Welcome to the 8th webinar

The webinar will last around 1h

The slides will be available on the Sen4CAP website in the coming 48 hrs (http://esa-sen4cap.org/)

Presenters:

Sophie Bontemps & Diane Heymans from *UCLouvain*
Dominique Laurent from *IGN France*
Tor Nielsen from *Planet*

Members of the consortium available to answer your questions

Webinar outline

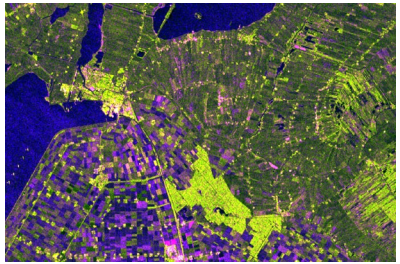
- Sen4CAP overview
- Sen4CAP evolution
    - Planning for version 3.0
    - Sen4CAP activities continuation in the AVL framework
- NIVA project building on top of Sen4CAP (IGN France)
- Planet Fusion for Checks by Monitoring (Planet)
- Next events

Webinar outline

- **Sen4CAP overview**
- Sen4CAP evolution
    - Planning for version 3.0
    - Sen4CAP activities continuation in the AVL framework
- NIVA project building on top of Sen4CAP (IGN France)
- Planet Fusion for Checks by Monitoring (Planet)
- Next events

Sentinel-derived **markers** and **products** assessed through selected **use cases**

Large dataset of metrics and crop markers from Sentinel-1, Sentinel-2 and Landsat8 processed along the season for each parcel and stored in a database



Products

- Crop type mapping
- Growing vegetation indicators
- Grassland mowing detection
- Agricultural practices monitoring

+ Tillage detection

Use Cases w/ Paying Agencies

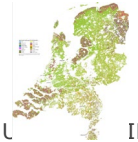
Use cases
Crop diversification
Perm. grassland monitoring
EFA-Land lying fallow
EFA-Catch crops
EFA-Nitrogen-fixing crops
Land abandonment
Interactive visualization

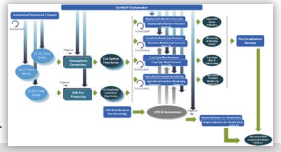
And many more!

Sen4CAP: from an ESA project to a toolbox

Design and prototyping
2017 – local sites

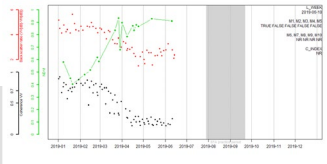
- Use cases selection
- Products Specifications
- Benchmarked Methods
- Algo & System design
- Prototype products
- Validation





Demonstration and validation
2018 & 2019 – national NRT

- Use cases demonstration
- National scale
- Continuous monitoring
- Validation & Fitness-to-use assessment
- Capacity building and training
- System qualification

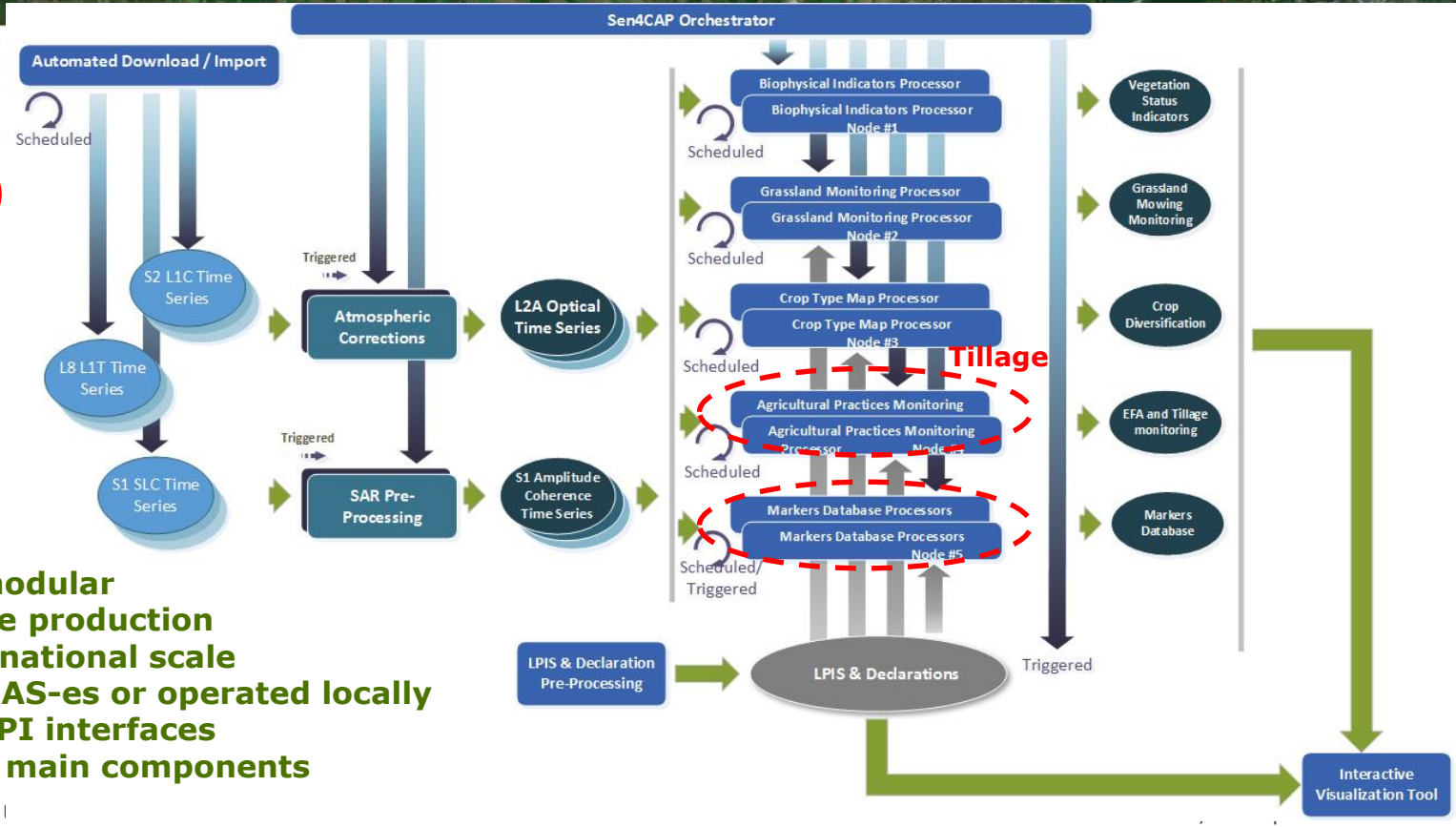


User uptake and system evolution
2020, 2021 …

- 330 downloads and 20+ Paying Agencies testing the system on CREODIAS
- Training with 44 participants from 20 different countries
- Webinars every month
- Support to users
- System evolution

Sen4CAP – An open-source system

Version 2.0 delivered on 8 Feb. 2021



- Sentinel-1 & -2
- Automated and modular
- For NRT or off-line production
- Demonstrated at national scale
- Portable on all DIAS-es or operated locally
- User-friendly & API interfaces
- Dockerization for main components

Markers and products assessed through selected use cases but available for many other applications

S2 reflectance and VIs

S2 biophysical indicators

S1 amplitude

S1 coherence

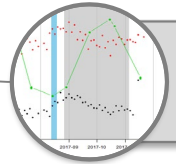
Markers DB

Subsidy applications

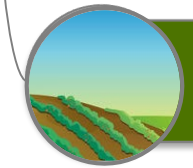
API interface

Crop type map

Grassland mowing product



Agri. Practices monitoring product



New schemes

Sen4CAP is free and open source
Based on open source existing software

Under GNU-GPL License

Based on **Orfeo ToolBox** framework

Cluster-ready architecture for distributed processing

Integration of **SNAP** tools and processing chains

Operational system required : **CentOS7** (GNU/LINUX)

PostgreSQL and **PostGIS** implementation

Sen4CAP system : simple parametrization and subsidy application upload

Before the monitoring period | Monitoring period

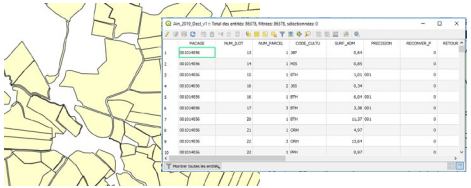
System initialization

Start of the season → End of the season...

Sen4CAP system : main parameters settings

Area of Interest	Shapefile to be uploaded
Monitoring period	Start and end dates to be defined
S1+S2 / S1+S2+L8	L8 to be selected

Subsidy application

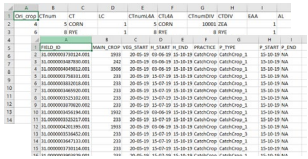


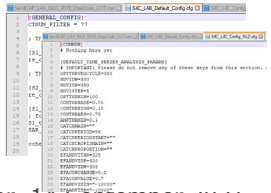
Upload data

Sen4CAP system : data from PA

Subsidy application (shp)	Subsidy application layer (shapefile)
Tables and config files (csv)	L4A crop code LUT L4B config file L4C config file + agri practices tables

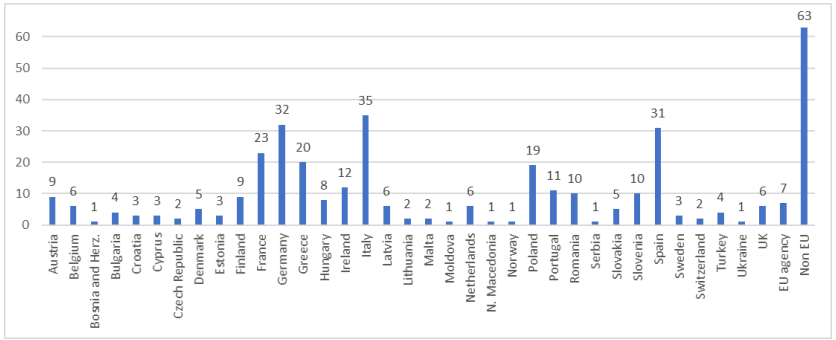
Tables and config files

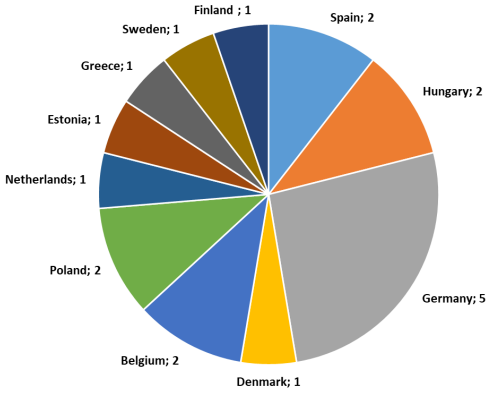




User community & Support

370 downloads since November 2019

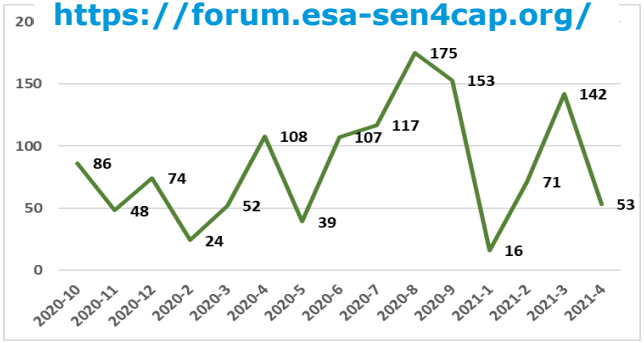




20+ Paying Agencies accessing **test Virtual Machines** on CREODIAS

Online forum

492 posts – 100 users



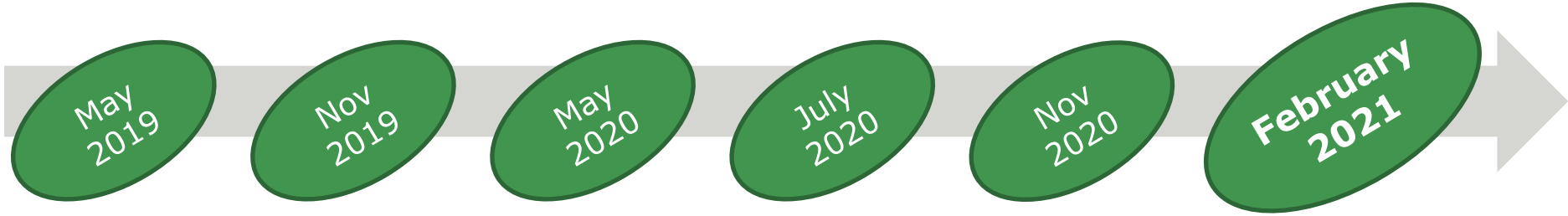
Webinars and Q&A sessions
Hands-on & online trainings
All ressources online

http://esa-sen4cap.org/content/presentations

Webinar outline

- Sen4CAP overview
- **Sen4CAP evolution**
    - Planning for version 3.0
    - Sen4CAP activities continuation in the AVL framework
- NIVA project building on top of Sen4CAP (IGN France)
- Planet Fusion for Checks by Monitoring (Planet)
- Next events

Version 2.0 released on the 8th February 2021



BETA version

Only available for the PAs

Version 1.0 release candidate

Open-source

Possibility for the PAs to access a test machine with the system

Version 1.1

1st consolidated version

Big evolutions:
- Corrections in the advanced processors
- Sen2Cor L2A compatible
- Move of the system database to a docker container
- …

Version 1.2

Mainly corrections, adaptations and improvements based on project and user's experience

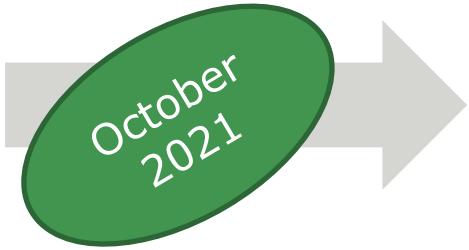
Version 1.3

Mainly corrections, adaptations and improvements based on project and user's experience

Version 2.0

Big evolutions:
- Markers database
- Tillage processor
- Dockerization
- …

Version 3.0 planned for October 2021



Version 3.0

Big evolution:
- new web interface
- more comprehensive markers DB

- Added
  - **New web interface**
    - Fully implemented in HTML5 and JavaScript (no server-side rendering)
    - Visualization of parcels and markers in the web interface
    - Improved raster visualization in the web interface
    - Web interface configurator
  - **More comprehensive markers DB -** users will have the option to extract also:
    - The reflectance markers for the S2 bands; the bands for which the markers are extracted will be configurable (none by default)
    - The number of valid pixels that were used for computing the mean and stdev for each parcel, for each acquisition
  - **Secured Sen4CAP services** via HTTPS and authentication tokens usage

Continuation of Sen4CAP activities within the ESA « Agricultural Virtual Laboratory »

- Continuing Sen4CAP activities funded by ESA:
    1) User Support: website, forum, Q&A sessions when needed, training, webinars

Continuation of Sen4CAP activities within the ESA « Agricultural Virtual Laboratory »

- Continuing Sen4CAP activities funded by ESA:
  1) User Support: website, forum, Q&A sessions when needed, training, webinars
  2) System evolution:
     a) System maintenance and evolution

- Possibility to compute M1-M5 markers independently from the L4C processor
- Simplification of the L4C input tables
- Add more data sources
- Crop classification possible without a declared crop type
- System maintenance operation visible in the web interface
- Maintenance & bug corrections
- Sen4CAP Services REST API documentation
- To be continued

Continuation of Sen4CAP activities within the ESA « Agricultural Virtual Laboratory »

- Continuing Sen4CAP activities funded by ESA:
  1) User Support: website, forum, Q&A sessions when needed, training, webinars
  2) System evolution:
     a) System maintenance and evolution
     b) Markers database evolution

- Modification of existing markers and/or addition of new markers based on users' feedback
- Markers evolution towards the new CAP regulation (from checks/compliancy to performance)
  - Call for new use cases in Oct-Nov 2021
    - Supporting the transition towards performance regulations
    - Sharing in situ data to perform R&D
    - Active participation of Paying Agency in assessment
    - R&D and implementation feasible in 6 months
    - Of interest for more than one region / country
  - 3-5 use cases selected by consortium and ESA
  - Benchmarking by consortium with shared in situ data
  - Assessment by consortium + Paying Agency
  - Implementation and documentation in Sen4CAP

Continuation of Sen4CAP activities within the ESA « Agricultural Virtual Laboratory »

- Continuing Sen4CAP activities funded by ESA:
  1) User Support: website, forum, Q&A sessions when needed, training, webinars
  2) System evolution:
     a) System maintenance and evolution
     b) Markers database evolution
     c) Sen4CAP integration in ESA Agricultural Virtual Lab

  - Sen4CAP as a standalone toolbox but also as an AVL service

Webinar outline

- Sen4CAP overview
- Sen4CAP evolution
    - Planning for version 3.0
    - Sen4CAP activities continuation in the AVL framework
- **NIVA project building on top of Sen4CAP (IGN France)**
- Planet Fusion for Checks by Monitoring (Planet)
- Next events

NIVA project building on top of Sen4CAP

Sen4CAP webinar – 14/09/2021

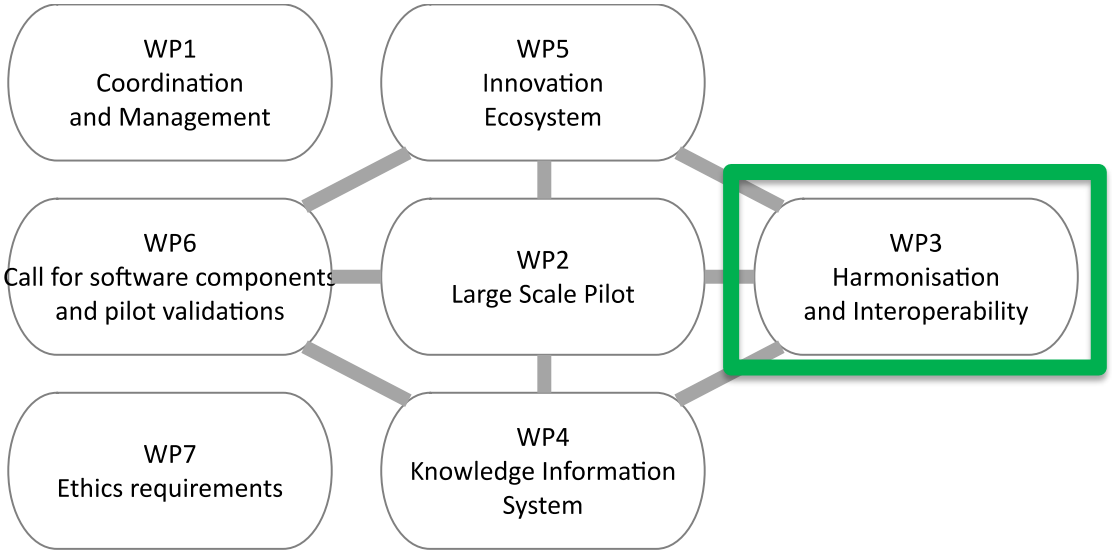
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009

The NIVA project

- NIVA: New IACS Vision in Action
- H2020 project
- Objectives:
  - –To develop e-tools to modernise the CAP
  - –To broader reuse of IACS data
- Consortium
  - 9 Paying Agencies
  - technical partners

  } 27 partners
- 3 years project (June 2019 to May 2022)

The NIVA project



(Main) source of today presentation

Data model
Base types for EO monitoring

What is it?

- A conceptual data model in UML (Unified Modeling Language)

- An attempt to provide a structured way to describe EO monitoring processes
  - Present steps and the possible options to be considered
  - No recommendation about a specific method to be chosen

- Model is limited to « Base types »
  - It is not about modelling whole AMS

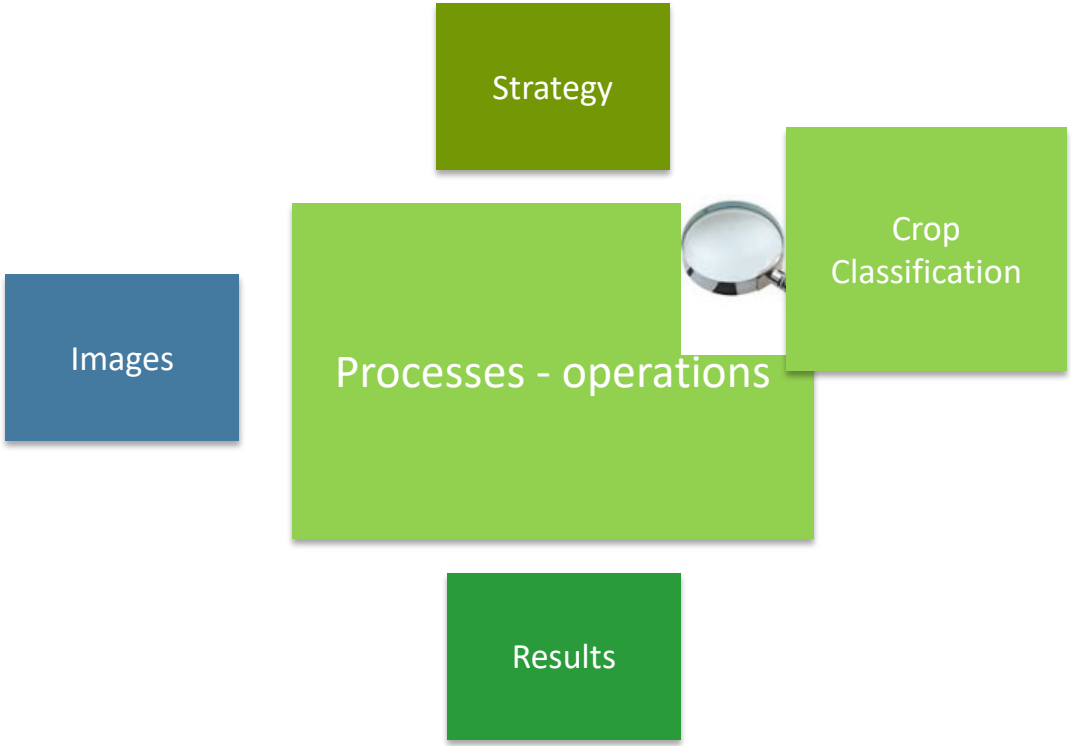
What are the sources?

- Experiences on EO monitoring
  - **Sen4CAP**
  - National experimentations (IGN)
  - Various presentations on EO monitoring

- Structuration and modeling work
  - **In the NIVA context**

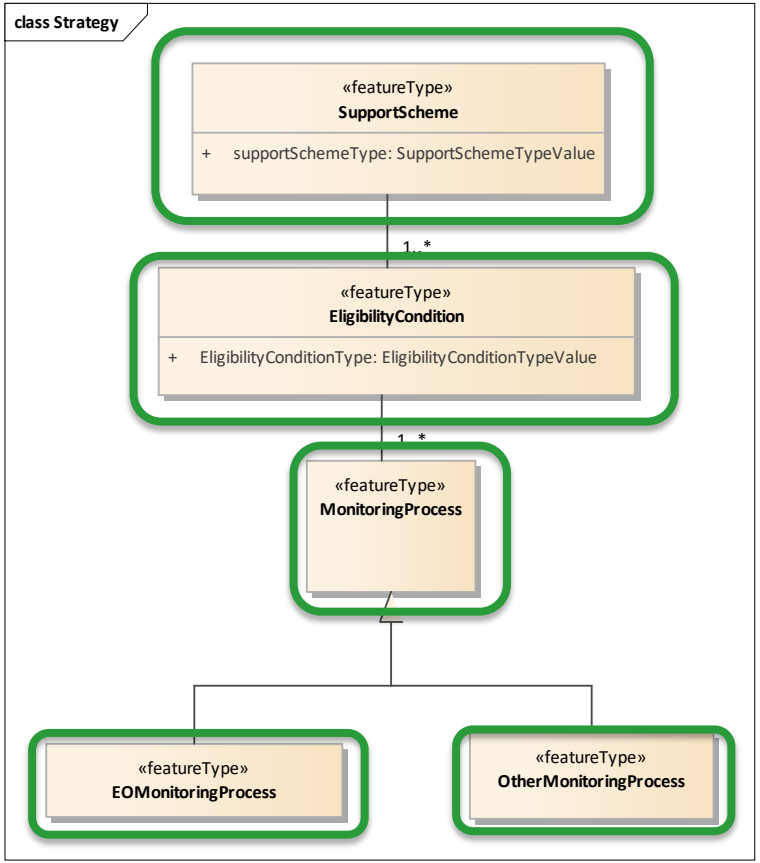
How does the model look like?

- The model is composed of 5 packages



How does the model looks like?

Extracts



To get payment according to a support scheme

One or several eligibility conditions have to be respected

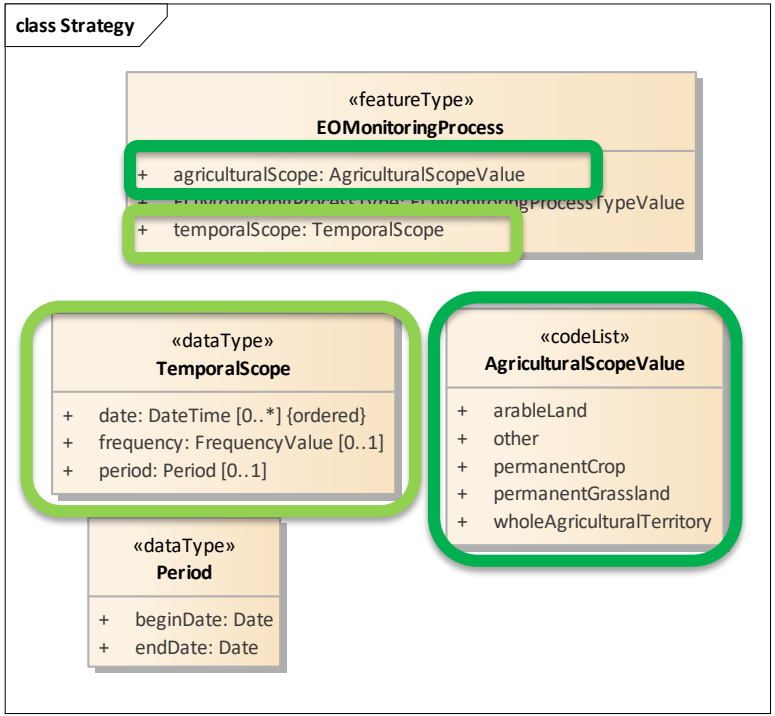
This respect has to be checked through a monitoring process

that may be based on EO process

or on something else

How does the model looks like?

Extracts

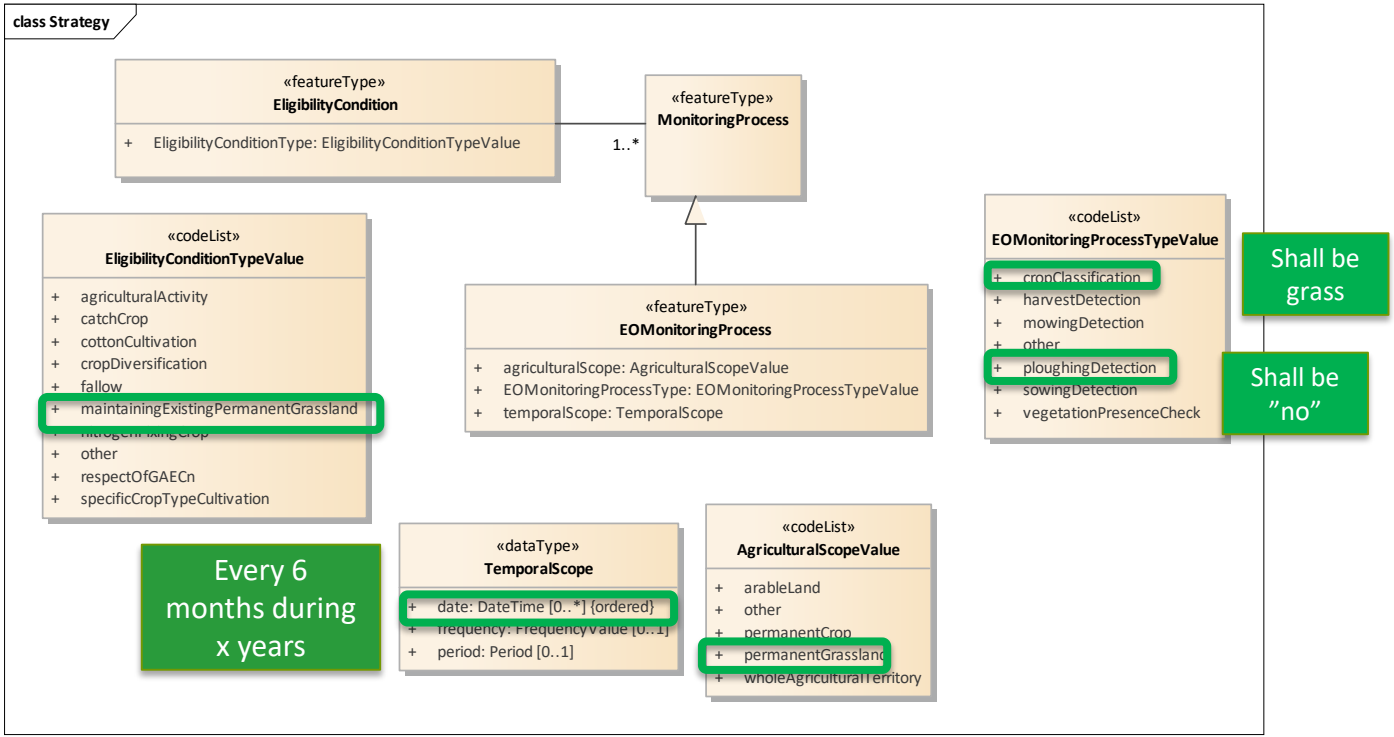


It is also useful to define where (in general) this process should occur

and when (or how often)

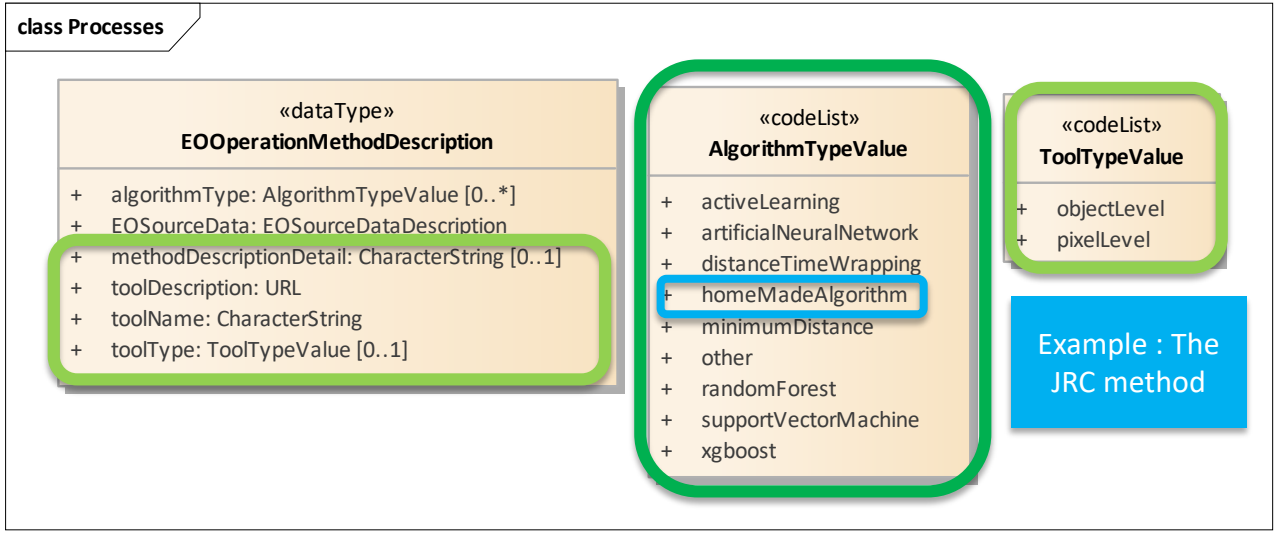
How does the model looks like?

Extracts



How does the model looks like?

Extracts



A key information is the algorithm used in the EO monitoring operation.

More detailed information about the method and the tool is also useful.

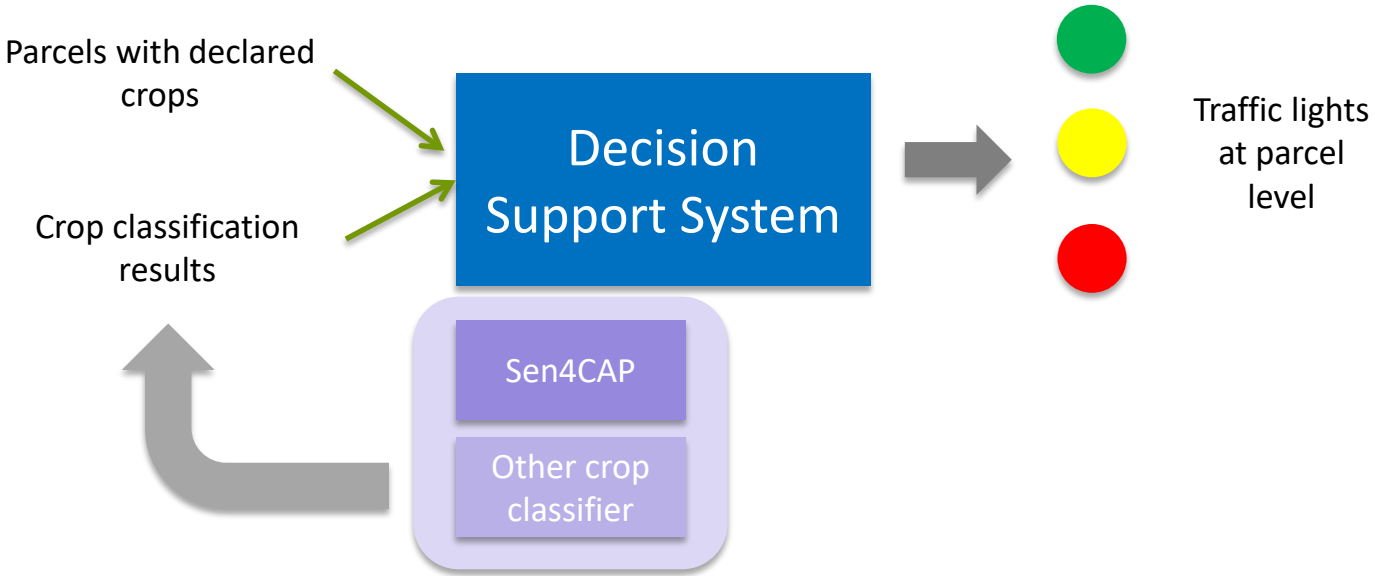
Code list is not exhaustive. Help welcome

What are the benefits of this model?

- Internal benefit for NIVA
  - Use Case (UC1a) about EO monitoring & traffic lights
  - Initial plan was to develop a crop classifier
  - But we discovered in November 2019 that it was already done by Sen4CAP
  - First version of the UML model was designed to help the UC1a team to redesign their plans
    - Avoid duplication of efforts
    - Build something missing or adding value

What are the benefits of this model?

- What NIVA has done to complement Sen4CAP
  - **Decision Support System**



  - **Advanced EO tool**
    - Specific issues (fallow, Mediterranean grasslands, small parcels …)

What may be the benefits of this model?

- Contribution to capacity building (PA)
  - Be aware of the various steps and options
- Starting point to document the EO monitoring process
- Contribution to benchmark studies
  - Make clear what is common and what is different between several methods

Where to find this model?

- First official version available on NIVA website
  - https://www.niva4cap.eu/deliverables/
  - Document D3.2 Common semantic model M12

- Current non-official version:
  - Send me an e-mail to get it (dominique.laurent@ign.fr)
  - Comments also welcome (work in progress)

- Final official version will be available on NIVA web site by end of the project (May or November 2022)
  - https://www.niva4cap.eu/deliverables/
  - Document D3.2 Common semantic model M36 (or M42)

Access to EO data

Context

- EO monitoring requires to deal with satellite images (mainly Sentinel)
  - Freely available in theory
  - But whose access and preprocess raise lots of issues in practice

- Lots of discussions within NIVA (and between NIVA and Sen4CAP)
  - Complex issue that no one was fully understanding

- => Something had to be done to improve the situation and get better common understanding

Context

- Deliverable about standardised connections between IACS and other applications (D3.5)
  - Decision to focus on 2 main topics
    - **Access to EO data**
    - Exchanges between IACS and FMIS
  - Content about EO data
    - Basic knowledge about satellite images and pre-processes
    - Capitalisation of experiences
      - by NIVA project
      - by NIVA partners (at national level)
      - other (conferences …)

Basic knowledge

- Satellite images main characteristics
  - Optical (Sentinel-2, Landsat-8, HHR)
  - Radar (Sentinel-1)
- Preprocesses, different levels of products, temporal series
  - Optical
  - Radar

Make S-1 data less mysterious

Basic knowledge

- Access to EO data
  - Explain the issue:
    - Access through ESA Hub not so easy
    - Need for storage and computation power (big volume of data)
  - Provide an overview of possible solutions
    - Alternative ways to get Sentinel images
    - Possible infrastructures (DIAS, other clouds, in-house …)

Feed-back from experiences

- Example 1: **DIAS assessment** (e-GEOS)

	CREODIAS	Mundi	ONDA	Sobloo	WEKEO
Sentinel 2	L1C: full archive L2A: Orderable (also non-ESA) rolling cache 1PetaByte	L1C: last 12 months L2A: last 48 months (only Europe data)	L1C: full ESA archive L2A: full ESA archive	L1C, L2A: orderable, available last 9 months	L1C: full metadata, orderable
Sentinel 1	SLC: full archive in EU, 6 month worldwide, GRD: full archive		Full archive for SLC and GRD. Part of the archive are on cold storage (delayed retrieval available)	SLC, GRD: orderable, available last 9 months	GRD, SLC: full metadata orderable
Landsat 5/7/8	Landsat 5/7/8 full archive over Europe	Landsat 7/8 orderable	Available since 04/2018 (for Europe)	Landsat 8 On-demand	-
Missing/other data retrieval	Ordering/Caching mechanism available	Missing L2A can be retrieved from ESA or processed if not available	Missing data can be Retrieved and hosted in native format. Available VHR commercial data (orderable)	Spot sample data available/orderable	Many datasets from Climate/Meteorology

Choice of CREODIAS (compatibility with Sen4CAP among main selection criteria)

Feed-back from experiences

- Example 2: **installing Sen4CAP**
  - Experience by OPEKEPE (Greece)
    - To get the crop classification results necessary for the NIVA Decision Support System
    - First test with CREODIAS virtual machine
    - Second test with local installation

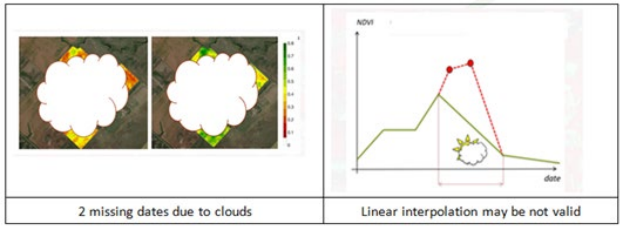
    Some struggle but it worked
    Support from Sen4CAP team very appreciated
  - Experience by ASP (France)
    - To get NDVI temporal series (for NIVA environmental indicators)
    - Too complex => alternative solution was preferred

Feed-back from experiences

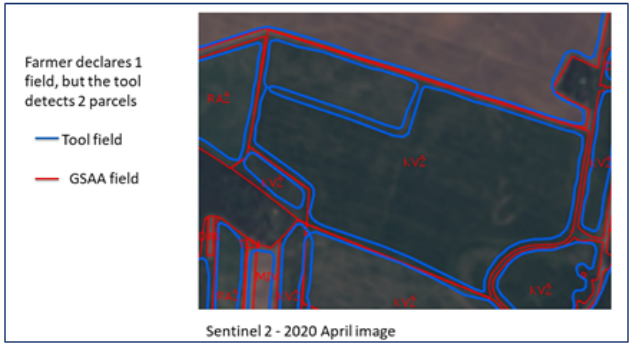
- Example 3: developing Open EO API
  - The Open EO API standard specifies how to:
    - discover which Earth observation data and processes are available at cloud back-ends
    - build processing graphs (list of jobs)
    - consume such services (run the predefined processing graphs)
  - Some **Open EO based micro-services developed by NIVA** on top of Sen4CAP
    - PA installs Sen4CAP
    - The Open EO avoids data file transfer and enables system-to-system data exchange

Feed-back from experiences

- Example 4: quality
  - Temporal series (cloud issues)
    - Document the gaps (NIVA – Copernicus phenology services)
    - Use markers from S2 and from S1 (Sen4CAP)
    - Fill S2 temporal series with S1 (research in IGN)
  - From pixels to parcels
    - Boundary pixels
    - Minimum number of pixels
    - Parcel heterogeneity



2 missing dates due to clouds | Linear interpolation may be not valid



Sentinel 2 - 2020 April image

Where to find this document?

- Should be available soon on NIVA website
  - https://www.niva4cap.eu/deliverables/
  - Document D3.5 Recommendations for standardised connections between IACS and other applications

- Target readers
  - General chapters (basic knowledge + general recommendations): everyone
  - Feed-back from experiences: more expert or more motivated readers!

NIVA
NEW IACS VISION IN ACTION

Thank you for your attention!

This project has received funding from the european union's horizon 2020 research and innovation programme under grant agreement no. 842009

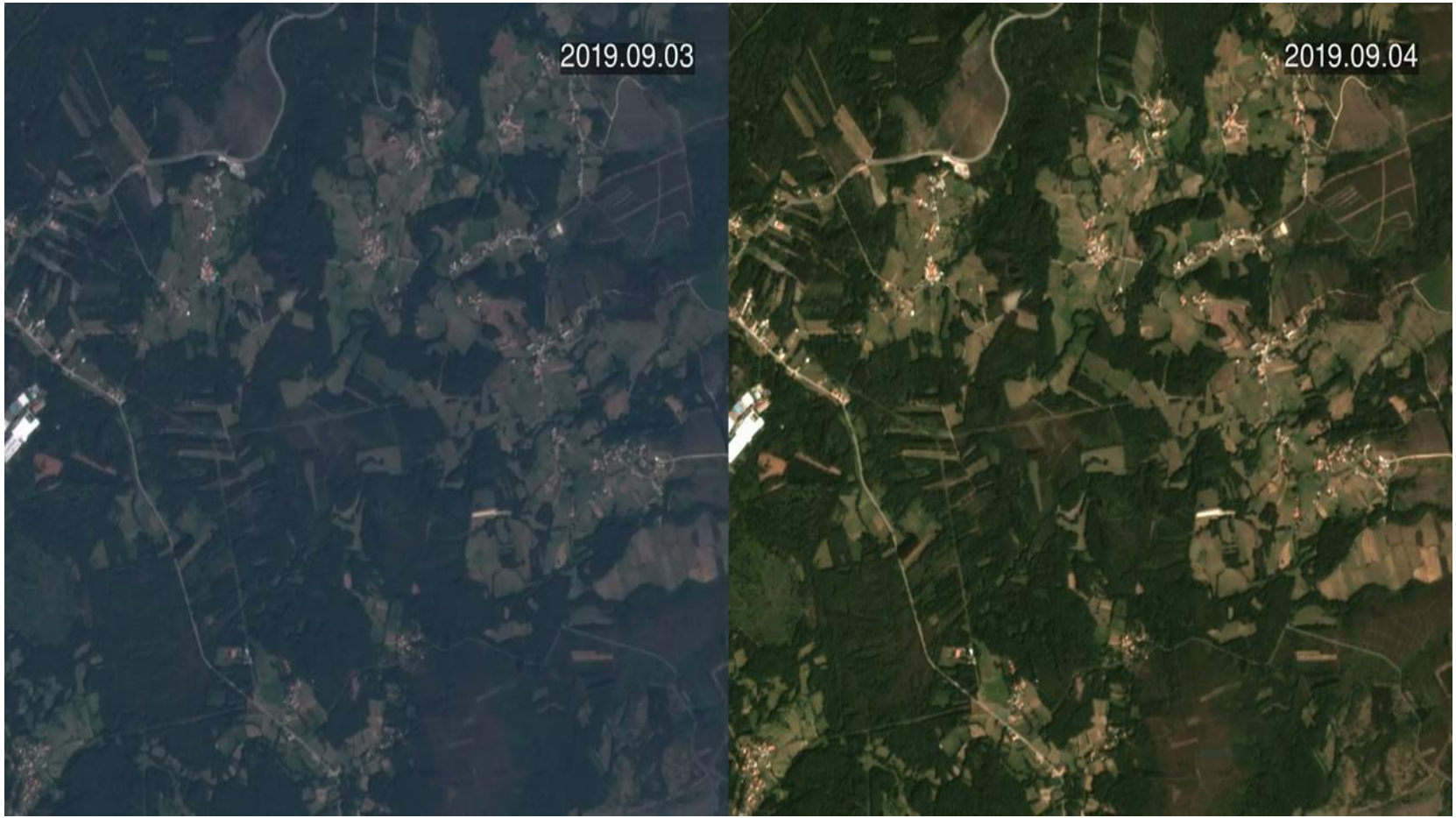
Webinar outline

- Sen4CAP overview
- Sen4CAP evolution
    - Planning for version 3.0
    - Sen4CAP activities continuation in the AVL framework
- NIVA project building on top of Sen4CAP (IGN France)
- **Planet Fusion for Checks by Monitoring (Planet)**
- Next events

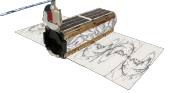
FUSION

PlanetScope Harmonised to Sentinel 2

For Checks by Monitoring (CbM)

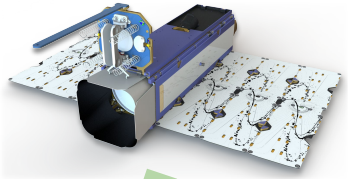


Galicia, Spain



FUSION

PlanetScope Harmonised to Sentinel 2

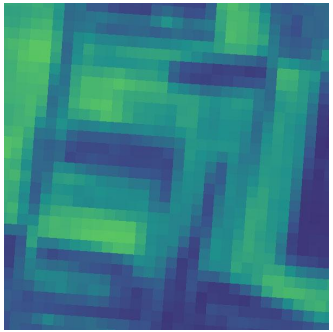


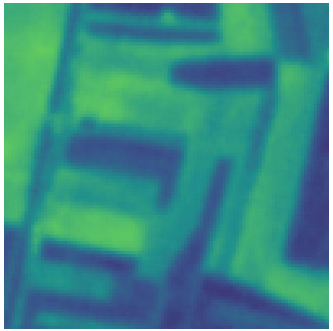
The Best of Both Worlds

- ➔ Sentinel-2 - Golden Standard data quality
- ➔ PlanetScope - High spatial and temporal resolution

Harmonisation Process

- ➔ Application of CESTEM machine learning process
- ➔ Radiometric and Geometric Adjustments
- ➔ Atmospheric Corrections and Cloud/Gap Removal





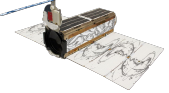
Sentinel-2 | **Planet Fusion**

Spatial Resolution	10m	3m
Revisit Time	3-4 days	Daily

ELSEVIER

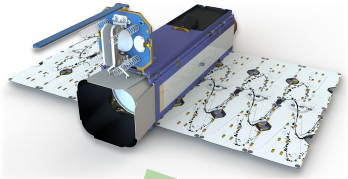
A Cubesat enabled Spatio-Temporal Enhancement Method (CESTEM) utilizing Planet, Landsat and MODIS data

Rasmus Houborg[a,*], Matthew F. McCabe[b]



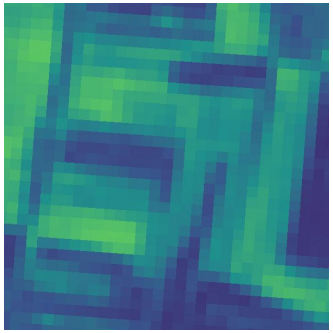
FUSION

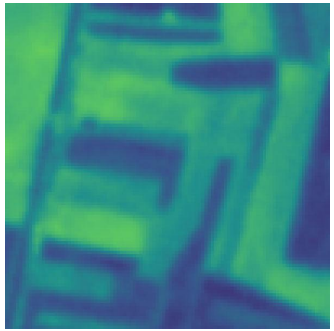
PlanetScope Harmonised to Sentinel 2



Key Specifications

- ➔ Radiometrically Sentinel-2 comparable
- ➔ Analysis Ready Data (ARD)
- ➔ Cloud & Gap Free
- ➔ 3 meter spatial resolution
- ➔ Daily coverage of all EU Member States





	Sentinel-2	Planet Fusion
Spatial Resolution	10m	3m
Revisit Time	3-4 days	Daily

ELSEVIER

A Cubesat enabled Spatio-Temporal Enhancement Method (CESTEM) utilizing Planet, Landsat and MODIS data

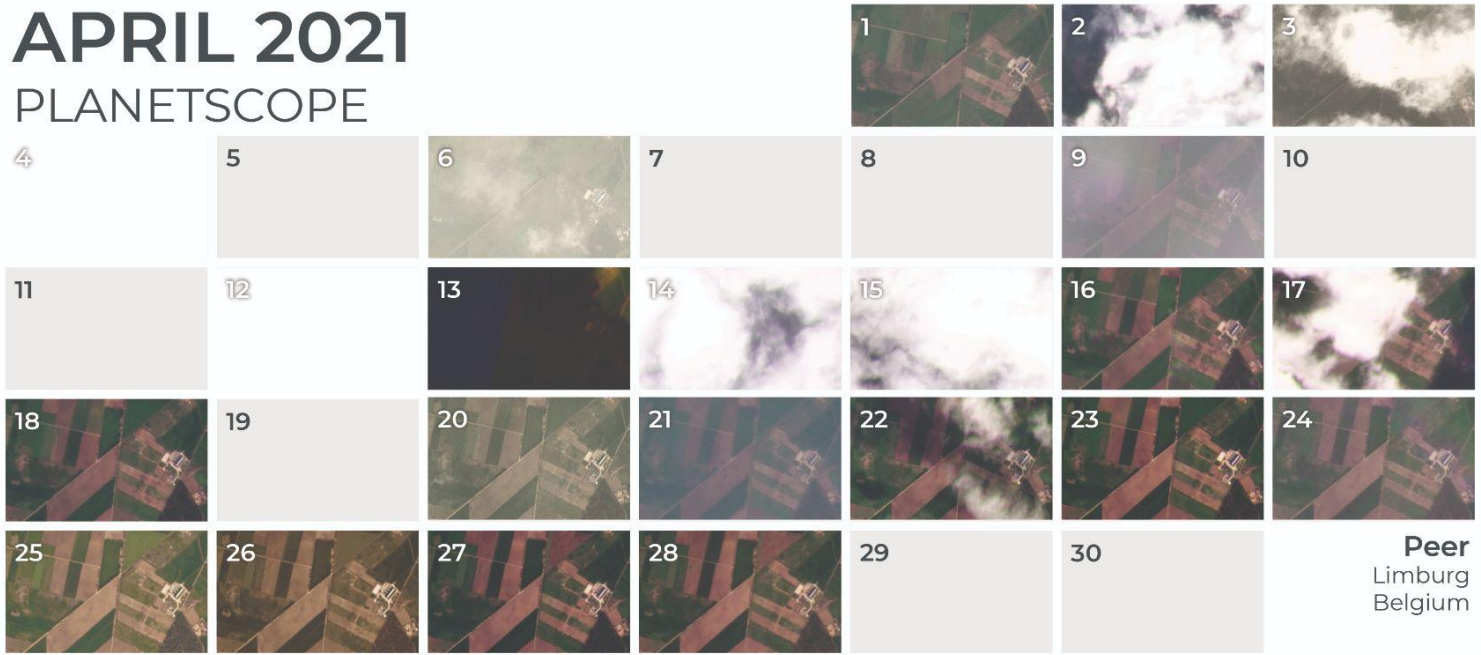
Rasmus Houborg[a,*], Matthew F. McCabe[b]

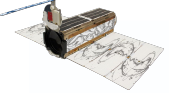
Everyday - Everywhere

Daily Cloud and Gap Free

Everyday - Everywhere

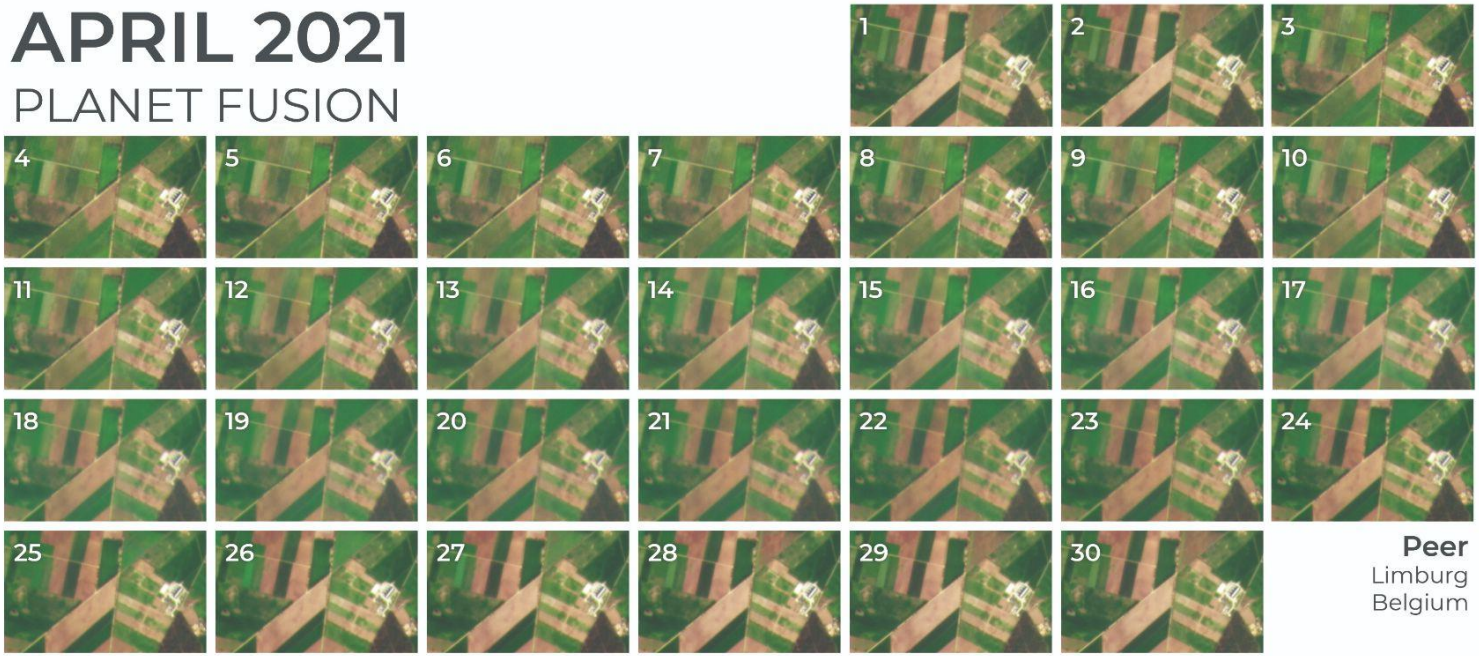
Daily Cloud and Gap Free





Everyday - Everywhere

Daily Cloud and Gap Free

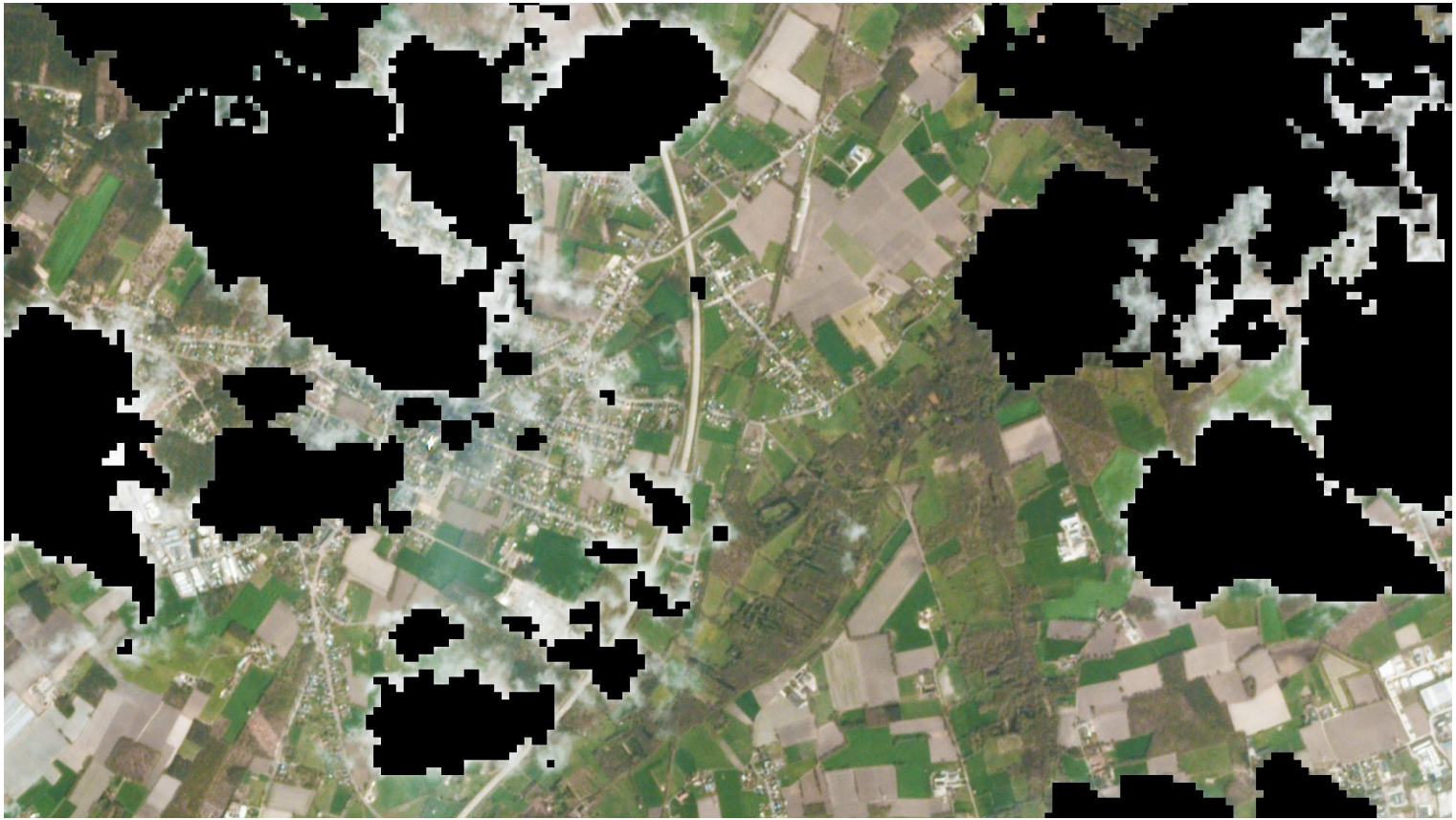


Cloud Removal

Step 1: Identify clouds and cloud shadows

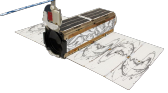
Cloud Removal

Step 2: Apply cloud mask



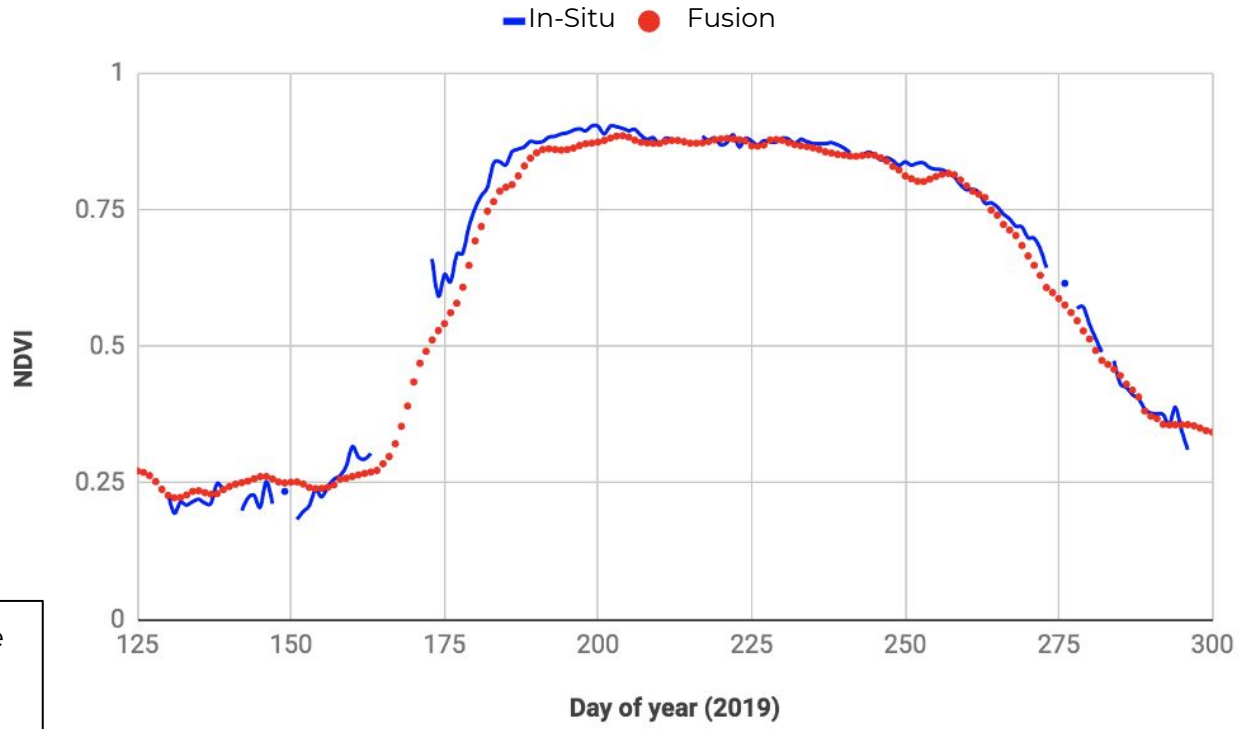
Cloud Removal

Step 3: Apply predicted values based on most recent observations



In-Situ Validation

Comparison against Arable Mark Spectrometers



Arable Mark Spetrometers are located in the field to collect ground truth on plant phenology

PlanetScope Fusion for Inconclusive Parcels

Early Results for Checks by Monitoring (CbM)

Small Parcels in Austria

Austria has 906.611 small parcels (112.452 ha) that cannot be satisfactorily processed by using Sentinel-2.

Small parcels are (JRC definition) too small to fit 8 Sentinel-2 pixel centres inside with inner 5m buffer and less than 60% pixel loss.

Fusion Pilot on 29.323 representative small parcels with ground truth from year 2020.

AgrarMarkt Austria

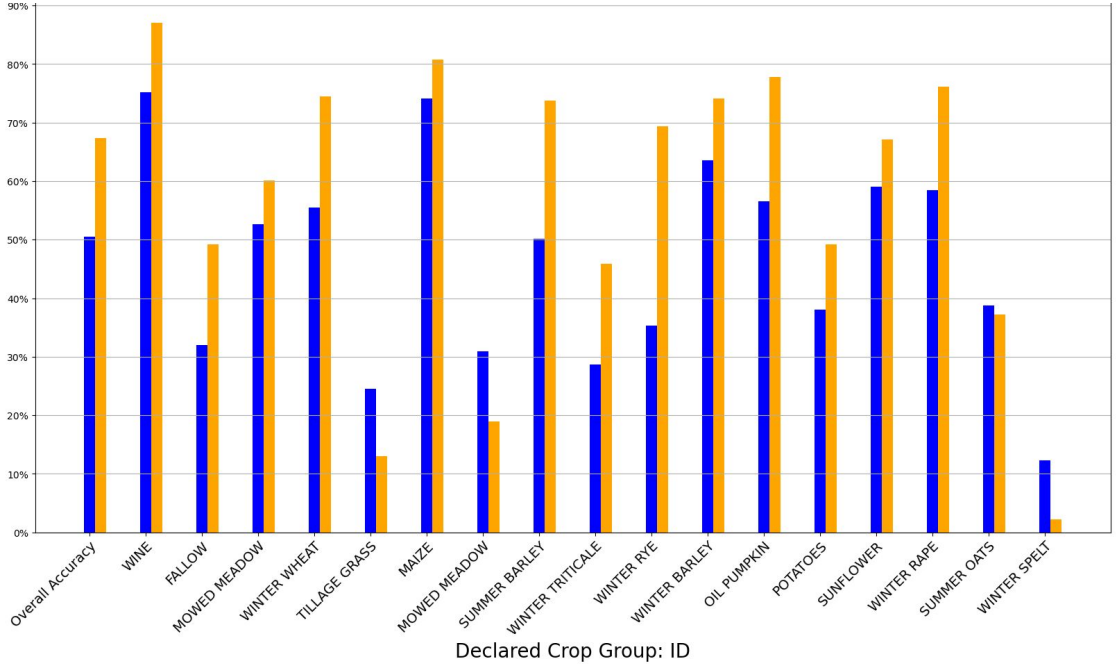
EO WIDGET

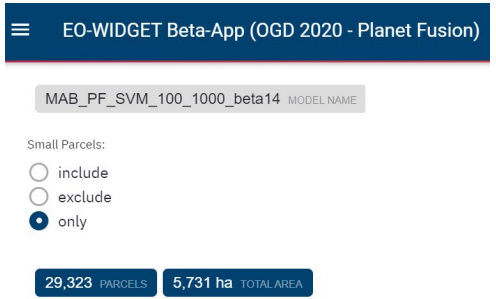
EOX

Small Parcels in Austria

Applying a crop classification marker

Accuracy & F1-Scores by Crop type - small parcels only





Achieved Crop type prediction quality for Small Parcels with Planet Fusion data enables automated processing within Checks by Monitoring (CbM)

Sentinel 1 + 2

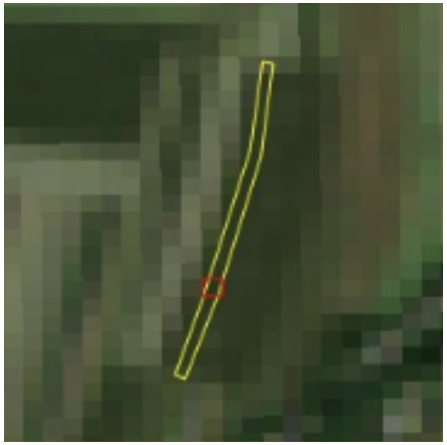
Planet Fusion

Narrow Parcels in Slovenia

Automated Part of Checks by Monitoring (CbM)

Slovenia has 191.324 small and narrow parcels that cannot be processed by Sentinel-2.

By using PlanetScope Fusion ARKTRP was able to process these claims to the Basic Payment Scheme (BPS) under the automated part of Checks by Monitoring (CbM)



Narrow parcel example

Mid Season(2021) Results

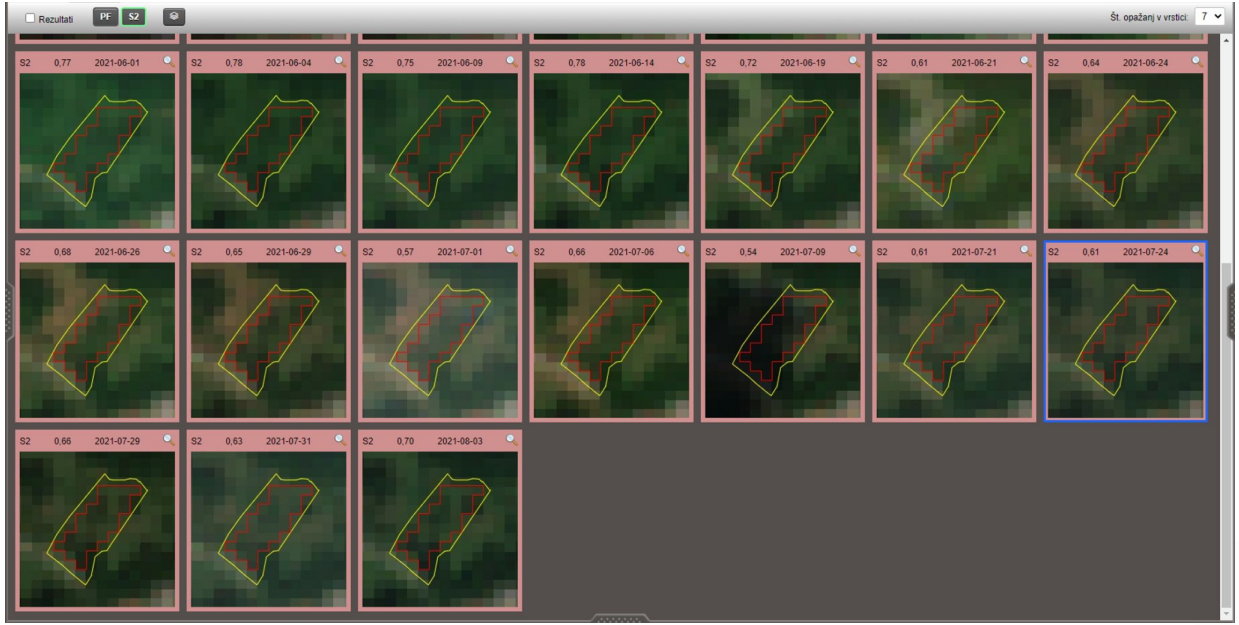
	No claim	Greenhouses	Vineyards	Hops	Extensive orchards	Arable land	Grassland	Olive trees	Orchards	Stock nurseries	Strawberry fields	TOTAL
Green	408	597	6,332	12	4,229	61,561	90,191	734	909	2	117	165,092
Yellow	0	273	1,898	8	2,380	5,652	15,447	220	283	4	67	26,232
TOTAL	408	870	8,230	20	6,609	67,213	105,638	954	1,192	6	184	191,324

ARSKTRP SINERGISE

Narrow Parcels in Slovenia

Expert Judgement part of Checks by Monitoring (CbM)

Sentinel-2 Time Series - Not able to identify mowing

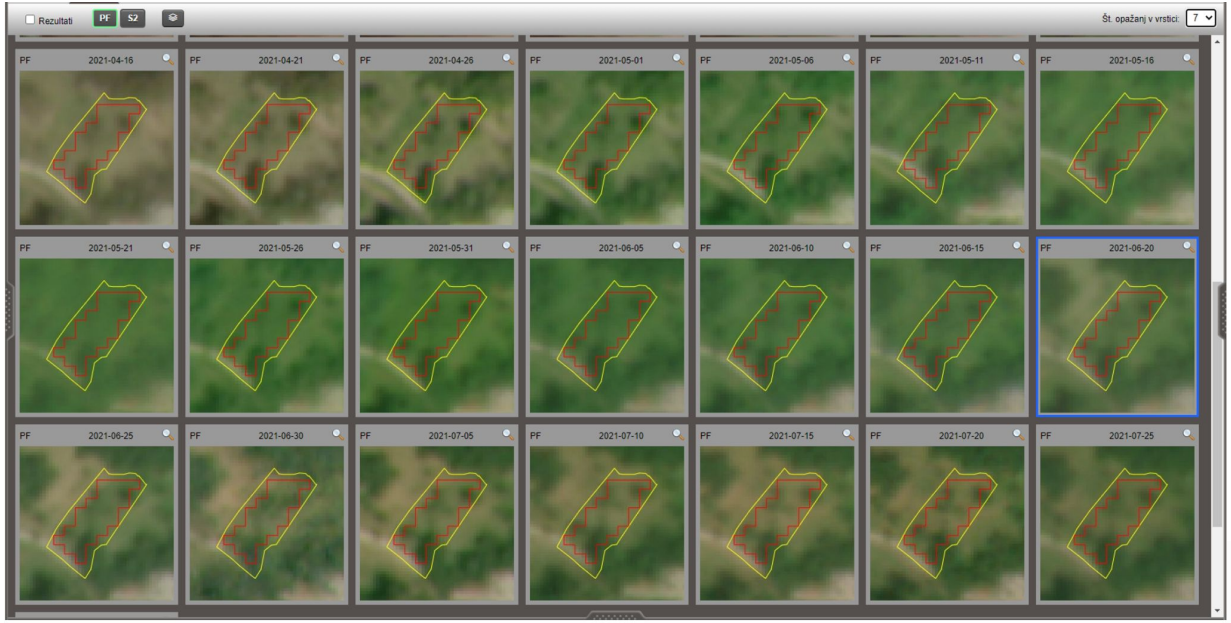


Orchard Example

Narrow Parcels in Slovenia

Expert Judgement part of Checks by Monitoring (CbM)

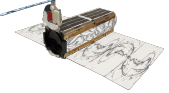
Planet Fusion Time Series - Mowing Identified



Orchard Example

ARSKTRP

SINERGISE



THANK YOU FOR LISTENING

Want to learn more?
tor@planet.com

Webinar outline

- Sen4CAP overview
- Sen4CAP evolution
    - Planning for version 3.0
    - Sen4CAP activities continuation in the AVL framework
- NIVA project building on top of Sen4CAP (IGN France)
- Planet Fusion for Checks by Monitoring (Planet)
- **Next events**

Next events

- **System 3.0** released in October 2021 (you will be informed by email)
- Next **webinar** on **2 November 2021**
- **Your suggestions ???**


Thank you for your attention
and your contribution
sen4cap
common agricultural policy