



# Gisat

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- Use of Sen2-Agri system for spring- and summer-season (April – October 2016) crop classification in the region of Central Bohemia
- Comparison of the L4A cropland mask and L4B crop-type map to Land Parcel Identification System (LPIS) farmer declarations and in-situ ground-data.

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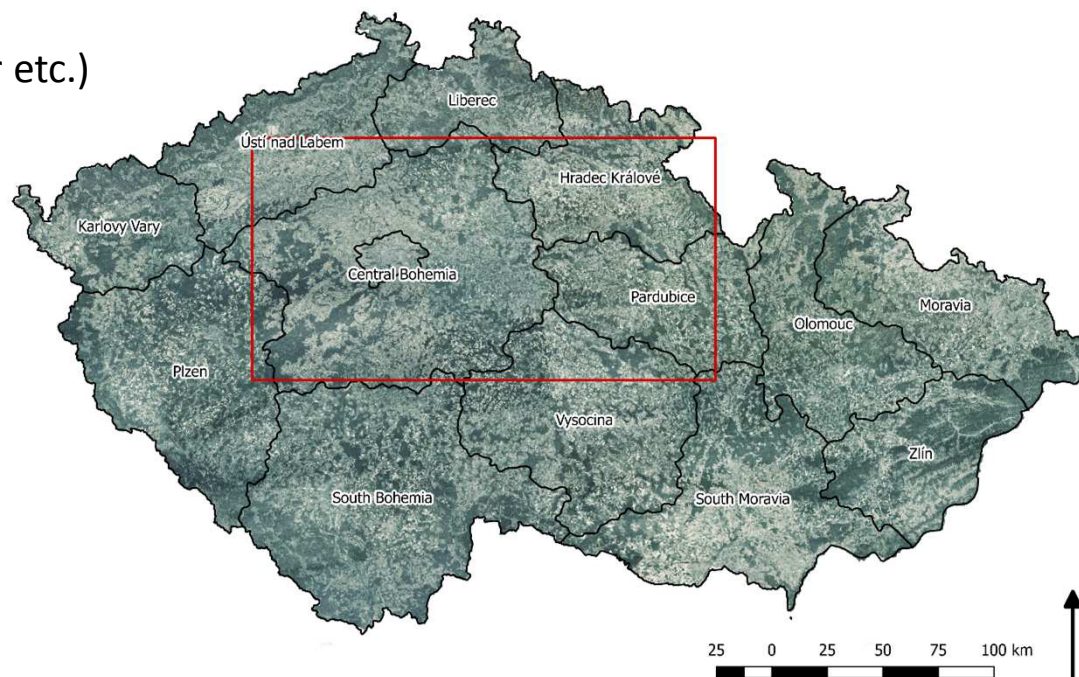




# Site features



- Prague and Central Bohemia (22,733 km<sup>2</sup>)
- Main crop types:
  - Winter cereals (e.g. winter wheat, winter barley, winter rye etc.)
  - Spring cereals (e.g. spring barley, spring wheat etc.)
  - Winter rapeseed
  - Fodder crops (e.g. alfalfa, clover etc.)
  - Sugar beet
  - Maize



25 0 25 50 75 100 km

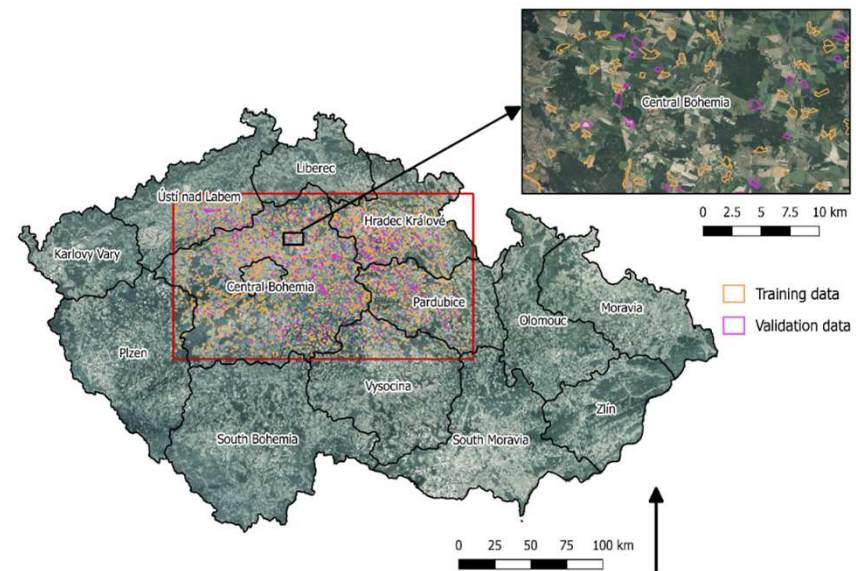
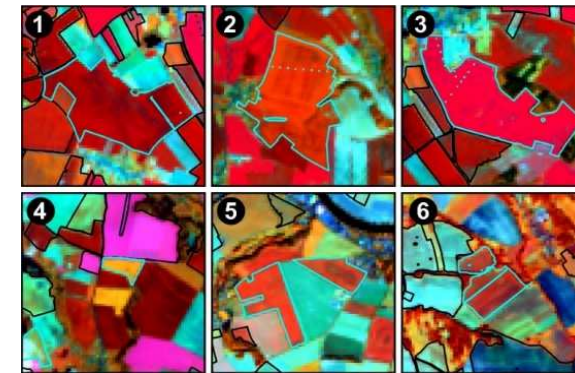


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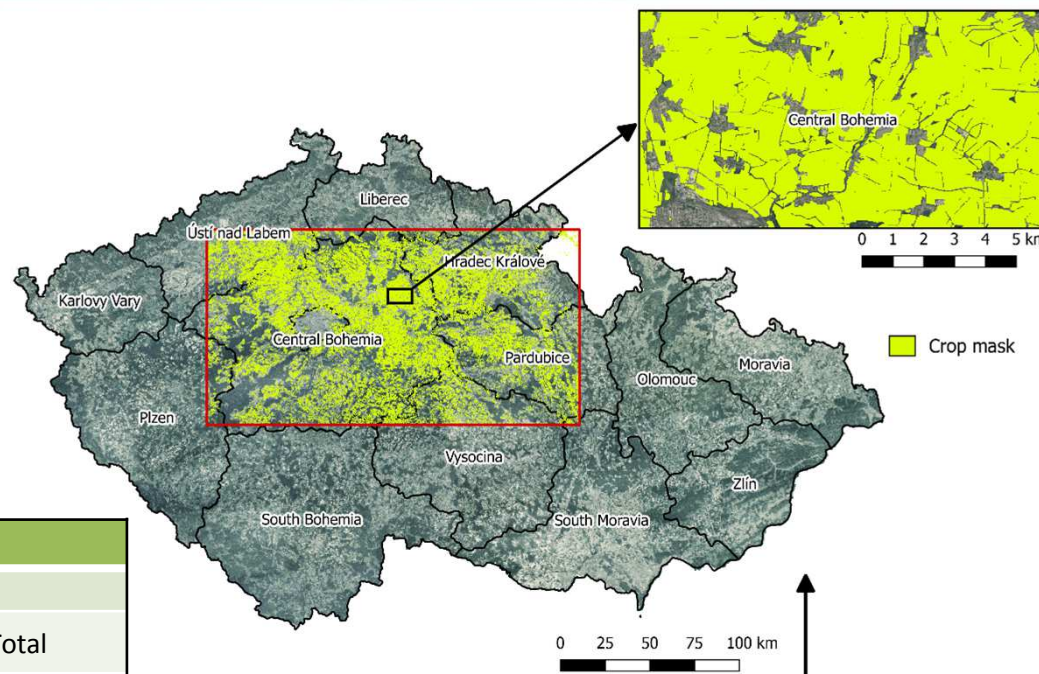
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- Earth Observation (EO) data:
  - 96 scenes from Landsat-8 and 112 scenes from Sentinel-2
- Training data:
  - Visual interpretation of the satellite imagery over 283 Land Parcel Identification System (LPIS) polygons
  - CORINE land cover database from 2012 over 1585 non-agricultural areas
- Validation data:
  - Crop mask generated using the LPIS polygons
  - In-situ data collected at 91 polygon locations, and farmer crop declarations at 684 polygon locations.



- Crop Mask
  - 36% of the study area is arable land
  - “Land” status - average of 9 images and maximum of 21 images per pixel
  - An overall accuracy of 89% (kappa coefficient 0.77)

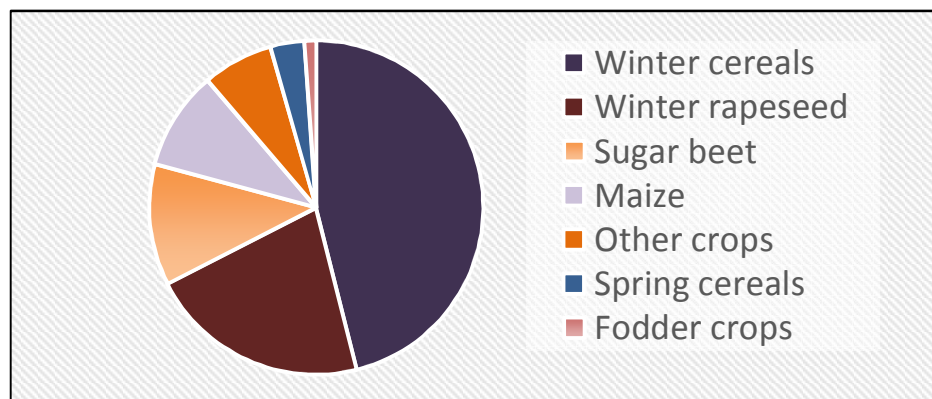
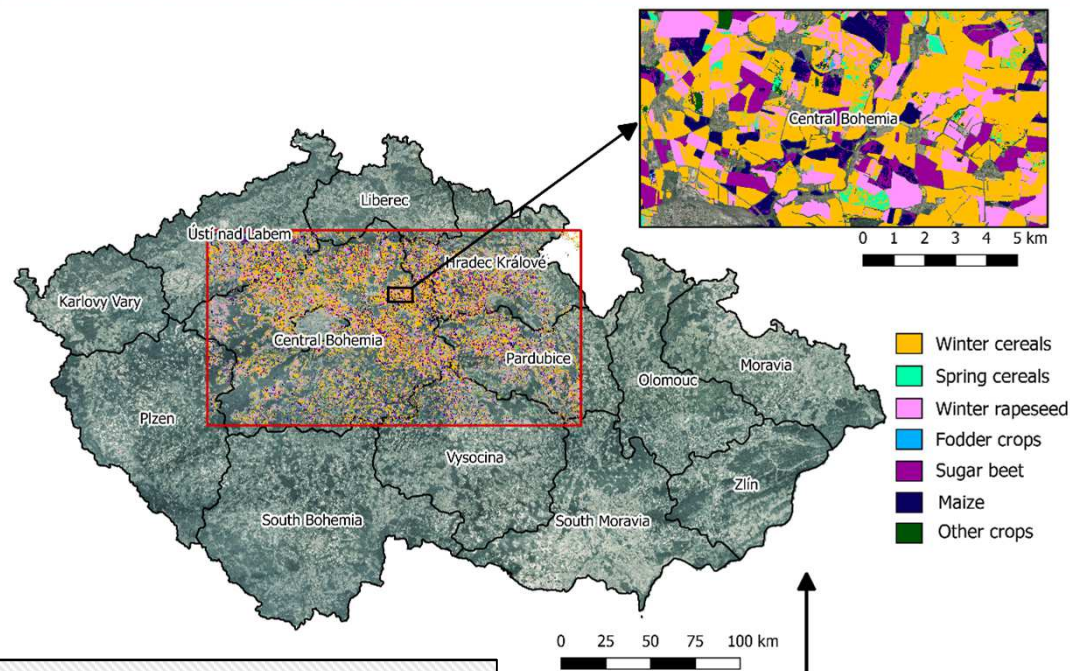


		Confusion matrix (number of pixels)		
		Validation dataset		
		Non-agriculture	Agriculture	Total
Classification (L4A product)	Non-agriculture	<b>127,861,082</b>	17,320,191	145,181,273
	Agriculture	6,956,622	<b>75,219,885</b>	82,176,507
	Total	134,817,704	92,540,076	<b>227,357,780</b>

Accuracy assessment				
Class	Commission	Omission	Producer's Accuracy	User's Accuracy
Non-agriculture	11.93%	5.16%	<b>94.84%</b>	<b>88.07%</b>
Agriculture	8.47%	18.72%	<b>81.28%</b>	<b>91.53%</b>

- Crop-type Map

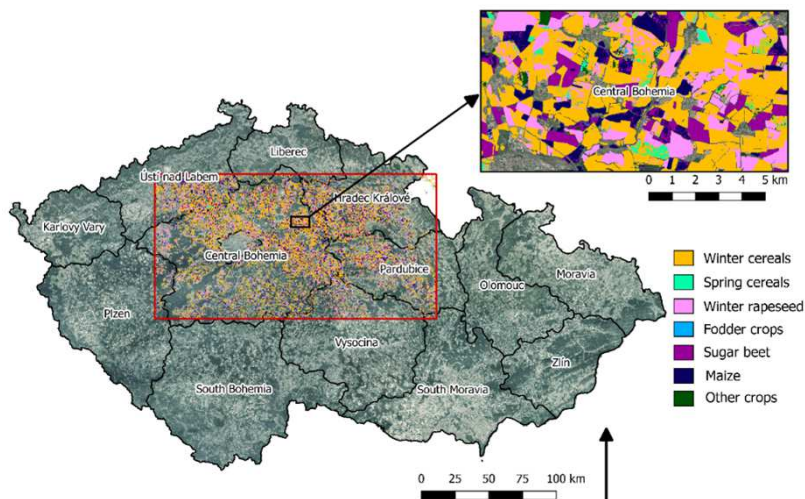
Crop	Area (ha)	Area (%)
Winter cereals	382044	46.1
Winter rapeseed	177022	21.4
Sugar beet	97468	11.8
Maize	79101	9.5
Other crops	56584	6.8
Spring cereals	27117	3.3
Fodder crops	9507	1.1
<b>Total</b>	<b>828843</b>	<b>100%</b>



- Crop-type Map

## Pixel-based validation

		Confusion matrix (number of pixels)							
		Validation dataset							
		Winter cereals	Spring cereals	Winter rapeseed	Fodder crops	Sugar beet	Maize	Other crops	Total
Classification (L4B product)	Winter cereals	<b>371364</b>	3823	12350	89	7858	1296	1873	398653
	Spring cereals	98222	<b>58939</b>	19985	551	13864	3925	42325	237811
	Winter rapeseed	12425	2266	<b>264104</b>	48	1819	287	1092	282041
	Fodder crops	46351	1713	30412	<b>9987</b>	22725	8995	4796	124979
	Sugar beet	8694	1216	4525	218	<b>273137</b>	10849	2834	301473
	Maize	2597	519	1746	4588	62594	<b>112339</b>	6276	190659
	Other crops	11635	7692	7413	1342	40935	21774	<b>75365</b>	166156
	Total	551288	76168	340535	16823	422932	159465	134561	<b>1701772</b>

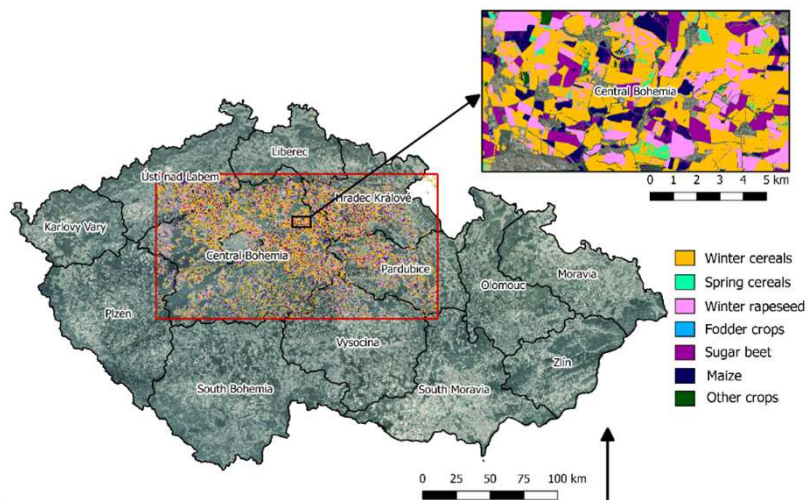


Accuracy assessment			
	Producer's Accuracy	User's Accuracy	F-Score
Winter cereals	<b>93%</b>	<b>67%</b>	<b>0.78</b>
Spring cereals	25%	77%	0.38
Winter rapeseed	<b>94%</b>	<b>78%</b>	<b>0.85</b>
Fodder crops	8%	59%	0.14
Sugar beet	<b>91%</b>	<b>65%</b>	<b>0.75</b>
Maize	59%	70%	0.64
Other crops	45%	56%	0.50
Kappa			0.61
Overall accuracy			<b>68.0%</b>

- Crop-type Map

Polygon-based validation

		Confusion matrix (number of polygons)							
		Validation dataset							
		Winter cereals	Spring cereals	Winter rapeseed	Fodder crops	Sugar beet	Maize	Other crops	Total
Classification (L4B product)	Winter cereals	139	42	2	21	0	0	2	206
	Spring cereals	0	25	0	0	0	0	2	27
	Winter rapeseed	0	4	106	9	0	1	2	122
	Fodder crops	0	0	0	4	0	1	0	5
	Sugar beet	1	3	0	15	99	27	21	166
	Maize	0	0	0	3	3	63	10	79
	Other crops	0	18	0	1	0	2	43	64
	Total	140	92	108	53	102	94	80	669



Accuracy assessment			
	Producer's Accuracy	User's Accuracy	F-Score
Winter cereals	99.0%	67.0%	.80
Spring cereals	27.0%	93.0%	.42
Winter rapeseed	98.0%	87.0%	.92
Fodder crops	8.0%	80.0%	.14
Sugar beet	97.0%	60.0%	.74
Maize	67.0%	80.0%	.73
Other crops	54.0%	67.0%	.60
Kappa			0.66
Overall accuracy			72.0%



# Use case



- The study has been supported by the Czech State Agricultural Intervention Fund (Czech Paying Agency)
- The agency is interested in operational crop monitoring service based on Sentinel imagery
- The intended use is expected within various decision making processes in the frame of Integrated Administration and Control System (IACS) of the EU's Common Agricultural Policy (including the LPIS update, administration and control mechanisms)
- The generated products served as the demonstrator of the capabilities of the Copernicus Sentinels for EO based agriculture monitoring
- The products have not been directly used by the agency



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# Feedback on system and products

- *Did you have the opportunity to operate the Sen2Agri system?*
  - Yes, we use the GUI of the Sen2Agri system
- *What is your experience*
  - Positive:
    - (1) Well designed and delivers as promises.
    - (2) Commendable support from the development staff.
  - Negative:
    - (1) The GUI is too inflexible
    - (2) The system is too demanding on computing resources and hence too slow.
- *What are your recommendations for the future for the system?*
  - (1) Improve the user guide and a ‘trouble shooting’ section
  - (2) Improve system performance

Thank you!



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# Users assessment



Feedback provided by the Paying agency:

- Sentinel data brings great potential in the agriculture, in both the public and private sector
- The frequency of data acquisitions and possibilities for time series analyses are enormous.
- However, the further actions have to be taken at the EU and national level to reach the real added value of the use of Sentinel data. The actions have to be taken cross wide - in respect of methodology, administrative, organizational and IT aspects.



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