The Norwegian National Ground Segment; Preservation, Distribution and Exploitation of Sentinel Data

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Outline

The Mission
The Approach
The Future
The Mission

- simplify access to Sentinel data
- ensure support for national services
- preserve data for Norwegian AOI
Why do you have two portals?
The Approach

colhub.met.no

• DHuS software suite
• GUI, OpenSearch, ODATA
• Served operational needs
• ESA CGS

satellitdata.no

• Open data space prepared for integration of non EO data like meteorology, oceanography etc.
• Metadata driven approach
• Integrating services
Norwegian Meteorological Institute/Post-Processing Infrastructure (PPI)
ESA Collaborative Ground Segment Node - Primary Sentinel 1 distribution node

ESAs Sentinel Distribution Nodes
- S1GRD/S3 Node 1
- SLC
- OCN / RAW
- S2
- DLR
- S3 L2
- GRDM
- EUMETSAT
- KSAT

Scalable Backends for S1 (GRD, SLC, OCN, RAW), S2 and S3
Scalable Backends; Product Ingestion/Synchronization
Sentinel S1A/B, S2A/B, Sentinel S3
Scalable Lustre Storage Backend
End-to-End Data Integrity (network traffic/on disk checksumming)
5PB Capacity, 80GB/s aggregated bandwidth

Scalable Frontends (FE)
- sentinelhub.met.no
- sentinelhub2.met.no
- colhub.met.no

ESA CGS node - DHR network
METSIS - MET Norway Scientific Information System

FIMEX - File Interpolation, Manipulation and EXtraction Library
Transformation

OGC WPS
• Subsetting
• Reprojection
• Reformatting

Example Sentinel-2:
• Extract variables B4, view and zenith angle over predefined AOI
• Reproject from UTM 32N (Tile VKN) to Arctic Polar Stereographic (EPSG:3995)

Result
8.7Mb vs 771Mb file ready to use in favoured projection
**Visualisation**

**Sentinel-1**
- All raw polarizations
- 40x40 m pixel resolution

**Sentinel-2**
- All bands resampled to 10x10 m pixel resolution
- Three RGBs
Data format - from SAFE to NetCDF-4/CF

CF -> Self describing

print(str("OPeNDAP: Supported in " + "multiple programming " + "languages."))
Ex1: Utilizing OPeNDAP

Task:
Detect Folgefonna glacier in a Sentinel-2 product and decide the glacier extent.

Tools:
Sentinel-2A OPeNDAP stream from TDS
Python with GIS libraries (gdal, cartopy, geopandas, shapely, etc.)

Available as Jupyter Notebook through gist:
http://nbviewer.jupyter.org
Gist code:
d5d29f5b2d691d8ed3c4b3cd65e2009e
Ex1: Utilizing OPeNDAP

- Created polygon by means of image slicing.
- Used 0.2% of all the pixels in the product.
- Could be applied to temporal aggregated product covering the same area.
Ex3: When OPeNDAP is not the solution

- Generating “large domain” products
- When you are offline
- Have to apply an algorithm to all products e.g. atmospheric correction.
Some numbers

colhub.met.no ~ 1.6 PB
  • Sentinel-1: 540 000
  • Sentinel-2: 420 000 (16 000)
  • Sentinel-3: 100 000

satellitdata.no
  • Sentinel-1: 250
  • Sentinel-2: 160 000

Credit: ESA
Future development:

- Orthorectified Sentinel-1 products
- Sentinel-3 products in NetCDF/CF
- OpenSearch API on index metadata
- Virtual Research Environment
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Primary distribution node for Sentinel 1: DHR network

- Number of users colhub.met.no: 430
- Number of users sentinelhub.met.no: DHR network: DLR, AIRBUS, ZAMG, STFC, CLS,...
- Used capacity on disk: 1.6PB
- Policy: 30 days global Sentinel, >30 days Norwegian area of interest
- Products: S1 GRD+GRDM KSAT, SLC, RAW, OCN; S2 A/B/DEM; S3 ESA+ S3 L2 EUMETSAT

Sentinel 1 numbers:

- Weekly throughput S1 relayed to mirror sites: colhub.met.no/CEDA Mirror Archive ~51TB
- Weekly S1 distribution into the DHR network: ~84TB (DLR, AIRBUS, ZAMG, STFC)
- Weekly S1 retrieval, global satellite data: ~35TB

Outlook: Extension of the contract with ESA: 600TB/month; S1,S2,S3,S5p
Primary distribution node for Sentinel 1: DHR network

Norwegian Meteorological Institute/Post-Processing Infrastructure (PPI)

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Scalable Backends for S1 (GRD, SLC, OCN, RAW), S2 and S3

Meta Data Replication

Scalable Frontends (FE)
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- sentinelhub2.met.no
- colhub.met.no

Scalable Lustre Storage Backend
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colhub.met.no (FE), last 1500h
DHR network

sentinelhub.met.no (FE), last 1500h
National Mirror Site
(https://www.satellitdata.no/)