Copernicus High Resolution Layer 2018: introduction of a new Built-up product at Pan-European scale using Sentinel data

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MISSION
Support decision makers in land management from local level to International

EXPERIENCE
30 years in EO based solutions for Land Resources Monitoring

SOLUTIONS
Value Added Product and Services
Forecasting models, statistical Indicators
Capacity Building, Knowledge Transfer

MEANS
Cloud based processing chain + Experienced thematic experts
Copernicus
High Resolution Layer
Copernicus

The objective of Copernicus is to provide relevant information/services to decision makers and users in the field of Environment and Security.

TEMU2020, Rennes, 30 Janvier 2020
Copernicus Land Monitoring services (CMLS)

5 main components
- Systematic monitoring of biophysical parameters
- Land cover and land use mapping (e.g. Corine Land Cover, High Resolution Layer)
- Thematic hot-spot mapping (e.g. Urban Atlas, Riparian Zones)
- Imagery and reference data
- European Ground Motion activity (to come)
Copernicus High Resolution Layers (HRL)

- HRL 2015 project is divided in 5 Lots, corresponding to each theme:
  - Lot 1: Imperviousness Degree – IMD
  - Lot 2: Tree Cover Density & Dominant Leaf Type – TCD & DLT
  - Lot 3: Grassland – GRA
  - Lot 4: Water and Wetness – WAW
  - Lot 5: Small Woody Features – SWF

- HRL 2018 is, at time, only divided in 4 lots (same as 2015)
  - Lot 1: Imperviousness Degree – IMD + **Built-up** -> **new**
HRL product examples

<table>
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<th>Imperviousness</th>
<th>Forests</th>
<th>Grassland</th>
<th>Water &amp; Wetness</th>
<th>Small Woody Features</th>
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https://land.copernicus.eu/pan-european/high-resolution-layers
EEA39 coverage

5.8 Mkm²
39 countries

- EU27
- + 5 member states EEA
- + 7 collaborative states
HRL Imperviousness: overview

• Imperviousness HRL: captures the spatial distribution of artificially sealed areas, including the level of sealing of the soil.

• Imperviousness data is available for the reference years 2006, 2009, 2012 and 2015 (2018 ongoing), and contains two types of products:
  1. **Status layers**: The percentage of sealed area is mapped for each status layer for any of the reference years at 10/20m spatial resolution, and as aggregated 100m products
  2. **Change layers**: 2 types of change products are available for each of the 3-year periods between the reference years:
     a. A simple layer mapping the percentage of sealing increase or decrease for those pixels that show real sealing change in the period covered. This product is available in 20m and 100m pixel size
     b. A classified change product that maps the most relevant categories of sealing change (unchanged no sealing, new cover, loss of cover, unchanged sealed, increased sealing, decreased sealing). This product is available in 20m pixel size only.
HRL Imperviousness: products

HRL IMD 2015 Status layer
HRL Imperviousness: products
HRL Imperviousness: New in 2018: Built-up

HRL IBU 2018 Status layer (under production)
Built-up: 1\textsuperscript{st} step: MASADA Toolbox (JRC)

Source: JRC
Built-up: 2\textsuperscript{nd} step: Broceliande (UBS)

Open Source Broceliande toolbox
- Developed by UBS (Obelix team)
- Maintained by François Merciol
- Use of spectral, spatial and texture information
- Tree representation for fast object parsing
- Random Forest classification
Built-up: 2nd step: Broceliande (UBS)

Open Source Broceliande toolbox
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- Maintained by François Merciol
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- Tree representation for fast object parsing
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Built-up production: input data

EO data: Sentinel-2 images (optical, 10m)
European Settlement Map (JRC)
Open Street Map
Built-up production: comparison

Sentinel-2 image, false color composite
Tessaloniki, Greece

ESA MASADA toolbox (v1)

JRC Pantex index

EDA MASADA toolbox (v2), adapted to S2

Our solution
Built-up production: validation

IBU User accuracy: 81.25%
IBU Producer accuracy: 92.86%

From H2020 Ecolass project

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Built-up production: validation

Occitanie, France
IBU User accuracy: 81.82%
IBU Producer accuracy: 94.74%

Bavaria, Germany
IBU User accuracy: 87.84%
IBU Producer accuracy: 92.86%

From H2020 Ecolass project
Built-up 2018: Rennes, first result
Conclusion & perspectives

• Mapping built up at Pan-European scale with Sentinel-2 images: above requested accuracies
• Open Source method, generic and robust
• Production: close to delivery
• Validation: internal validation + independent validation

• Future: better spatial resolution? Built-up height?
Thank you ...

But also our partners:
• Geoville (Austria)
and our sub-contractors:
• Université Bretagne Sud (France)
And last but not least our client:
• European Environment Agency
SWF production: results

Not yet validated by EEA

France

1:10000