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Data and Services at the Finnish CollGS

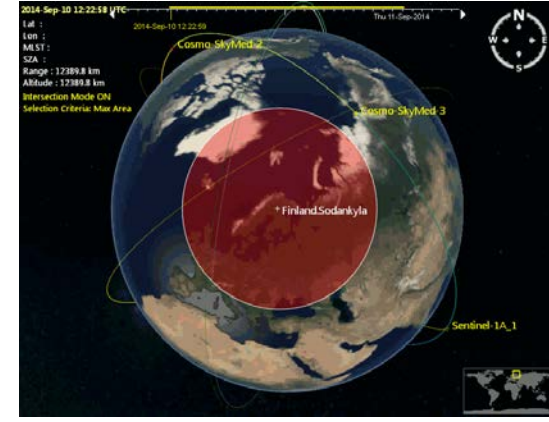
Baltic from Space - Helsinki 29-31 March 2017

Jyri Heilimo / Finnish Meteorological Institute
Finnish NCP



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National Satellite Data Center

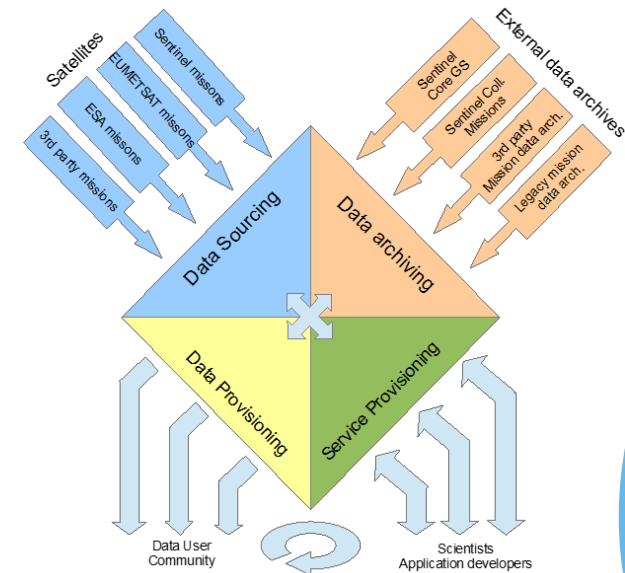


National satellite data center providing satellite data reception and data processing services to Finnish and international partners



National Satellite Data Center

- Focus on operational 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 SAR data for Baltic Sea ice monitoring and icebreaker support
 - Provide reliable access to and maintain local long-term archive of satellite 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)





Finnish Collaborative GS

1. Sodankylä Ground Station

- Local reception of Sentinel-1 pass-through data
- Focus on Near real-time and **Quasi-Real-Time** services
- **Ice monitoring to support icebreakers operating in Baltic Sea**

Current status:

- S1 DFEP and IPF installed
- Sentinel-1B tasking by ESA
- Dedicated pass-through downlink to Sodankylä
- Automated scheduling of downlink and processing to be developed



Data requirements

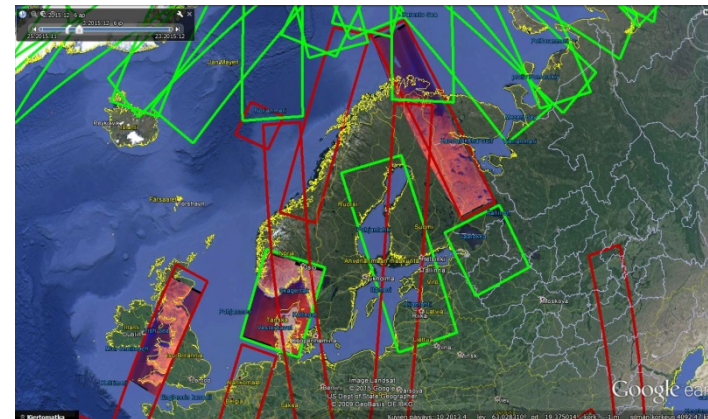
- S1 pass-through
- **EW HH+HV**

Aol:

- Baltic Sea

Timeliness:

- QRT < 1 hrs
- Daily products





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
- Hosted processing services (IaaS, PaaS)

Current status:

- Automated downloading in place
 - S1 downloading since spring 2015
 - S2 downloading since summer 2016
 - S3 downloading from S3PreOps
- Dissemination system (DHUS)
 - Virtual Environment
 - FINHUB dissemination operational May 2016

SENTINEL - 1 Areas of Interest

Marine research
EW HH+HW, Baltic Sea, Kara sea, Barentz sea

Operational use:
EW GRDM, Baltic Sea
IW GRDH, Baltic Sea

Land applications:
IW GRDH & SLC



SENTINEL - 2 Areas of Interest

Water quality:
- Baltic Sea drainage basin

Snow and Hydrology:
- Baltic Sea drainage basin

Land use applications
- Finnish and Estonian land area



SENTINEL - 3 Areas of Interest

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

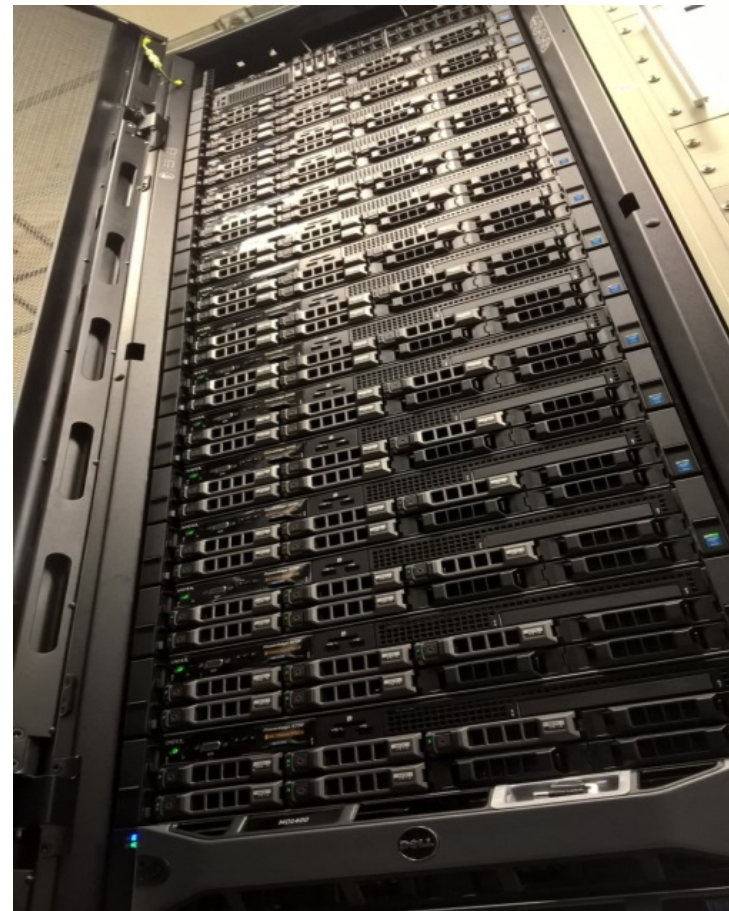
OCLI:
- Pan-European (FSC, lake ice, Phenology)





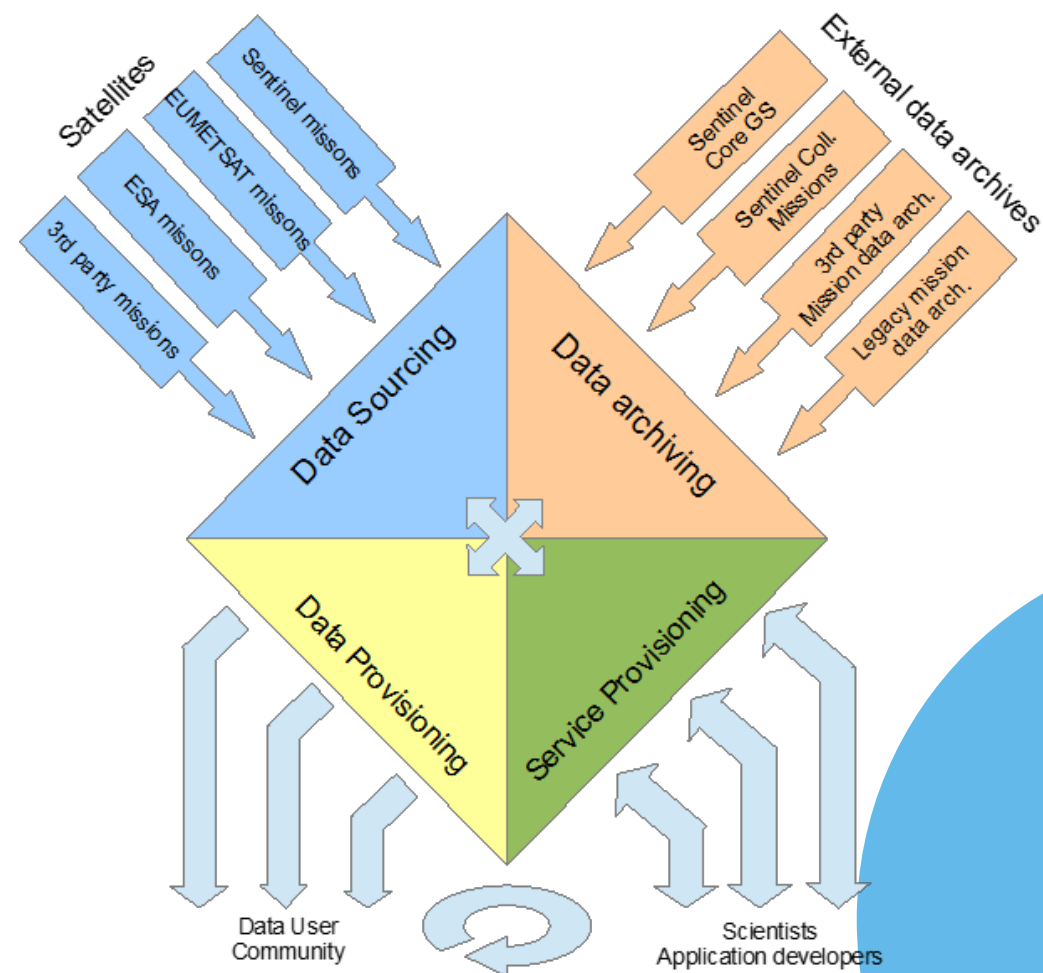
High power computing environment

- Virtualization environment for operational product processing and hosted processing
 - CPU cores: 224, memory: 2 TB
- Ceph storage offers a scalable storage for satellite data and products
 - Total capacity 800TB
 - 500TB S3 object storage (Amazon S3) for Sentinel data storage
- CalFIN -Calvalus processing cluster
 - System for efficient Remote sensing data **storage and processing**
 - Based on open source Big Data solution (Apache Hadoop)
 - 25 Nodes, 400TB storage



Future plans – Regional Exploitation Platform

- Satellite data has traditionally been processed in monolithic processing centers
- The paradigm is changing towards distributed and networked centers
- NSDC can provide to Regional Exploitation Platform
 - Fast access to data including both satellite data, products and in-situ data
 - Processing capacity (cloud, clusters, VMs) / IaaS
 - Processing software (toolboxes, commercial sw) / PaaS
 - General platform functionality (user management, access control, accounting, security, portals)



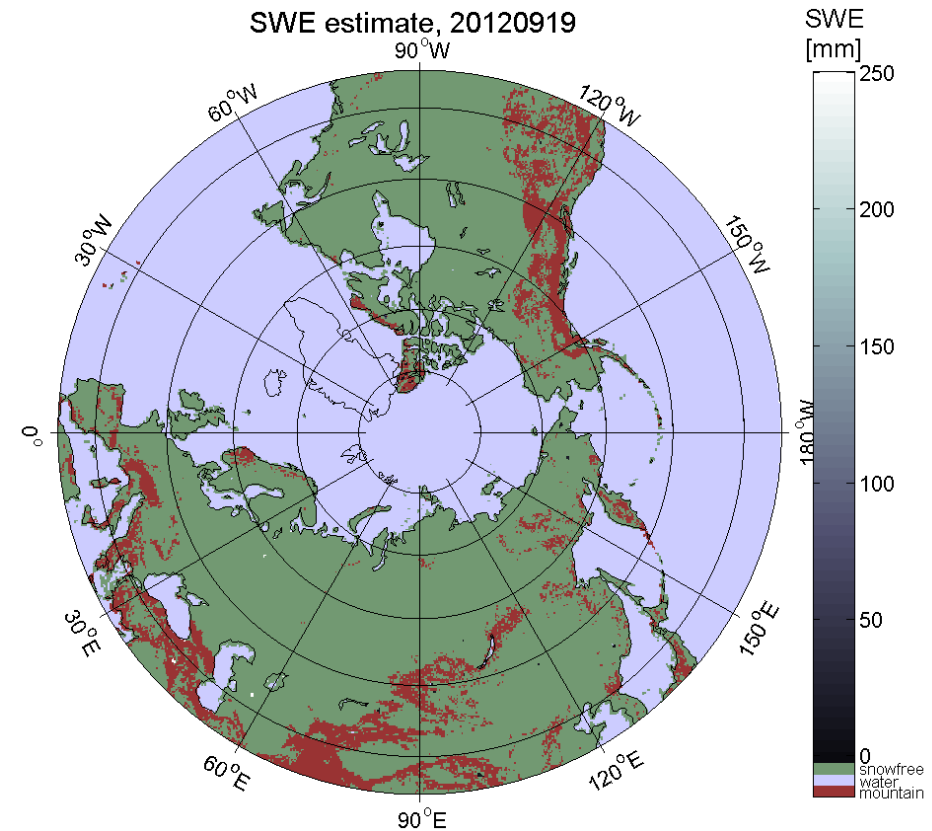


Sample products



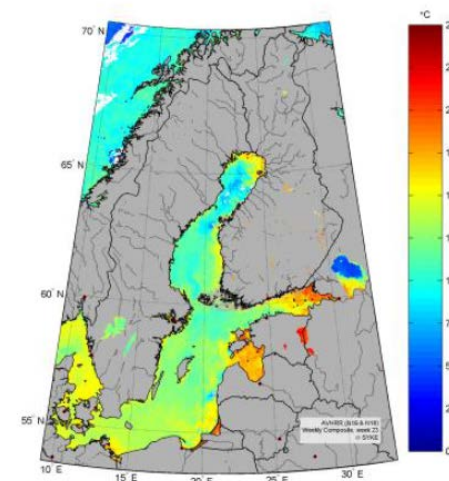
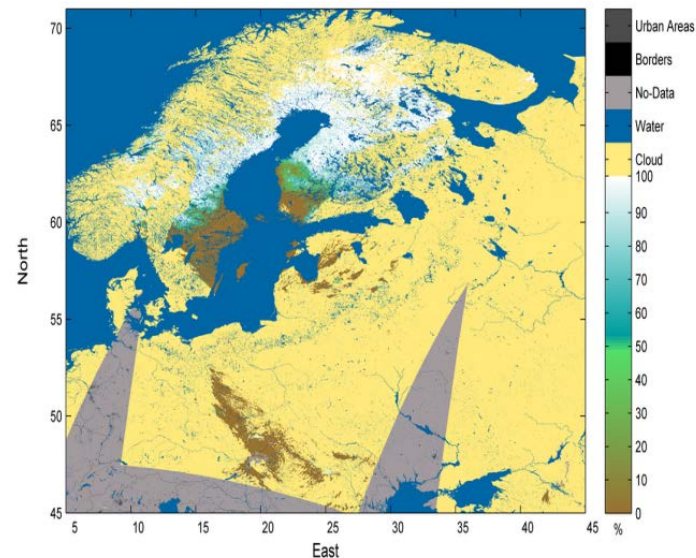
Operational Snow monitoring of Northern Hemisphere - FMI

- 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



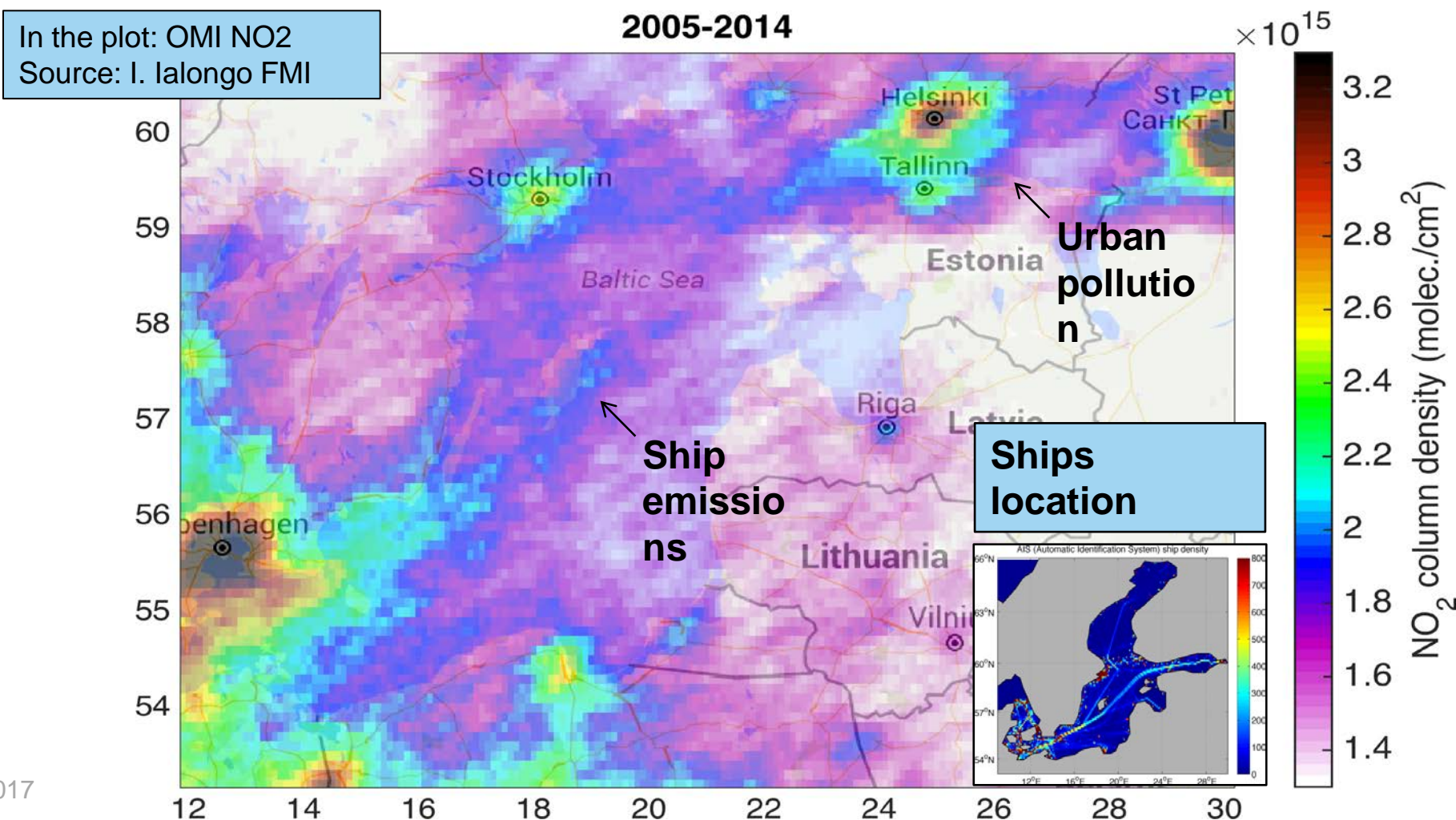
SYKE, NSDC and NRT monitoring services

- For some NRT services SYKE still **retrieves L1** data from NSDC and processes it locally
 - **Daily Sea Surface temperature (AVHRR)**
 - **Phenology monitoring (MODIS Terra)**
- New services are being set up **at NSDC infrastructure** and only the L2/L3 results are transferred to SYKE
 - **Daily water quality for Baltic Sea (MODIS Aqua, 2012-2016)**
 - **Snow products over Northern Europe (MODIS Terra, 2007-)**



Kuva 6. Pintaveden lämpötila 4. -9.6. (viikko 23) 2013.

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



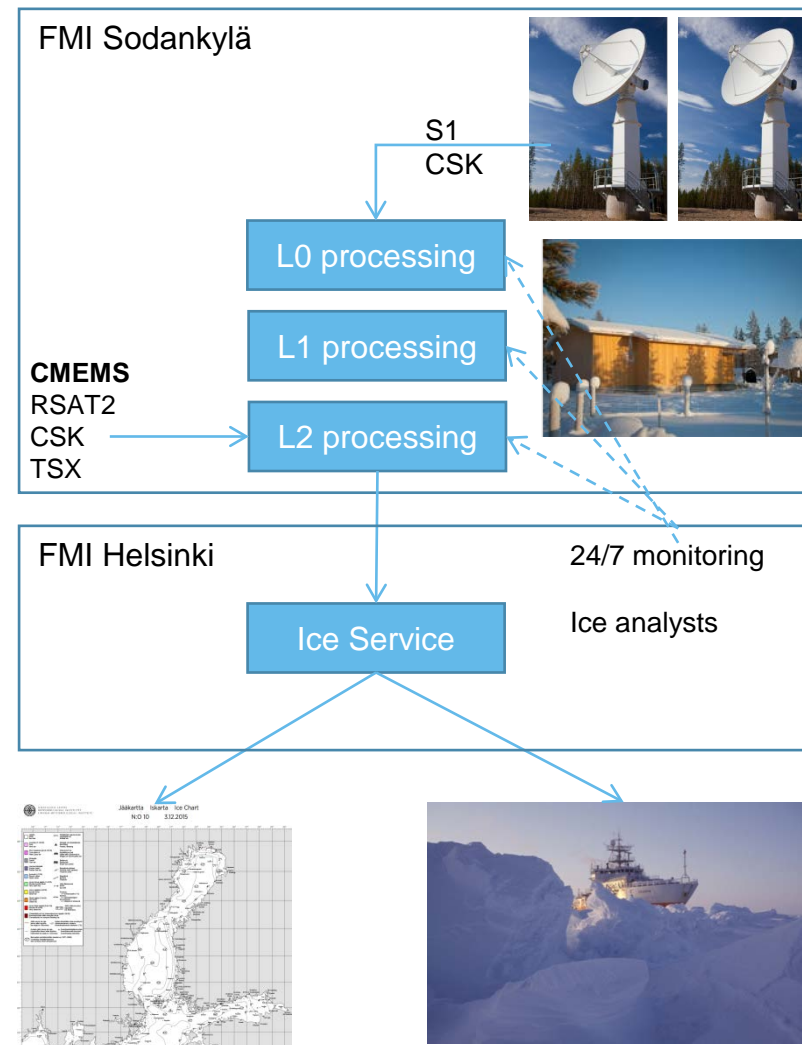


Baltic Sea Ice Monitoring

- **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 and Swedish 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-1B EW HH+HV & CSK & RSAT2 & TSX
- Sentinel-1B QRT service under development
- AOI: Northern Baltic Sea
- Time: Nov – May

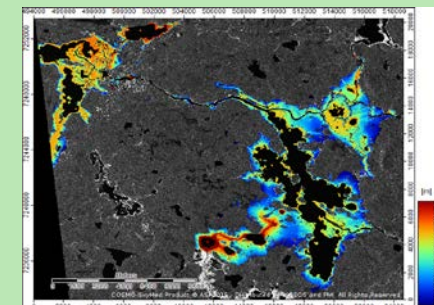
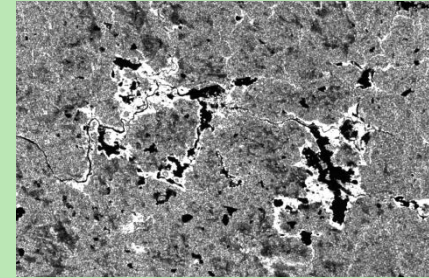




Flood detection and monitoring

- Annual flooding of rivers in Bothnia
 - Spring floods due snow melt
 - Autumn floods due heavy rain
- Operational service for regional authorities
 - Flood covered area, Flood depth
 - Forest floods

- Data needs
 - Cosmo-SkyMed and S1 IW
 - Polarisation: HH + HV
 - Time: Apr-May
 - Timeliness: NRT ~3hrs
 - Aol: Finland



Flood Mapping Analysis

Satellite image

Calibration

Terrain correction
(digital elevation model)

Water detection
(using threshold value)

Removal of the natural
waters and bogs
(rivers, lakes etc.)

Majority filter
(decrease noise)

Output writing



Image © Matias Takala

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