Welcome to the 13th 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 & Maxime Troiani from UCLouvain
Cosmin Udriou & Laurentiu Nicola from CS Romania

Members of the consortium available to answer your questions
Webinar outline

• Sen4CAP overview

• New use cases and processors
  o Parcels heterogeneity
  o Bare soil detection
  o Change of land category

• System evolution
  o New version 4.0

• Conclusions and next steps
Webinar outline

• **Sen4CAP overview**
• **New use cases and processors**
  o Parcels heterogeneity
  o Bare soil detection
  o Change of land category
• **System evolution**
  o New version 4.0
• **Conclusions and next steps**
Sen4CAP system

Guidance by DG-Agri, JRC, DG-Grow.

User group: 6+1 Paying Agencies

Funded by European Space Agency

EO Experts

User group:

EO Experts

Funded by European Space Agency

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User group:

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From an ESA project ...
…to an open source systemuptaken by the CAP community
Markers and products assessed through selected use cases but available for many other applications

Markers DB

- S2 reflectance and VIs
- S2 biophysical indicators
- S1 amplitude
- S1 coherence

Crop type map

Grassland mowing product

Agri. Practices monitoring product

Subsidy applications

New schemes

API interface

Markers DB
Sen4CAP
Open-source system

- 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

Version 4.0 delivered today

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Webinar outline

• Sen4CAP overview
• **New use cases and processors**
  o Parcels heterogeneity
  o Bare soil detection
  o Change of land category
• System evolution
  o New version 4.0
• Conclusions and next steps
**New uses cases**

**Sub-parcel heterogeneity**
*marker(s)*

**Bare soil markers**

**Change of cover**
from year to year

- Permanent Grassland
- Arable Land
- Permanent Crop

**New Optical & SAR variables**
- all year round

**Per pixel analysis**

**Markers DB**

*Image credit: MILENOV Pavel et al., 2021, JRC*
R&D with 7 pilot countries (8 Paying Agencies), sharing calibration and validation data

- 1 or 2 S2 tiles
- 1 or 2 years (2020-2021)
- All Sentinel-1 and Sentinel-2 preprocessed
Heterogeneity Workflow

Input data preparation – period p

- L2A – 10m B,C,D
- L3B – 10m NDVI

Input data preparation

- Lpis imported (.tif)

Clustering (MiniBatchKmeans)

Remove isolated pixel

Raster of Clusters

Raster of Connectivity

Period S1 result

Spatial smoothing

- Number & size of clusters?
- Difference of NDVI between clusters?
- Are the clusters compact?
Heterogeneity Workflow

Input data preparation – period p
- L2A – 10m
- L2B – 10m
- B2, B3, B4, B8
- NDVI

Input data preparation – period p
- Lpis imported (.tif)

Clustering (MiniBatchKmeans) → Remove isolated pixel → Raster of Clusters

Extraction and markers at parcel level

Decision results

Period P S1 result

Period P S2 result

Parcel-level analysis
## Heterogeneity – Markers S2 & S1

<table>
<thead>
<tr>
<th>Marker</th>
<th>Description</th>
<th>Possible Value at each period P</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>More than one big cluster (&gt;(\text{PerHetero}) % of the parcel) with S2</td>
<td>1 / 0 / NA</td>
</tr>
<tr>
<td>M2</td>
<td>At least 2 clusters with more than (\text{NPixClS2}) &amp; M1 =1</td>
<td>1 / 0 / NA</td>
</tr>
<tr>
<td>M3</td>
<td>DistNDVI &gt; (\text{ThrdNDVIdist})</td>
<td>1 / 0 / NA</td>
</tr>
<tr>
<td>M4</td>
<td>Compact S2 &gt; (\text{ThrdCompactS2})</td>
<td>1 / 0 / NA</td>
</tr>
</tbody>
</table>

### S2 Markers

Parameters:
- \(\text{PerHetero}\) = Percentage of the biggest cluster in the parcel (default = 90%)
- \(\text{NPixClS2}\) = Number of S2 pixel needed to determine if a cluster can be big enough (default = 20)
- \(\text{NPixClS1}\) = Number of S1 pixel needed to determine if a cluster can be big enough
- \(\text{ThrdNDVIdist}\) = difference of NDVI needed for heterogeneity
- \(\text{ThrdCompactS2}\) = Threshold of compactness (varies according to the radius \(C\) - see connectivity raster)

(Saxony – radius = 3, thrdcompacts2 = 3 VS Greece – radius = 2, thrdcompacts2 = 1.7)
**Heterogeneity – decision period**

- **Period P**
  - Raster of Clusters
  - Raster of Connectivity
  - Extraction + markers
  - Period P S2 result

- **Period PM**
  - decision results

- **Period PM**
  - decision results

- **Period PM**
  - decision results

Resampled Sentinel2 images – 10 days
Resampled Sentinel1 images – 7 days

P = 30 days (min of 20/21 days)
PM = 3 * P

13rd Sen4CAP Webinar, 9 April 2024
Heterogeneity – C_INDEX decision

**STRONG**: All (3) periods with all markers = 1

**MODERATE**: At least 1 period with all markers = 1

**WEAK**: One marker missing each period

**POOR**: Half of the markers = 1

P_Hete_L = Last confirmed period with best detection

<table>
<thead>
<tr>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>P4</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>P5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

\[ P_{Hete\_L} = 1 & C\_INDEX = \text{MODERATE} \]

\[ P_{Hete\_L} = 2 & C\_INDEX = \text{STRONG} \]

\[ P_{Hete\_L} = 2 & C\_INDEX = \text{STRONG} \]

S1 as support for S2 detection & when not available
Heterogeneity – C_INDEX decision

**STRONG**: All periods with all markers = 1

**MODERATE**: At least 1 period with all markers = 1

**WEAK**: One marker missing each period

**POOR**: Half of the markers = 1

Saxony Results: 27,5% with a detection

→ POOR: 71%
→ WEAK: 27%
→ MODERATE: 1%
→ STRONG: 1%

Greece Results: 8,5% with a detection

→ POOR: 68,5%
→ WEAK: 29,5%
→ MODERATE: 1%
→ STRONG: 1%
Heterogeneity – Example in Greece

Last confirmed detection – p6
Detection – p7
Detection – p8
No Compacity – p9

STRONG detection with S2

Id = 626

NDVI

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Heterogeneity – Example in Greece

Last confirmed detection – p6
Detection – p7
Detection – p8
No Compacity – p9

S2

S1

STRONG detection

Id = 626
Bare Soil: Classification

Input data preparation
- S2 time series
- L2A bands, L3B and variables (MBD1)

Bare Soil Classification

Random Forest model
- (S2)

BS detection
- S2 results

Input data preparation
- S2 time series
- L2A bands, L3B and variables (MBD1)

Bare Soil Classification

Random Forest model
- (S2)

BS detection
- S2 results

BS detection
- S2 results

BS detection
- S2 results

BS detection
- S2 results
For each parcels and at each date during the period of training

→ **Looks if NDVI, NDTI, BSI, NDMI < BS_threshold**

  ✓ The date and parcel goes to the calibration dataset as bare soil

→ **Looks if NDVI, NDTI, BSI, NDMI > NBS_threshold**

  ✓ The date and parcel goes to the calibration dataset as vegetation
**Bare Soil Classification S1 & S2**

### Input data preparation

- **S2 time series**
  - L2A bands, L3B and variables (MBD1)

- **S1 time series**
  - BCK, VV, VH, Ratio & COHE (resampled weekly – MDB L4A)

### Bare Soil Classification

- Thresholds on S2 variables (NDVI, NDTI, NDMI, BSI)
- BS calibration data S2 observations
- NBS calibration data S2 observations
- BS calibration data S1 observations
- NBS calibration data S1 observations

### Random Forest model (S2)

- BS detection S2 results

### Random Forest model (S1)

- BS detection S1 results

### Calibration dataset

- Vegetation

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Bare Soil: Complete workflow

Input data preparation

- **S2 time series**
  - L2A bands, L3B and variables (MBD1)

- **S1 time series**
  - BCK, VV, VH, Ratio & COHE (resampled weekly – MDB L4A)

Bare Soil Classification

- **Thresholds on S2 variables** (NDVI, NDTI, NDMI, BSI)
- **BS calibration data**
  - S2 observations
- **NBS calibration data**
  - S2 observations
- **BS calibration data**
  - S1 observations
- **NBS calibration data**
  - S1 observations

Random Forest model (S2)

- **BS detection**
- **S2 results**

Random Forest model (S1)

- **BS detection**
- **S1 results**

Times series analysis & markers generation

- **BS general results**
- **Time series analysis**

BS detection: BS results
Time Series Analysis & Markers

Example

Conf: Strong

Conf: Doubtful
# Time Series Analysis & Markers

<table>
<thead>
<tr>
<th>Description</th>
<th>Values possible</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M1</strong></td>
<td>First observation of BS with conf &gt; $thr_{bs}$ → <strong>Allow to set the START_BS_S2</strong></td>
</tr>
<tr>
<td><strong>M2</strong></td>
<td>Observation of BS in conf &gt; $thr_{bs}$ → +1 → 1$^{st}$ confirmation → <strong>LookEnd</strong> = True (look for the end of the BS period) → <strong>Allow to see number of strong BS in the BS period</strong></td>
</tr>
<tr>
<td><strong>M3</strong></td>
<td>Observation of BS in conf &gt; $thr_{bs}$ → +2, BS in conf &lt; $thr_{bs}$ → +1 &amp; NBS in any conf → -1 → <strong>Number of strong observation – number of noise in the BS period</strong></td>
</tr>
<tr>
<td><strong>M4</strong></td>
<td>Observation of NBS with conf &gt; $thr_{nbs}$ → <strong>Allow to set the END_BS_S2</strong></td>
</tr>
<tr>
<td><strong>M5</strong></td>
<td>Observation of NBS in conf &gt; $thr_{nbs}$ → +1 → <strong>Allow to see number of strong NBS in the Plong period (2 months) after the BS period</strong></td>
</tr>
<tr>
<td><strong>M6</strong></td>
<td>Observation of NBS in conf &gt; $thr_{nbs}$ → +2, NBS in conf &lt; $thr_{nbs}$ → +1 &amp; BS in any conf → -1 → <strong>Number of strong observation – number of noise</strong></td>
</tr>
</tbody>
</table>

**Parameters:**

- $Thr_{bs}$: Threshold of BS that indicate the minimum confidence level in the BS prediction to be consider as a strong detection.
- $Thr_{nbs}$: Threshold of NBS that indicate the minimum confidence level in the NBS prediction to be consider as a strong detection.
- $Pshort$: 1. As the maximum number of days after after the START_BS where if the END_BS is not found, the ENDS_BS is equal to the START_BS. 2. to see if there a strong detection of BS after the set of the ENDS_BS. When it happens two times, the END_BS is restarted.
- $Plong$: Long period that is used as the duration to look for vegetation (NBS) after the END_BS. It has an impact on the M5 and M6.
Confidence level in the detection

**Strong**: $M_2 \geq 3$, $M_3 \geq 2$ and $M_6 \geq 0$

**Good**: $M_2 > 0$, $M_3 \geq 0$ and $M_5 > 0$

**Medium**: $M_2 > 0$ and $M_3 \geq 0$

**Poor**: $M_2 \geq 0$ and $M_3 < 0$

**Doubtful**: only $M_1 = 1$ (only one strong BS)
Results & use of S1 as confirmation of S2

Czechia:
52,5% of the parcels with a detected bare soil (M1_S2)

<table>
<thead>
<tr>
<th>Confidence</th>
<th>S2</th>
<th>With S1 conf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doubtful</td>
<td>19.07%</td>
<td>1.78%</td>
</tr>
<tr>
<td>Poor</td>
<td>6.34%</td>
<td>1.59%</td>
</tr>
<tr>
<td>Medium</td>
<td>18.49%</td>
<td>4.58%</td>
</tr>
<tr>
<td>Good</td>
<td>25.92%</td>
<td>9.28%</td>
</tr>
<tr>
<td>Strong</td>
<td>30.17%</td>
<td>18.66%</td>
</tr>
</tbody>
</table>

Sweden:
32,7% of the parcels with a detected bare soil (M1_S2)

<table>
<thead>
<tr>
<th>Confidence</th>
<th>S2</th>
<th>With S1 conf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doubtful</td>
<td>32.66%</td>
<td>3.25%</td>
</tr>
<tr>
<td>Poor</td>
<td>6.52%</td>
<td>0.75%</td>
</tr>
<tr>
<td>Medium</td>
<td>13.07%</td>
<td>1.32%</td>
</tr>
<tr>
<td>Good</td>
<td>12.50%</td>
<td>1.88%</td>
</tr>
<tr>
<td>Strong</td>
<td>35.24%</td>
<td>17.62%</td>
</tr>
</tbody>
</table>

→ 36% of the parcels with a detection with a S1 confirmation

→ 25% of the parcels with a detection with a S1 confirmation
Bare Soil – Example in Sweden

<table>
<thead>
<tr>
<th>NewID</th>
<th>M1_S1</th>
<th>M2_S1</th>
<th>M3_S1</th>
<th>M4_S1</th>
<th>M5_S1</th>
<th>M6_S1</th>
<th>START1_BS_S1</th>
<th>END1_BS_S1</th>
<th>Conf1_S1</th>
<th>Nbr_S1</th>
<th>Look_nextS1</th>
<th>START2_BS_S1</th>
<th>END2_BS_S1</th>
<th>Conf2_S1</th>
<th>Nbr2S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>546</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>12-02-21</td>
<td>13-05-21</td>
<td>Strong+ S1</td>
<td>9</td>
<td>VRAI</td>
<td>31-08-21</td>
<td>05-09-21</td>
<td>Good</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>M1_S1</th>
<th>M2_S1</th>
<th>M3_S1</th>
<th>M4_S1</th>
<th>M5_S1</th>
<th>M6_S1</th>
<th>START1_BS_S1</th>
<th>Conf1_STARTS1</th>
<th>END1_BS_S1</th>
<th>Nbr_S1</th>
<th>Look_nextS1</th>
<th>START2_BS_S1</th>
<th>END2_BS_S1</th>
<th>Conf2_STARTS1</th>
<th>Nbr2S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>-3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>08-02-21</td>
<td>01-03-21</td>
<td>Strong</td>
<td>4</td>
<td>VRAI</td>
<td>26-04-21</td>
<td>26-04-21</td>
<td>Doubtful</td>
<td>4</td>
</tr>
</tbody>
</table>
Bare Soil – Example in Belgium

2021-2022 Smoothed Time Series

2021 main crop = Winter barley
2022 main crop = Sugar beet

ID: 100

NDVI smoothed
NDVI mean & std

LAI smoothed
LAI mean & std

Harvest
CoverCrop
BareSoil S2
BareSoil S1
Change of Agricultural Category

Y0

Perennial Crop

Y1

Arable Land

Y2

Y3

Permanent Grassland
Change of Agricultural Category - Workflow

Input data preparation

Markers generation
- P1 (Sep-Dec)
  - L4E - BS Calibration + Model
  - L4E - BS detection
  - Stability & Consecutiveness Marker
  - Vegetation growth marker

Markers generation
- P2 (Jan-June)
  - L4E - BS detection
  - Stability & Consecutiveness Marker
  - Vegetation growth marker

L4A - Classification

Consolidation

LPIS + crop code LUT (Y0)

LPIS + crop code LUT (Y1)

Change of Agricultural Category

P1 analysis
- Change P1 results

P2 analysis
- Change P2 results

Files/data
- Permanent Crop
- Permanent Grassland
- Arable Land

Algorithm
Change of Agricultural Category – LPIS/GSAA standardization

Luxembourg

<table>
<thead>
<tr>
<th>Year</th>
<th>Full LPIS</th>
<th>Reduced Size LPIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>60,000</td>
<td>40,000</td>
</tr>
<tr>
<td>2021</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td>2022</td>
<td>55,000</td>
<td>45,000</td>
</tr>
</tbody>
</table>

Saxony

2020 loss = 12.08%
2021 loss = 13.34%
2022 loss = 10.25%

Czechia

2020 loss = 18.4%
2021 loss = 16.12%
2022 loss = 15.26%

2020 loss = 12.55%
2021 loss = 13.71%
2022 loss = 10.60%
Change of Agricultural Category – Vegetation Growth

Wallonia (Belgium)

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Change of Agricultural Category – Bare soil

Czechia

Period 1

NDVI time serie, parcel 836

RF BS detection
BS period prediction (conf = Strong)
Change of Agricultural Category – Vegetation stability & outlier consecutiveness

From grasslands to maize

Luxembourg
Change of Agricultural Category – Markers analysis

### Change score computation: Tresholds values Period 1

<table>
<thead>
<tr>
<th>Marker</th>
<th>Tresholds</th>
<th>Change score value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio_stability</td>
<td>TTdaysS2 &gt; 0</td>
<td>+2</td>
</tr>
<tr>
<td>Consec_stability</td>
<td>TTdaysS2 &gt; 0</td>
<td>+1.5</td>
</tr>
<tr>
<td>Permanent crop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AreaVeg</td>
<td>AreaVeg &gt; 50</td>
<td>+1</td>
</tr>
<tr>
<td>Ratio_stability</td>
<td>Ratio_stability &gt; 20</td>
<td>+1</td>
</tr>
<tr>
<td>Annual crop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AreaVeg</td>
<td>AreaVeg &gt; 50</td>
<td>+1.5</td>
</tr>
</tbody>
</table>

### Change score computation: Tresholds values Period 2

<table>
<thead>
<tr>
<th>Marker</th>
<th>Tresholds</th>
<th>Change score value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio_stability</td>
<td>TTdaysS2 &gt; 0</td>
<td>+2</td>
</tr>
<tr>
<td>Consec_stability</td>
<td>TTdaysS2 &gt; 0</td>
<td>+1.5</td>
</tr>
<tr>
<td>Permanent crop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AreaVeg</td>
<td>AreaVeg &gt; 20</td>
<td>+1</td>
</tr>
<tr>
<td>Ratio_stability</td>
<td>Ratio_stability &gt; 20</td>
<td>+1</td>
</tr>
<tr>
<td>Annual crop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AreaVeg</td>
<td>AreaVeg &gt; 50</td>
<td>+1.5</td>
</tr>
</tbody>
</table>

### Agricultural category change prediction

- X >Change score treshold P1
- X >Change score treshold P2
Change of Agricultural Category – interpretation grid

- **Permanent grassland**
  - For TEMP & PERM grassland: assuming grassland is ploughed
  - Ploughing date will depend on the plantation date of crops
  - If plantation in autumn:
    - Presence of bare soil in P1
    - Low veg. growing (young trees, but herb. cover)
  - If plantation in spring:
    - Presence of bare soil in P2 (Feb-Mar)
    - Low veg. growing (young trees, but herb. cover)

- **Temporary grassland**
  - For TEMP & PERM grassland:
    - Base soil in P1 (crop sowing)
    - Vegetation growing + conspicuousness in P1 and/or P2

- **Arable land**
  - If summer crop:
    - P1: bare soil (crop harvest, grass sowing)
    - P2: bare soil, veg. conspicuousness
  - If winter crop:
    - Harvest & grass sowing before P1
    - Absence of bare soil both in P1 and P2

- **Annual cropland**

- **Perennial cropland**
Change of Agricultural Category – interpretation grid

Key: absence of harvest
- If summer crop is:
  - P1: Bare soil (crop harvested before P1)
  - P2: Bare soil, veg. growing & consecutive
- If winter crop is:
  - Harvested before P1
  - Absence of bare soil both in P1 and P2

For TEMP & PERM grassland:
- Bare soil in P1 (crop harvested)
- Vegetation growing and consecutive in P1 and/or P2

For TEMP & PERM grassland: assuming grassland is ploughed
- Presence of bare soil in P1
- Low veg. growing (young trees, but herb. cover)
- Presence of bare soil in P2 (Feb-Mar)
- Low veg. growing (young trees, but herb. cover)

Annual crop is harvested, then permanent crop in autumn or spring:
- Bare soil in P1 or P2
- If plantation in autumn: low veg. growing (young trees, but herb. cover)
- If plantation in spring: presence of bare soil + low veg. growing (young trees, but herb. cover)
Webinar outline

• Sen4CAP overview
• New use cases and processors
  - Parcels heterogeneity
  - Bare soil detection
  - Change of land category
• System evolution
  - New version 4.0
• Conclusions and next steps
Sen4CAP versions

Version 1.0 release candidate
- Open-source
- Possibility for the PAs to access a test machine with the system

Version 1.1, 1.2, 1.3
- Markers database
- Tillage processor
- Dockerization
- ...

Version 2.0
- Web interface
- Products visualization
- Additions in MDB
- Secured services
- Dockerization
- ...

Version 3.0
- Support for MAJA 4.5.4

Version 3.1
- Updates for the Creodias datasources
- Updates for USGS datasources
- New markers in MDB1
- ...

Version 3.2
- Bare soil processor
- Change detection processor
- Heterogeneity processor
- Copernicus DAS data source
- ...

Version 4
- Markers database
- Tillage processor
- Dockerization
- ...

ESA UNCLASSIFIED - For Official Use
Version 4 new features

• **System evolution – New version 4.0**
  - New Postgis 16-3.4 version for new installations
  - New Copernicus Data Space Ecosystem (DAS), LSA and ASF data source
  - Removed the SciHub data source
  - Added Bare soil processor
  - Added Change detection processor
  - Added Heterogeneity processor
Version 4 new features

- **New Copernicus DAS data source**
  - New account needs to be created
  - Local root not supported yet
  - In the next future to support the access to EO data via S3 API
- **New LSA data source**
- **New ASF data source**
Version 4 new features

• **Bare soil processor**
  - **Inputs**:
    - MDB 1
    - MDBL4A_SAR_Main
  - Simple start/end dates selection

• **Heterogeneity processor**
  - **Inputs**:
    - L3B (NDVI only)
    - S1 weekly temporal resampled rasters
    - CropType processor is launched automatically inside
    - L2A with validity masks
• **Change detection processor**

  - **Inputs:**
    - MDB1
    - MDB L4A Optical Main
    - Bare soil products

  - Two sites are involved
    - Main site
    - Reference site

  - Start and end dates to be provided for both reference and main site
Webinar outline

• Sen4CAP overview

• New use cases and processors
  o Parcels heterogeneity
  o Bare soil detection
  o Change of land category

• System evolution
  o New version 4.0

• Conclusions and next steps
Next events

- **Forum** for your questions about the system 4.0 (and other)

- **ESA ITT** about « Sen4CAP cloudification »
SEN4CAP – future developments & opportunities

- While after several years of funding and contract changes, the SEN4CAP project comes to an end, ESA intends to initiate a long-term perspective with a dedicated Invitation to Tender

- Cloud readiness:
  - Transform SEN4CAP key functionality into modular cloud-based services and deploy e.g. in CDSE
  - Implementation to follow a cloud native approach and expose functionality via API and python libraries

- Open-Source readiness:
  - Ensure and prepare resulting source code for community contributions and engage with relevant initiatives

- Basic scientific enhancements:
  - Not the focus of this ITT, but selected critical CAP related enhancements to be implemented as well

INFORMATION-AS-A-SERVICE PATHFINDER: SEN4CAP

Evolve existing SEN4CAP algorithms to cloud-based on-demand services

- open-source consolidation
- ready for community maintenance & evolution
- modular functionality via client libraries and APIs
- datacube-centric refactoring

Call for Proposals, Q2

~ 400-600K, one pathfinder

interested? ➔ Patrick.griffith@esa.int
Next events

- **Forum** for your questions about the system 4.0 (and other)

- **ESA ITT** about « Sen4CAP cloudification »

- **Your questions ???**
Thank you for your attention and your contribution