

Project information

Keywords

remote sensing, SAR, land cover,

Project title

NorthState TromSAR - Climate Variability in SAR Land Cover Monitoring

Year

2017

Project leader

Jörg Haarpaintner

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

Troms Fylke

Participants

- Norut (Jörg Haarpaintner)
- NINA (Hans Tømmervik)
- Kartverket (Steinar Vaardal)

Flagship

Terrestrial

Funding Source

Terrestrial flaship: 440 kNOK

Summary of Results

NorthState – TromsSAR was an extension of the EU FP7 project NorthState in order to apply the experience of land cover monitoring with synthetic aperture radar on Troms County.

All Sentinel-1 data over Troms County from January 2015 to October 2017 have been processed and statistically analyzed in regard to 9 different land covers:

1. Water
2. Settlements
3. Glaciers and Snow
4. Bare land
5. Heathland
6. Peatland
7. Agricultural land and grassland
8. Deciduous forest
9. Conifer forest.

Mean monthly backscatter signatures of co- and cross-polarization backscatter, VV and VH, respectively, have been established, using training polygons extracted from visual interpretation and combination of aerial photography from Kartverket (norgebilder.no), SAR mosaics and NIBIO's landcover data set AR50 for Troms County.



Figure 1: Sentinel-1 VV and VH monthly averaged backscatter signatures for 9 different land covers.

The same training polygons have then be used for a maximum likelihood classification using the monthly dual-polarization mean backscatter mosaics (Figure 2) from May to October as well as a winter average (December to March) as features. Other feature combinations as well as data from each single year have also been used.

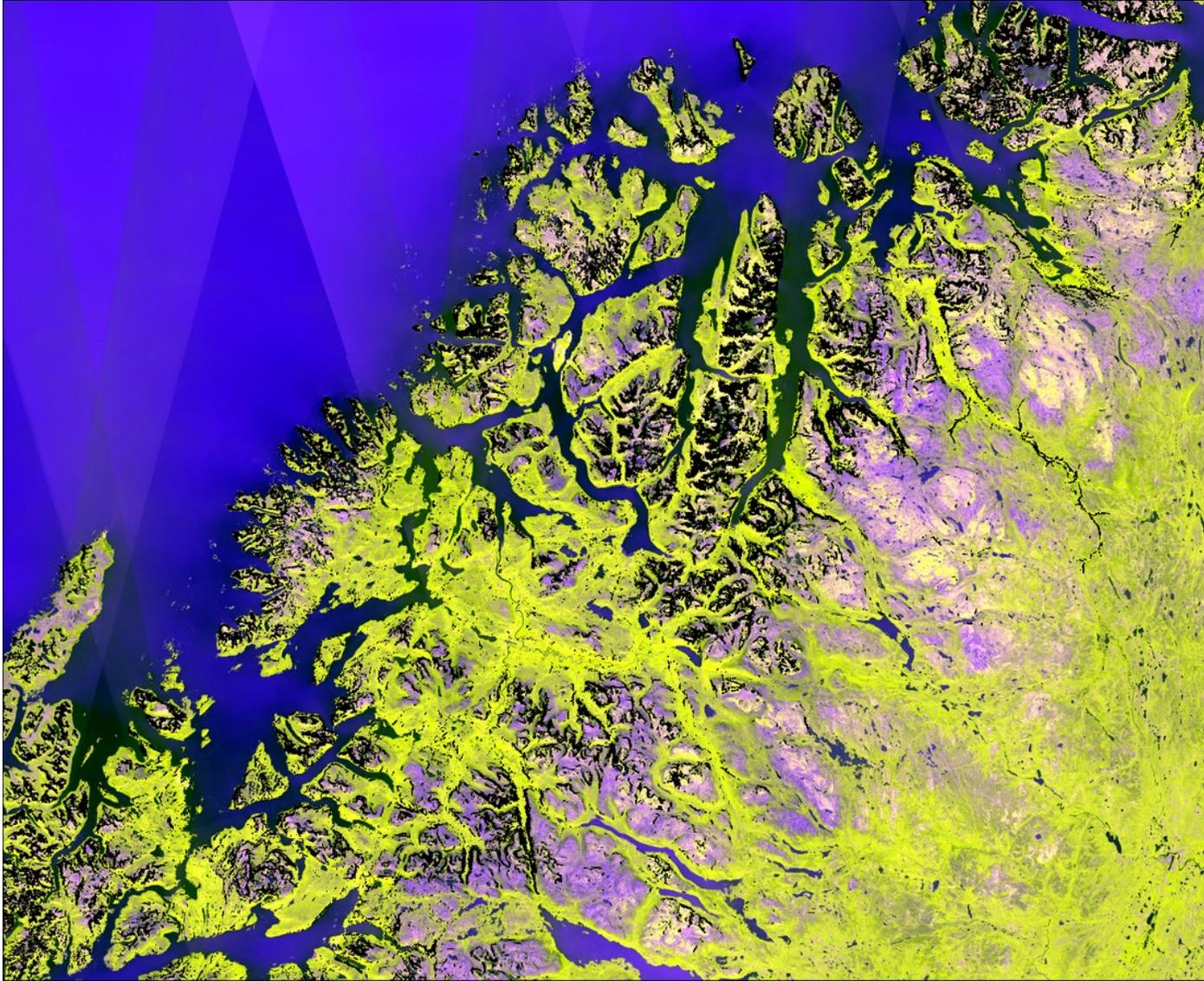


Figure 2: Sentinel-1 mosaic averaging all data for the summer month June to September from the years 2015-2017.

The result of the classification is a 9 class land cover map over Troms county based only on Sentinel-1 CSAR data (Figure 3). The land cover map has then been validated with the AR50 data set over the whole region, showing an overall accuracy of 65% comparing seven land cover classes, excluding water and settlements that have been masked. When only comparing the forest and non-forest areas, the overall accuracy of the Sentinel-1 land cover map according to the AR50 data is 87.8 %. The results here are encouraging, since Sentinel-1 CSAR data can be utilized independently of clouds which is important in Fennoscandia and Arctic. A detailed view comparing Sentinel-1 land cover map and the AR50 data in the Målselv area is shown in Figure 4.

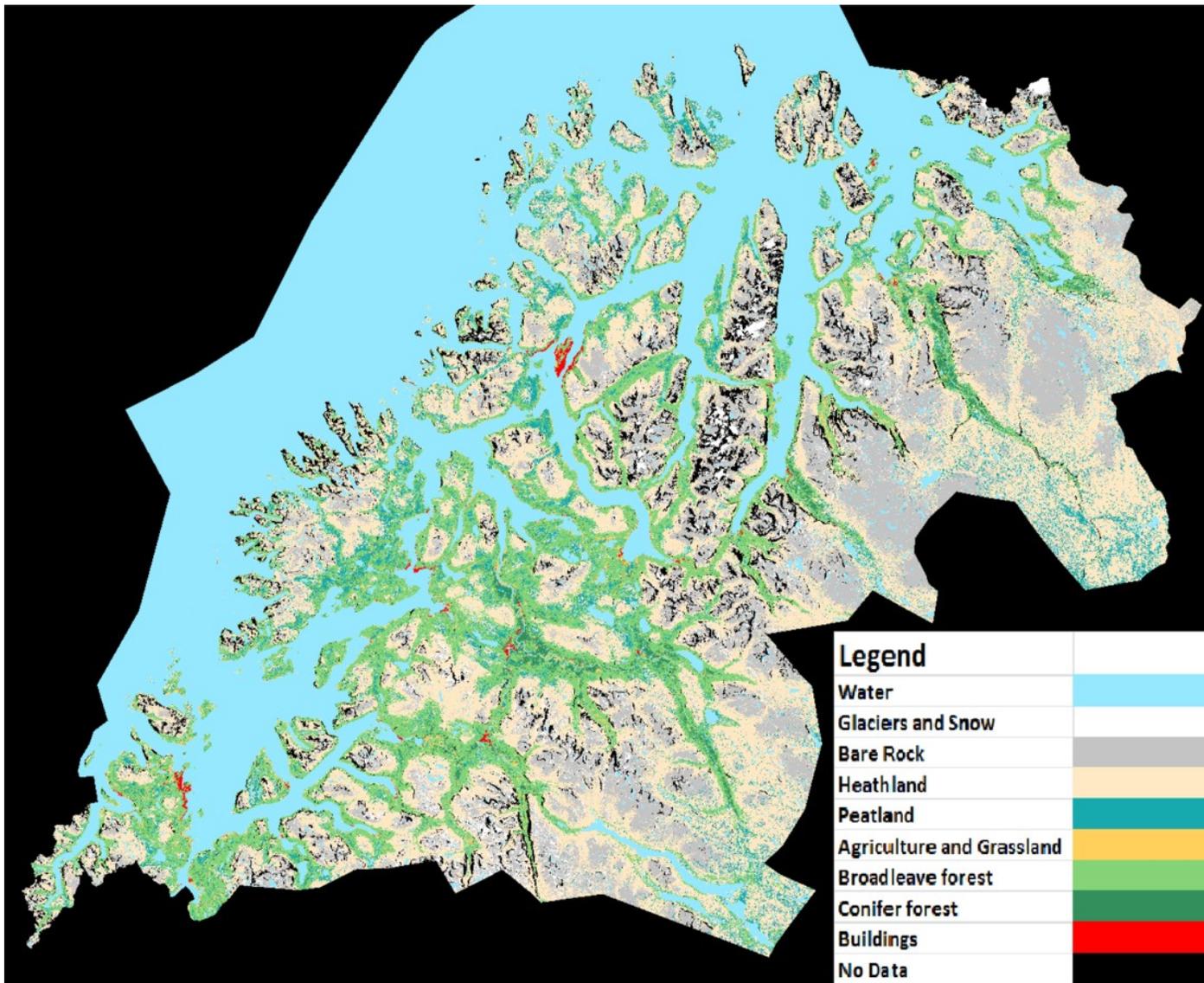


Figure 3: 9 class Land cover map over Troms County based on Sentinel-1 data from 2015-2017.

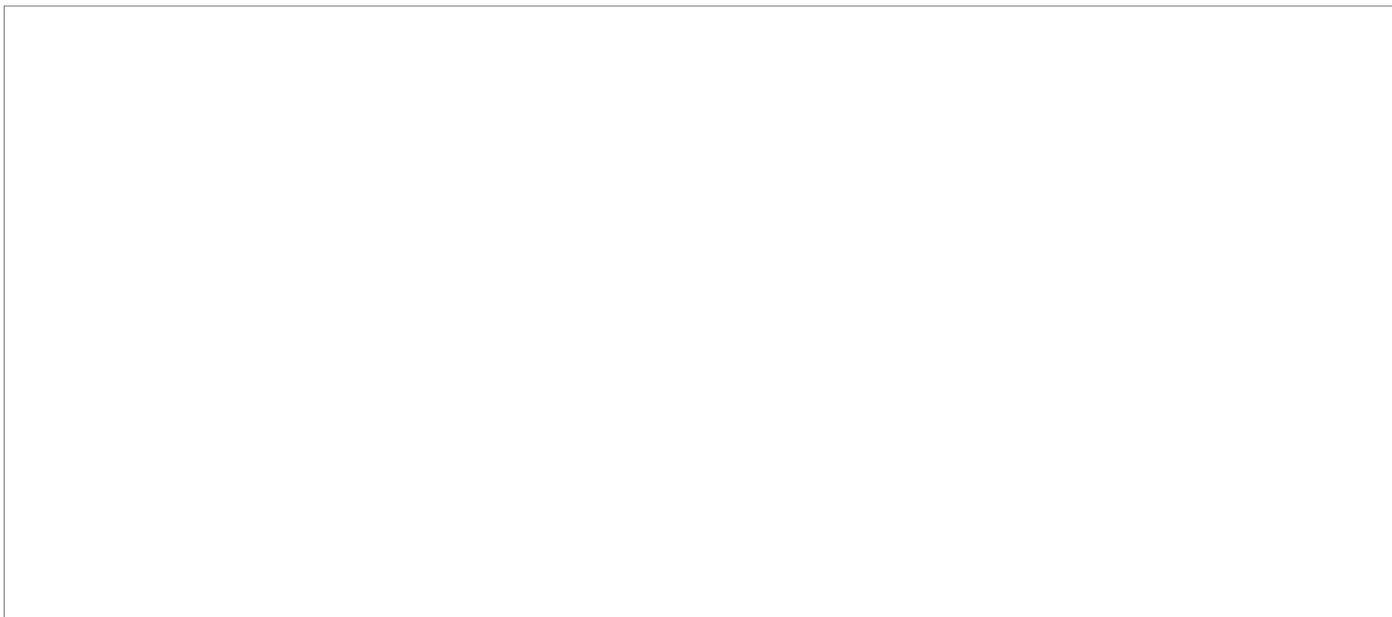


Figure 4: Full resolution comparison between the Sentinel-1 Land cover map (left) and the AR50 data (right).

A field campaign using a remote piloted aerial system (RPAS), a DJI Phantom 3 Pro quadcopter, was undertaken collecting very high resolution aerial image mosaics at 5 different locations on Breivikeidet. These measurements will be compared with in-situ measurements of vegetation properties using hand held NDVI-instruments/NDVI-cameras as well as vegetation composition, forest stand properties and tree heights. These measurements will serve for further validation of the satellite image classifications using fused SAR-Optic imagery for further improvements of the SAR-based land cover maps.

Master and PhD-students involved in the project

N/A

For the Management

Results will be presented at the Yearly Program Meeting on 11 Dec 2017.

Published Results/Planned Publications

Planned publication:

- Land Cover Monitoring of Troms County (Norway) with Sentinel-1 CSAR.
- Multi-sensor land cover monitoring in Troms County with Sentinel-1&2
- Comparison of RPAS with ground in-situ measurements of plant physiologies.

Communicated Results

Results will be presented at the Yearly Program Meeting on 11 Dec 2017.

Interdisciplinary Cooperation

Remote Sensing, Plant Ecology & Mapping

Budget in accordance to results

The funding from the Fram Centre was used according to plans.

Could results from the project be subject for any commercial utilization

No

Conclusions

The project was run as planned and increased the cooperation between the three institutions. The results show high accuracies that still need to be published, presented and be made available to other FRAM institution members.