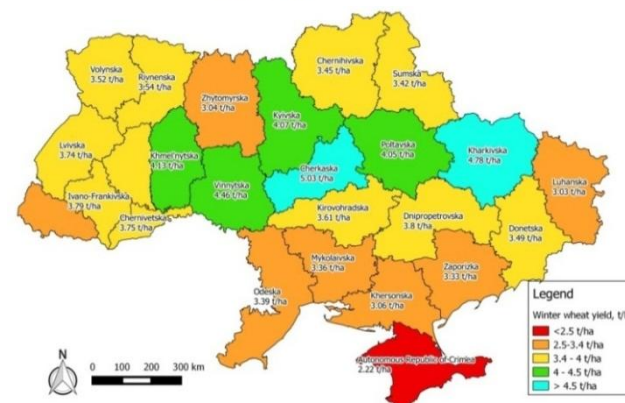
Crop classification & area assessment



Biophysical parameters estimation



Crop yield forecasting



NASU-JRC Information day, 14.09.2016, Kiev, Ukraine

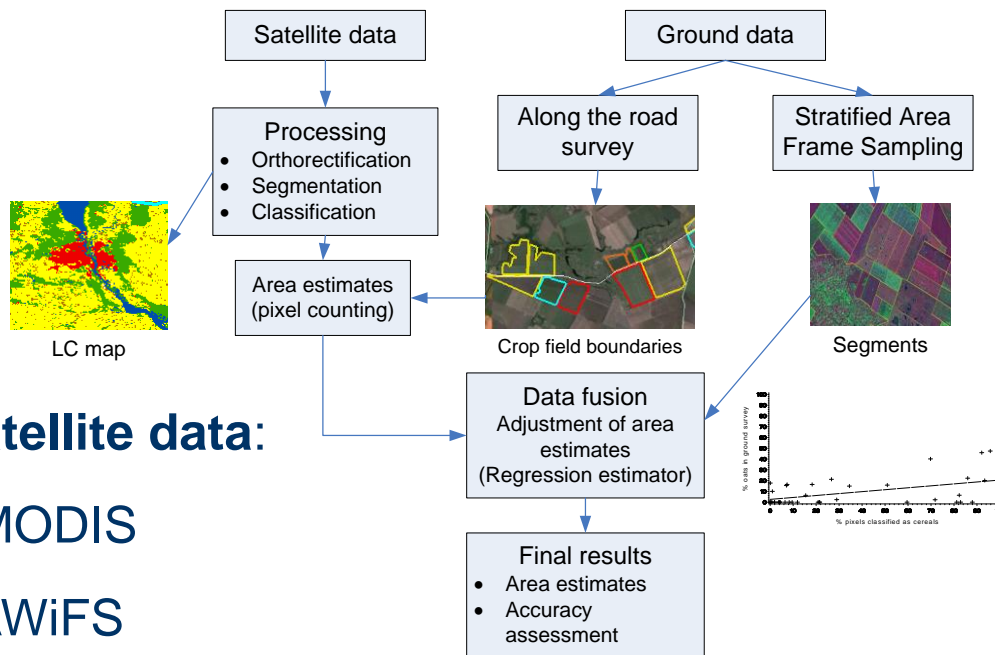


Contract no. 255189

“Crop area estimation with satellite images in Ukraine”

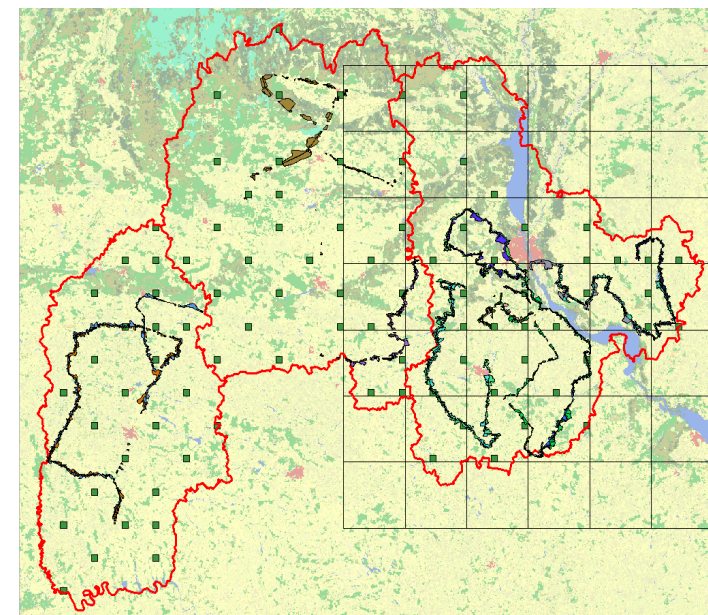


- Coordinator from JRC : **J.F. Gallego**



Satellite data:

- MODIS
- AWiFS
- Landsat-5/TM
- LISS-III
- RapidEye



Area frame sampling (segments) and along the road surveys (curves)

Efficiency of satellite data use for crop estimation:

Price is 1.5 lower

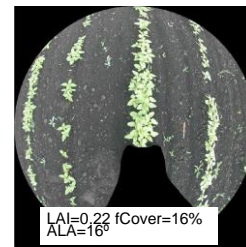
Project “Evaluation of the coherence between Copernicus products and crop biophysical parameters”



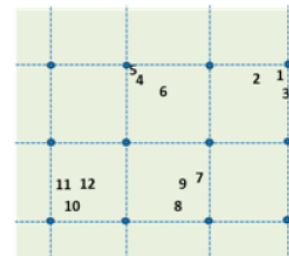
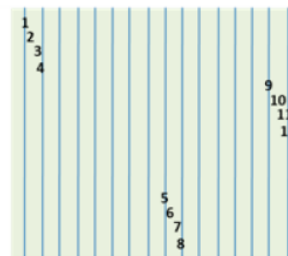
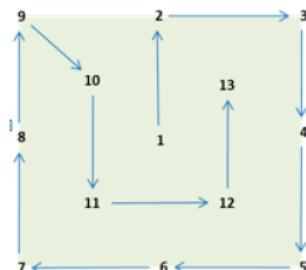
- Evaluation of the **relationship** between the **crop biophysical** parameters measured on field with or vegetation indices extracted from **high resolution sensors**; and an assessment of the uncertainties of low-resolution (1 km) **biophysical products** from **Copernicus** program.



DHP imagery samples

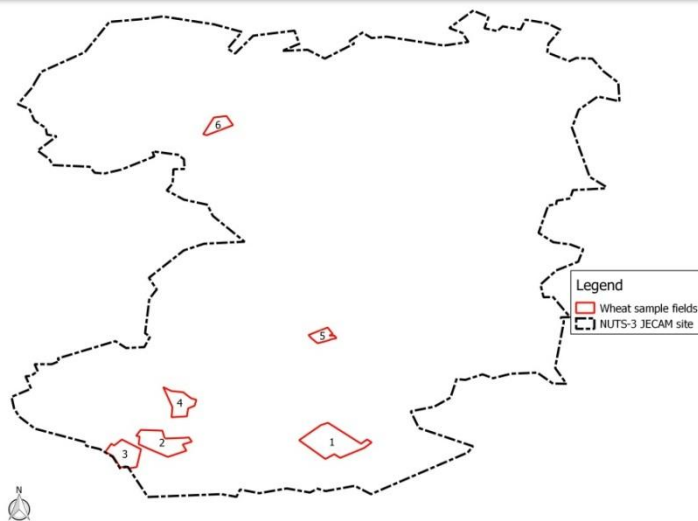


Results of processing with CAN-EYE

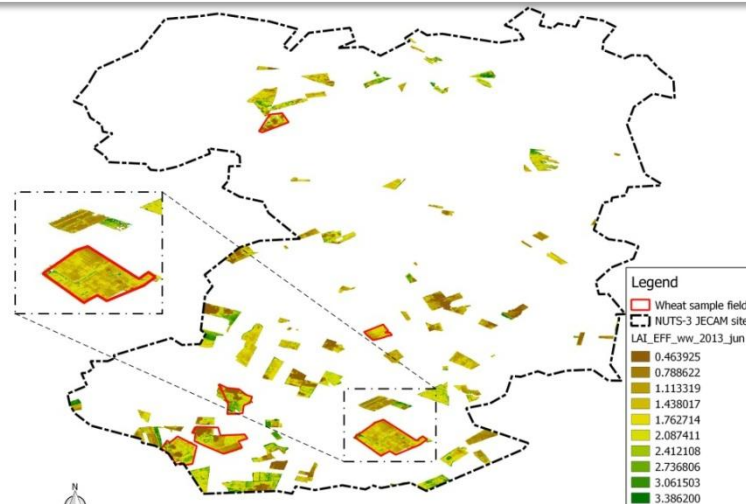


VALERI sampling strategies for **random** (left) or **row** (centre) and **regularly planted** vegetation (right).

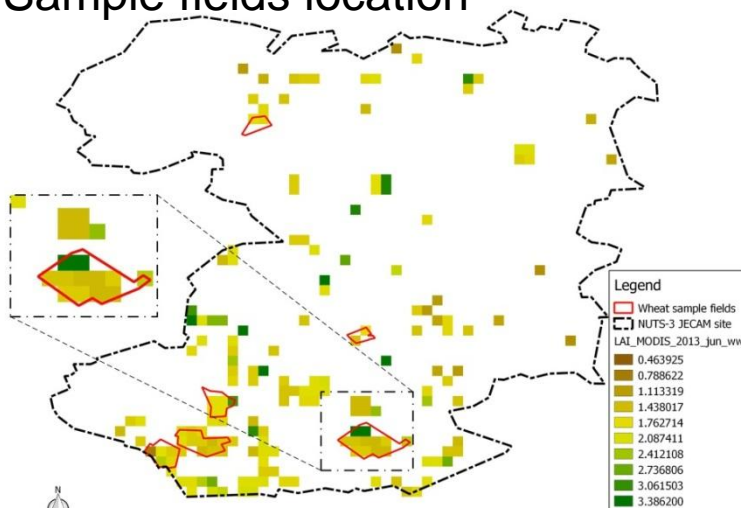
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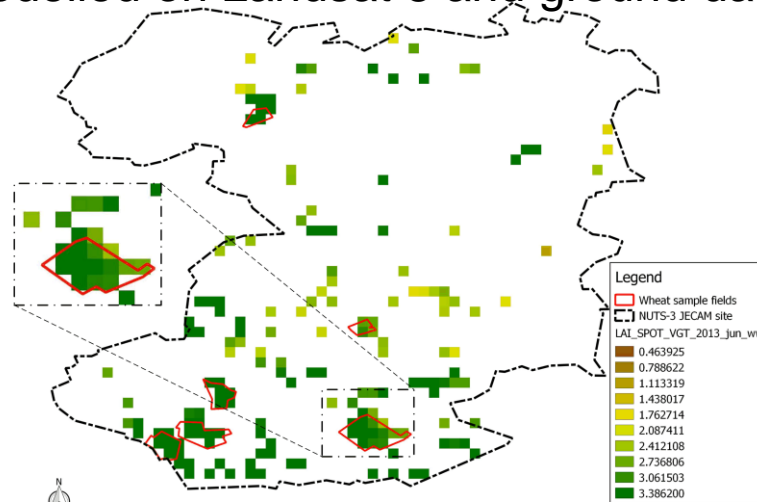
Sample fields location



Modelled on Landsat 8 and ground data



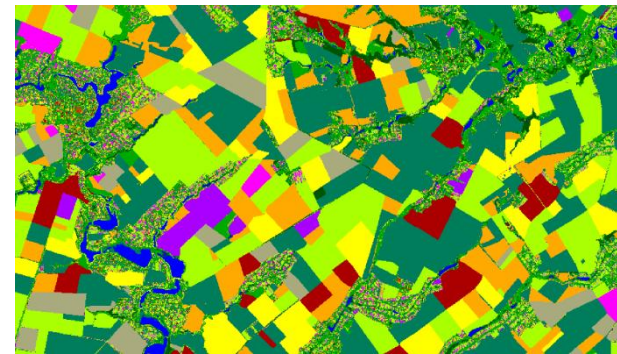
MODIS MOD15A2 product



SPOT-VGT Copernicus product

A small globe of the Earth is positioned in the upper left corner of the page. It shows the continents of Europe, Africa, and Asia, with the Atlantic Ocean to the left and the Indian Ocean to the right. The globe is tilted slightly, showing the North Pole at the top.

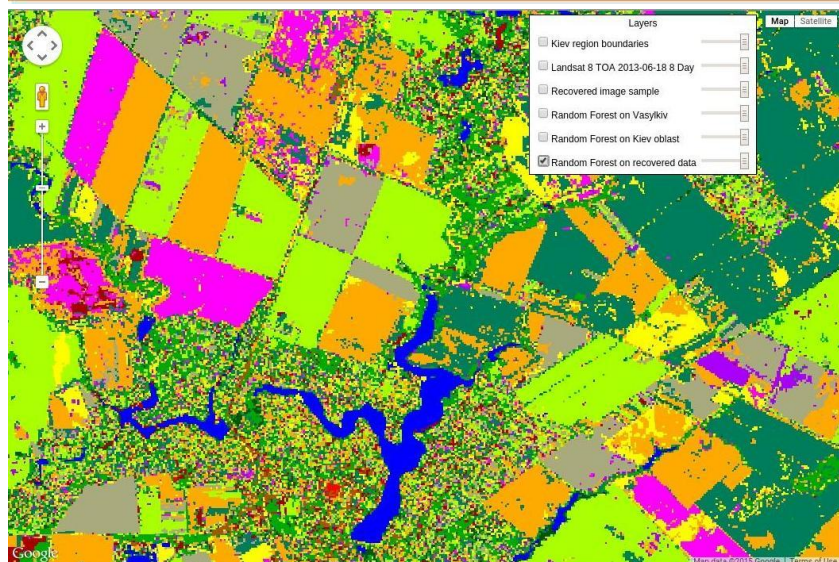
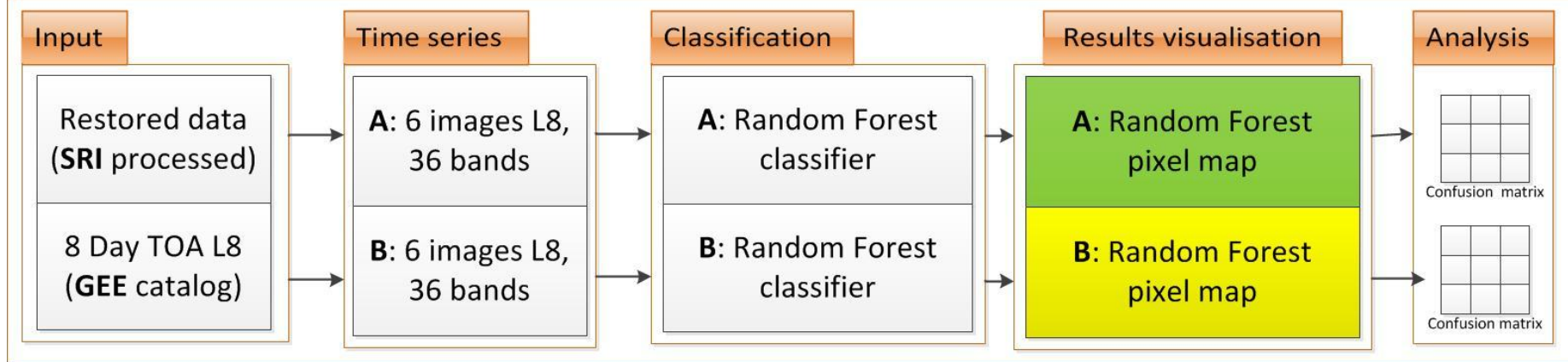
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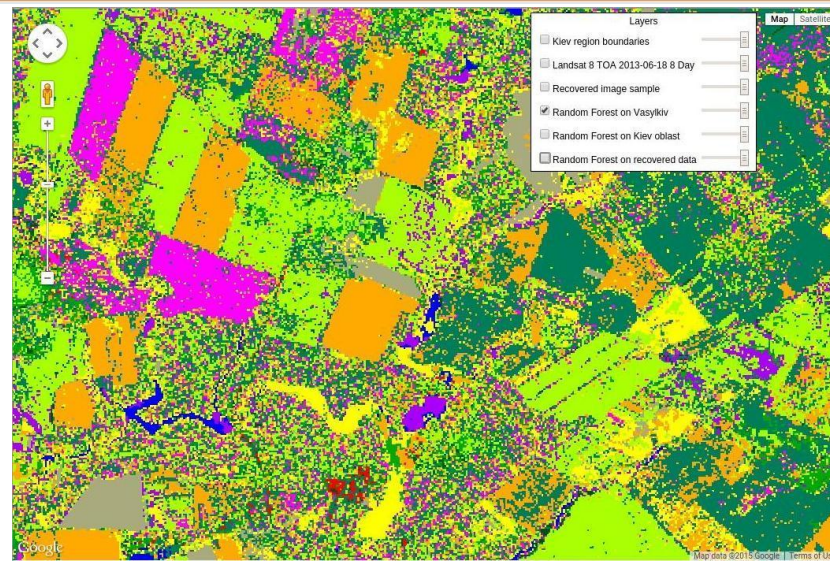
Data processing workflow



Experiment 1. Preferable input selection



A

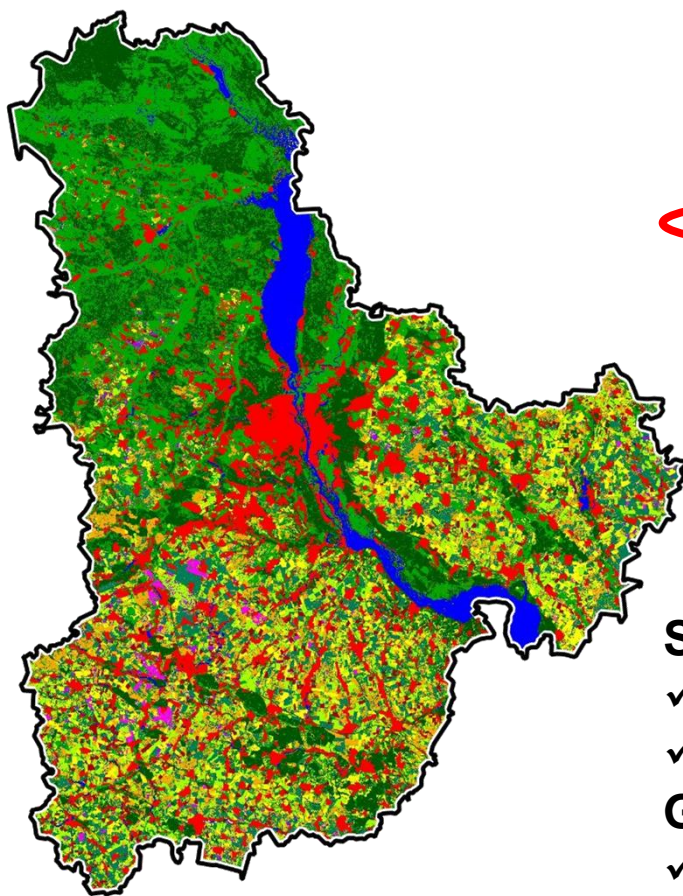


B

Multi mission crop classification (2015)



Legend



- Artificial
- Winter wheat
- Winter rapeseed
- Spring crops (wheat, barley)
- Maize
- Sugar beet
- Sunflower
- Soybeans
- Forest
- Grassland
- Bare land
- Water

Satellite data:

- ✓ 4 Landsat-8 scenes
- ✓ 15 Sentinel-1 scenes

Ground data:

- ✓ 547 ground samples
(train and test sets)

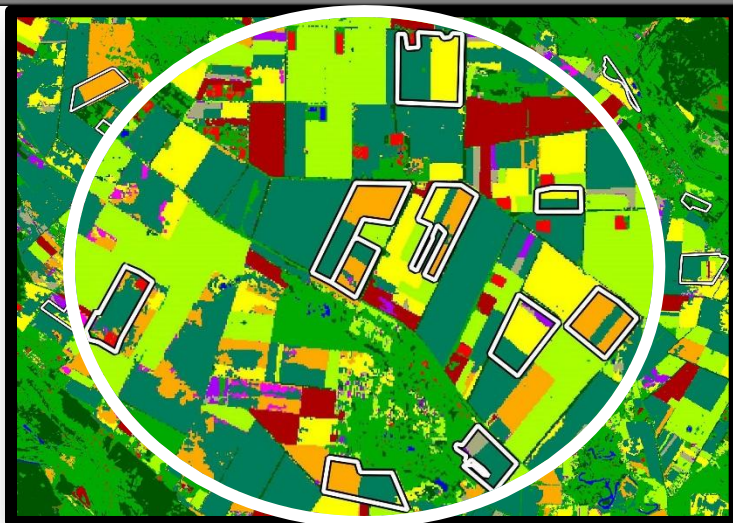
KYIV OBLAST (2015)

Satellite	OA, % pixel based
L-8 + S-1	92.7
SENTINEL-1	91.4
LANDSAT-8	85.4

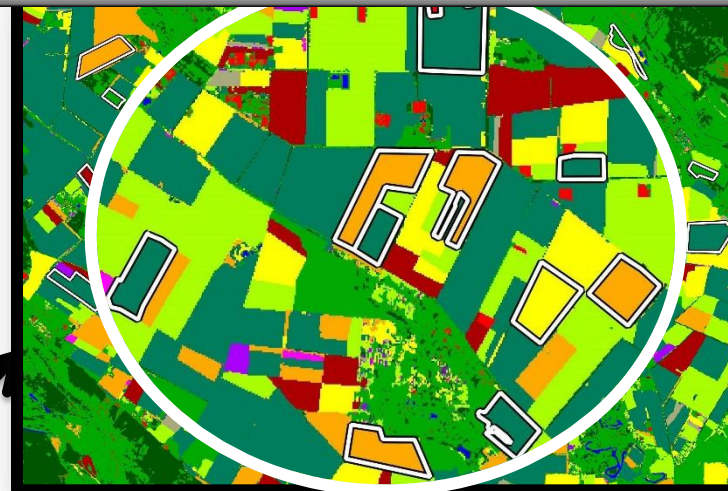
Filtration results (Kyiv oblast)



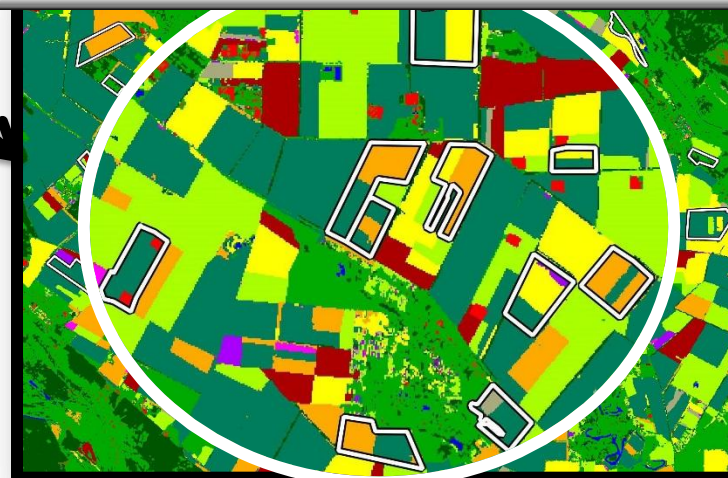
Pixel-based classification map



A majority voting scheme



Method that divides parcel into the fields

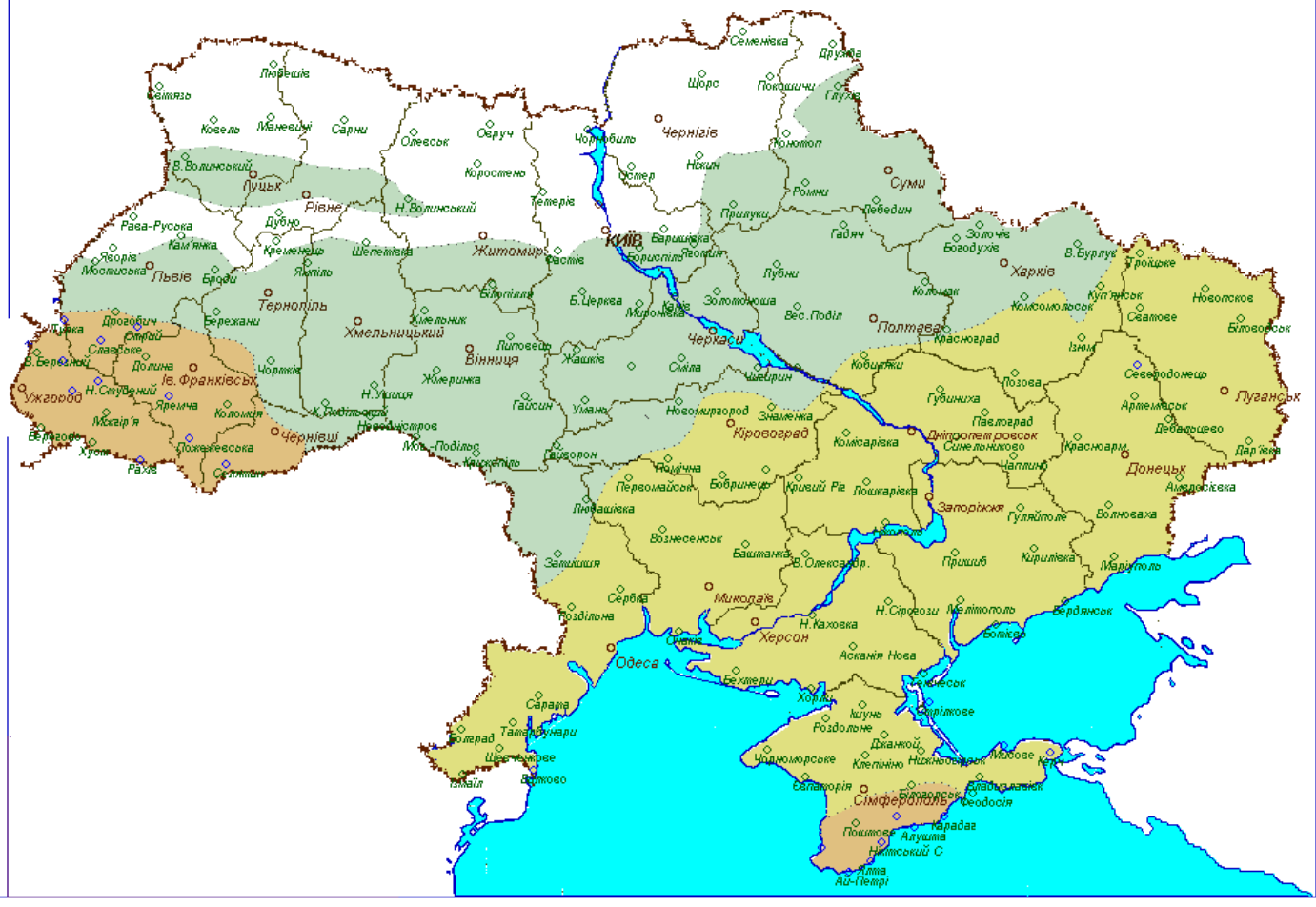


MARS approach in Ukraine (Ukr Hydrometcenter)



- Adopt
- Meteorological
- Plan
- Assessment
- Planning
- Development
- Data
- Analysis
- Monitoring
- Decision

Weather stations location

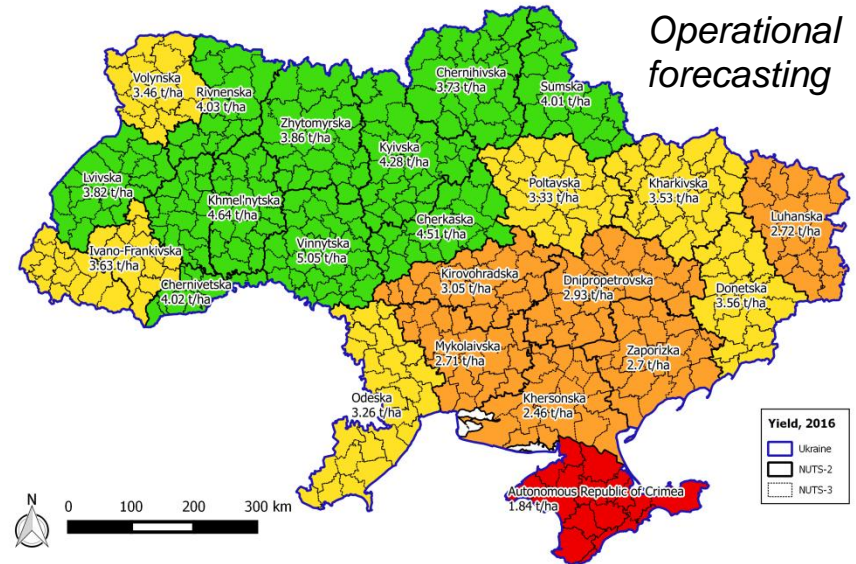


Crop yield forecasting: towards Monitoring Agricultural Resources (MARS)



- **Providing products since 2011 for Ukraine:**

- ESA GLOBCOVER cropland, 300 m, 2008
- MODIS MOD13Q1 **NDVI**;
- Statistical data from State Statistics Service of Ukraine;
- Up to 2 months before harvest



		2010	2011	2012	2013
NDVI	RMSE	8.2	6.2	6.8	5.8
	average	6.8	-3.7	-3.4	2
FAPAR	RMSE	8.9	5.2	5.6	4.1
	average	7.6	-2.1	-0.5	0.8



Challenges and further steps



- **Dedicated Program in NASU** to support national priorities and cooperation with JRC;
- **Implementation of MARS program** for crop yield forecasting in Ukraine;
- **GEOGLAM-Ukraine program** in line with GEO strategic plan to provide applied scientific results of satellite crop monitoring to Ministry of Agriculture



Thank you!

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