

Workshop on checks and management of agricultural land in IACS

28-30 May 2018 - Vilnius

Relevance of different types of satellite images for preparation of monitoring in Walloon Region (BE)

Cozmin LUCAU, Emilie BERIAUX



Beatrice LETEINTURIER, Emeline JACQUEMIN



OVERVIEW

1. CONTEXT
2. OBJECTIVES
3. DATA SET AND METHODOLOGY
4. PRELIMINARY RESULTS
5. CONCLUSIONS AND PERSPECTIVES

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CAP: OTSC → checks by monitoring Walloon Paying Agency (OPW) Walloon Agricultural Research Center (CRA-W)

CAP



**The monitoring approach:
a new concept of checks**

LPIS of good quality
GSAA in place
Effective retro-active recoveries

Checks by monitoring
(substituting OTSC)

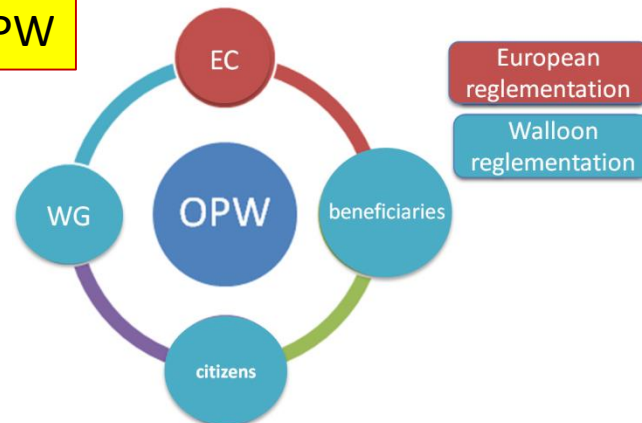
Assurance on the size of the land
to be paid

Assurance on activities on
claimed land

- Focus on prevention (alerts to farmers)
 - Farmer as a partner
 - Increased compliance
- Reduction of inspections in the field (in most cases no visits to the field necessary)
 - No need for multiple visits (e.g. for catch crops)



OPW



CRA-W

Regional public body



410
including
120
scientists



300 ha
experimental
fields,
orchards,
greenhouses,
laboratories...



3 sites
Gembloux,
Libramont,
Mussy-la-
ville



150
research
projects at
regional,
national
and
European
level



29
automatic
agricultural
weather
stations
'PAMESEB
network'

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3. Use of correctly processed imagery
6. Future use of data; S1, S2, micro-satellites,
HAPs, RPAS etc. as input to monitoring, or to QC of
systems/methods

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OBJECTIVES

Crops identification (check of crop diversification)

Prospection of abilities of different sensors (in terms of temporal, spectral and spatial resolutions) for classification purpose over agricultural zone in Walloon Region

Change detection in crop plots using SENTINEL imagery

! LPIS session !

To help farmers to declare through the GSAA and administration to identify the new splitted parcels

To target the incorreced plots of the LPIS gathering several land covers

OVERVIEW

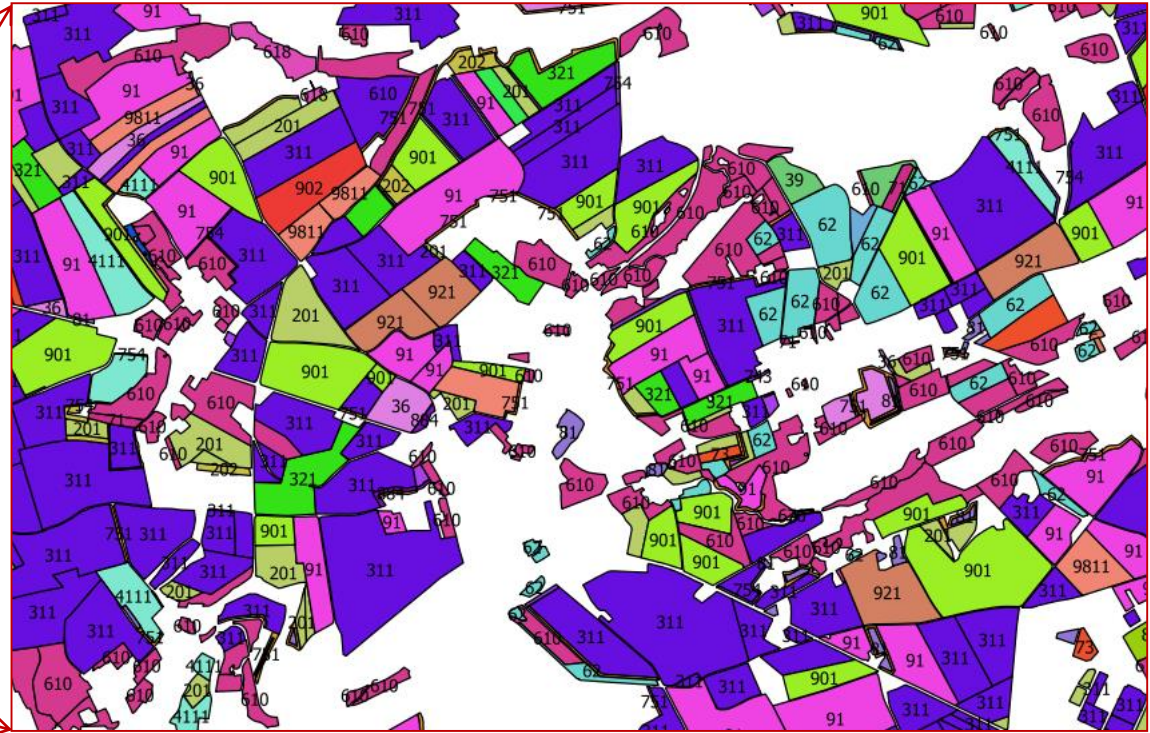
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DATA SET AND METHODOLOGY

2017 campaign

- LPIS

- 154 different crop types
- 12 main crop types > 90 % of total area (767 421 ha)

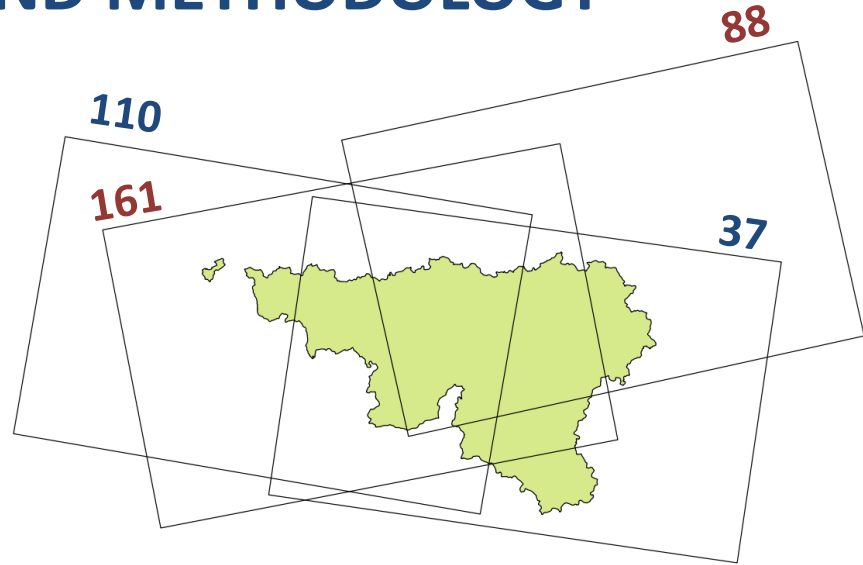


Physical blocks (+/- 78 000) but including also data at agricultural parcel level (+/- 280 000, since 1990)!!!

DATA SET AND METHODOLOGY

2017 campaign

- LPIS
- satellite images
 - Sentinel 1 (A & B)



Two descending tracks : 110 and 37

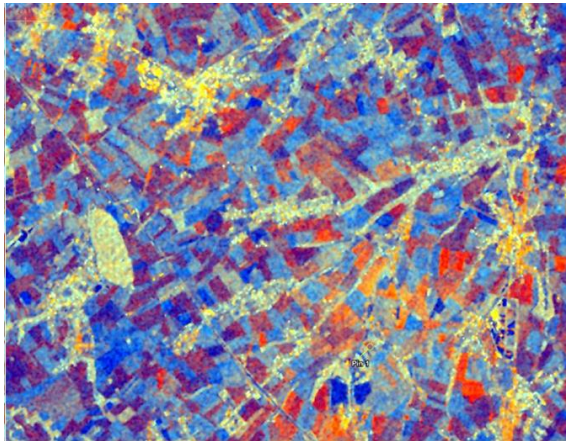
(acquisition time \pm 05:50 UTC)

Two ascending tracks : 161 and 88

(acquisition time \pm 17:40 UTC)

All S1 A&B images between january to july 2017 for each track (\pm 35 acquisitions A+B per track)

Pre-processing using SNAP algorithms (GRD to 60)

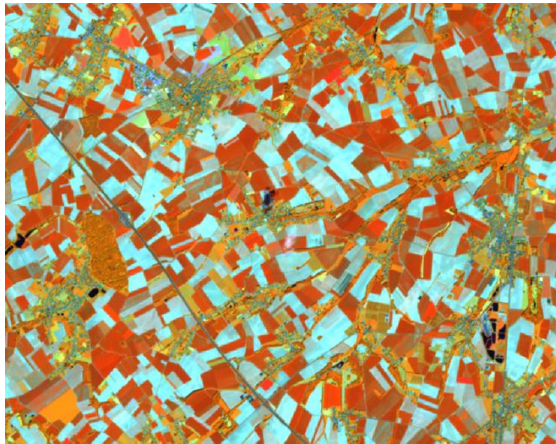


S1A, 6 May 2017 (RGB: VH, VV, VH/VV)

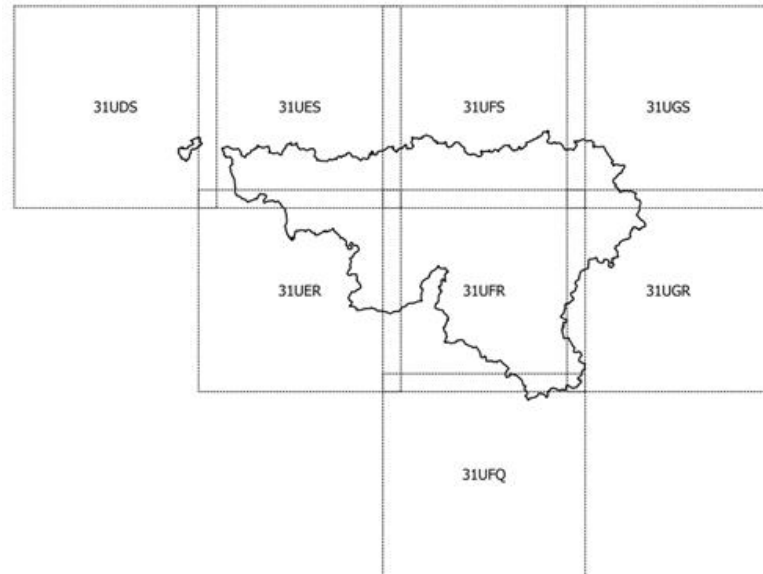
DATA SET AND METHODOLOGY

2017 campaign

- LPIS
- satellite images
 - Sentinel 1 (A & B)
 - Sentinel 2 (A)



S2A (level, 2a) 26 May 2017 (RGB: 4, 3, 2)



16 available images between 1/01/2017 to 31/07/2017

Pre-processing (CNES)

Linear interpolation for cloudy areas / images

DATA SET AND METHODOLOGY

2017 campaign

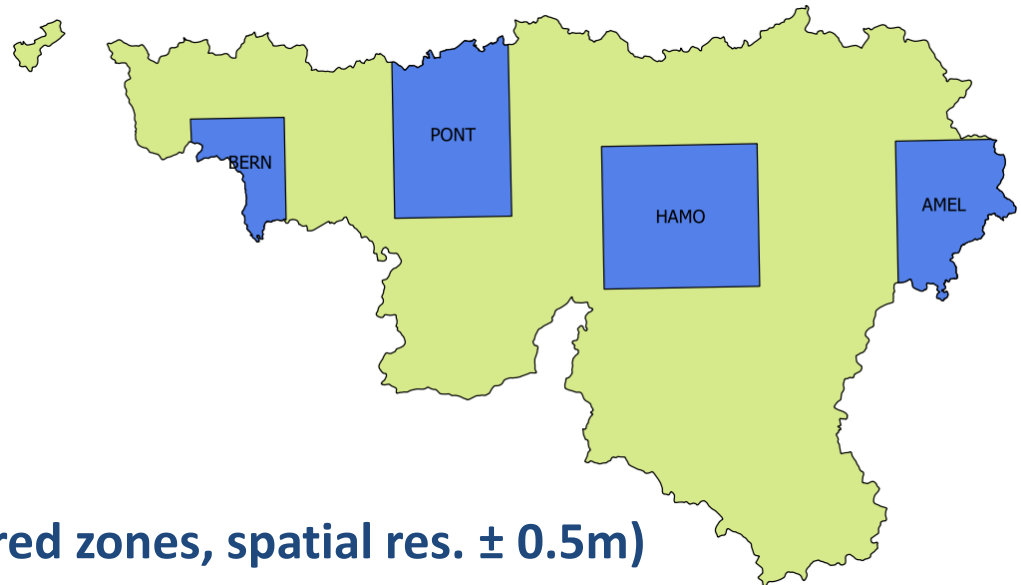
- LPIS

- satellite images

- Sentinel 1

- Sentinel 2

- VHR (over the four considered zones, spatial res. $\pm 0.5m$)



Zone	Date 1	Image	Date 2	Image
BERN	2/04	WV2	7/08	WV4
PONT	2/04, 9/04	WV2, WV3	28/08	GE1
HAMO	9/04	WV3	7/08	WV4
AMEL	8/04	WV2	7/08	WV4

DATA SET AND METHODOLOGY

2017 campaign

- LPIS
- satellite images
 - Sentinel 1
 - Sentinel 2
 - VHR (over the four considered zones)
- OTSC data

OPEN SOURCE

- R
- QGIS
- SNAP
- Sen2Agri
-

DATA SET AND METHODOLOGY

SENTINEL 1&2 IMAGES

Parcels > 0.5 ha

15 m buffer inside parcels

Period: january to july 2017

S1: 35 acquisitions per track

S2: 16 images (clouds → interpolation)

Means and metrics of **60** (VV, VH, VH/VV - S1) and **NDVI, NDWI and brightness** (S2) at parcel level

RANDOM FOREST

(object oriented classification, crop type level → crop group level)

Confidence level

Zonal scale

OK

Regional scale

OK

But important detailed data set useful also for updates, etc ...!!

VHR IMAGES

All parcels

small buffer where shadow

Only two dates (images)/zone:
april and august

MAXIMUM LIKELIHOOD

(+ visual photointerpretation f. of confidence level and crop type)

OK

X

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PRELIMINARY RESULTS

(zonal scale)

Overall accuracy - between 0.93 and 0.98 using Sentinel images

- > 0.99 using 2 VHR images (**automatic + visual !**)

Site	No of parc.		Number of different crop group type	Overall accuracy of classification results using different images						
	Sentinel (1 & 2)	VHR		OPTIC + 2 SAR	OPTIC + 1 SAR	2 SAR (ASC + DESC)	1 SAR (DESC)	1 SAR (ASC)	3 SAR (ASC + DESC)	2 VHR
AMEL*	8589 (12316 for SAR)	13503	11	0.97	0.97	0.98	0.97	0.98	-	> 0.99
BERN	7365	6451	18	0.93	0.93	0.91	0.92	0.91	-	> 0.99
PONT	14934	15184	21	0.94	0.95	0.94	0.93	0.94	0.94	> 0.99
HAMO	17334	14111	25	0.94	0.94	0.94	0.93	0.93	0.94	> 0.99

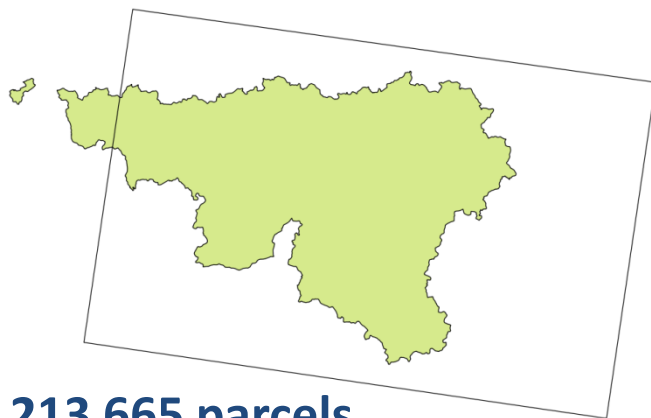
* - 2017 – very longues cloudy periods over Belgium and only one S2A operational satellite

PRELIMINARY RESULTS

(regional scale)

Overall accuracy of 0.92 (track 161) and 0.93 (track 37) using Sentinel 1 (A & B)

Track 37

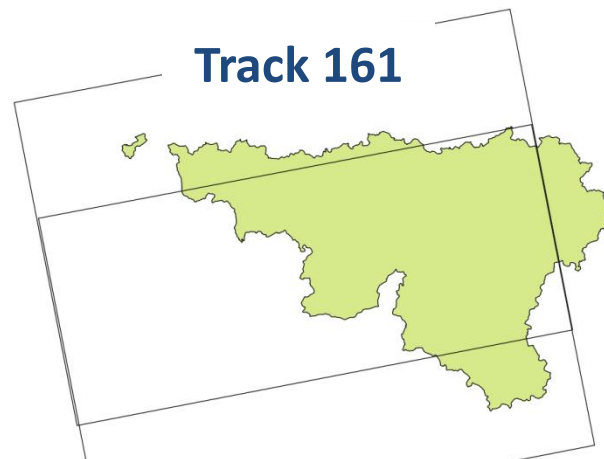


213 665 parcels

40 crop group types

OA = 0.93

Track 161



220 776 parcels

41 crop group types

OA = 0.92

PRELIMINARY RESULTS

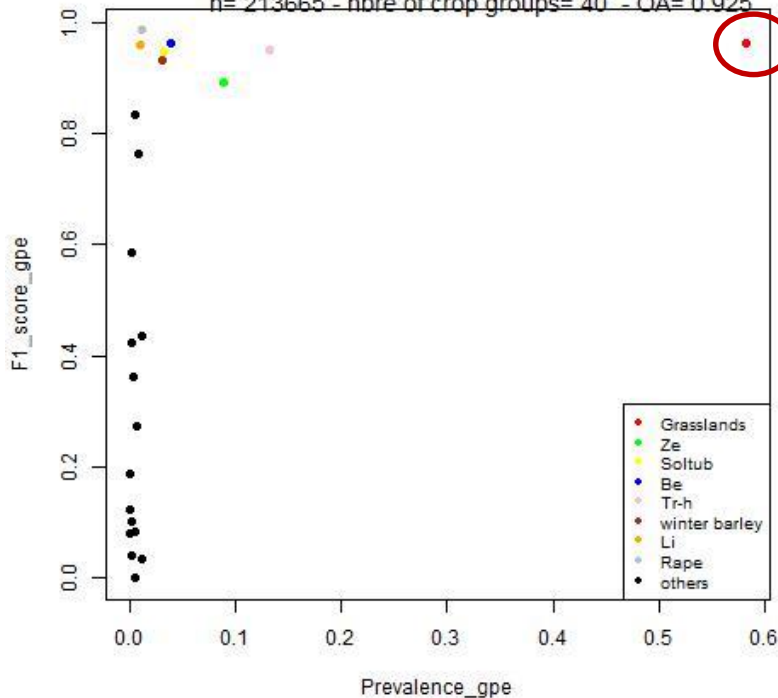
(regional scale)

Grassland parcels to be analysed more in details (larger period, adapted monitoring method, etc ...)

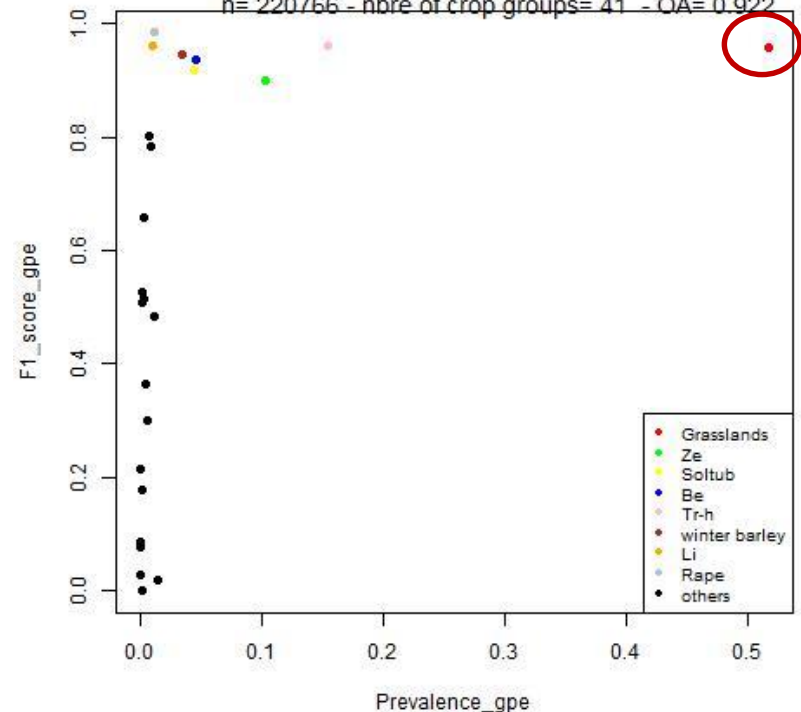
Track 37

Track 161

Distribution of the F1-score per crop group in function of the Prevalence validation with the LPIS validation sample (50%)
zone WR - S1 (orbit D - track 37)
n= 213665 - nbre of crop groups= 40 - OA= 0.925



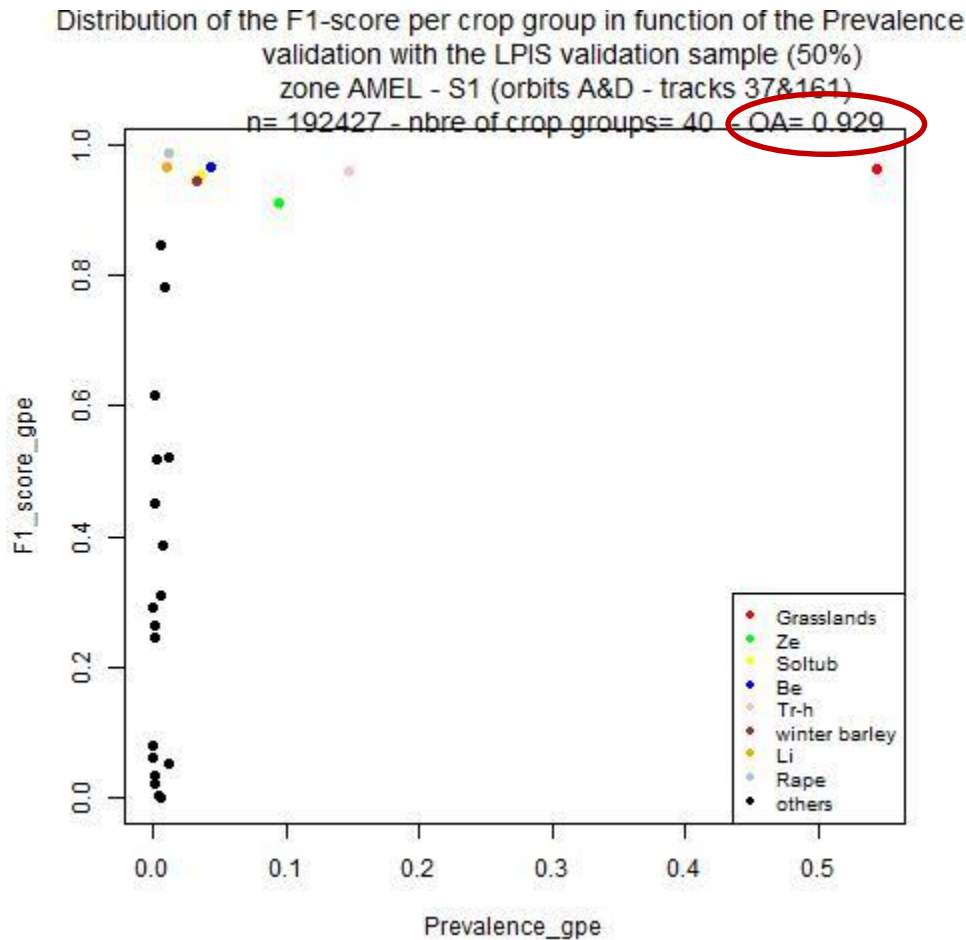
Distribution of the F1-score per crop group in function of the Prevalence validation with the LPIS validation sample (50%)
zone WR - S1 (orbit A - track 161)
n= 220766 - nbre of crop groups= 41 - OA= 0.922



PRELIMINARY RESULTS

(regional scale)

Track 37 + 161



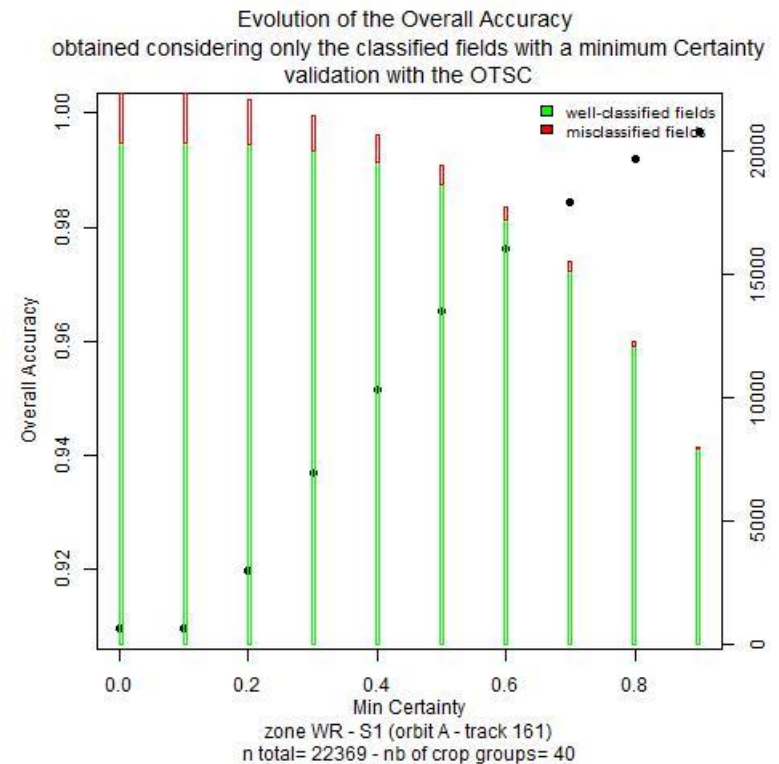
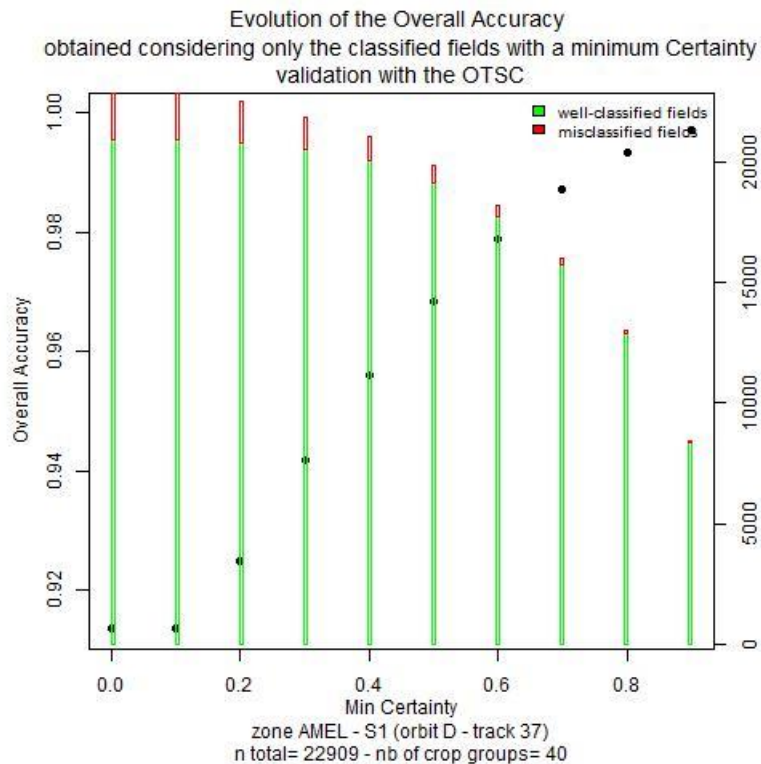
PRELIMINARY RESULTS

(regional scale)

More in depth validation results using the 2017 control data set and confidence level estimated from classification algorithm

Track 37

Track 161



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Zonal scale

- VHR classification (+ **photointerpretation**) give better results: > 0.99 of OA but only on small areas
- Optical data (S2) + one track of SAR images (S1) give best results of automatic classification in terms of overall accuracy
- The use of more than one SAR track (S1) with optical images (S2) seems to not improve the classification results
- The combination of two SAR tracks (S1) improves very slightly in some cases the classification results comparing with only one SAR track
- No impact if combining more than two S1 tracks

CONCLUSIONS AND PERSPECTIVES

Regional scale

- Availability of optical images (S2) is often a problem due to the cloudy cover in Belgium (in 2018 seems to be a little bit better also due to availability of S2 B images ...and the weather 😊)
- S1 SAR images seems to give very promising results for crop identification
- up to now, based on some preliminary tests, seems that there is a very limited impact on payment (= correct declarations of farmers in terms of crop type)

CONCLUSIONS AND PERSPECTIVES

- Testing of the proposed method on 2018 campaign data set
- Combining the both approach pixel based and object based classification
- Monitoring of land cover evolution (S1 coherence , S2)
- S1 → crop identification + S2 → temporal evolution + S1 coherence (markers)
- Better use of orthophotos (acquisition every year in Belgium) for update
- DIAS and SEN4CAP
- More close collaboration with JRC in order to adapt our results into operational way for future checks by monitoring
- Open to share our experience with other PA/MS

Thank you for your attention !



Cozmin LUCAU - DANILA



c.lucau-danila@cra.wallonie.be

Rue de Liroux, 9 - B-5030 GEMBLOUX - Belgium

OUR PARTNERS !

