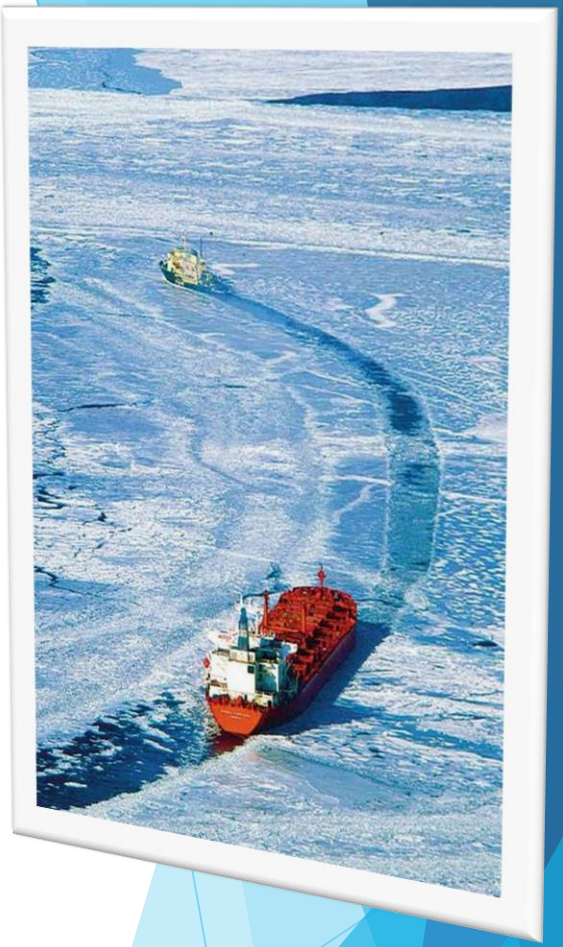
Upgrading Estonian Ice charting service



Jekaterina Sluzenikina, Sander Rikka, Rain Elken, Rivo Uiboupin

Liis Sipelgas

Background

Estonian Weather Service performs **duties of Ice Service** in during winter navigation period

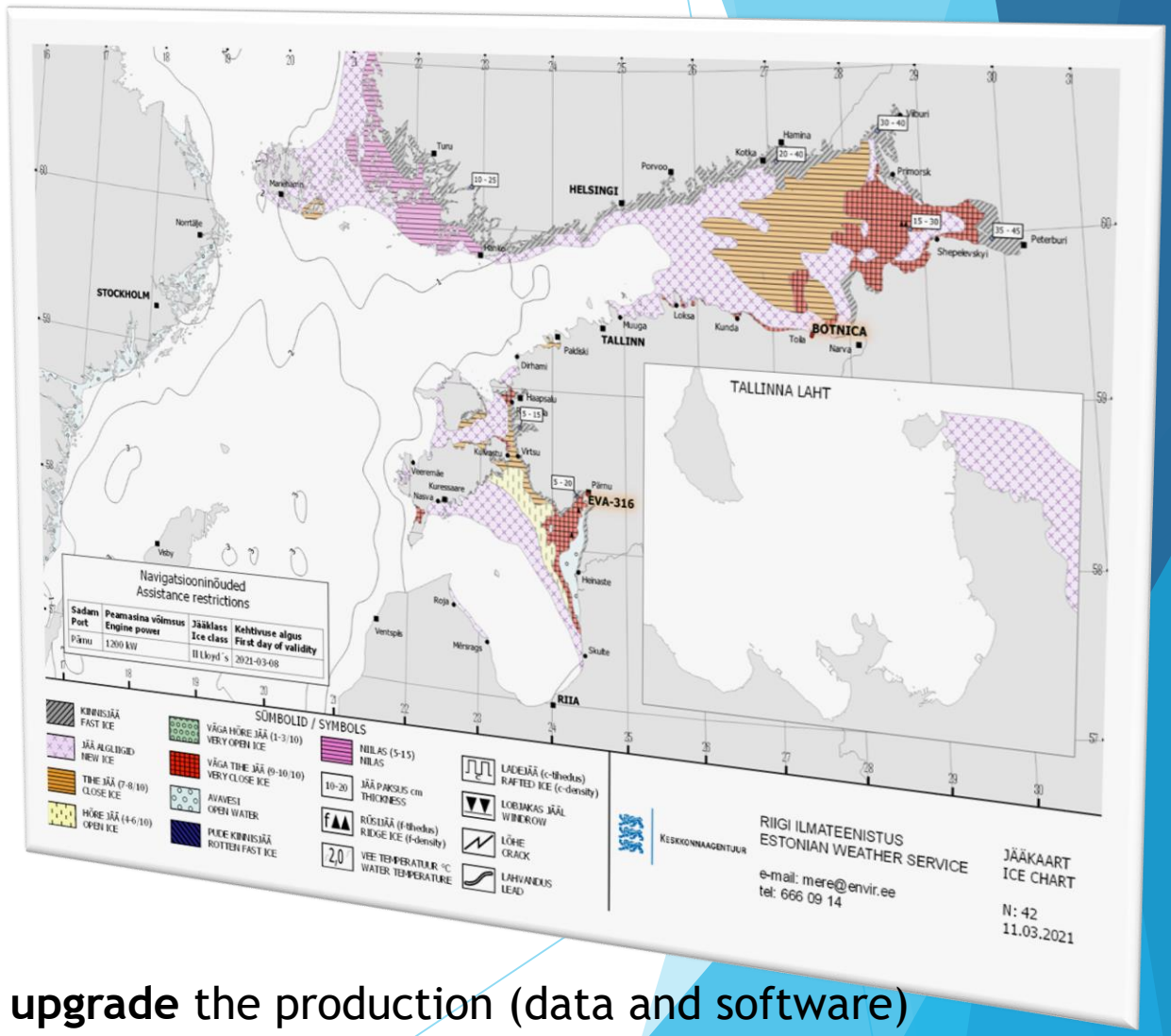
- **Responsibilities** of Estonian Ice Service incluce **daily production of:**

  - ❑ **Ice report -** an overview of ice conditions in text format

  - ❑ **Ice Map-** Maps of ice cover areas (including information about ice type and thickness)

Ice Maps have been produced in Estonian Ice Service since 1945

Over the years different data sources have been used in ice map production (earlier observations, but over the last decides satellite data has been the main sorce of ice information)



=> Few years ago there was **a decision**/need to **upgrade** the production (data and software) of **ice mapping**

Conceptualisation of new/upgraded ice charting service

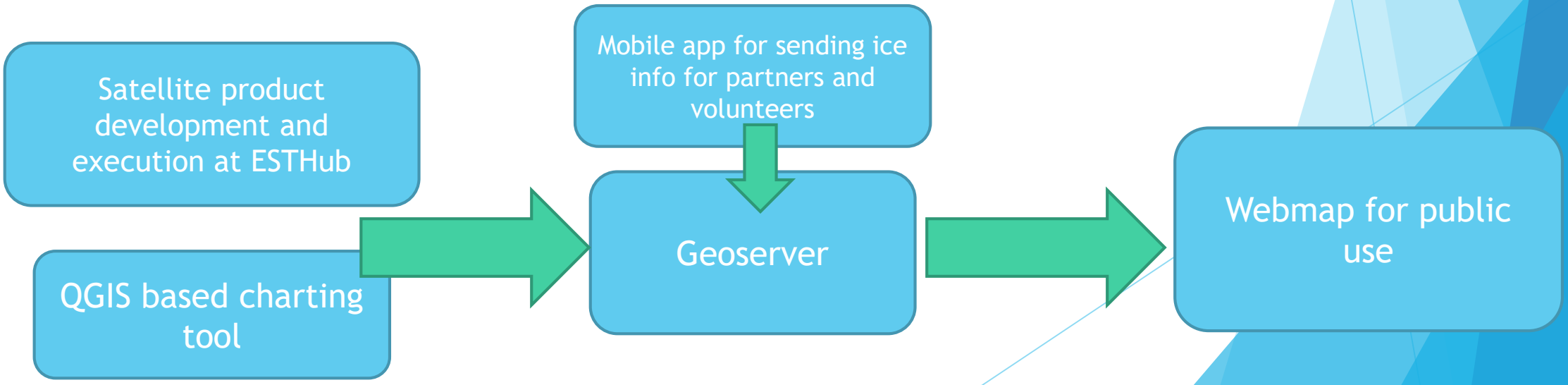
❑Gathering background information

- Identifying the needs of partners (Estonian Transport Administration) and forecasters (who are responsible for compiling the daily ice information
- Get acquainted with the work of the Finnish Ice Service

❑Formulating the activities and workflow for ice service upgrade

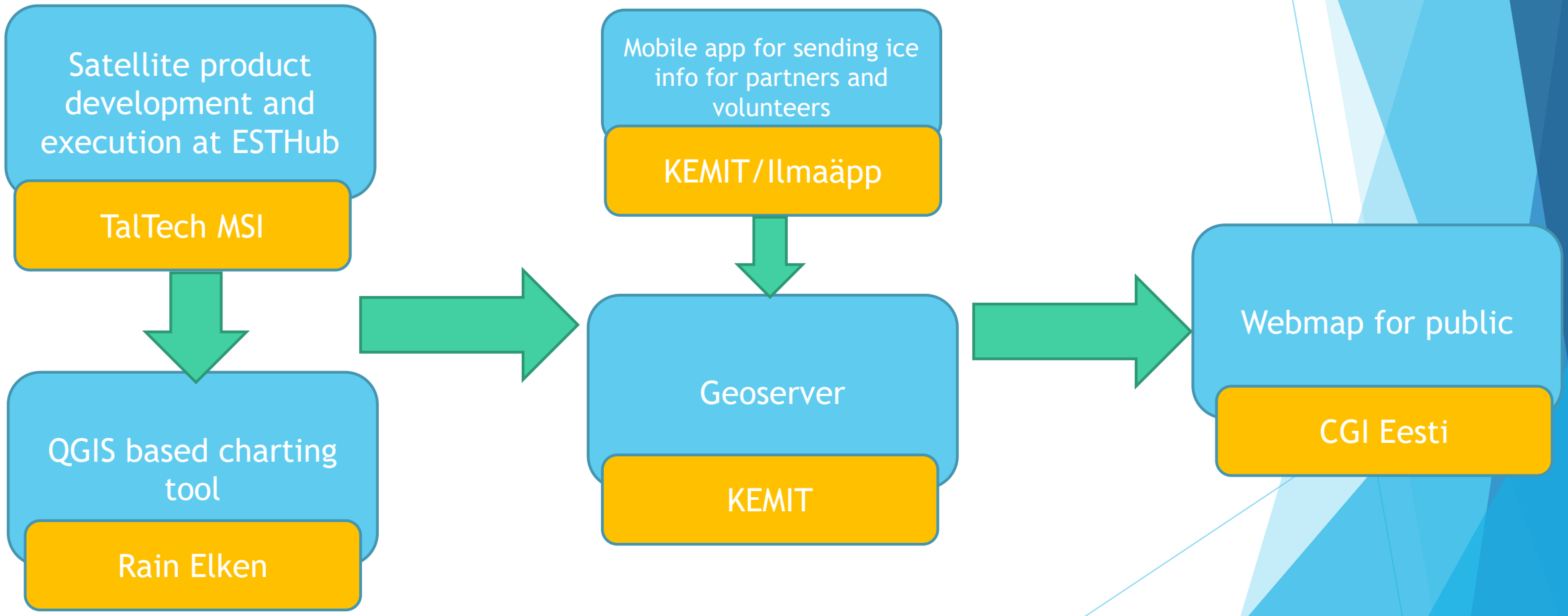
❑ **To be developed:**

- New visualiations and **products** from Sentinel **satellite imagery**
- **GIS** based **tool** for **ice charting**
- Tool (**mobile app**) to collect ice thickness information from **volunteers** and partners
- For public/partners **web map** with access to satellite imagery together with ice map



The project „JAAK“ was funded by RIA and in 2019 and KEMIT pronounced the public tender to fulfil the activities formulated in „Ice Project“ concept

Partners responsible for different parts of project



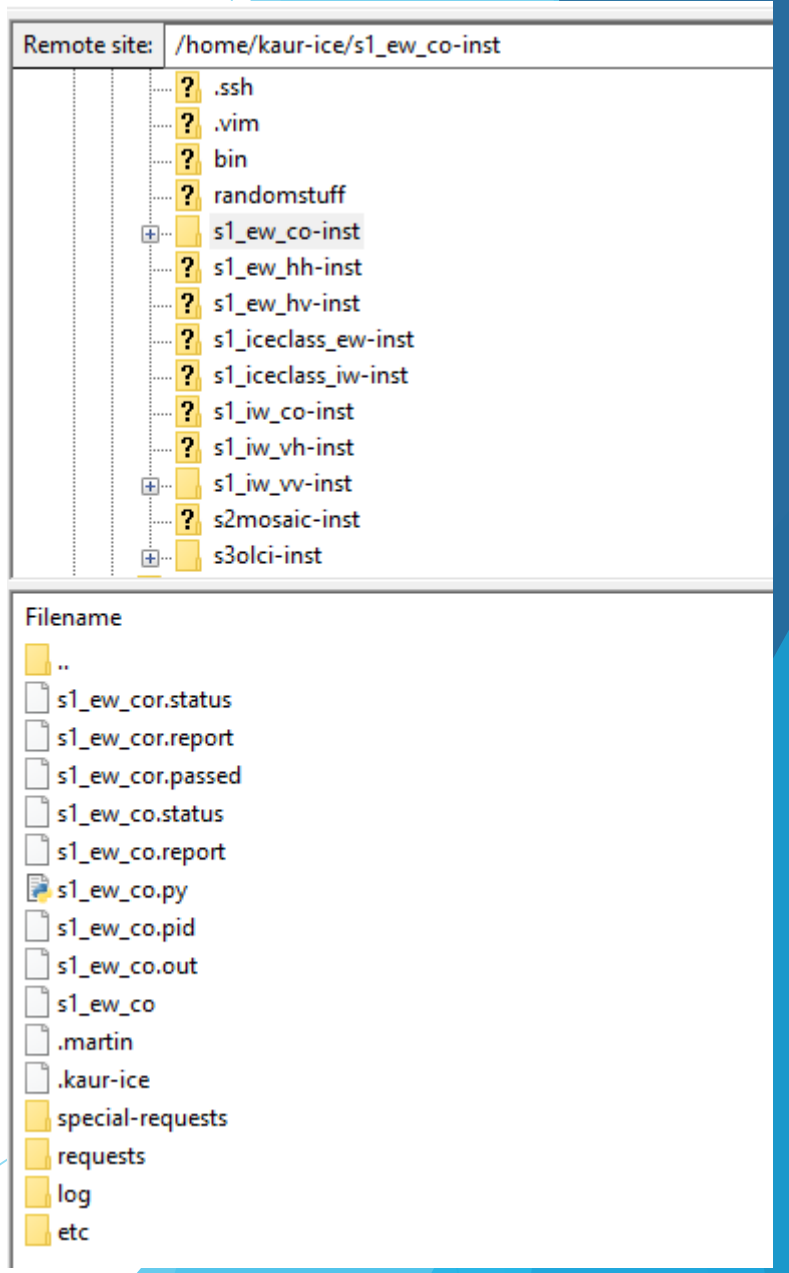
Satellite products development => responsible partner TalTech MSI

List of products developed and operationally **running** at **EstHub**

- **Sentinel-1** =>pre-processed (calibrated/subsetted/resized) EW and IW Geotiff
  - Products to simplify ice charting process developed from S1 data
  - **Pre-classified sea ice product** (ice types distinguished) S1 IW and EW data
  - **Per-classifided lake ice product** (ice types distinguished) S1 IW and EW data

- **Sentinel-2** =>**daily colour composite** mosaic over Estonia
- **Sentienl-3**=>**daily colour composite** over Estonia

For each product separate environment is set up at EstHub for operational execution

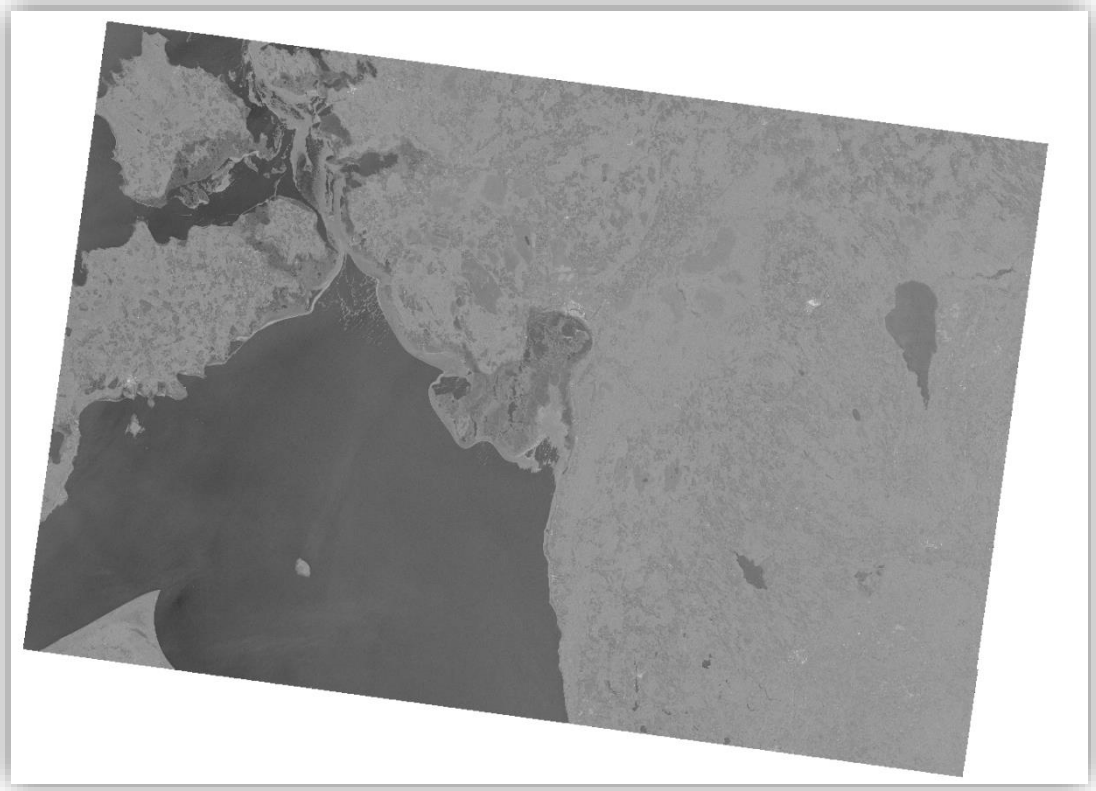


Sentinel-1 operational processing at EstHub

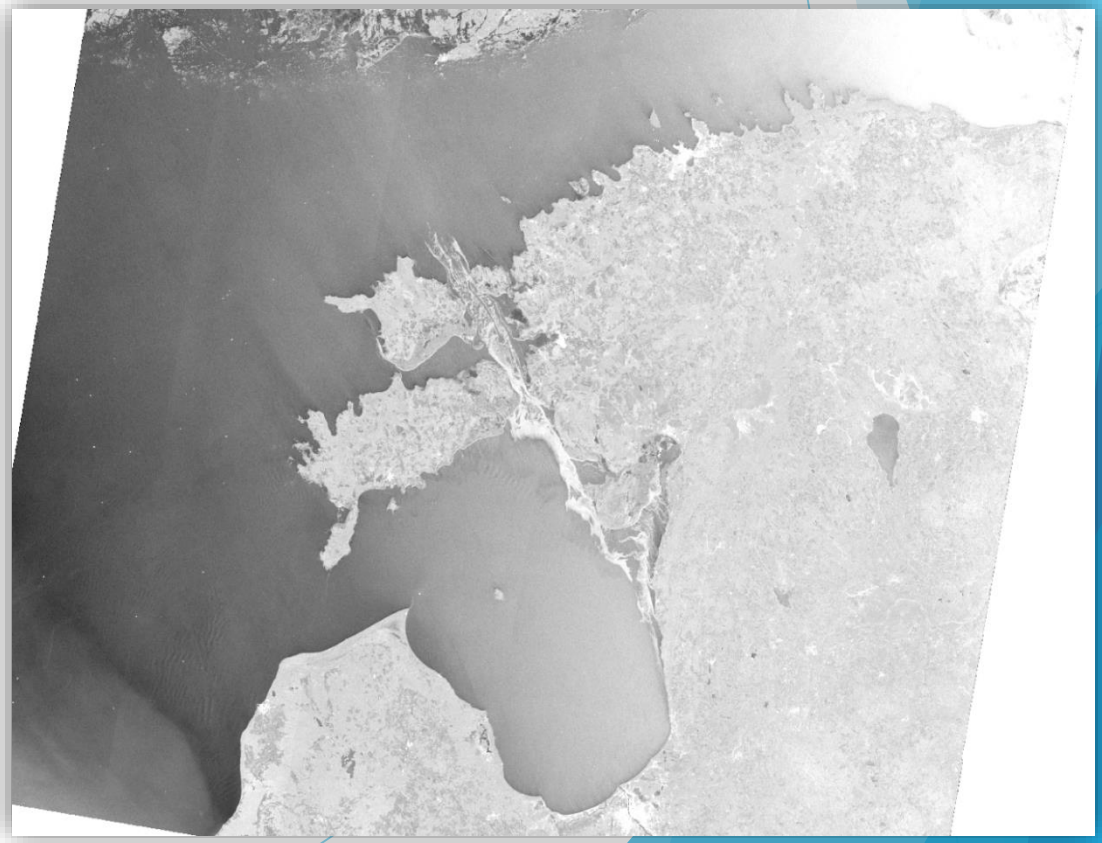
- **Production of pre-processed (calibrated/sub-setted) S1 images**

Original data	Software used	Product output format
Sentinel 1 EW, IW	SNAP based .xml and SHELL for operational executing	GeoTIFF

IW

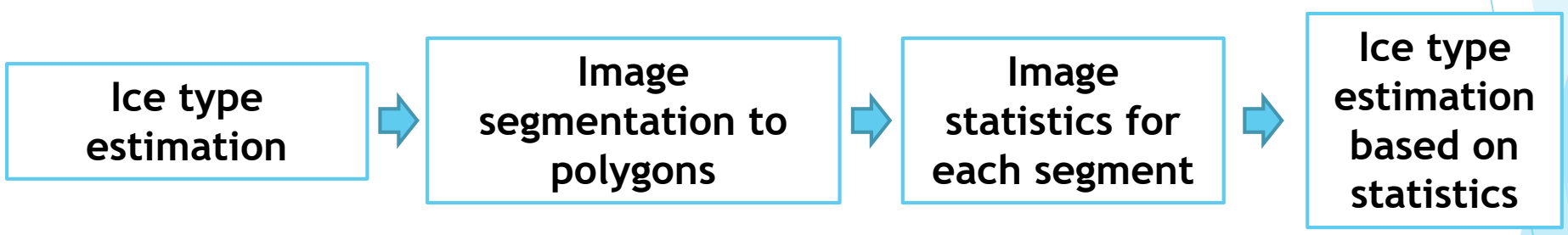


EW



- **Production of pre-classified sea ice product (ice types distinguished) from S1**
- **Production of per-classifided lake ice product (ice types distinguished) fromS1**

Original data	Software used	Product output format
Sentinel-1 EW, IW	.py (ice type identification with Tensorflow) and SHELL for operational executing	.SHP GeoTIFF



- **Original polygons**
- **Ice and water estimation and prediction confidence**
- **Ice areas are divided to 3 classes + prediction confidence**

Pre-classified lake ice

Pre-classified sea ice

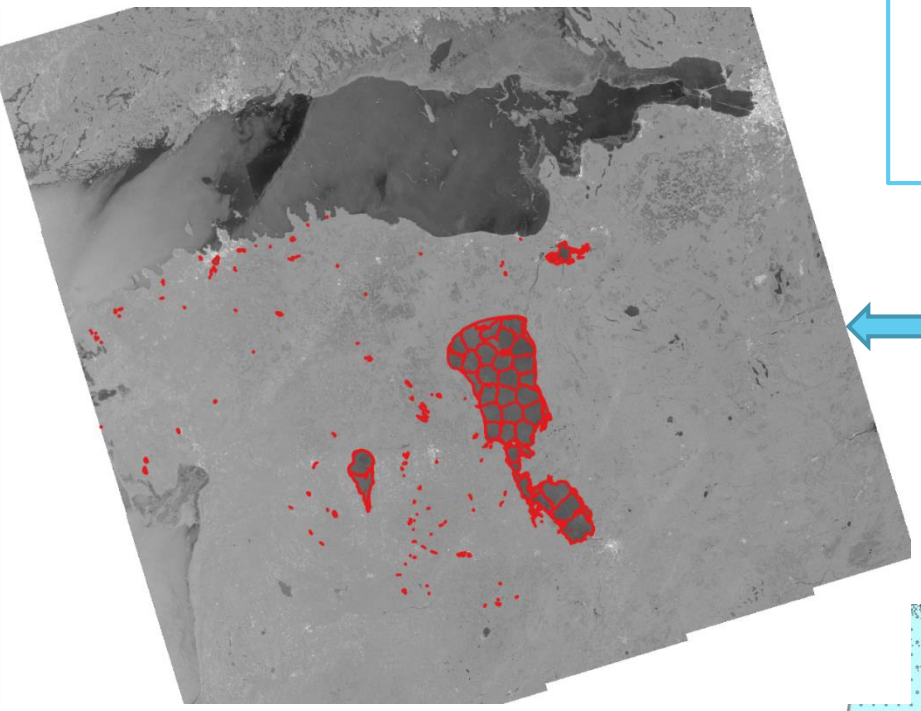
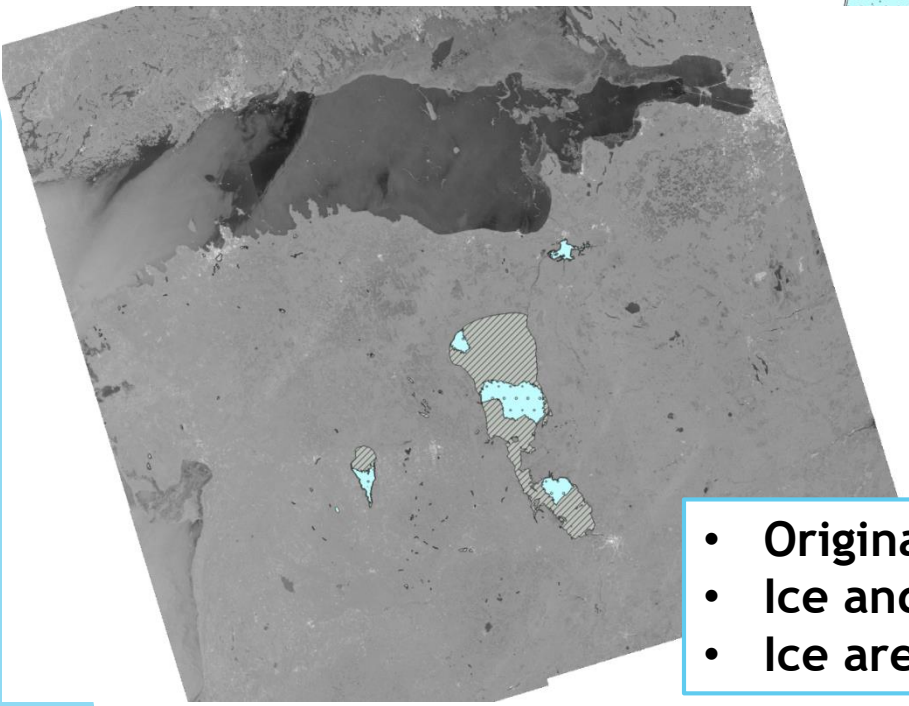
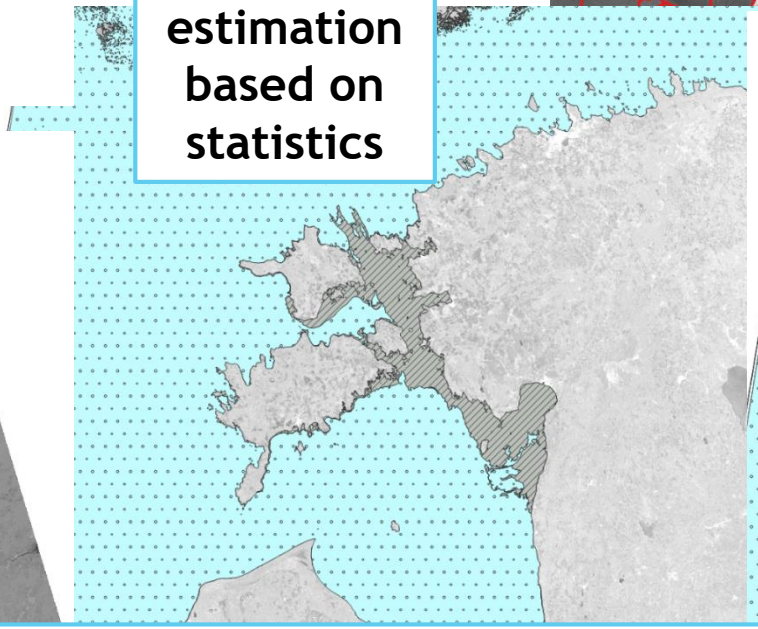


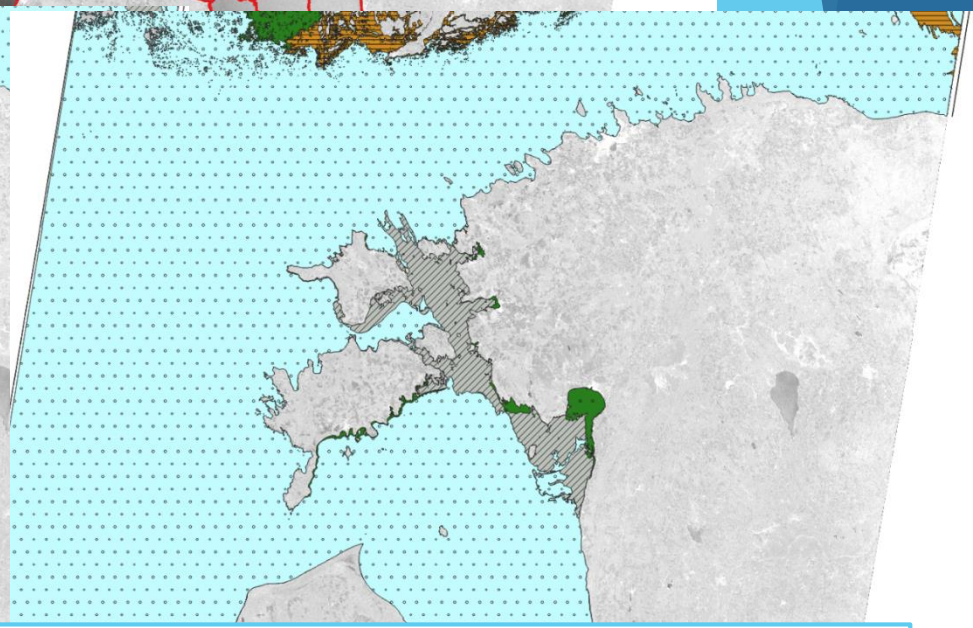
Image segmentation to polygons

Image statistics for each segment

Ice type estimation based on statistics







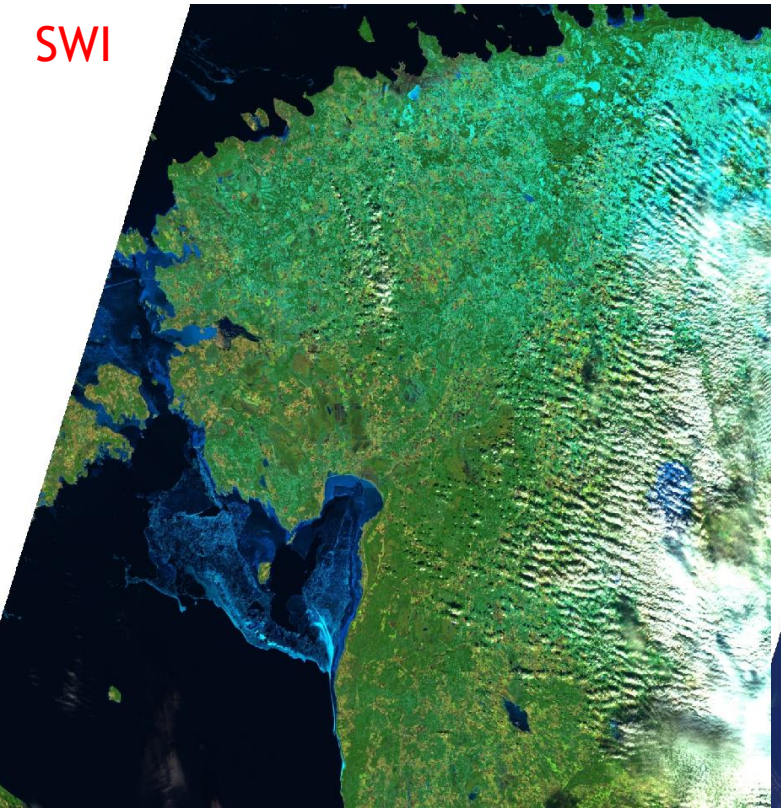
- Original polygons
- Ice and water estimation and prediction confidence
- Ice areas are divided to 3 classes + prediction confidence

Sentinel-2 and Sentienel-3 operational processing at EstHub

- Sentinel-2 => daily colour composite mosaic over Estonia
- Sentienl-3 => daily colour composite over Estonia

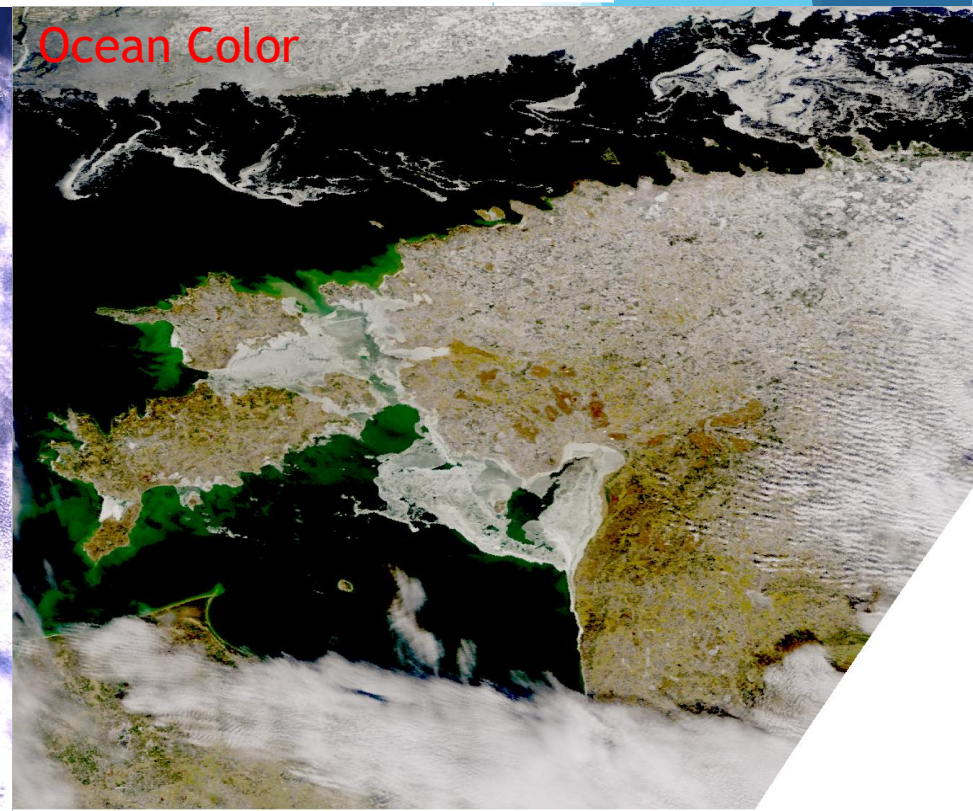
Original data	Software used	Product output format
Sentinel 2 MSI	SHELL based GDAL (and .py) for operational executing	GeoTIFF
Sentinel-3 OLCI	PYTROLL and SHELL for operational executing	GeoTIFF

SWI



BTH

Ocean Color



QGIS based Ice charting plugin for forecasters responsible for daily ice map production

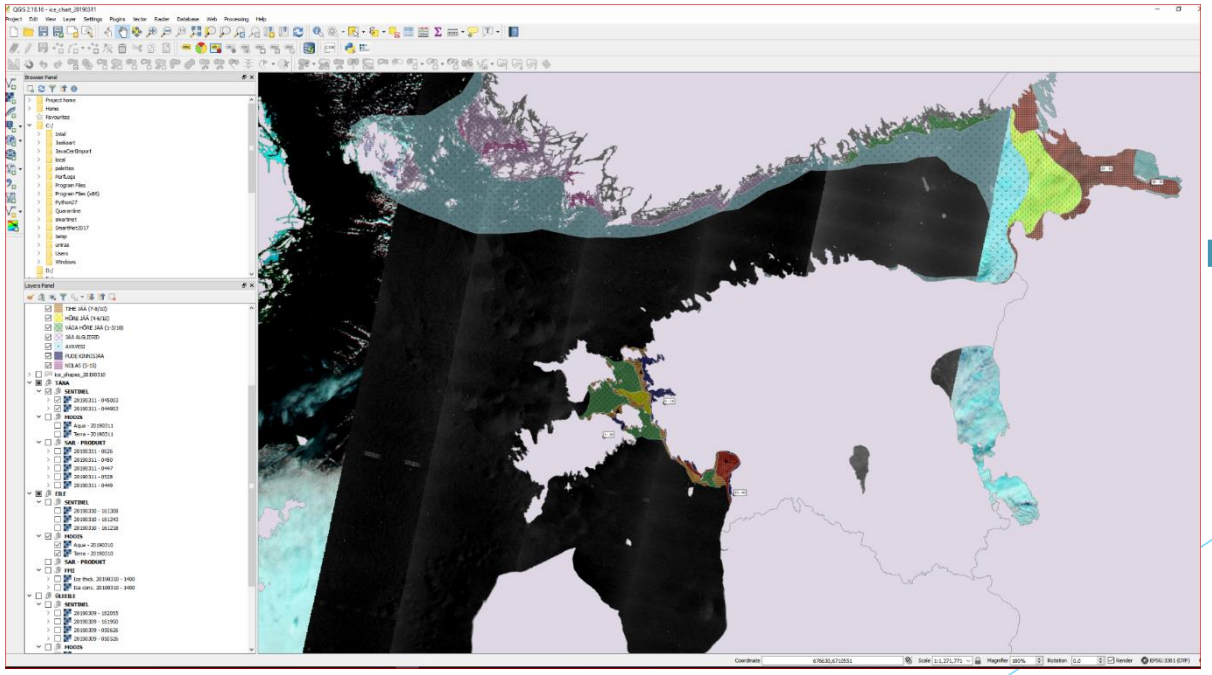
=> Responsible partner GIS expert Rain Elken

Functionality of plugin=>

- **Daily creation** of predefined **ice map template**
- **automatic input** of **satellite products**
- **automatic moving** of **pre-classified polygons** from satellite data **to ice chart**
- **automatic transfer** of **ice map** to the **Geoserver**
    - and all standard functionalities of GIS to change the ice chart

Satellite products

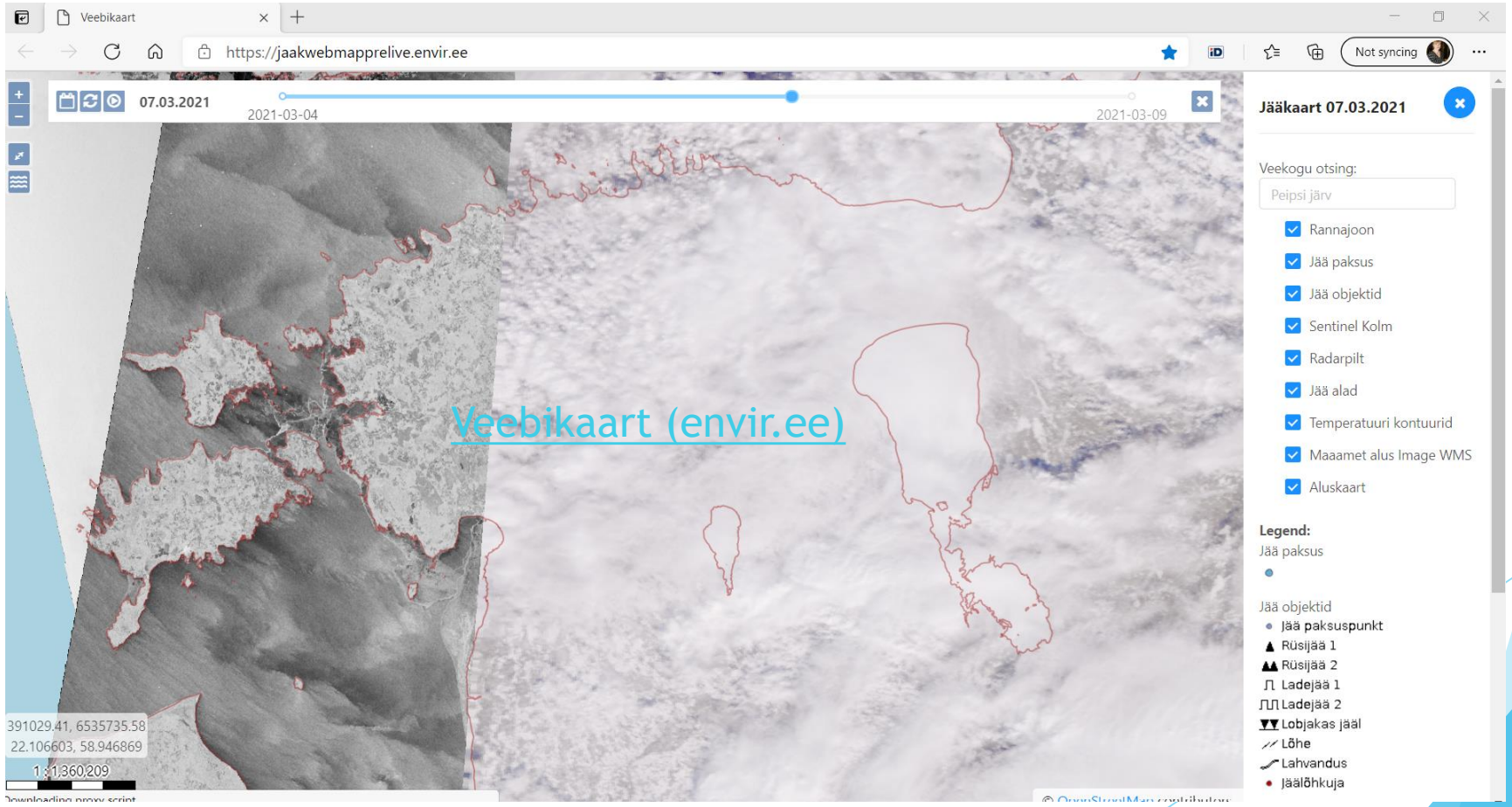
Observations



Sea Ice chart

Web map for partners and public => responsible partner CGI Estonia

- Will be **freely accessible** from **Estonian Weather Service webpage** and **include**
  - **Ice map** (sea and lakes)
  - **Satellite imagery**
  - **Observations** from **volunteers** and partners



Thank you for attention