Lessons Learnt from National Application Studies for Future Copernicus Global Land Products

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GeoVille

Information Systems and Data Processing GmbH

Our Background

Type of Business
- Satellite based Geo-Information Solutions

Year of Foundation
- 1998

Company seats & representation
- Innsbruck (AT)

References
- > 130 countries; > 450 projects

Managing director & founder
- Dr. Christian Hoffmann

Staff
- +50 geo-experts

Quality & environment system
- ISO 9001:2015 & ISO 14001:2015

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Capacity Provided for Operational Copernicus Land Monitoring Services

- Since 2006 GeoVille mapped **more than 20 Mill km²** for European Copernicus Land Monitoring Services
- Copernicus dedicated production **capacity was increased by more than 18 times in the last 10 years**
- Increasing thematic diversity of our product portfolio

CLMS Product	2006	2009	2012	2015
HR Landcover	**0.75 Mill km²**	**1.3 Mill km²**	**4.2 Mill km²**	**13.9 Mill km²**
Imperviousness	0.75 Mill km²	1.3 Mill km²	2.6 Mill km²	6.0 Mill km²
Forest			1.6 Mill km²	
Grassland				1.9 Mill km²
Water & Wetness				6.0 Mill km²
VHR Landcover			**600 Tsd. km²**	**150 Tsd. km²**
Natura 2000				150 Tsd. km²
Riparian Zones			600 Tsd. km²	

Land Monitoring Services - Challenges

- New sensors have high revisit rates and provide continuous big data streams in high spatial resolution (i.e. Sentinels)…
- … but require new approaches for data storage, handling and processing
- Increasing demand in spatial resolution and monitoring frequency, with specialised land cover products fulfilling national reporting obligations
- Continuous monitoring of status and changes of landcover characteristics
- Bringing together different sensor technologies from optical and SAR to gain advanced information from both sensor types and at the same time levelling out any deficiencies
- Provision of end-users sufficient confidence information of the land cover classification on a per pixel level
- Documentation and accessibility of production methods and intermediate datasets to ensuring re-producibility

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Global Land Cover Monitoring System

Processing and Dissemination Platform for Monitoring Environmental, Economic and Social Change Worldwide

- ✓ High spatial resolution
- ✓ Dense time intervals
- ✓ Petabytes of EO data
- ✓ Supercomputing power
- ✓ Deep learning analytics
- ✓ Fully-automatic

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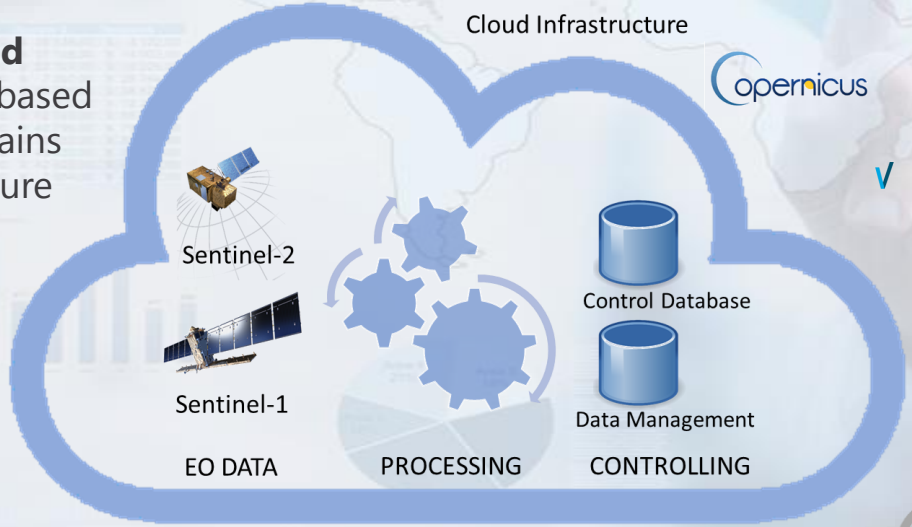
Flexible Data Access, -Processing and Production Control

EODC

- **Fully-automatic S1/S2 based land cover processing chains** have been employed in various national, transboundary and continental projects and studies

- **Large scale products and user activated services** based on flexible processing chains built for cloud infrastructure direct data access and processing…



GCP

- **Real-time progress viewer User Interface** to provided most recent status of the production progress for the service provider but also for the customer

DIAS

AWS

- … allowing **harmonised production by consistently applying workflows and methods.**

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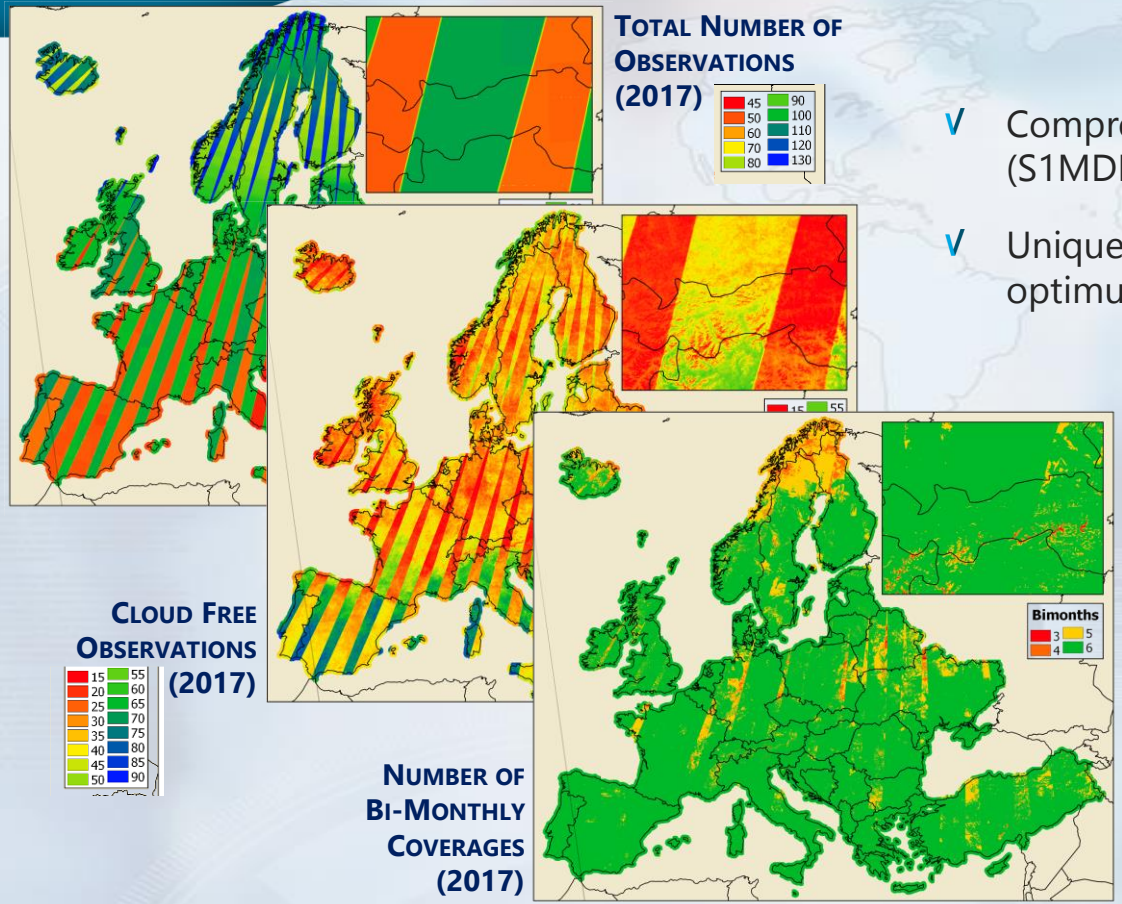
Sentinel-1 & Sentinel-2 Meta DataBase



- Comprehensive Sentinel metadata database system (S1MDB & S2MDB)
- Unique data quality assurance tools - data usage of optimum quality
- Based on PostgreSQL and can easily be deployed to all processing platforms
- Products can be filtered by parameters, like sensor, processing-level, sensing-time, cloud coverage, etc
- Mandatory for product confidence information on pixel level

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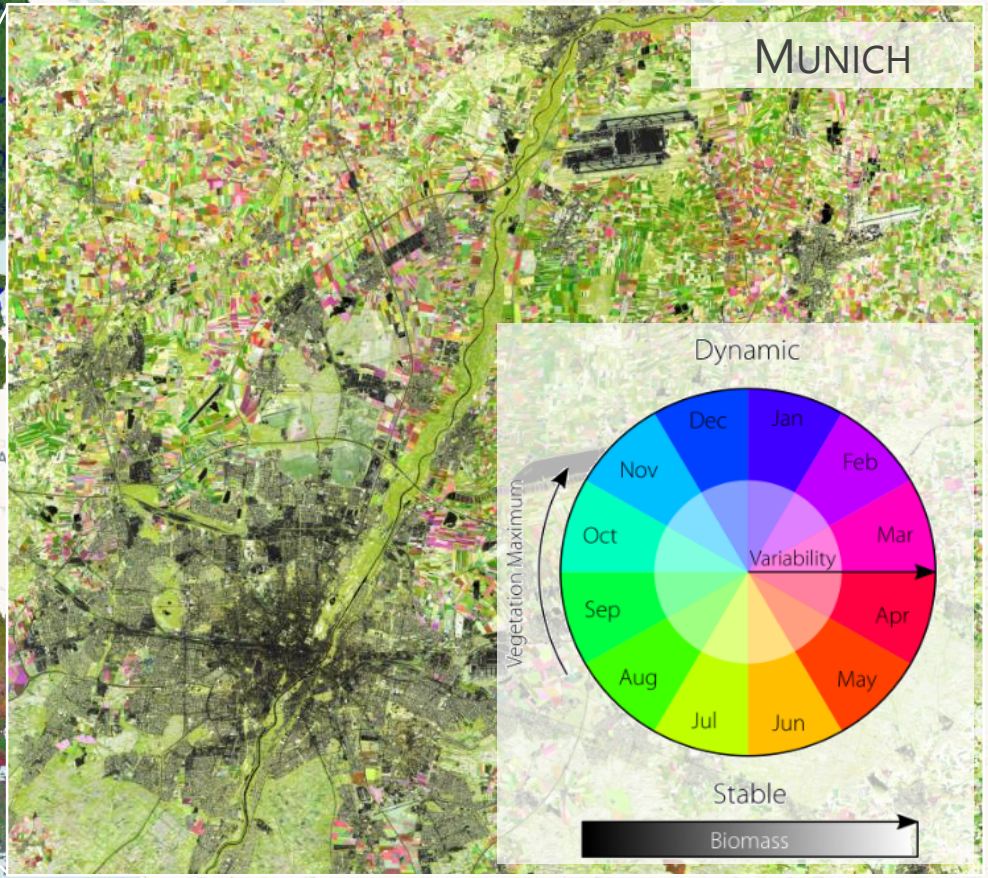
Sentinel-2 Time Series [2016 – 2018]

23.605.726.320.000
PIXELS PROCESSED

980 TILES
(100 SCENES/TILE)



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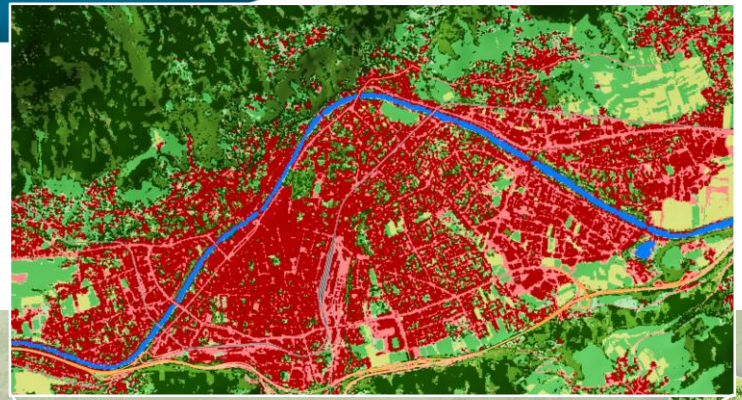
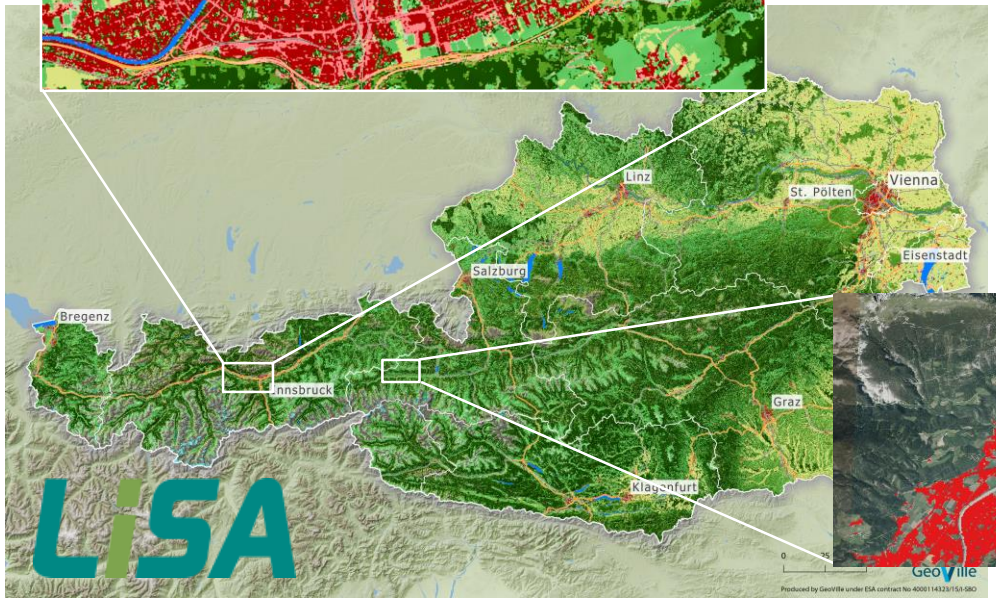
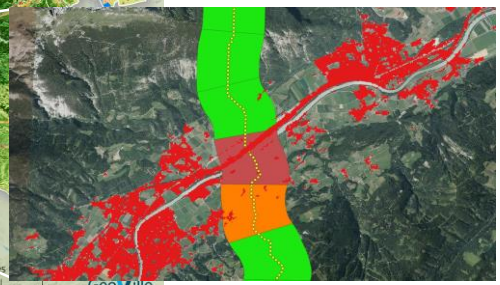
Use Case – Land Montioring System Austria







- Integration of Copernicus data supported the implementation of an operational land monitoring system ✓
- First, validated Sentinel-2 based land cover map ✓
- Dynamic products are available at a monthly frequency ✓
- Perform a continuous mapping of the national land cover and monitor its change ✓
- For the use of national public institutions ✓

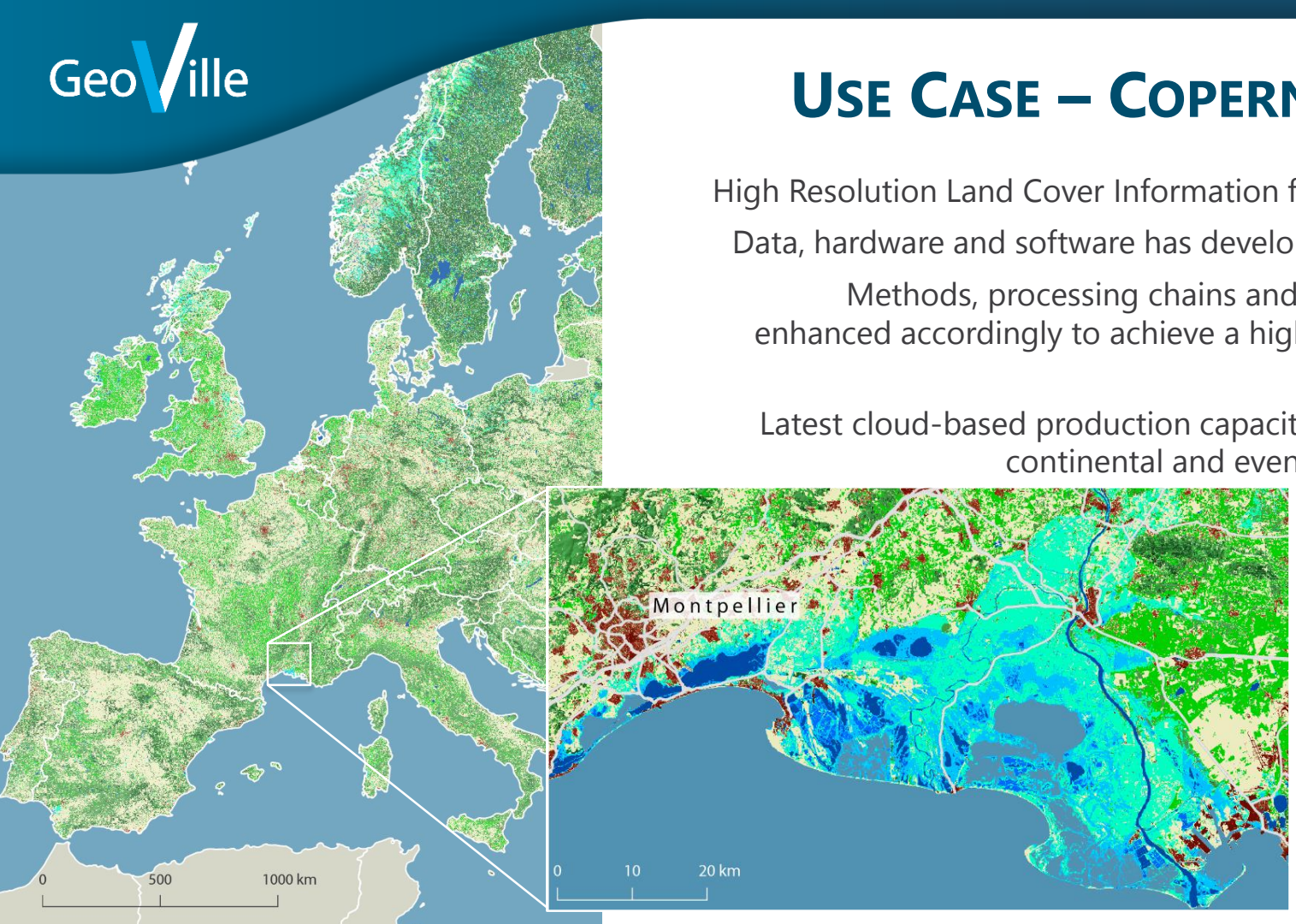
The Austrian Case

Towards ecological connectivity

umweltbundesamt

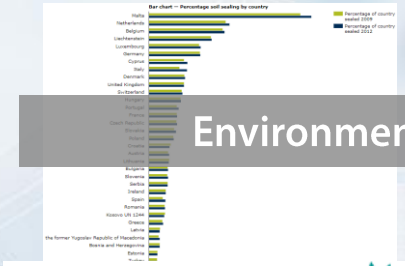
Use Case – Copernicus HRL

- High Resolution Land Cover Information for entire Europe ✓
- Data, hardware and software has developed significantly ✓
- Methods, processing chains and workflows were enhanced accordingly to achieve a high and consistent product quality ✓
- Latest cloud-based production capacities are ready for continental and even global roll-outs ✓
- For public and commercial use ✓



Copernicus
Europe's eyes on Earth

Use Case – Copernicus HRL - Applications

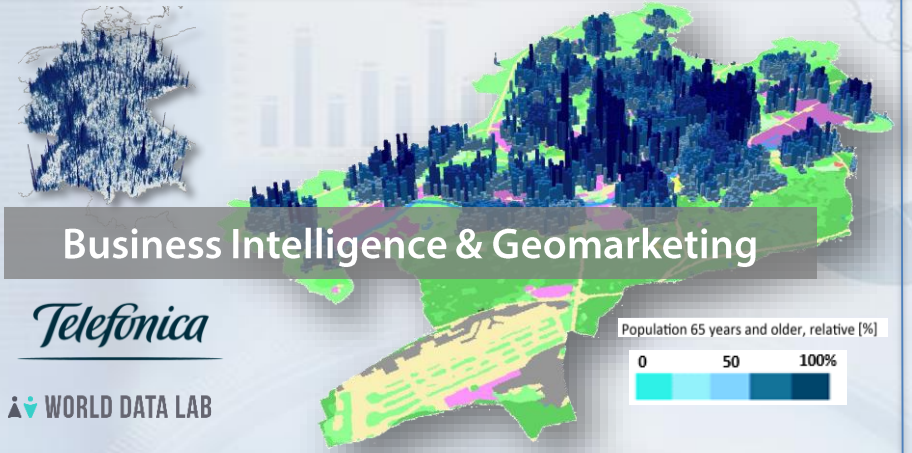


Environmental Reporting

European Environment Agency

5G Network Planning

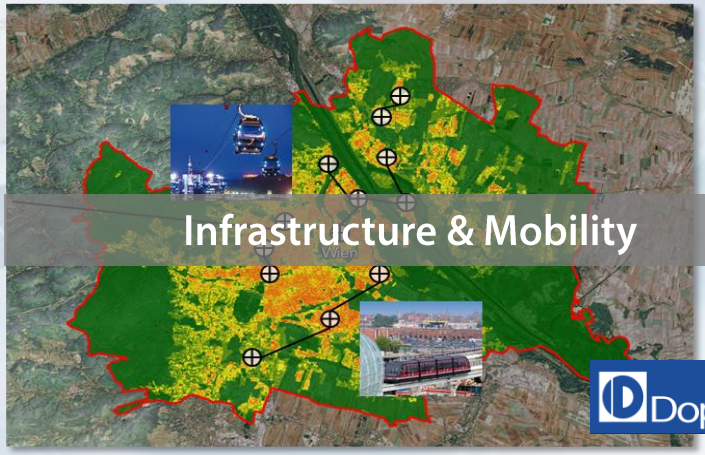
T-Mobile



Business Intelligence & Geomarketing

Telefónica

WORLD DATA LAB

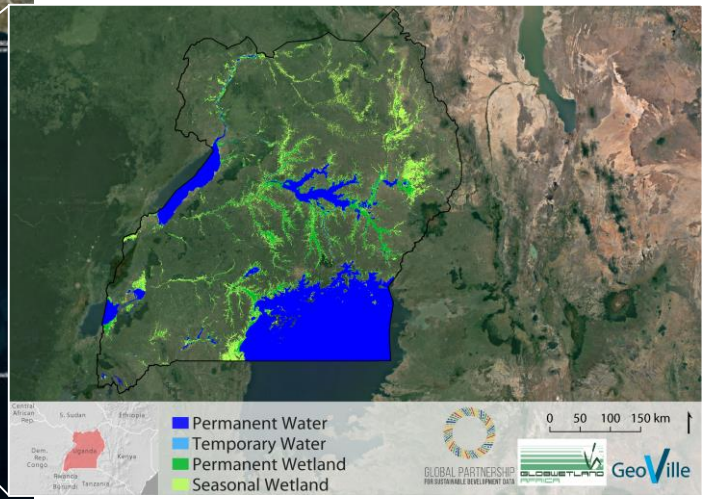


Infrastructure & Mobility

Doppelmayr

Use Case - Monitoring Wetlands

- Application the method of Copernicus Water & Wetness HRL for out of Europe application ✓
- EO4SD Water Resource Management and Wetland Monitoring ✓
- GlobWetland Africa ✓
- UN SDG indicator 6.1.1. monitoring for Uganda ✓



Land Monitoring

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Lessons Learnt

- Automatization of key critical processing steps, performance improvements of computing as well as the targeted simplification of complex product definitions allow comprehensive high-resolution monitoring in even shorter observation cycles
- Processing petabytes of data need integrated cloud-based infrastructure to allow for sufficient data management, processing and monitoring of the production process
- Time-series analysis is essential for achieving higher degree of automation and at the same time increase the quality of product outputs
- Ingestion of well-balanced hybrid classification process of SAR and optical data that fuses both information types in a way to gain advanced information from both sensor types
- Absolute and relative calibration of datasets in space and time is mandatory to achieve homogenous and consistent product quality and allow comparability
- Harmonisation of products (Local/European/Global) is required for integrated application by EEA and third party users
- Confidence information on a per-pixel level is mandatory to estimate the reliability of the product and any information that is derived from it

Thank you!

For further information please contact:

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