ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

National Satellite Data Centre and Finnish Collaborative GS

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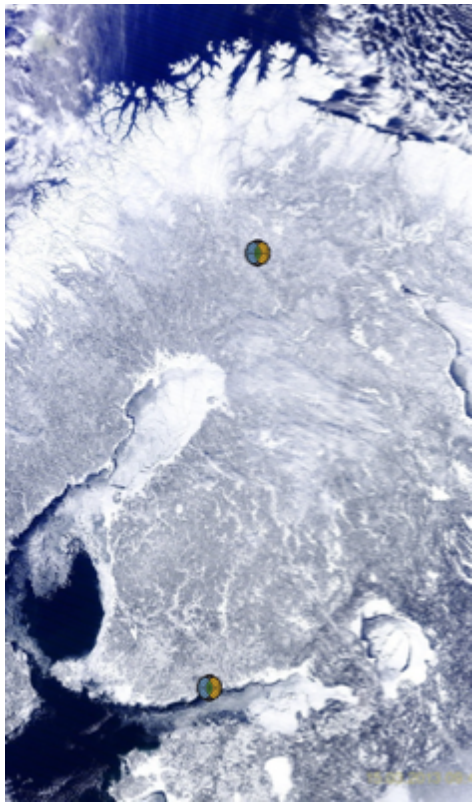
National Satellite Data Center





National satellite data center providing satellite data reception and data processing services to Finnish and international partners

National Satellite Data Center

- Focus on NRT services and scientific use
- Satellite downlink services
  - Sodankylä's location is nearly optimal (67.3678° N, 26.6327° E)
  - 3 antennae
- Satellite data processing and services
  - Provide fast access of S1 scenes for Baltic Sea ice monitoring and icebreaker support
  - Provide reliable access to and maintain local long-term archive of Sentinels' data
  - Process local and/or NRT products (e.g. Baltic Sea water quality, Snow extent, etc)
  - Cloud processing and archiving capacity available for external users (IaaS, PaaS)

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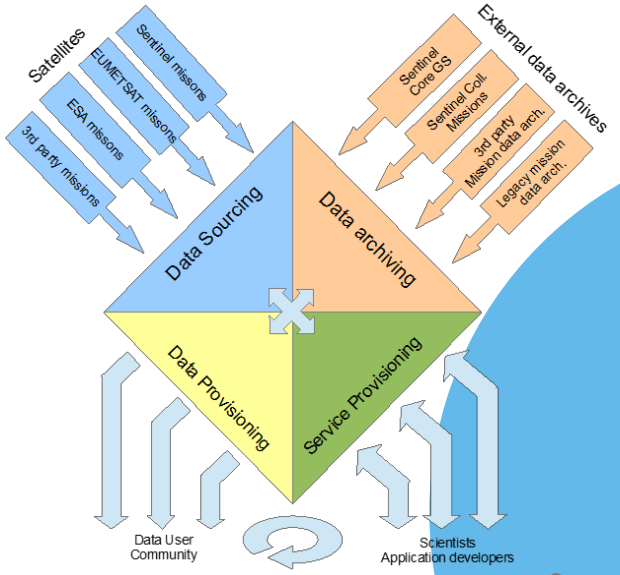


Satellite data availability from FMI Arctic Research and Satellite data centre

Current operational (free access)

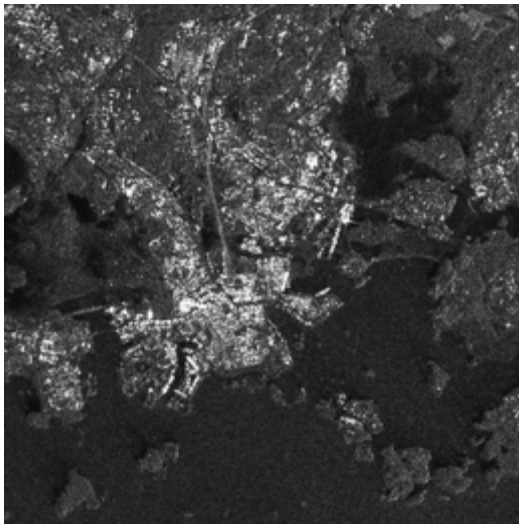
- EOS-Terra/MODIS
- EOS-Aura/ OMI
- Suomi-NPP/VIIRS & OMPS
- Sentinel 1
  - GRD EW
  - SLC IW
  - QRT (locally downlinked)
- Sentinel 2

Current operational (commercial)

- COSMO-SkyMed (SAR)

In future:

- Sentinel-3
- Sentinel-5P (UV product)



Finnish Collaborative GS

1. Collaborative Acquisition Station

- Local downlink of Sentinel-1 pass-through data
- Focus on **Quasi-Real-Time** services

- **Ice monitoring to support icebreakers operating in Baltic Sea**

Data requirements
- S1 pass-through
- **EW HH+HV**

AoI:
- Baltic Sea

Timeliness:
- QRT < 1 hrs
- Daily products

Current status:
- S1 DFEP and IPF installed
- S/C tasking in progress
- Automated scheduling of downlink and processing
  - to be developed

Finnish Collaborative GS

2. Collaborative Archive Centre

- Local mirror site: S1, S2, S3, S5P
- Dissemination to local users and neighboring countries
- Long-Term Archiving
- Bulk processing
- Automated product generation (water quality, snow cover and SWE…)
- Hosted processing services (IaaS, PaaS)

Current status:

- Automated downloading in place
  - S1 downloaded from colhub since spring 2015
  - S2 downloading: Operational since May 2016
- Dissemination system (FINHUB)
  - FINHUB data dissemination opened in May 2016

Areas of Interest

Marine research
EW HH+HW, Arctic Ocean, Greenland Caspian sea, Antarctica

Operational use:
EW HH+HW, Baltic Sea operational backup

Land applications:
IW VV+VH
IW HH+HV

Areas of Interest

Water quality:
- Baltic Sea drainage basin

Snow and Hydrology:
- Baltic Sea drainage basin

Land use applications
- Finnish and Estonian land area

Areas of Interest

SLSTR:
- Baltic Sea drainage basin (FSC, lake ice, Land cover)
- Northern Hemisphere (FSC, SWE)

OCLI:
- Pan-European (FSC, lake ice, Phenology)

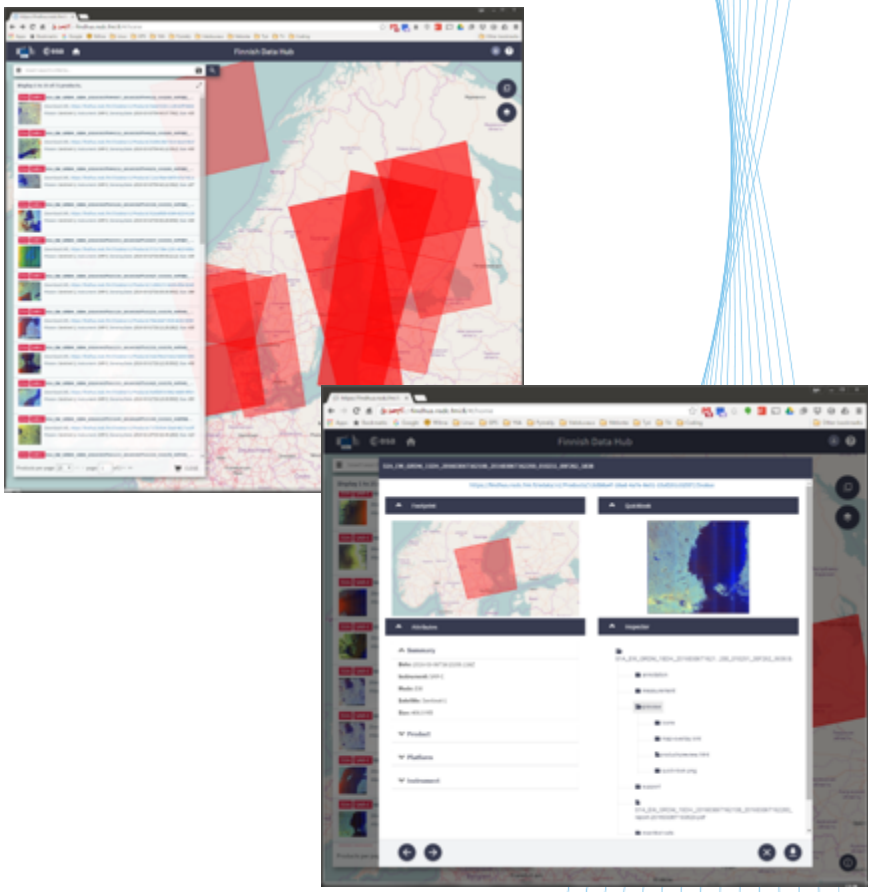
Data dissemination - FINHUB

- Sentinels' data dissemination to users
- Utilises the ESA developed DHuS system
  - Easy to migrate from ESA SciHub
  - Same Graphical user interface
  - Same M2M interface

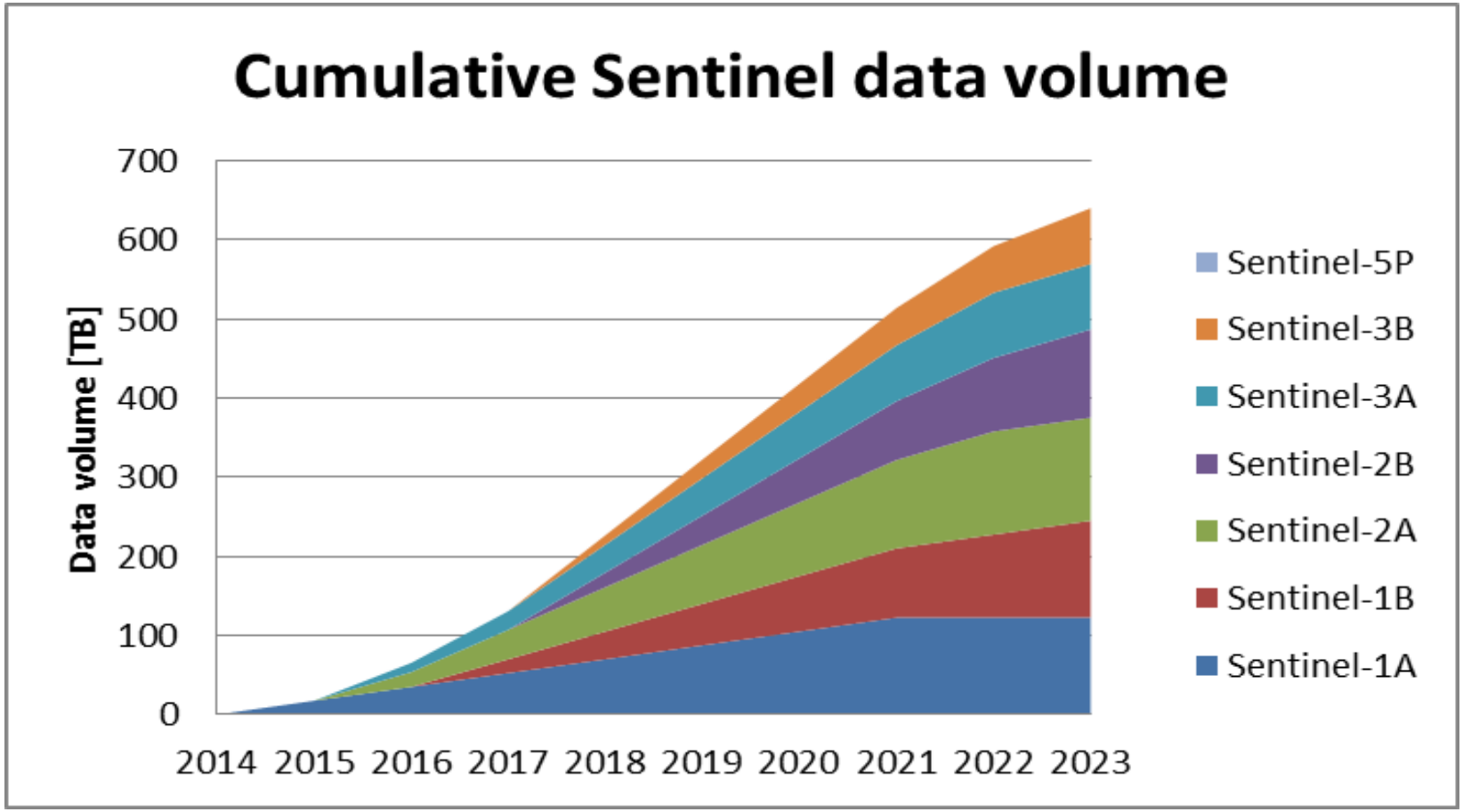
- Mostly Finnish users, but also users from Skandinavia, Central Europe

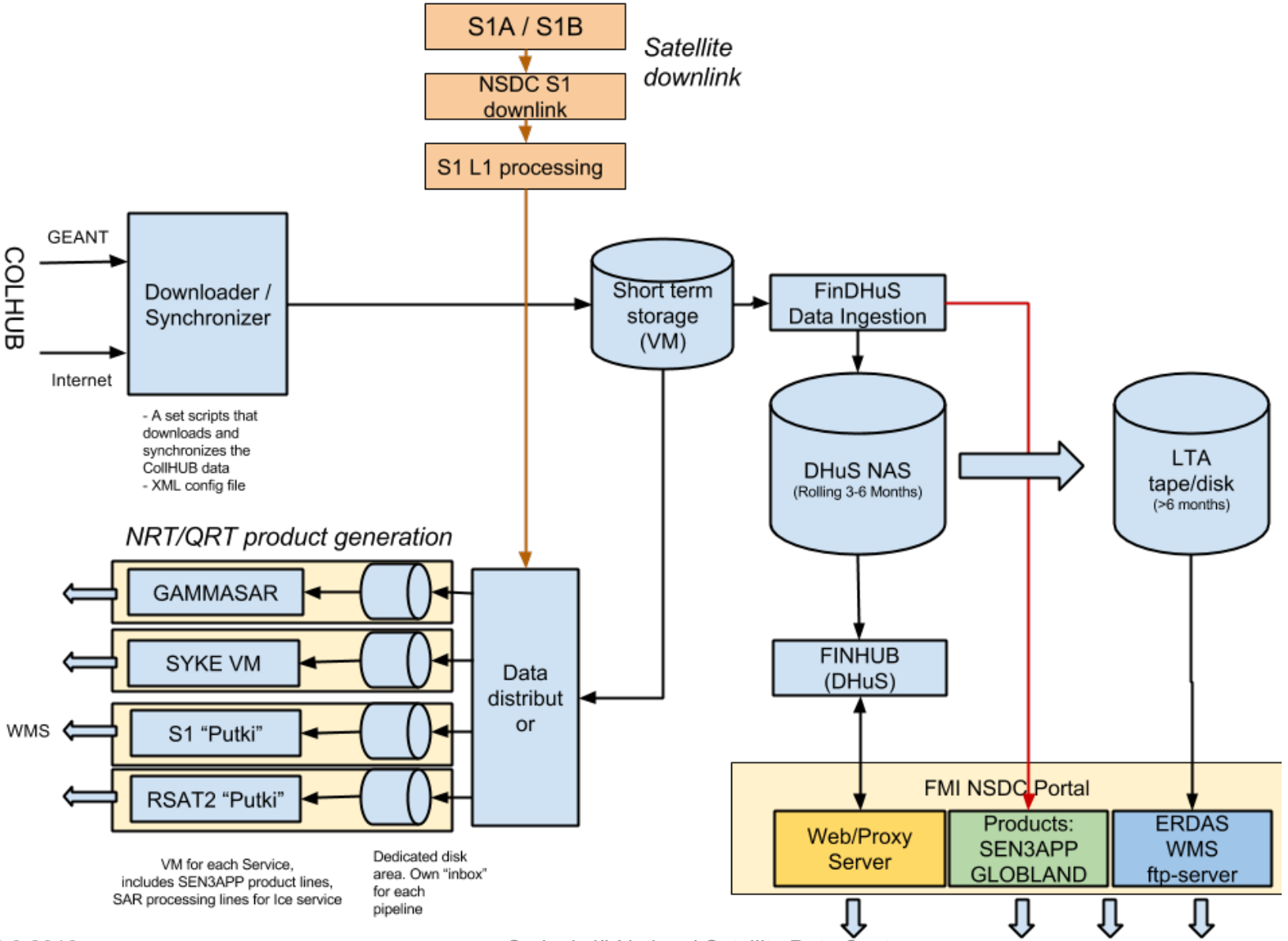
- Current archive data volume:
  > 150 TB

- https://finhub.nsdc.fmi.fi



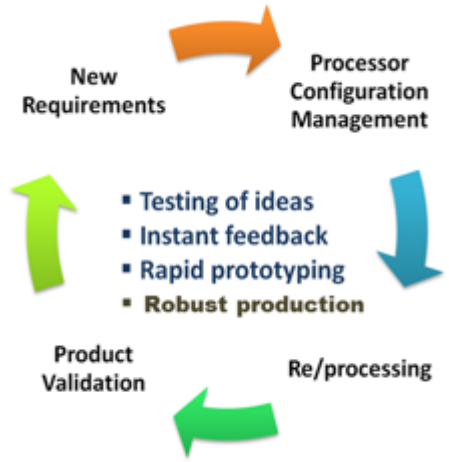
Data volumes - estimate




S1A / S1B
Satellite downlink
NSDC S1 downlink
S1 L1 processing
GEANT
COLHUB
Internet
Downloader / Synchronizer
- A set scripts that downloads and synchronizes the CollHUB data
- XML config file
Short term storage (VM)
FinDHuS Data Ingestion
DHuS NAS
(Rolling 3-6 Months)
LTA tape/disk
(>6 months)
NRT/QRT product generation
GAMMASAR
SYKE VM
WMS
S1 "Putki"
RSAT2 "Putki"
Data distributor
VM for each Service, includes SEN3APP product lines, SAR processing lines for Ice service
Dedicated disk area. Own "inbox" for each pipeline
FINHUB (DHuS)
FMI NSDC Portal
Web/Proxy Server
Products: SEN3APP GLOBLAND
ERDAS WMS ftp-server

Calvalus – Processing system

- System for efficient Remote sensing data **storage and processing**
- Based on open source Big Data solution (Apache Hadoop)
- Implements commonly used processing workflows
- Provides common Remote sensing software components
- Provides interfaces for implementing customized data processors and algorithms

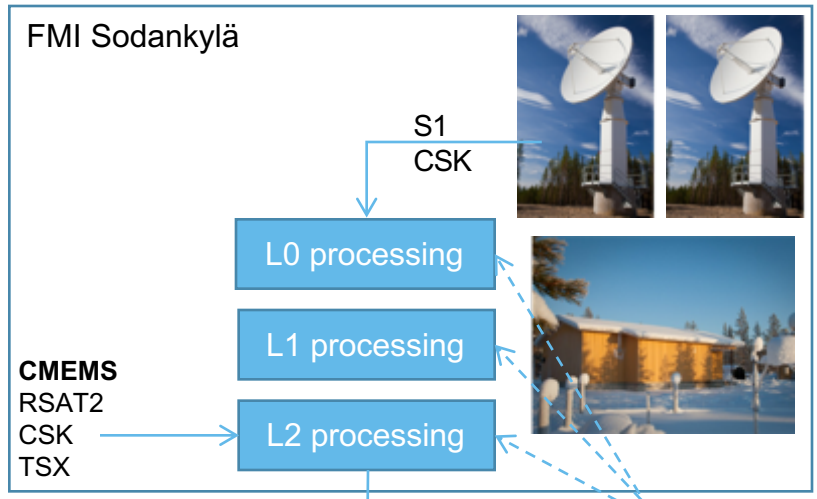


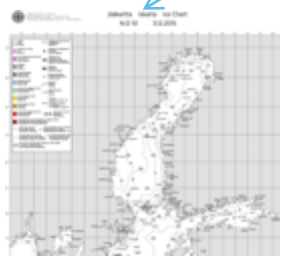
Applications and services

Baltic Sea Ice Monitoring

- Commercial and environmental needs
  - Finland is essentially an island
  - ~90% of Finland's import and export via sea routes
  - Gulf of Finland is one of the most busiest marine routes for oil transport
- Operative Service
  - Availability target 99.9%
  - Quasi-real-time / NRT needs
  - Daily products
- Customer:
  - Finnish Transport Agency
  - Finnish, Swedish, Estonian Ice breakers
- Operations:
  - Fully automated processing lines at Sodankylä
  - Operators and ice analysts in 2 shift
  - 24/7 monitoring of the processing lines

Data need:
- Sentinel-1 EW HH+HV pass-through (+RSAT2, CSK, TSX)
- AOI: Baltic Sea
- Time: Nov – May



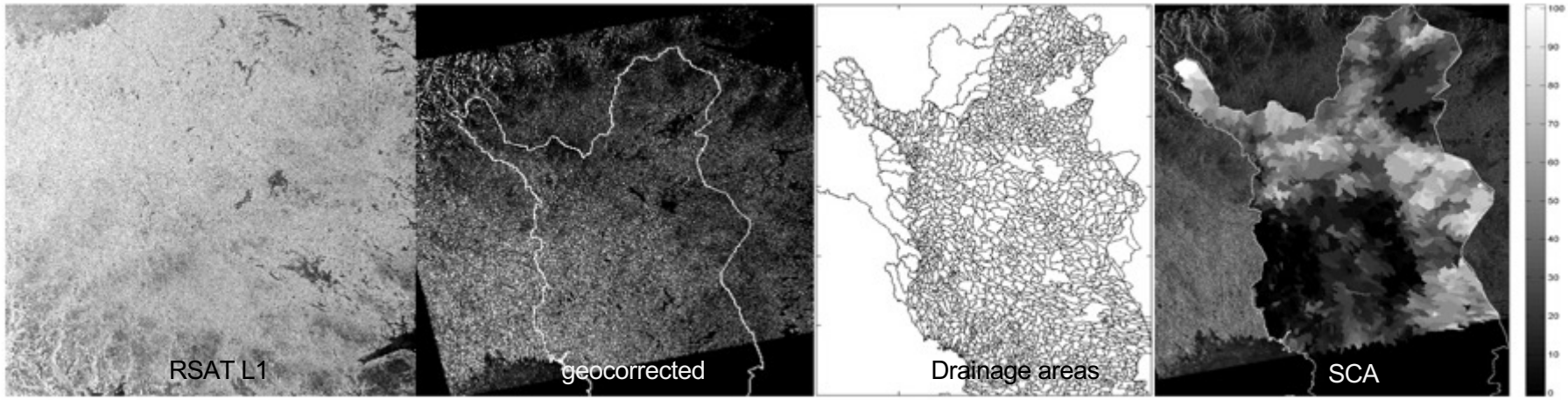


Snow cover monitoring

- Monitoring on Snow in boreal forest
  - Fractional snow cover
  - Combined with SWE (from passive μ-wave radiometers)
- Applications
  - Snow melt start
  - Frosting and thawing of soil
  - Hydrological estimates for river runoffs (officials, energy sector, agriculture)
  - Snow on top of ice
  - Ice thickness

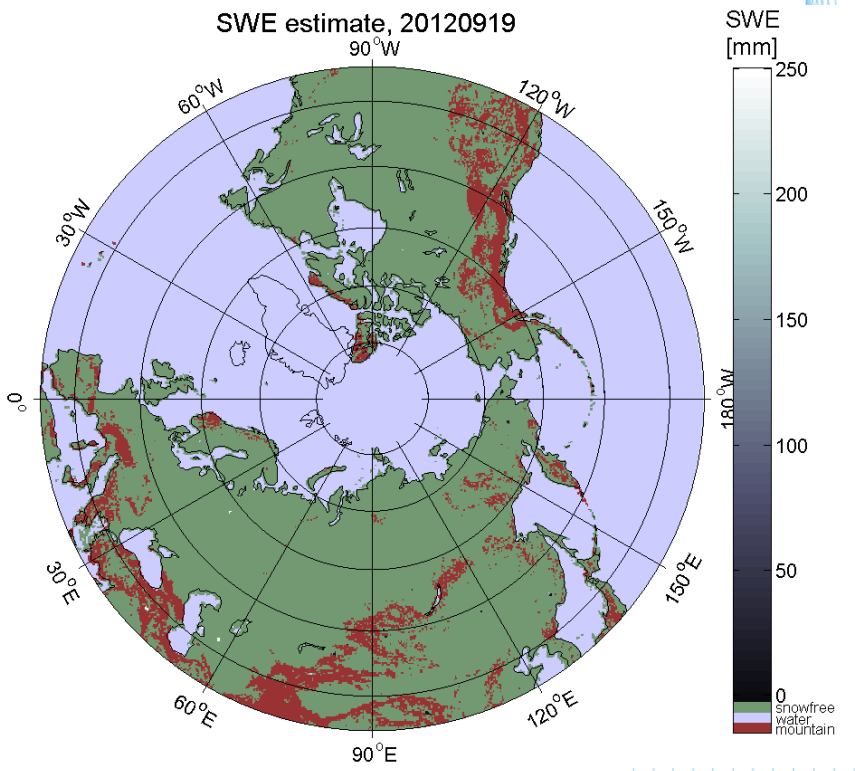
Data needs:

- Data: S1 IW HH or VV / **EW HH**
- AoI: Finnish Land Area + Scandinavia, Baltic Countries
- Time: 1 Feb – 30 June
- Orbit: ascending/descending (all available scenes)
- Timeliness: 3-24 hours from sensing



Operational Snow monitoring of Northern Hemisphere

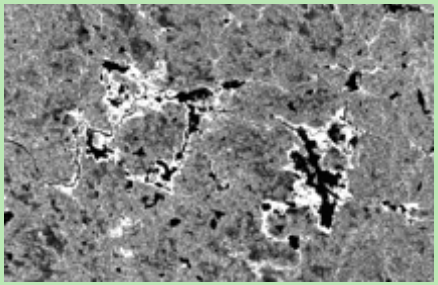
- Snow Water Equivalent (SWE)
  - 35 year-long CDR time-series on snow conditions of Northern Hemisphere
  - High resolution pan-European SWE
- Snow Extent (FSC)
  - 20 years Snow Extent data record of Northern Hemisphere

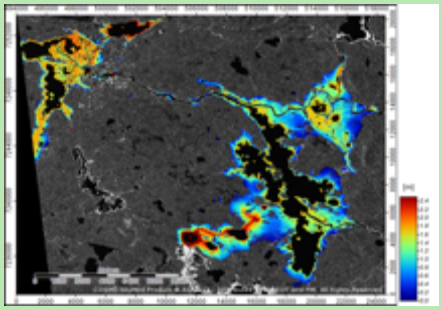


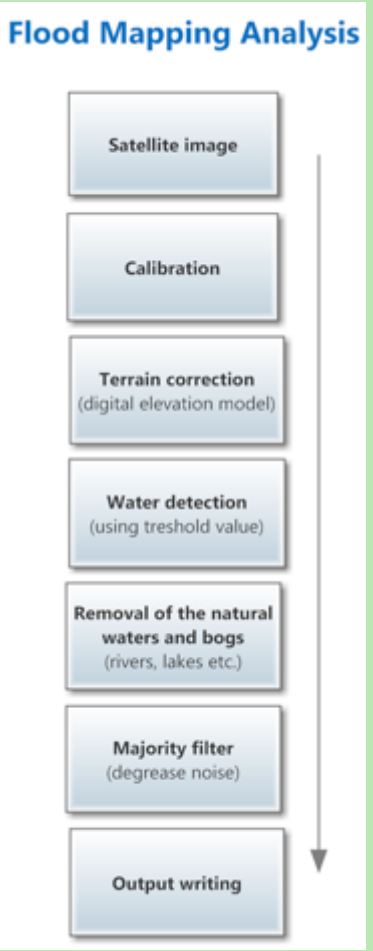
Flood detection and monitoring

- Annual flooding of rivers in Bothnia
  - Spring floods due snow melt
  - Autumn floods due heavy rain
  - Data need: CSK or S1 IW Apr-May
- Operational service for regional authorities
  - Flood covered area, Flood depth
  - Forest floods

- Data needs
  - Mode: CSK HIMAGE, S1 IW
  - Polarisations: HH + HV
  - Time: Apr-May
  - Timeliness: NRT ~3hrs
  - AoI: Finland





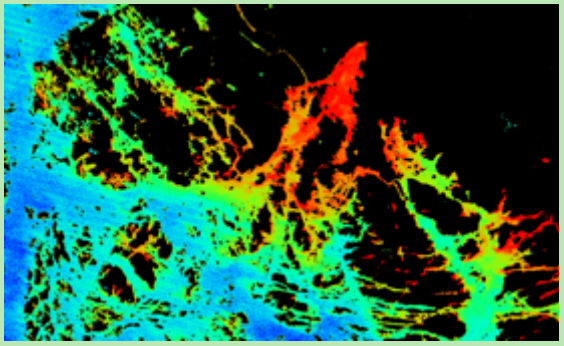


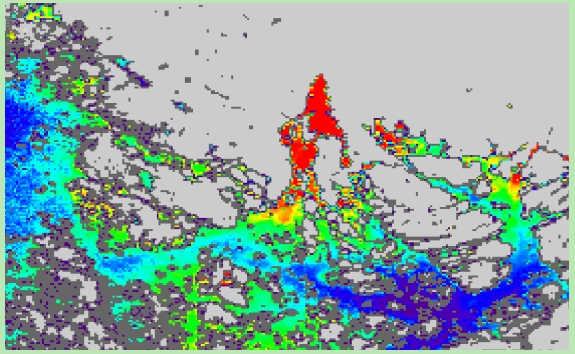
Water quality services

- Specific features in nordic areas
  - Cloud coverage
  - Specific optical properties in Nordic waters (coloured dissolved organic matter in water)
  - Standard Level 2 products not OK, Local tailoring needed

Data Needs

- High resolution data needed from
  - Sentinel 3 for Baltic Sea
  - Sentinel 2 needed for archipelago and lakes
- Timeliness: NRT
  - SST: Detect upwelling
  - Chl-a, Algae blooms: For weekly Algae reports
  - For rapid planning of research vessels
  - For turbidity, detect resuspension

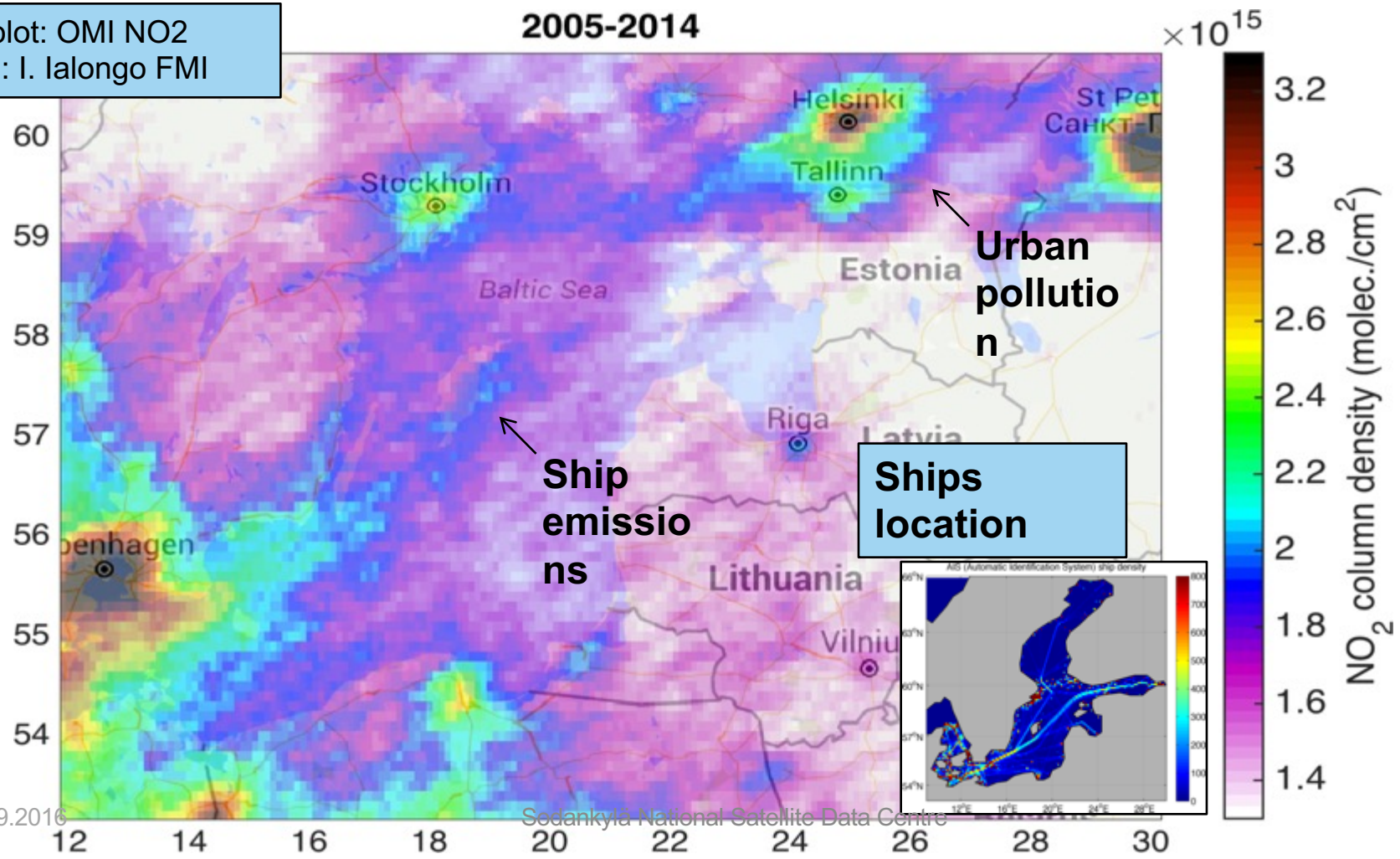




MERIS TSM 3
Turbidity

Monitoring Air Quality in the Baltic region: preparation for S5P exploitation

In the plot: OMI NO2
Source: I. Ialongo FMI



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