

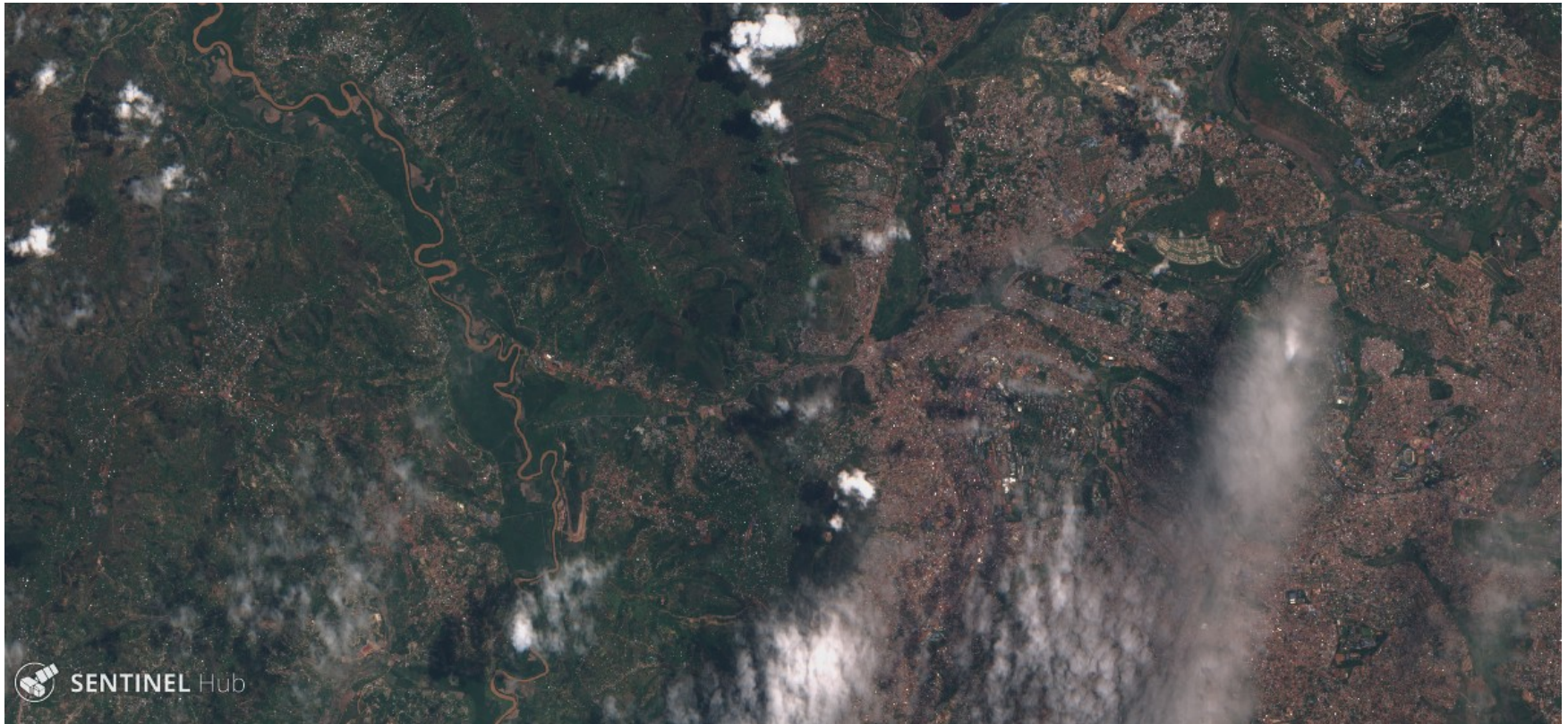


Crop statistics based on remote sensing data in Poland

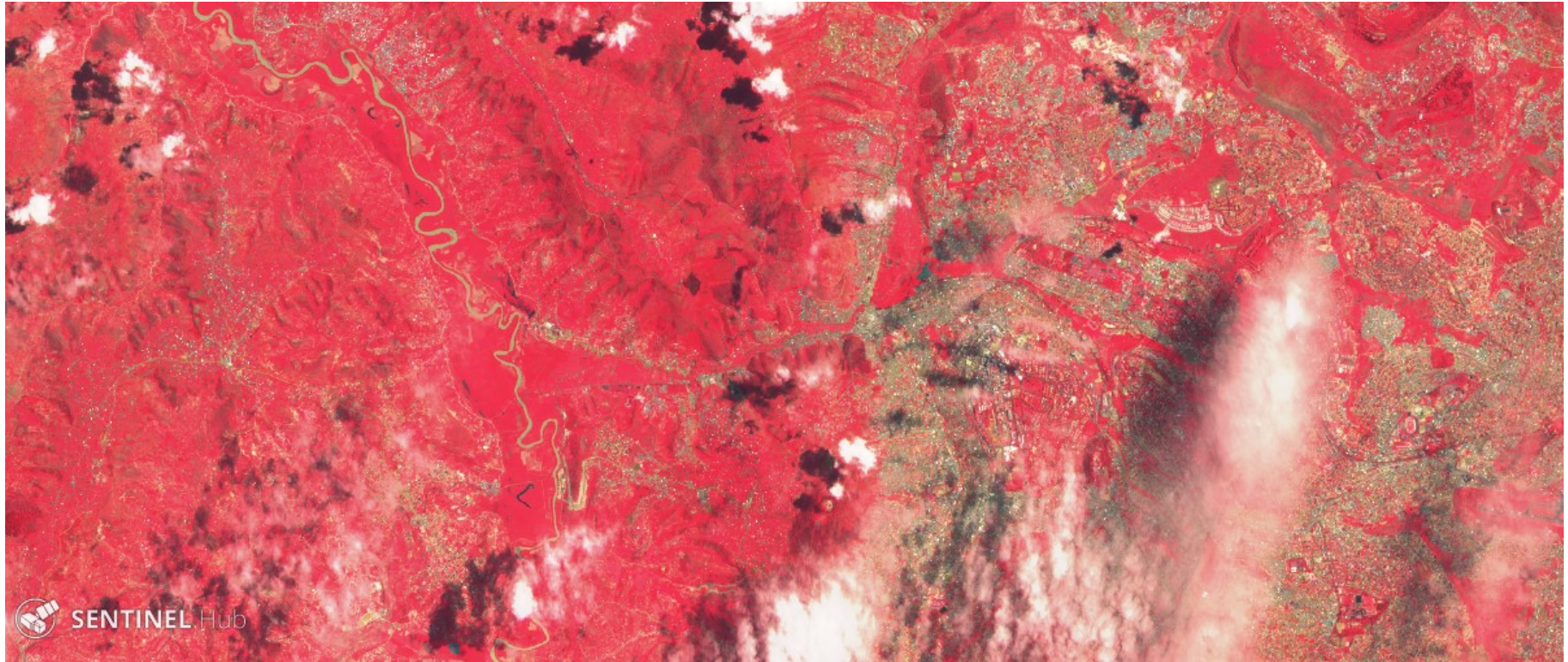
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Agriculture Department
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Seminar on Data Science Campus, Kigali, Rwanda 29 April
-1 May 2019

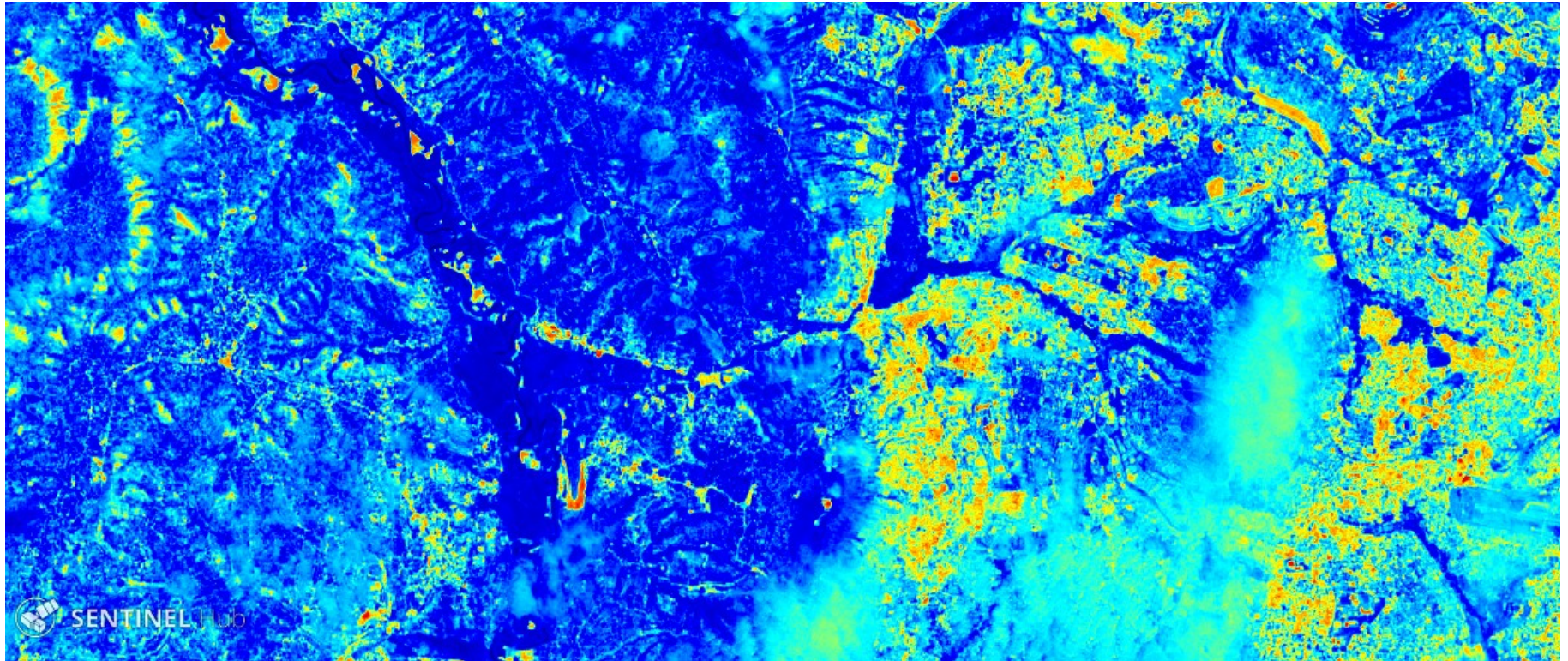
Sentinel 2, Kigali 28.04.2019 true colors



Sentinel 2, Kigali 28.04.2019 vegetation index



Sentinel 2, Kigali 28.04.2019 moisture index



Data

- Remote sensing data

SENTINEL 1 , 2 & 3 (EU Copernicus) – data obtained each 3-6 days, 10-20 m spatial resolution (S1 & S2), LANDSAT, NOAA, MODIS

- in-situ data

The questionnaire with geo-coordinates and photos provided by Regional Statistical Offices

- Administrative registers

Paying agency data: Land Parcel Identification System, crop declarations, in-situ inspections

- Maps

Data Base of Topographic Objects, hypsography

- Statistical data

Partners

Central Statistical Office

Regional Statistical Office in Olsztyn – in situ data coordinator

Regional Statistical Offices

Space Research Centre - Polish Academy of Science – processing, calculations

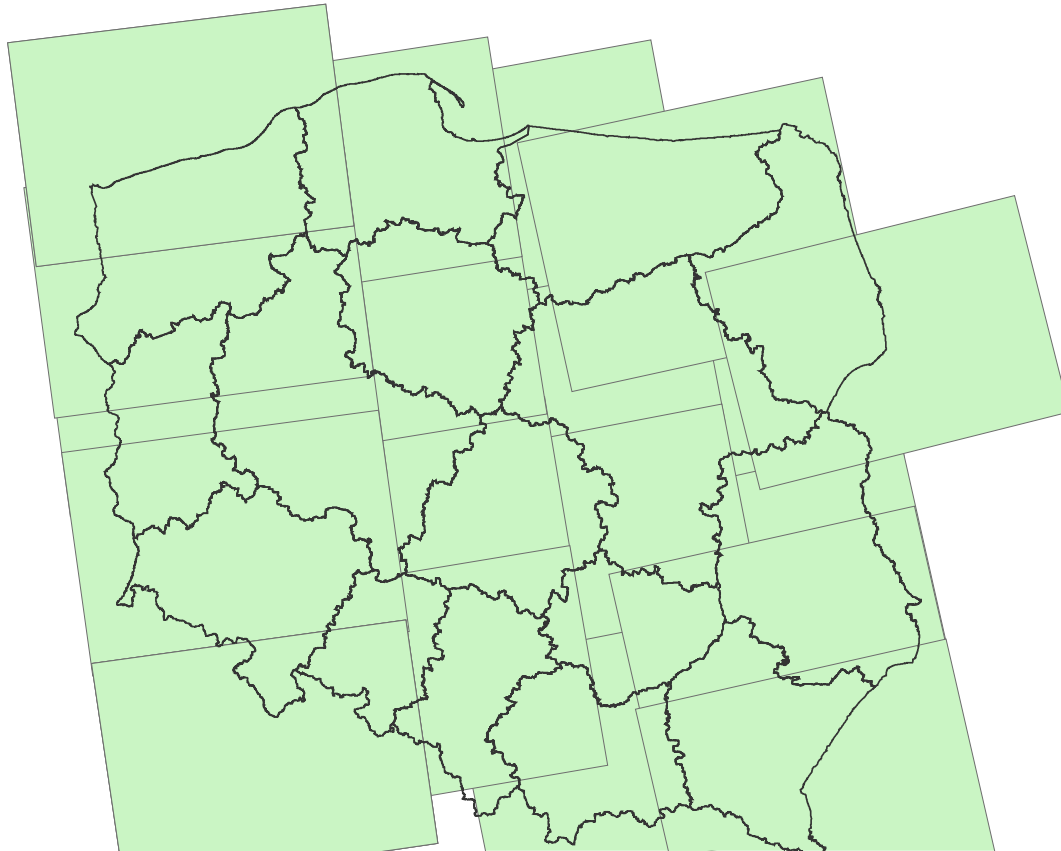
Institute of Geodesy and Cartography in Warsaw – crop monitoring, yield estimates

Started since 2015 with perspective of full implementation in Statistics Poland after 2020

Methods

- Huge amount of data – ca **1.5 TB per scene (15-16 scenes for PL)**
- Preprocessing of satellite data
- Segmentation (object recognition) with administrative data, S2
- Time series for each crop in the given season
- Long time series of yield statistics
- Machine learning (supervised – training sample) – support vector machine, random forest, k-nearest neighbors
- Validation – coherence matrices, accuracy
- Generalization

Sentinel 1 – ascending paths



Visualization of the in-situ geodatabase with images.



A number of training samples per the Sentinel 1 path in on year (2017-2018)

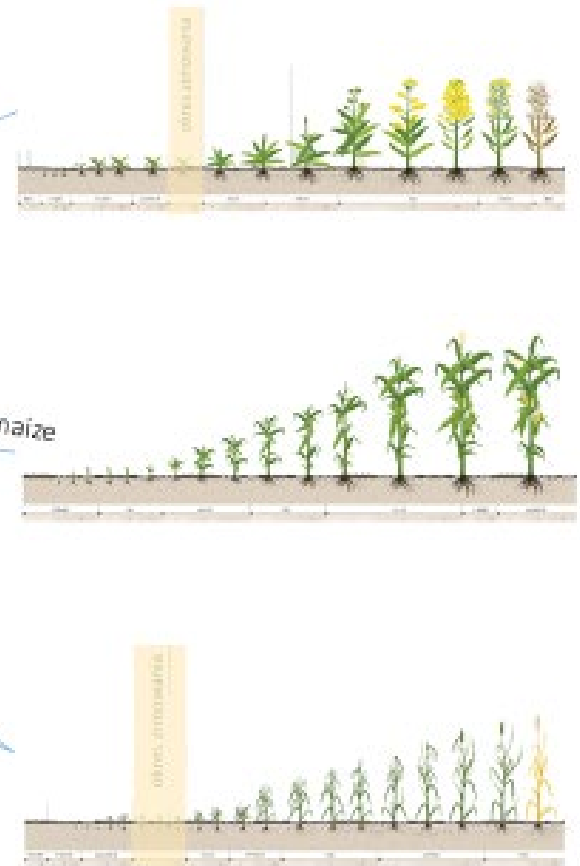
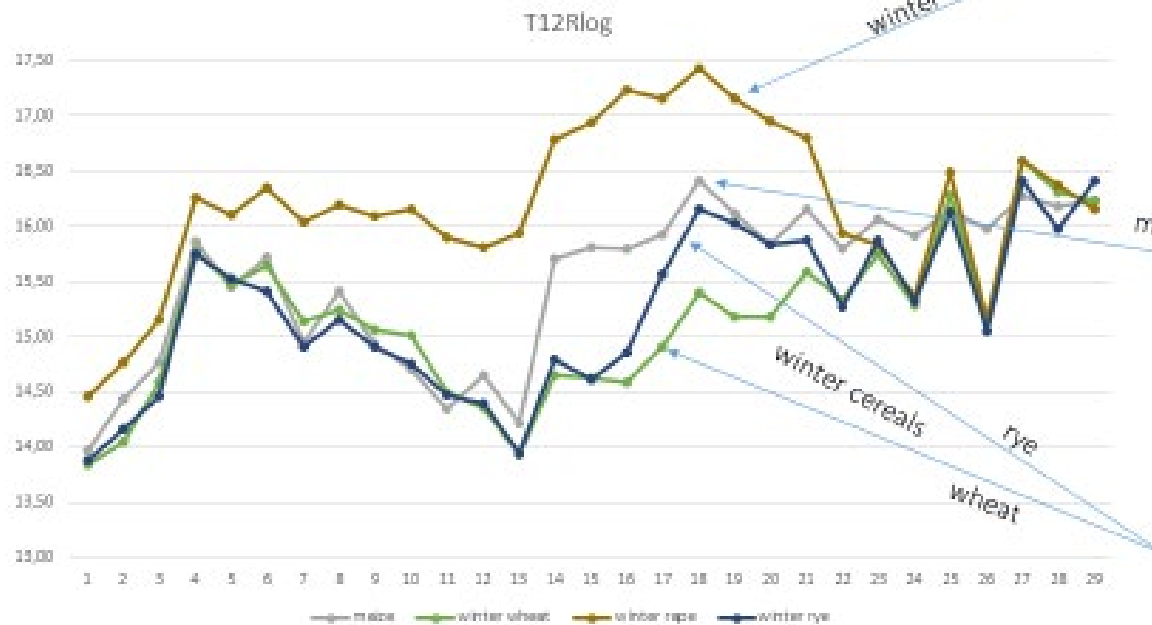
Crop / Path	Total	summer barley	winter barley	maize	mixed of spring cereals	mixed of winter cereals	avena	summer wheat	winter wheat	summer triticale	winter triticale	summer rape	winter rape	rye
Poland	5084	481	340	509	448	207	426	432	559	218	448	134	476	406
Path 1	579	46	40	53	33	18	53	39	88	24	52	11	73	49
Path 2	1059	97	95	109	88	38	73	101	106	35	90	36	94	97
Path 3	1325	139	76	134	138	39	120	112	147	52	126	14	133	95
Path 4	1109	97	89	114	95	66	93	96	123	55	93	32	82	74
Path 5	1012	102	40	99	94	46	87	84	95	52	87	41	94	91

Radar (SAR) data in crop recognition



Crop mapping

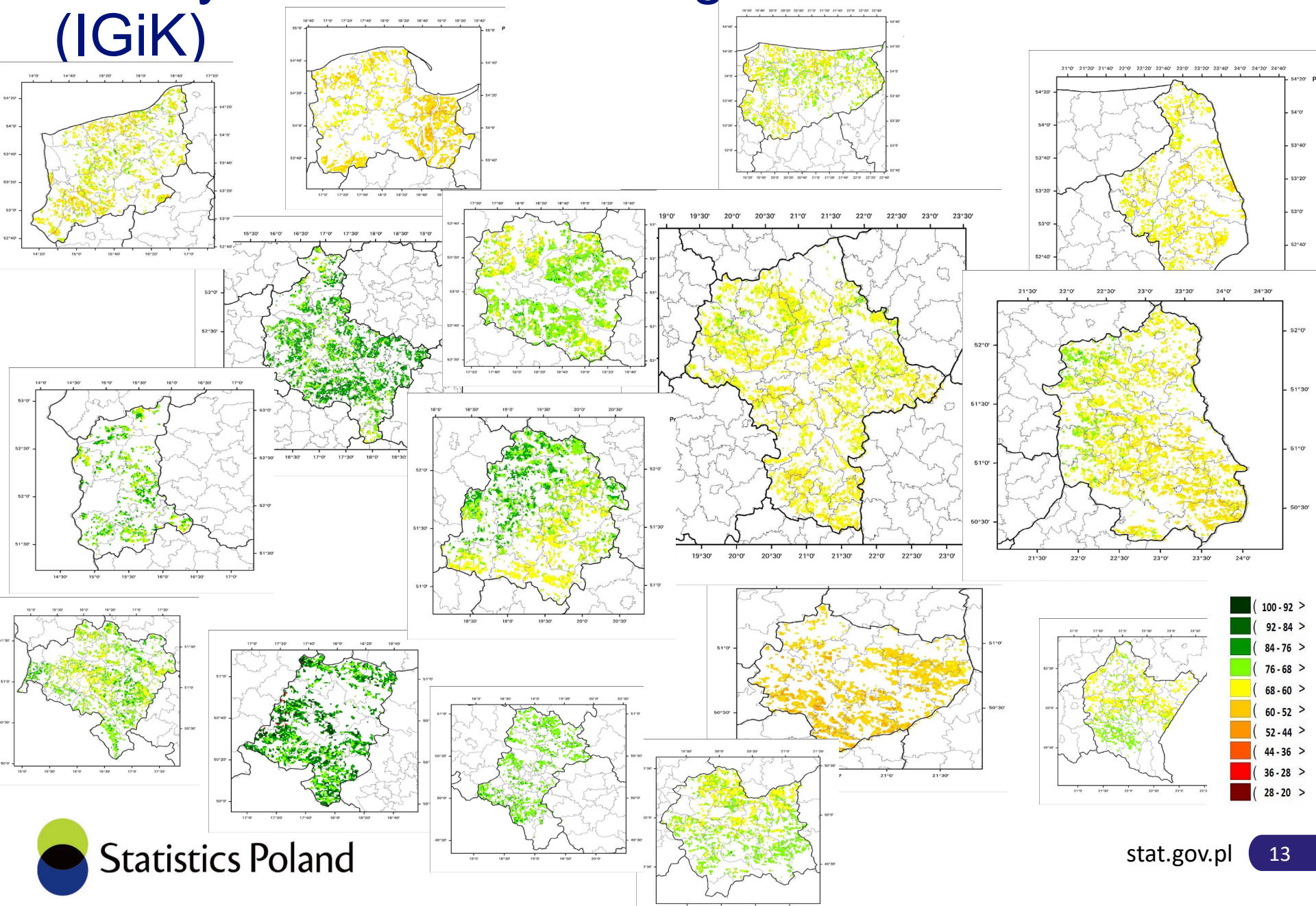
- Time series of radar satellite images – Sentinel-1
- Classification based on phenological changes in vegetation reflected by changes in radar signal backscatter mechanism in time



Results for major agricultural crops in Poland in 2017 based on S1 (SAR)

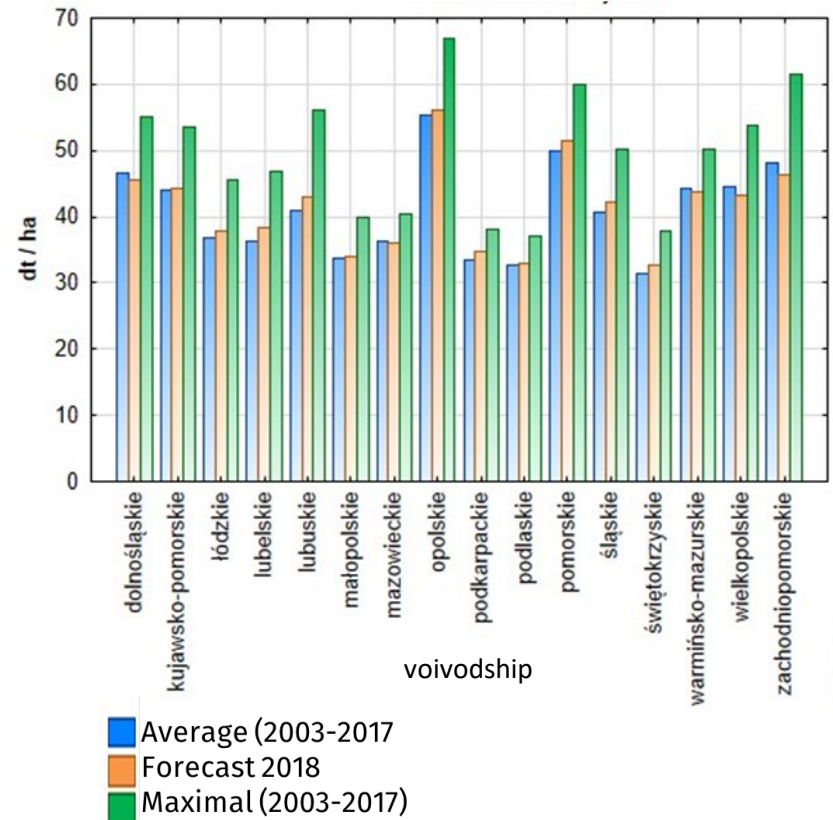
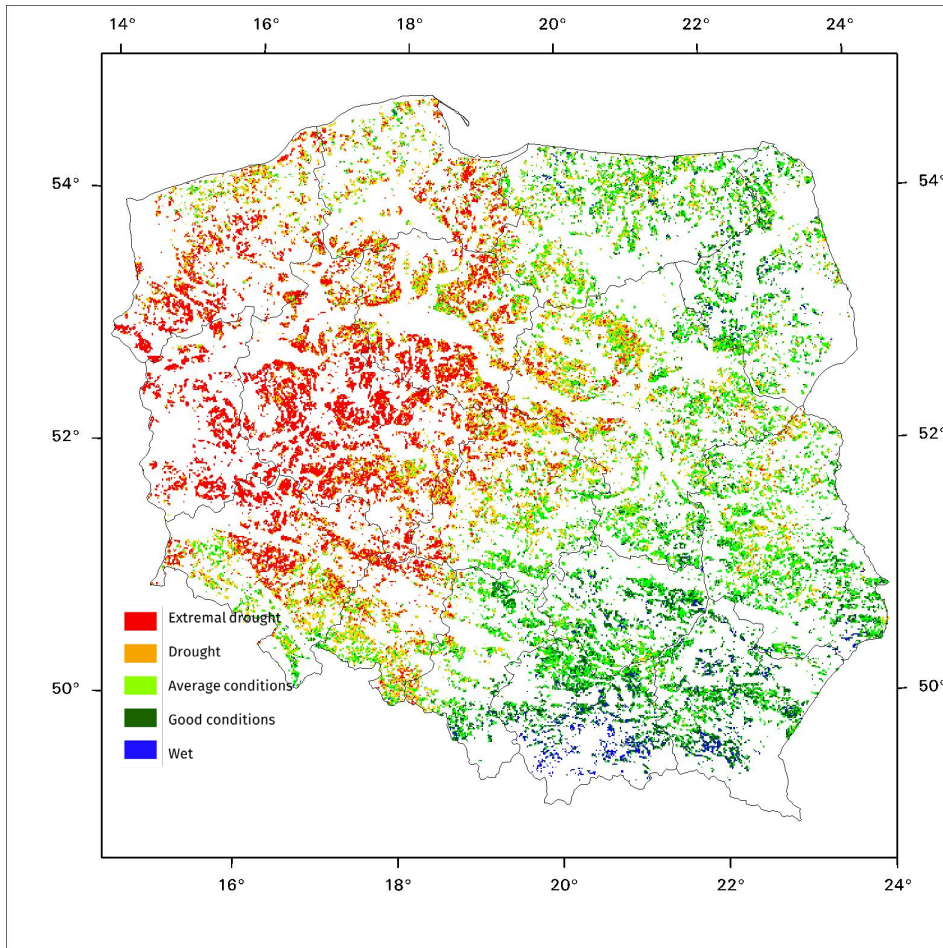
Crop	Area in thousands ha
winter wheat	1 474
summer wheat	770
winter triticale	1 034
summer triticale	380
winter barley	564
summer barley	866
avena	727
rye	1 026
mixed winter cereals	370
mixed spring cereals	978
maize	1 993
winter rape	1 288
summer rape	323

Corn yield forecast for regions in 2017 in dt/ha (IGiK)



Drought and yield forecasts in 2018 (agricultural land)

Wheat yield forecast for 2018
(Institute of Geodesy and Cartography)



Conclusions

- Satellite data are efficient for the assessment of crop area and yielding in Poland
- The classification methods is to be further developed
- High quality of in situ data required (at least 30 plots per one crop per a scene/region)
- Preferred access to spatial admin data e.g. vectorized parcels
- Combining different data sources