Operational camera networks for snow products validation: status and applications

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QA4EO-IDEAS Cal/Val Workshop #2 02.12.2020

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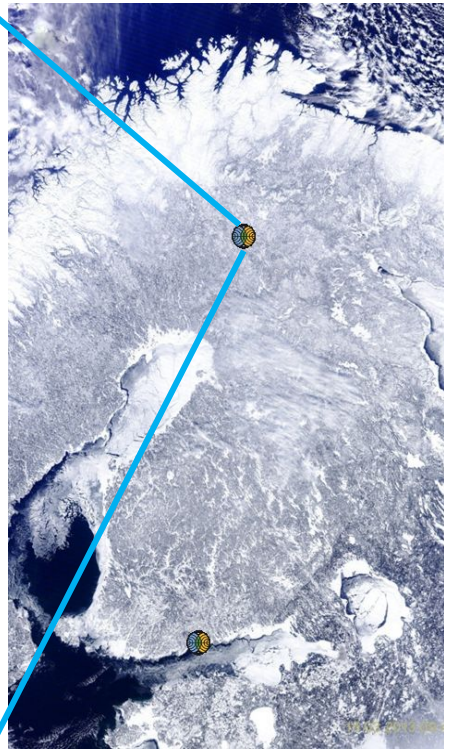
esa

IDEAS-QA4EO

Outline

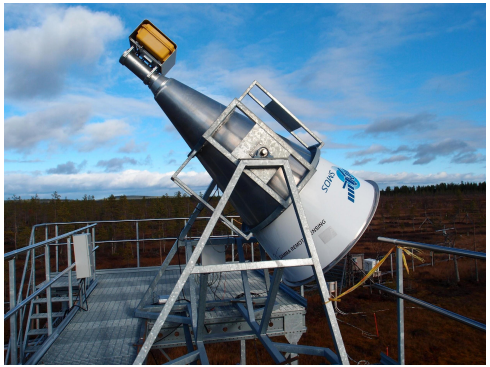
- Sodankylä Cal/Val Super-site & CIMR
- ESA SnowPEx - continuation
- FMIPROT & Camera Network Portal
- NRT Processing and visualization of webcam data
- NRT Cal/Val System
- Future work

Sodankylä Cal/Val Super-site & CIMR



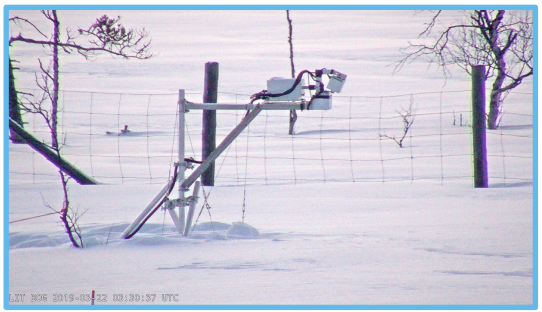
Sodankylä Cal/Val Super-site & CIMR

- Season-long observational datasets using ground based Cal/Val instruments
- Support by relevant ancillary data
- Various radiometers
  - Sodrad 1:
    - Reference instrument for AMSR-E, SSMIS @ 10.65, 21, 18.7, 37 GHz
  - Sodrad 2:
    - High frequency configuration @ 90, 150 GHz (e.g. AMSU)
  - ELBARA 2 and 3:
    - ESA reference instrument for SMOS @ 1.4 GHz, dual pol.
  - ASD FieldSpec Pro Jr



Sodankylä Cal/Val Super-site & CIMR

- RIKOLA Hyperspectral Camera
- Sodankylä Synthetic Aperture Radar (SodSAR)
- ICOS tower
- Reference measurements
- Manual snow survey program
- Intensive Field campaigns
- Continuous spectral albedo measurements
- Continuous active and passive microwave measurements
- Sodankylä FTS station (Fourier transform infrared spectrometer)
- Balloon soundings
- AirCore (atmospheric sampling system)



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ESA SnowPEx -continuation

- Continuation of ESA SnowPEx was kicked of in Oct. 2020
- Assessment of newly developed satellite-based SWE & SCE datasets
  + continuation of earlier activities
- International Community-wide workshop in 2021

SnowPEx Activities

- **Intercompare** and **evaluate** global / hemispheric (pre) operational **snow products** derived from different EO sensors and generated by means of different algorithms, assessing the product quality by objective means.
- Evaluate and intercompare temporal **trends of seasonal snow parameters** from various EO based products in order to achieve well-founded **uncertainty estimates** for **climate change** monitoring.

SnowPEx has resulted in several journal articles

FMIPROT & Camera Network Portal

https://fmiprot.fmi.fi

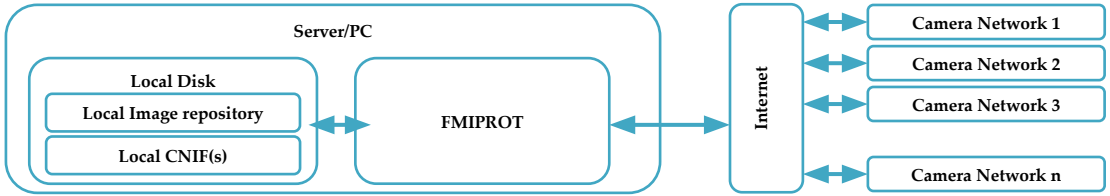
FMIPROT: A toolbox for automated processing of webcam images

Acquisition, *processing*, *visualization*

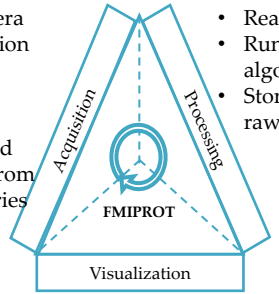
Camera Network Portal: A *collection of metadata* of camera networks which can be used for environmental monitoring.

Operational Monitoring: Processing chains deployed using *FMIPROT,* running in *NRT*, *producing* environmental *data*, *available in common formats* and *visualized* in graphs.

FMIPROT System Concept

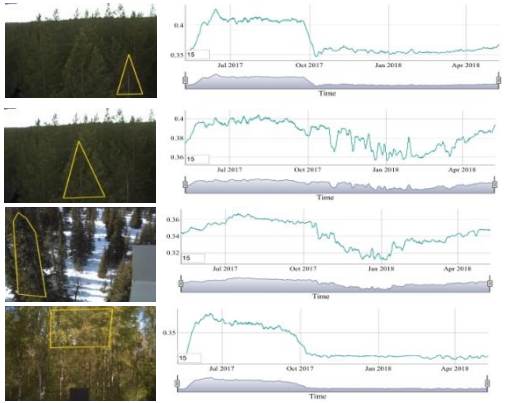


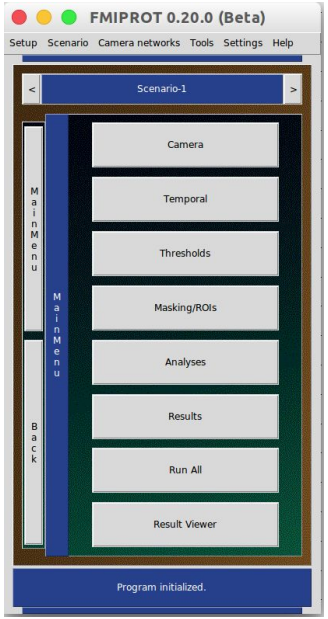
- Get camera information from CNIF(s)
- List and download images from repositories



- Read images
- Run algorithms
- Store results as raw data

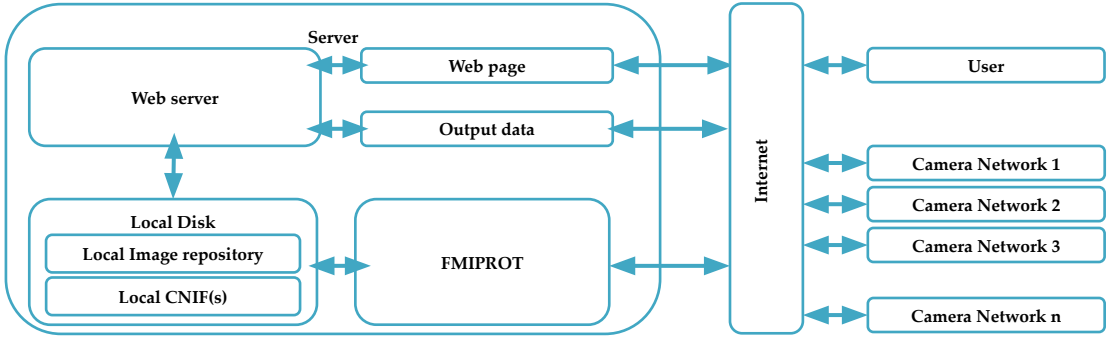
- Generate report with visualized results





Tanis et al, 2018.

FMIPROT System Concept



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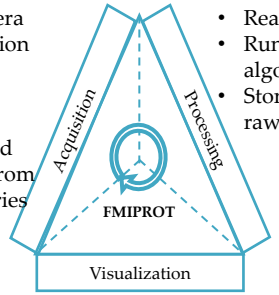

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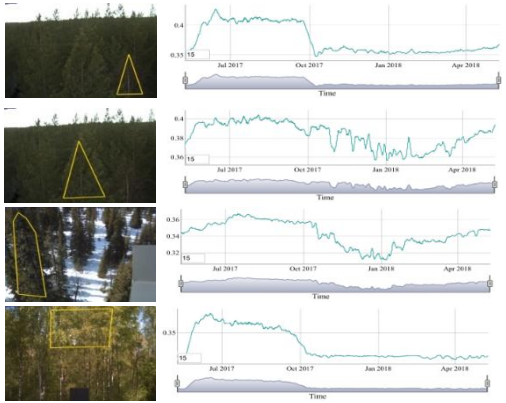

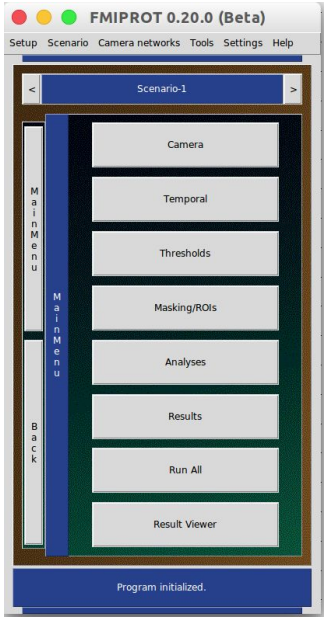

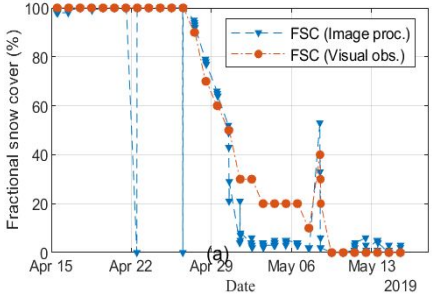

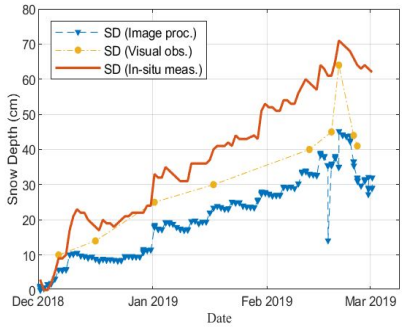

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Tanis, 2020.

FMIPROT & Camera Network Portal

FMIPROT
- Downloads
- Publications
- Tutorials

Camera Network Portal
- MONIMET
- UEF
- PHENOCAM
- EUROPHEN
- LUMIKE

Operational Monitoring
- MONIMET SD
- LUMIKE SD
- MONIMET FSC
- LUMIKE FSC
- MONIMET Vegetation
- UEF Vegetation
- LumiPilotti
- Download Data

Cal/Val Activities

Contact Information

Operational Monitoring

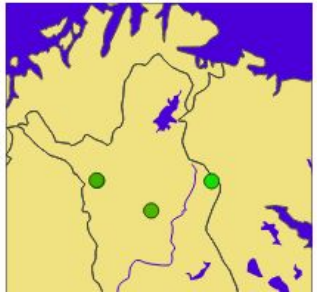
Multiple sets of setups are running in FMIPROT server regularly, triggered by a job scheduler, producing near real time results for operational monitoring of snow cover and vegetation. The processing system is explained in this study. Details of the algorithms used in the processing can be found in the publications here.

Operational monitoring is in development. Processing options, the data and the availability may change without notice. Although the algorithms are published, processing options in the setups (thus, the output data) defined for the monitoring are not in final phase and not validated.

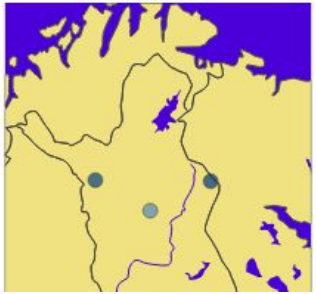
7 sets of setups are defined for operational monitoring. Visualized results, the setup reports (processing options) and output data can be accessed from the links below and from the sub menu on the left side of the page.

Latest values

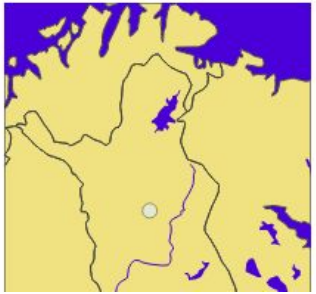
Vegetation Indices



Snow Cover Fraction



Snow Depth



https://fmiprot.fmi.fi

FMIPROT
- Downloads
- Publications
- Tutorials

Camera Network Portal
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- UEF Vegetation
- LumiPilotti
- Download Data

Cal/Val Activities

Contact Information

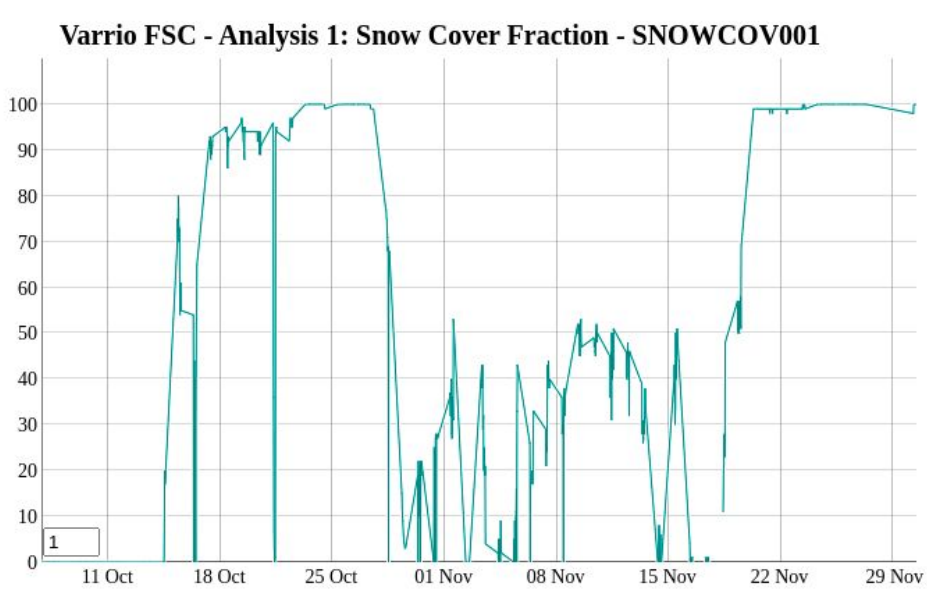
Fractional snow cover monitoring with MONIMET Camera Network

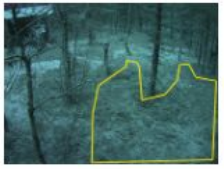
Results

7 setups are defined for operational monitoring.

Select setup to switch to: varrio

varrio





>Setup report page
>Download/Open data file
Plot:
Snow Cover Fraction
Reset plot | Toggle help

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https://fmiprot.fmi.fi?page=MONIMET FSC

Tanis, 2020.

NRT Cal/Val System

Purpose: NRT and annual comparison of satellite derived and webcam derived snow cover data and their visualization.

At hand: Webcam data, algorithm, platform/toolbox, satellite derived snow cover fraction data.

To do: Webcam processing chains, comparison processing chains, online visualization, more webcam data, better webcam processing scenarios

NRT Cal/Val System Progress

- Webcam data processing chains are deployed for snow cover monitoring

Name	Setups	Analyses	Clock	Intervals	Last run time	Link to the results
Snow depth monitoring with MONIMET Camera Network	4	4	5 - 20	30 mins.	Start: 2020-11-30 19:00:01 EET Finish: 2020-11-30 19:00:40 EET	
Snow depth monitoring with LUMIKE Cameras in Sodankylä	1	4	5 - 20	60 mins.	Start: 2020-11-30 19:01:02 EET Finish: 2020-11-30 19:03:12 EET	
Fractional snow cover monitoring with MONIMET Camera Network	7	7	5 - 20	30 mins.	Start: 2020-11-30 19:05:01 EET Finish: 2020-11-30 19:06:16 EET	
Fractional snow cover monitoring with LUMIKE Cameras in Sodankylä	1	2	5 - 20	60 mins.	Start: 2020-11-30 19:06:01 EET Finish: 2020-11-30 19:07:22 EET	
Vegetation monitoring with MONIMET Camera Network	15	35	5 - 20	30 mins.	Start: 2020-11-30 19:10:02 EET Finish: 2020-11-30 19:16:35 EET	
Vegetation monitoring with UEF Cameras	2	2	5 - 20	30 mins.	Start: 2020-11-30 19:11:02 EET Finish: 2020-11-30 19:12:01 EET	

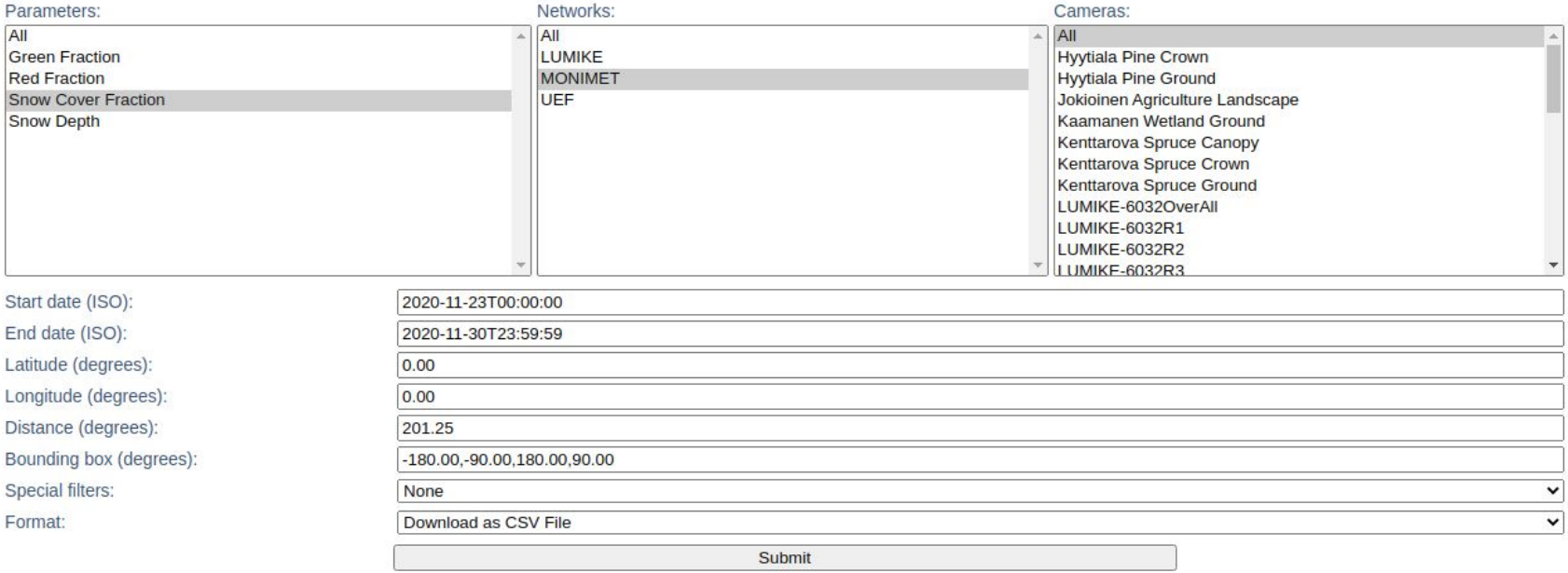
Last run is on time | Running now | Next run is late

https://fmiprot.fmi.fi?page=Operational Monitoring

NRT Cal/Val System Progress

- Webcam data processing chains are deployed for snow cover monitoring
- A dissemination system (API & web page form) for the webcam derived data is created and the toolbox was modified accordingly

NRT Cal/Val System Progress



https://fmiprot.fmi.fi/operational/getdata.php?**parameters**=Snow+Cover+Fraction&**network**=MONIMET&**startdate**=2020-11-23T00%3A00%3A00&**enddate**=2020-11-30T23%3A59%3A59&**format**=csv

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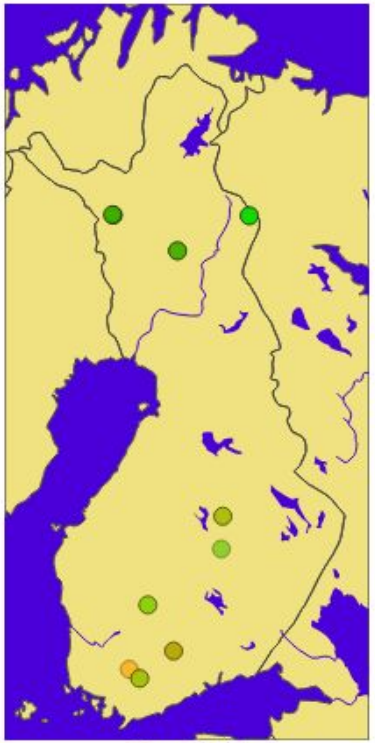
https://fmiprot.fmi.fi?page=Download Data

NRT Cal/Val System Progress

- Webcam data processing chains are deployed for snow cover monitoring
- A dissemination system (API & web page form) for the webcam derived data is created and the toolbox was modified accordingly
- “Latest values” maps are created for visualization

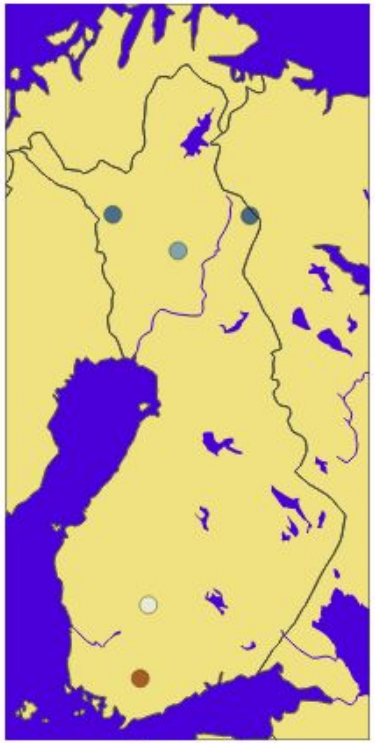
NRT Cal/Val System Progress

Vegetation Indices



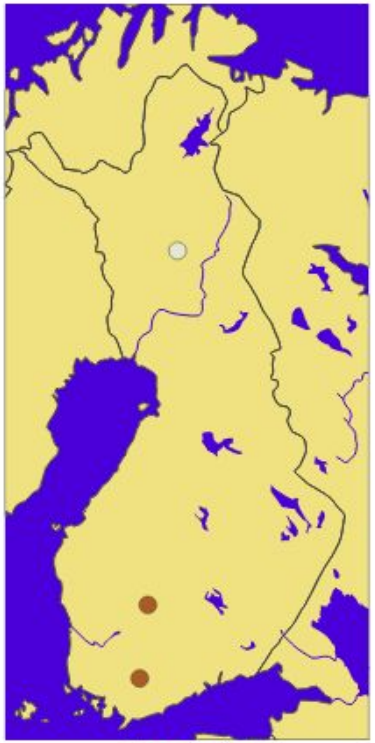
Show in list

Snow Cover Fraction



Show in list

Snow Depth



Show in list

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NRT Cal/Val System Progress

- Webcam data processing chains are deployed for snow cover monitoring
- A dissemination system (API & web page form) for the webcam derived data is created and the toolbox was modified accordingly
- “Latest values” maps are created for visualization
- Comparison processing chains are created for two Copernicus snow cover products (latest 7 days and 1 year temp. window)

Name	Sets of calc.	Clock	Intervals	Last run time
Copernicus Snow Cover Extent Northern Hemisphere 1km Resolution	2	1 - 2	1400 mins.	Start: 2020-12-02 01:15:01 EET Finish: 2020-12-02 01:15:21 EET
Copernicus Snow Cover Pan European 500m Resolution	2	1 - 2	1400 mins.	Start: 2020-12-02 01:15:22 EET Finish: 2020-12-02 01:15:29 EET

Last run is on time | Running now | Next run is late

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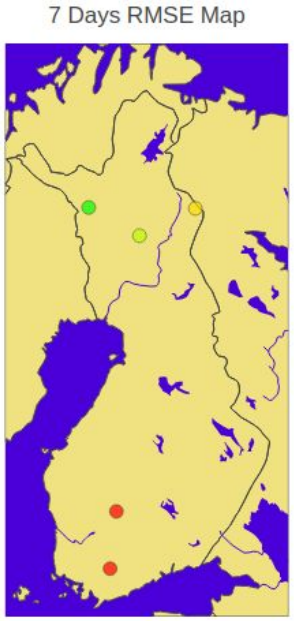
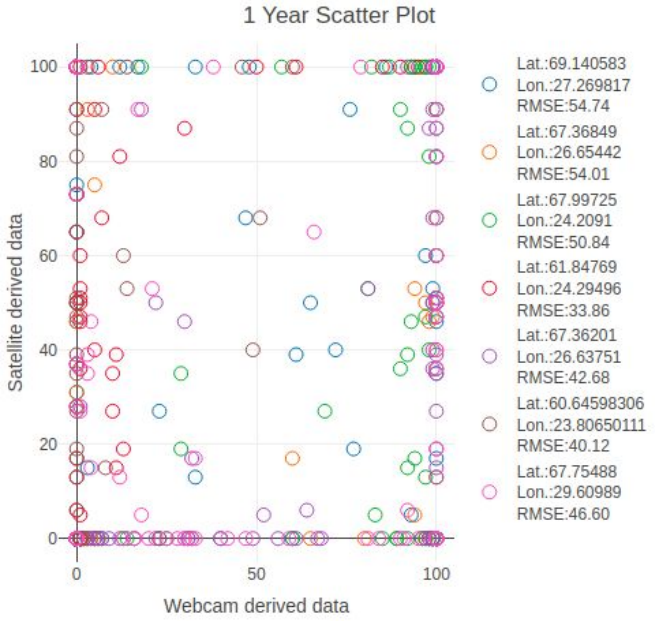
https://fmiprot.fmi.fi?page=Cal/Val Activities

NRT Cal/Val System Progress

- Webcam data processing chains are deployed for snow cover monitoring
- A dissemination system (API & web page form) for the webcam derived data is created and the toolbox was modified accordingly
- “Latest values” maps are created for visualization
- Comparison processing chains are created for two Copernicus snow cover products (latest 7 days and 1 year temp. window)
- The comparisons are visualized showing RMSE on maps and value pairs in scatter plots

NRT Cal/Val System Progress

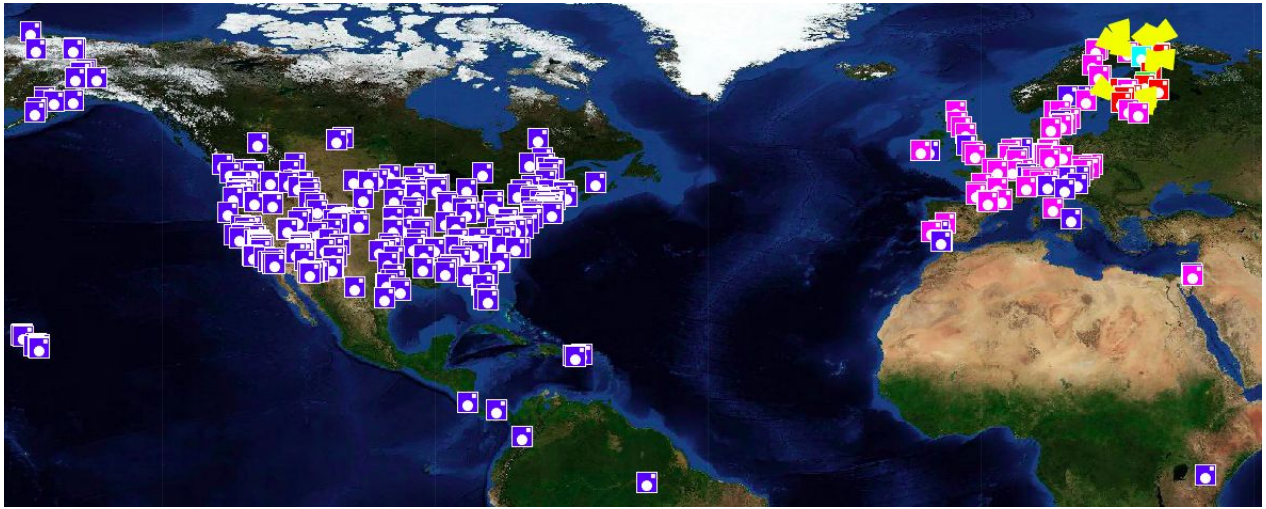




https://fmiprot.fmi.fi?page=Cal/Val Activities

NRT Cal/Val System Future Work

- More cameras to be added in Finland (on-going)
- More camera to be added, in Europe and North America
- Existing webcam processing scenarios to be improved
- Visualization options to be improved



https://fmiprot.fmi.fi?page=Camera Network Portal

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Thank you

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