Production of Copernicus High Resolution Layers 2018 – A Cloud Native Land Cover Mapping Environment on MUNDI for Large Scale Processing

Data Engineers

System Engineers/DevOps

Dr. Gernot Ramminger (GAF AG)

Marcus Sindram (1), Gernot Ramminger (1), Martin Ickerott (1), Carolin Sommer (1), Anna Homolka (1), Christoff Fourie (1), Christoph Rieke (1), Cornelia Storch (1), Benjamin Mack (2)

(1) GAF AG, (2) MunichRE

Data Scientists

Software Developers

With support from H2020 ECoLaSS

Horizon 2020

Call - Earth Observation:

EO-3-2016: Evolution of Copernicus services

- Introduction
  - Production of Copernicus High Resolution Layers 2018 – Forest & Grassland Layer
  - Production of Copernicus High Resolution Layers 2018 – Requirements / Challenges
- MUNDI – A Copernicus DIAS Platform
- Cloud Native Processing Framework – Technological Building Blocks
- Processing Framework – Analysis Ready Data
- Processing Framework – Interactive Thematic Processing
- Outlook

Production of the Copernicus High Resolution Layers 2018 – Forest & Grassland

Update of & new HRLs:

- Forest and forest change(FOR)
- Grassland and grassland change (GRA)

AoI: EEA39 countries, ~ 5.8 Mio km²

Consortium :

- GAF: Lead (FOR & GRA)
- SIRS: Partner (FOR)
- GeoVille: Partner (GRA)
- e-GEOS: Partner (GRA)

Framework:

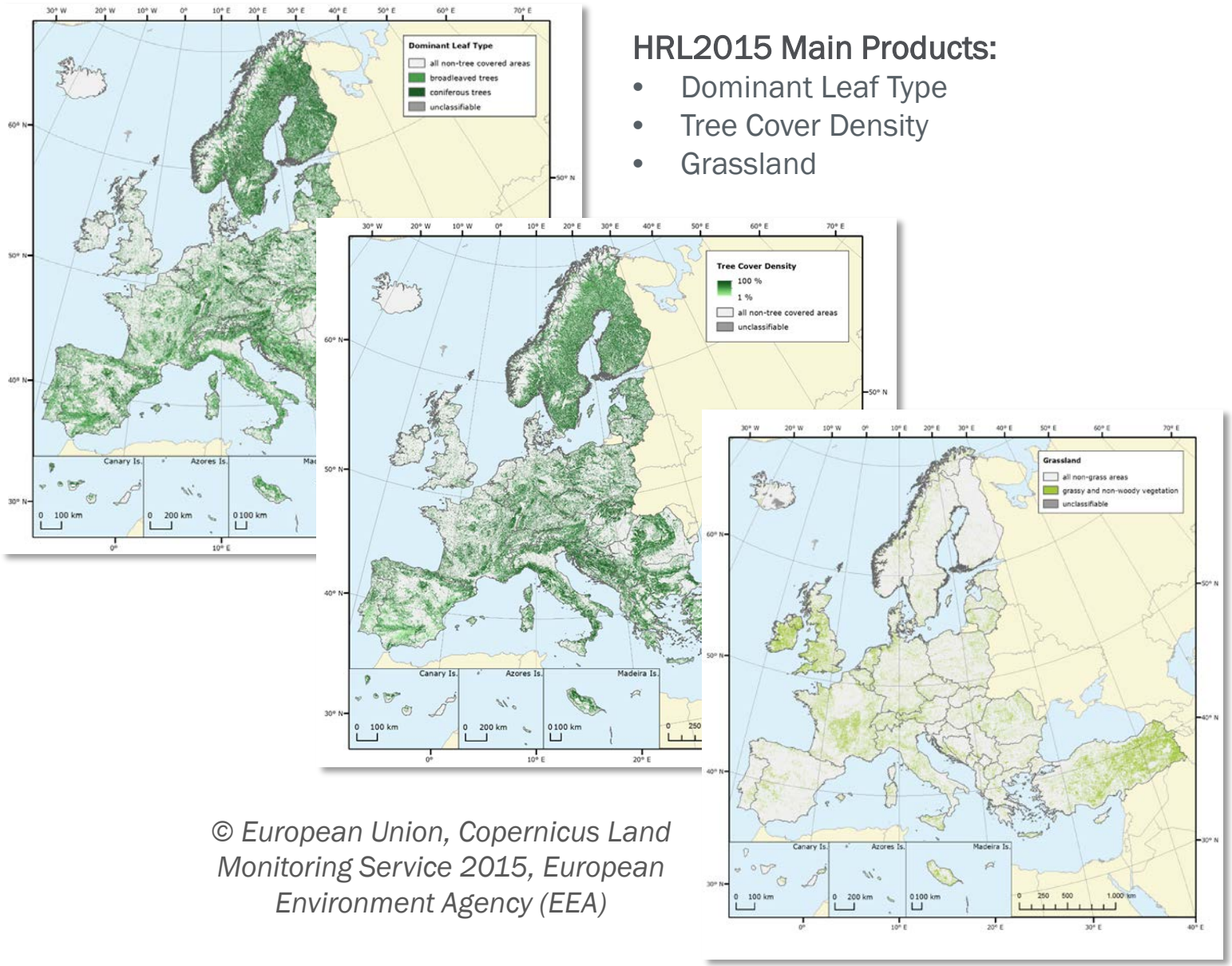
European Environment Agency (EEA) tender No EEA/IDM/R0/18/009: “Copernicus Land monitoring services — High Resolution land cover characteristics for the 2018 reference year”

European Environment Agency

Time Plan:

December 2018 – May 2020

GAFAG GeoVille e-geos SIRS



HRL2015 Main Products:

- Dominant Leaf Type
- Tree Cover Density
- Grassland

© European Union, Copernicus Land Monitoring Service 2015, European Environment Agency (EEA)

Production of the Copernicus High Resolution Layers 2018 – Forest & Grassland

High Resolution Forest Layer – New Products:

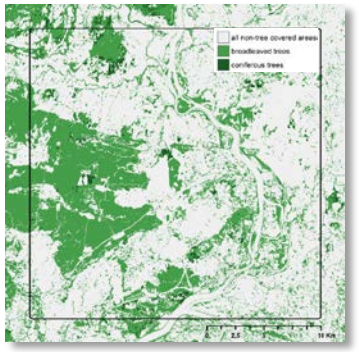
- Primary Status Products: Tree Cover Density, Dominant Leaf Type & Forest Type (incl. MMU) @10m (before @20m)
- Derived Status Products: Tree Cover Density, Forest Type, Broadleaved Cover Density & Coniferous Cover Density @100m
- Change Products: Tree Cover Change Mask, Dominant Leaf Type Change @20m and Derived Correction Layer for 2015-2018 and 2012-2015)

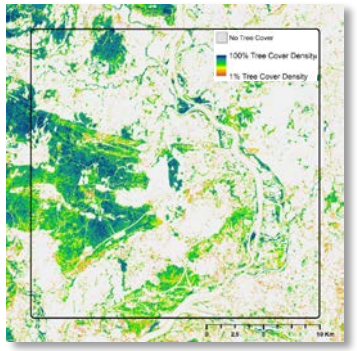
High Resolution Grassland Layer – New Products:

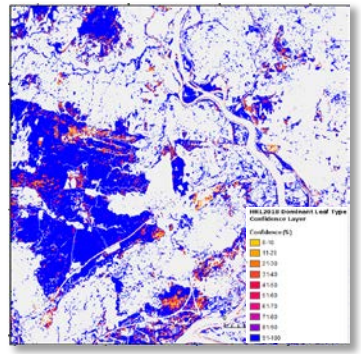
- Primary Products: Grassland Status Map @10m (before @20m), Grassland Change Map 2015 – 2018 (@20m)
- Additional Products: Grassland Vegetation Probability Index, Ploughing Indicator, Confidence Layer

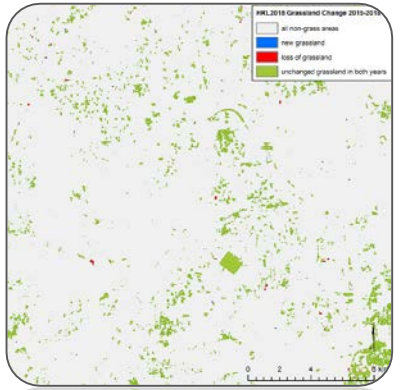
Key Intermediate Products:

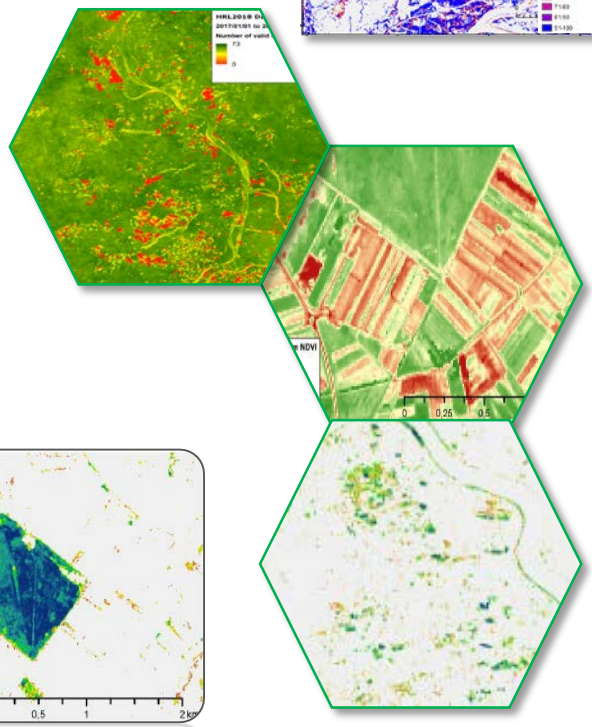
- Sentinel-1 / Sentinel-2 based Time Features,
- Production Unit Layer, Parent Scene Identification Layer, Data Score Layer, Data Density Layer, Time Series Completeness Layer
- Reference Database

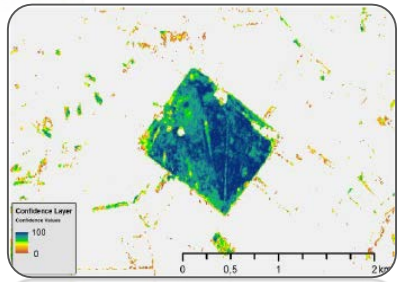






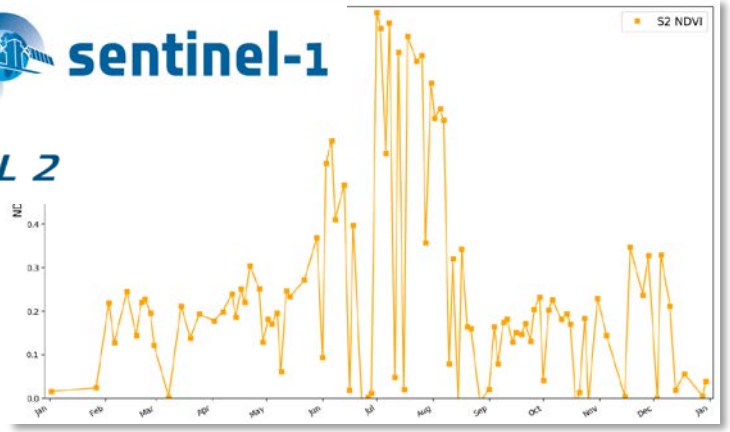




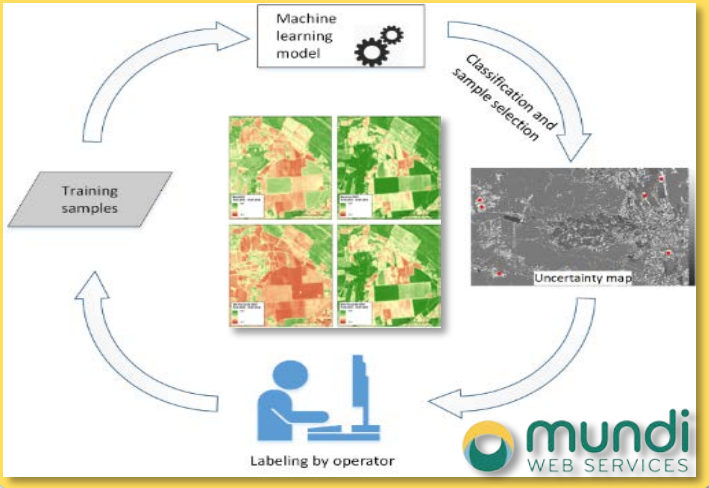


Requirements & Challenges:

- short time frame to derive main products, very high thematic accuracy
  - → high degree of automation and scalability required
  - → usage/exploitation of multi-temporal EO data
  - → fast accessibility to data
- ensure harmonisation & calibration, reproducibility & consistency
  - → partners involved, use the same methodological approach & workflows
  - → common processing environment
  - → provision of key intermediate products
- Handle Regional Diversity, include additional data
  - → Multi-level classification approach based on bio-geographical regions
  - → LUCAS 2018, VHR IMAGE 2015 / 2018, Land Parcel Information System data, data from CORDA



Cloud Native Processing Framework for Land Cover/Land Use and Change



Mundi Webservices – A Copernicus DIAS Platform

Scalable Cloud Platform

OpenStack

Enriched Data collection

Professional Tools & App Collection

Individual Support

Technical - Business – Functional

An open technology platform with built-in compliance, and ease-of-use, for businesses of any size, in any industry – on demand

Open Telekom Cloud

Copernicus EO Data & Services

- Sentinel-1, -2, -3, 5P
- Temporal: 36M (EEA39), 12M (Global) & Access to DLR LTR
- Copernicus Land, Emergency,...

Other EO / Non-EO Data

- Landsat 8 and 7
- Cosmo SkyMed
- IRS data
- Statistics Data, GIS Maps, etc
- Project based collections!!

Tools, Apps & Formats

- OSGeo GDAL Toolbox,
- CNES Orfeo Toolbox,
- ESA SNAP Toolbox,
- Data Cube service,
- Jupyter Notebooks
- Open Telekom Cloud advanced features like MapReduce,...
- Spacemetric Keystone for Process automatisation
- COTS upcoming

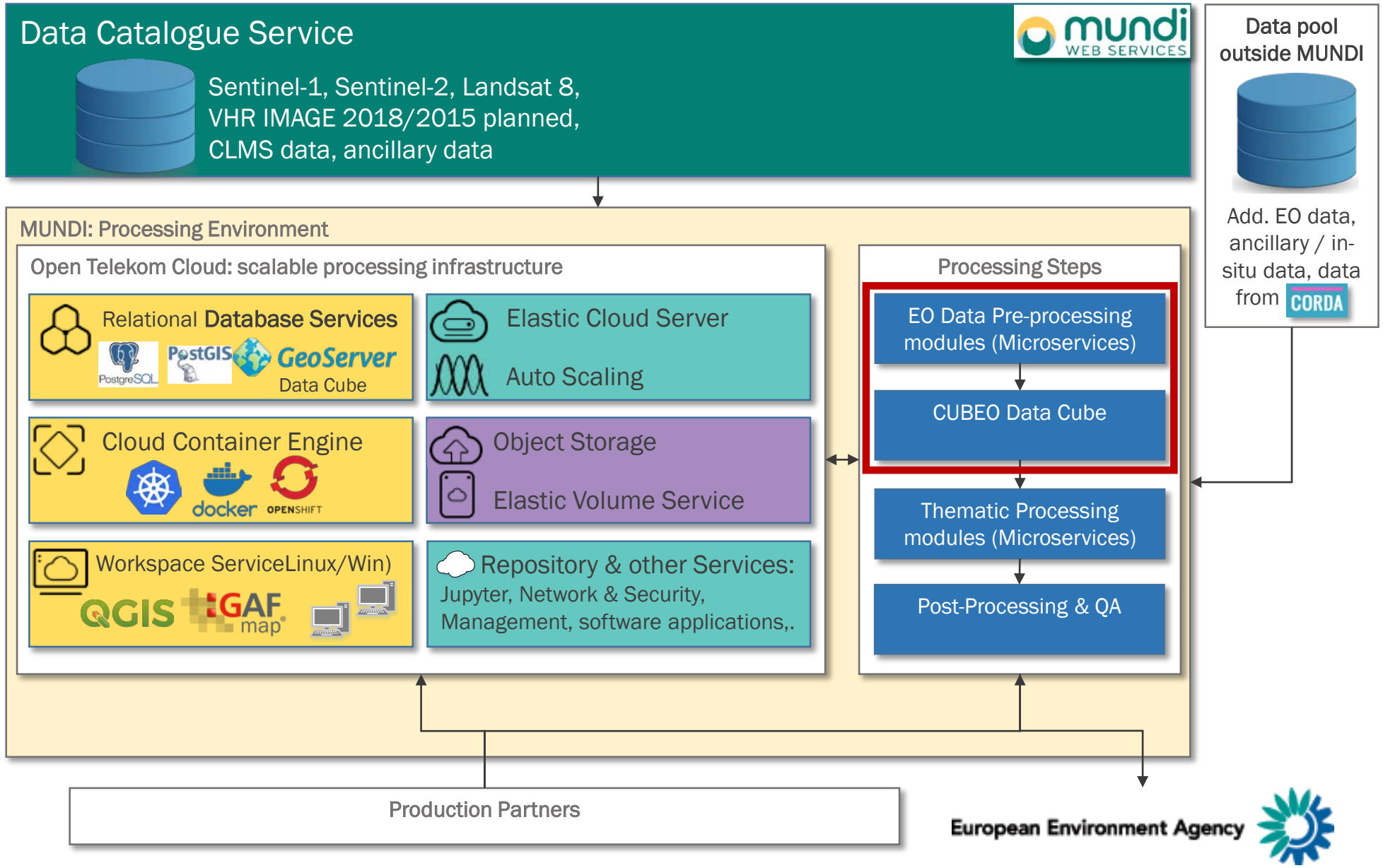
Individual Support

- Helpdesk
- Technical Support packages,
- Thematic Support packages to come

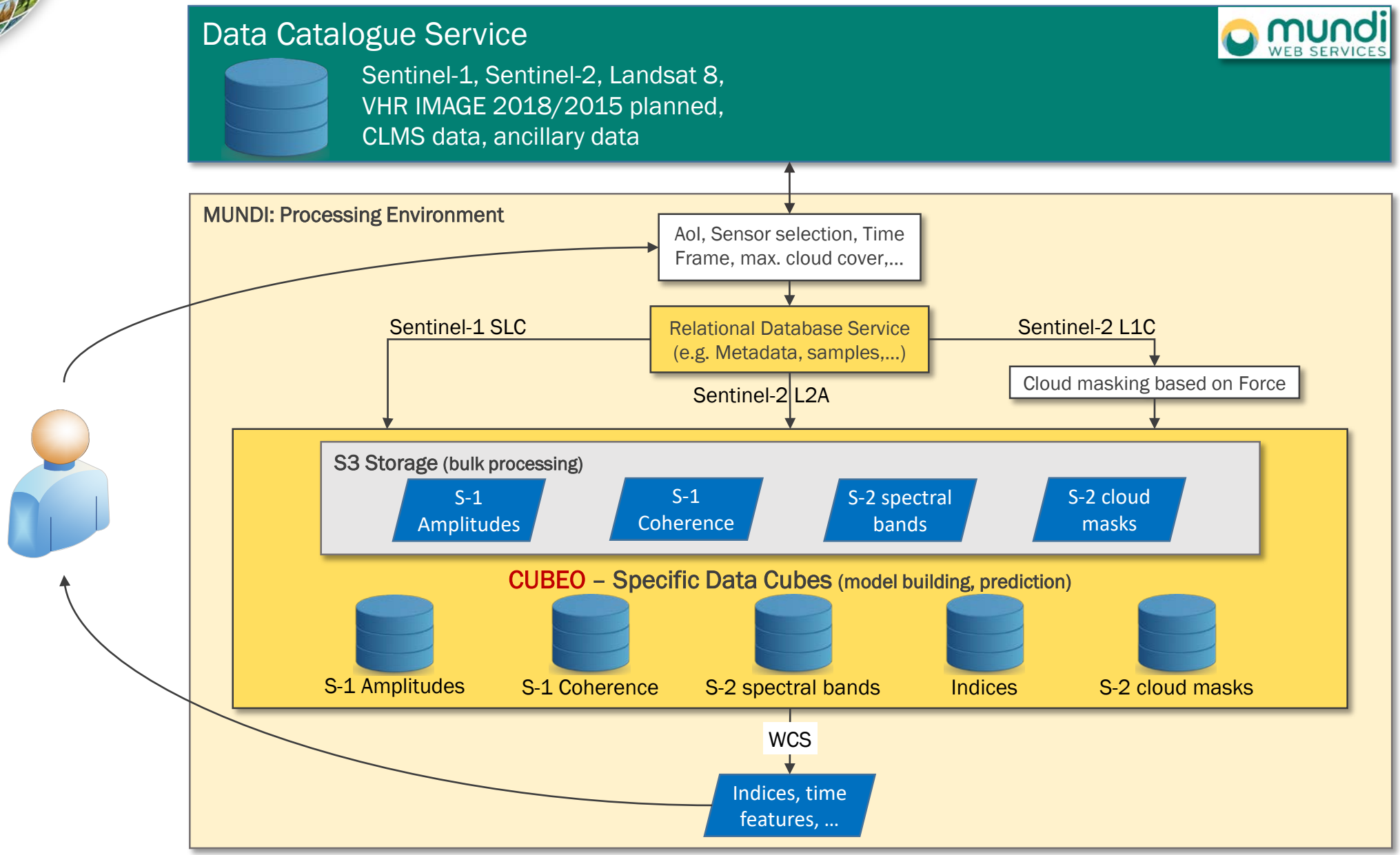
Open Telekom Cloud price calculator
https://cloud.telekom.de/en/infrastructure/open-telekom-cloud/price-calculator/

mundi WEB SERVICES www.mundiwebservices.com

Cloud Native Processing Framework – Technological Building Blocks



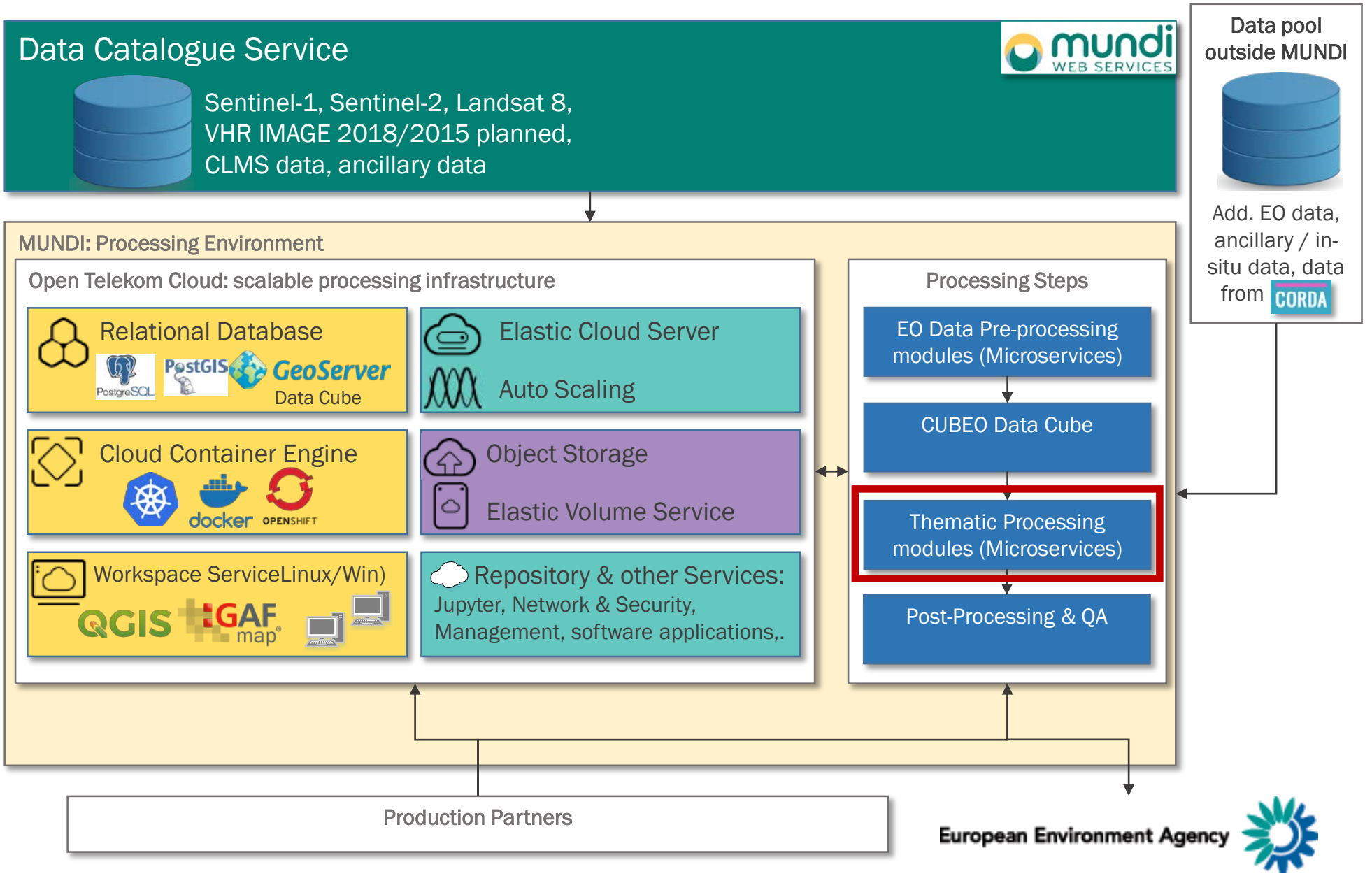
Cloud Native Processing Framework – Analysis Ready Data



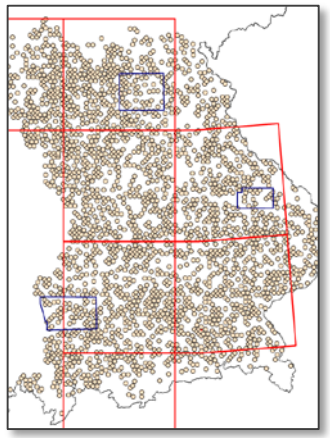
CUBEO Data Cube – A Scalable and modular EO Data preparation pipeline developed by e-geos AN ASI / TELESPAZIO COMPANY

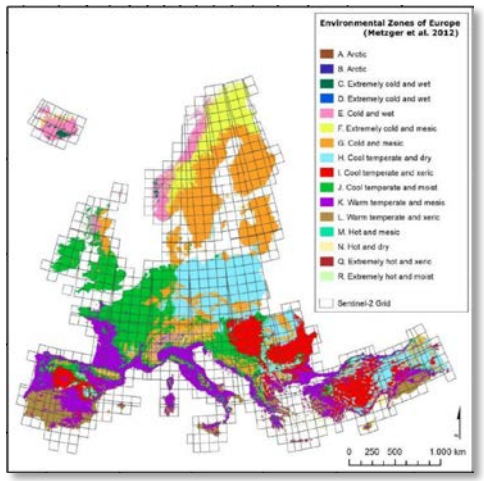
and powered by MEEO Meteorological Environmental Earth Observation

Cloud Native Processing Framework – Technological Building Blocks



Cloud Native Processing Framework – Thematic Processing





MUNDI: Processing Environment

training geometries
specific data cubes

Image bands
(S3 storage)

AoI selection

WCS

Microservices Architecture

interactive (& iterative) process

- Image data extraction and feature calculation for training geometries
- model building, initial prediction of selected training samples
- evaluation of results (accuracy metrics, confusion matrix), preview of map for selected areas
- optimisation loop: hyperparameter tuning, feature selection, active learning, outlier detection

distributed computing (orchestrated) for large scale processing

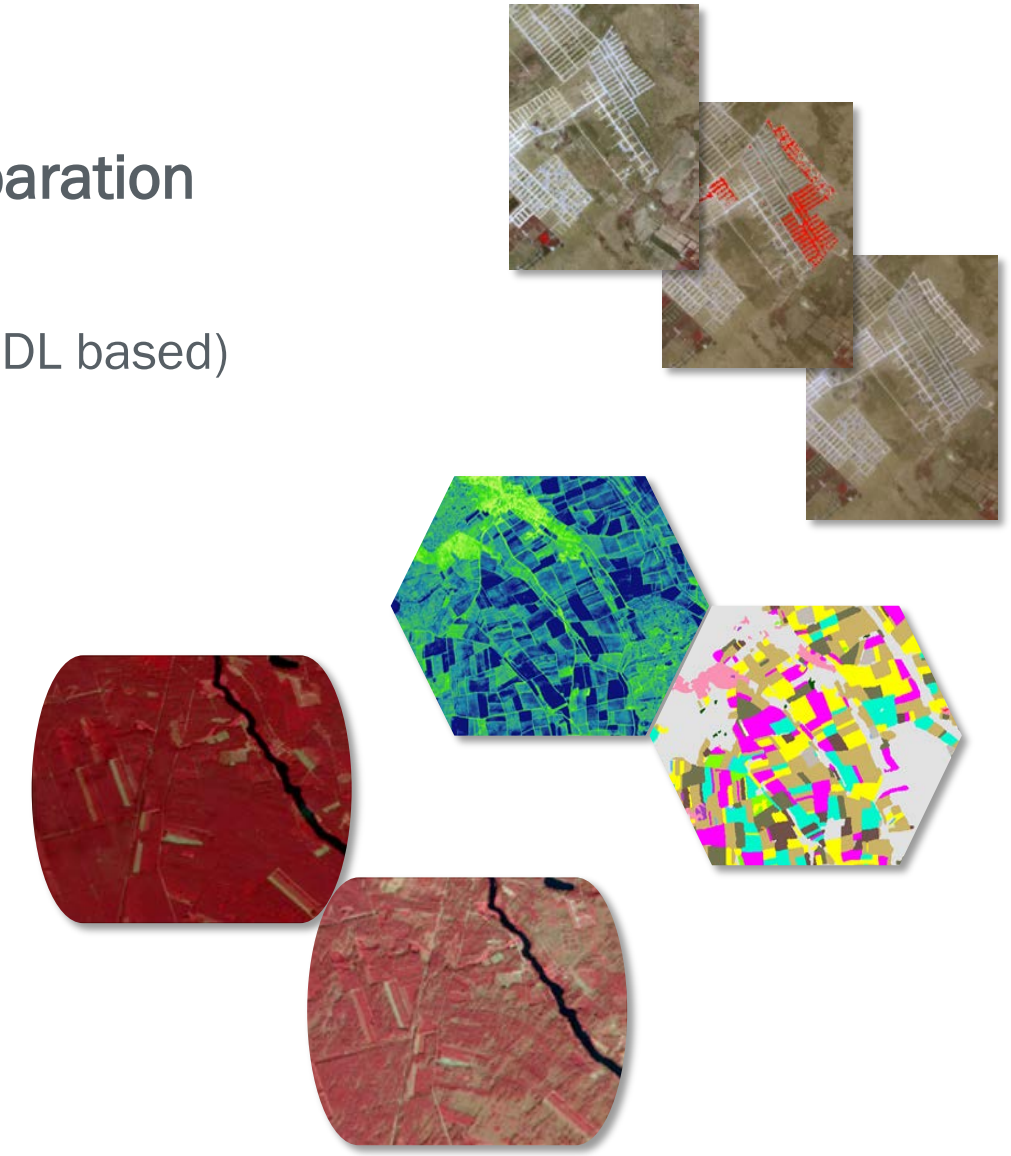
- feature calculation
- prediction of map

QA measurements

- result ready for post-processing
- branch model to sub-regions

Extensions currently in development & preparation

- Web-Frontend as processing control center
- Templates & Modules for specific workflows (ML+DL based)
  - CAP (Common Agricultural Policy) Monitoring
  - Near Real-Time Deforestation Alert System
  - Storm Damage Assessment in forest areas
  - Infrastructure Monitoring,...
- Dashboard for specific services
- Optimisation of processes
- ...



Thank You Very Much
For Your Attention

Contact:

Dr. Gernot Ramminger (gernot.ramminger@gaf.de)

GAF AG, Arnulfstr.199, D-80634 Munich, Germany

https://www.gaf.de, info@gaf.de

Join our Team @

GAFAG
an e-GEOS (ASI / Telespazio) Company

mundi WEB SERVICES