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Sodankylä-Pallas Supersite for SMAP CAL/VAL activities

SMAP Workshop 2011

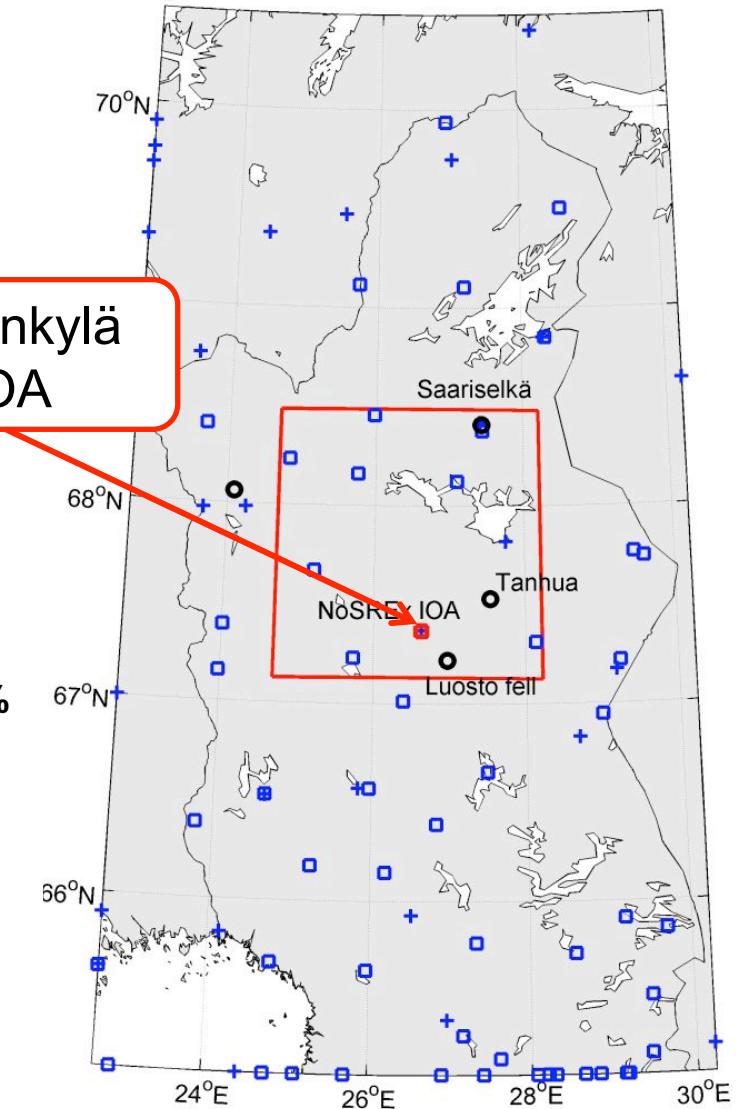
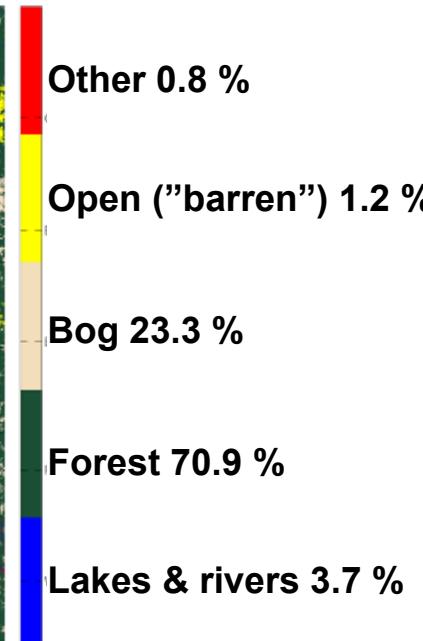
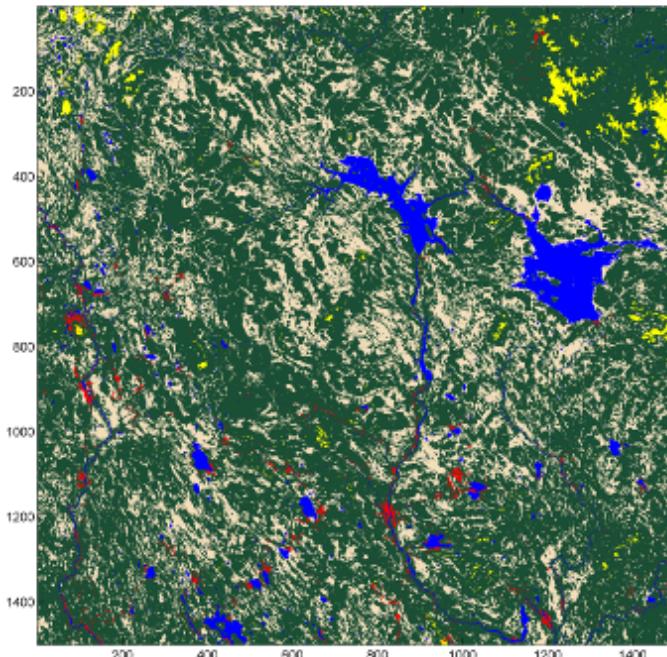
**Finnish Meteorological Institute,
Arctic Research**





Sodankylä-Pallas

- CAL/VAL area: 150 km x 150 km
- Land class information from Corine Land Cover 2006





Intensive Observation Area (IOA)



Site typical boreal coniferous forest on mineral soil

Average permanent snow cover:
6th Nov – 25 May (1971-2000)

Average maximum snow depth: 80 cm

Easy access and technical support





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Tower-based measurements

Passive microwave:

October, 2009 – ongoing (L-band)

December, 2009 – ongoing (C, X, Ka, W-bands)

Active microwave:

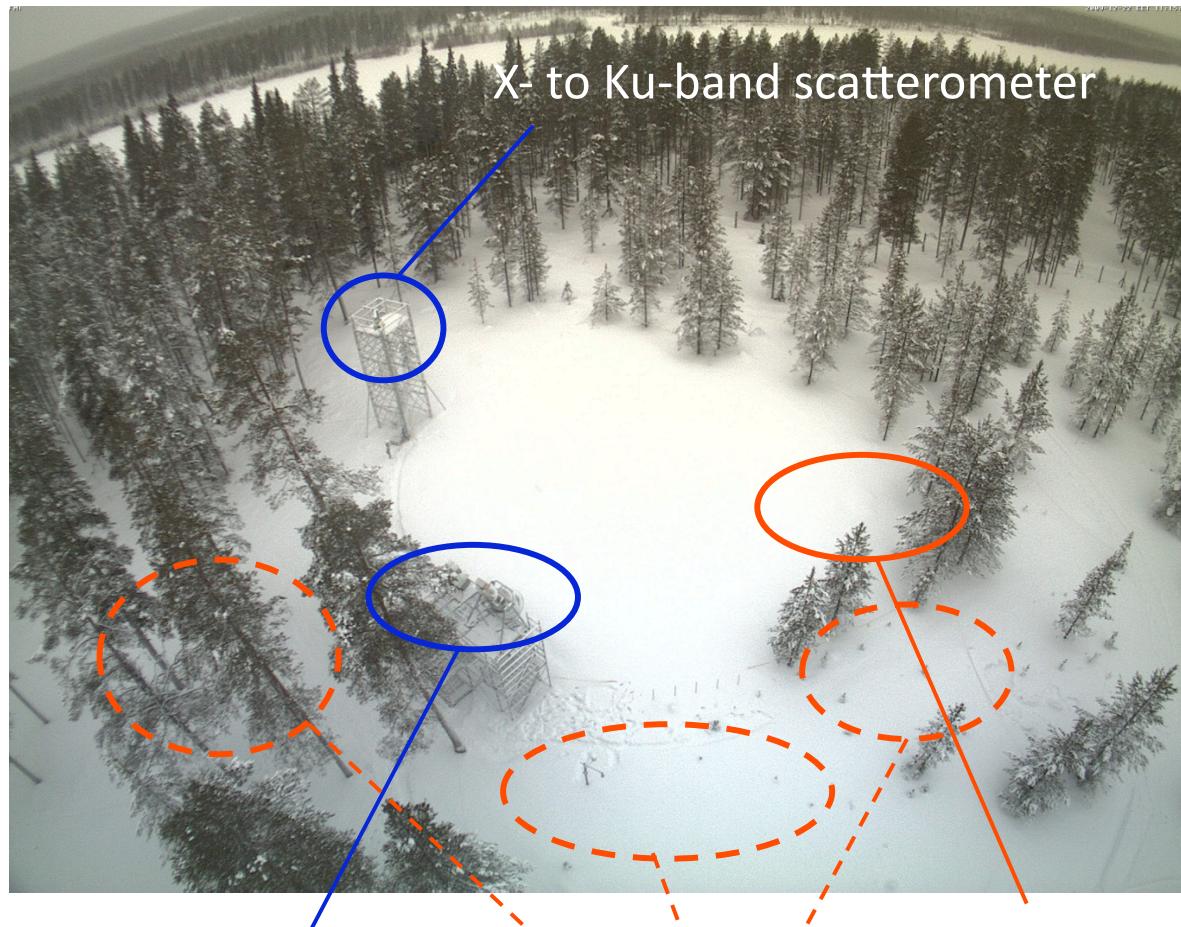
October, 2009 - ongoing





Photo: webcam on 38 m tower

Intensive Observation Area (IOA)



L to W band
radiometers

X- to Ku-band scatterometer
Automatic sensors (Soil
moisture, Temperature,
bulk SWE, Snow Depth)

Bi- weekly
snowpits

Measurement towers for
instrument installation (5 m, 8m,
38m)

In vicinity of meteorological/
atmospheric sounding
observations and CO₂ flux
measurements

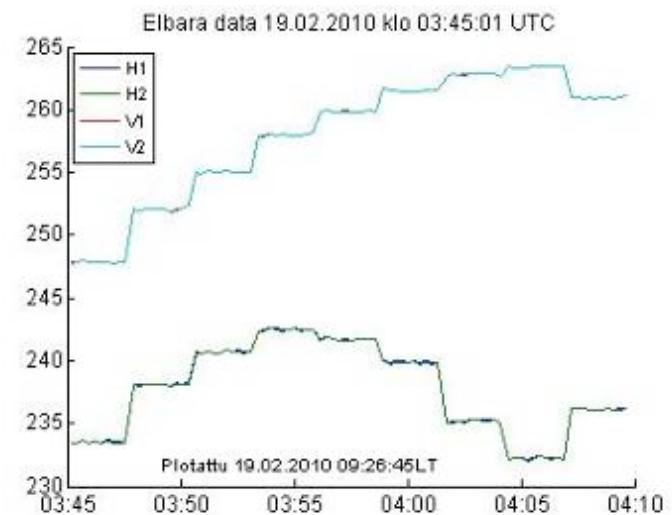
Manual snow cover
measurements on site

Automatic sensors (soil moisture
and temperature profile, SWE,
snow depth, snow temperature
profile)



ELBARA-II

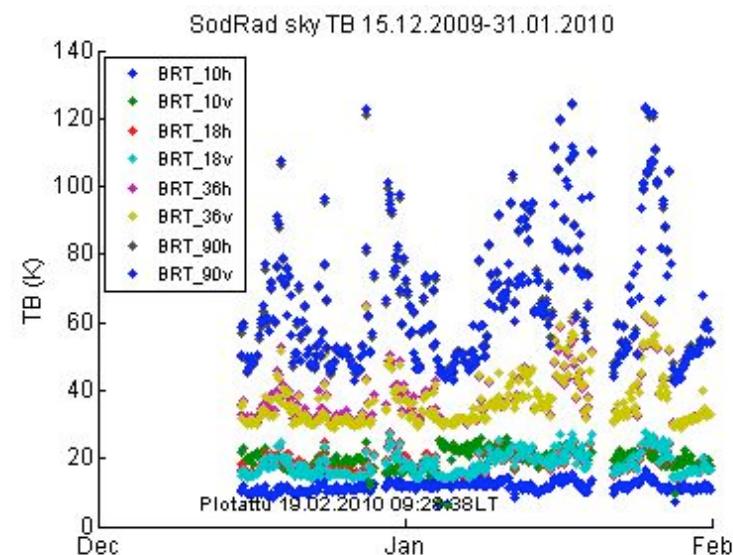
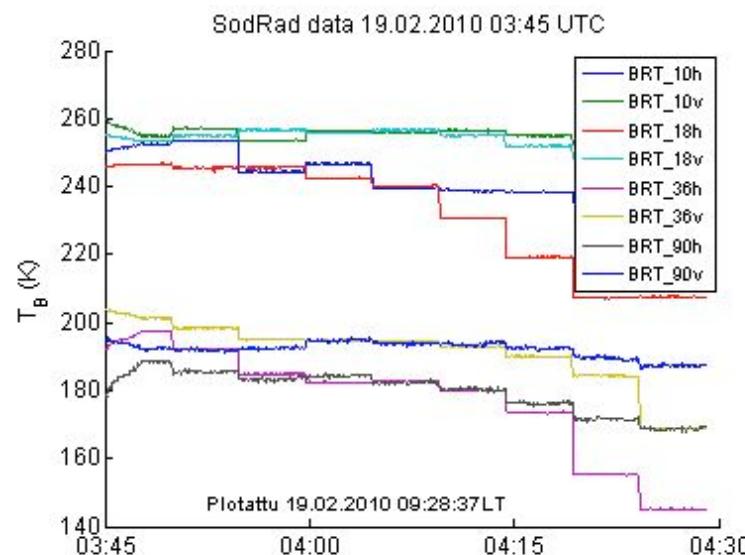
- Dual pol L-band radiometer
- Manufacturer GAMMA remote sensing
- ESA owned reference instrument for SMOS cal/val purposes
- 30 min long measurement every 3 h
- Data available at inc. angles 30 - 70°
- Internal two-point calibration using terminated load and ACL
- Short sky measurement every night to verify receiver stability
- Fixed angle measurements
 - During freezing/thawing
 - From Nov 2010, between elevation scans





SodRad

- X-, K-, Ka- and W- band dual pol radiometers
- Manufacturer Radiometer Physics GmbH
- 30 min measurement every 3 h
- Data available at inc. angles 30 – 70 °, azimuth scanning possible
- Sky tip calibration every 12 h
- Sky measurement used to verify stability between snow observations





Active microwave observations - SnowScat

- Frequency scanning scatterometer, stepped CW from 9.15 to 17.9 GHz
- Manufacturer GAMMA remote sensing, Instrument on loan from ESA
- measurement every 3 h
- Azimuth scan of 100° (6° steps, 17 looks)
- Data available at inc. angles 30°, 40°, 50°, 60°
- HH/VV, HV/VH
- Every measurement includes two views of calibration sphere

Parameter	Nominal Observations
Sequence start	01:45 (UTC) + every 3 hrs
Sequence total duration	1 h 45 minutes
Integration time	0.00256 s
Azimuth scan range ^{*)}	-62° < α < 34°
Azimuth scan step	6°
Elevation scan range	30° < θ < 60°
Elevation scan step	10°
Frequency	9.199984 – 17.798512 GHz
Polarization	HH,HV,VH,VV
Step duration	45 s
Estimated data per sequence	8 MB
Internal calibration loop	Before each polarization cycle (at every measurement angle)
Calibration target	Before and after each measurement cycle





Manual in situ measurements

Three snow pit sites

- IOA (bi-weekly)
- Bog (1 km distance, bi-weekly)
- Lake ice (once/month)



Parameters

- Stratigraphy
- Density profile (snow fork and snow scale)
- Grain size profile
- Temperature profile
- Snow moisture
- Bulk values for SD, SWE, density



In addition, several periods of detailed activites

- Snow depth/SWE distribution
- SSA measurements/ NIR photography
- High resolution penetrometry
- Daily snow pit measurements
- Instruments in continuous observation mode (diurnal change observation)





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Manual soil frost measurements

- Frost tubes in Open area, Forest and Bog site.
- Manually recorder three times per month (6th, 16th and 26th)
- Comparison to temperature profile measurements





Continuous automatic measurements

- Soil moisture vertical profile
- Soil temperature profiles
- Snow depth and snow water equivalent (acoustic and gamma ray measurements)
- Snow temperature profile
- Weather (AWS) and radiation measurements

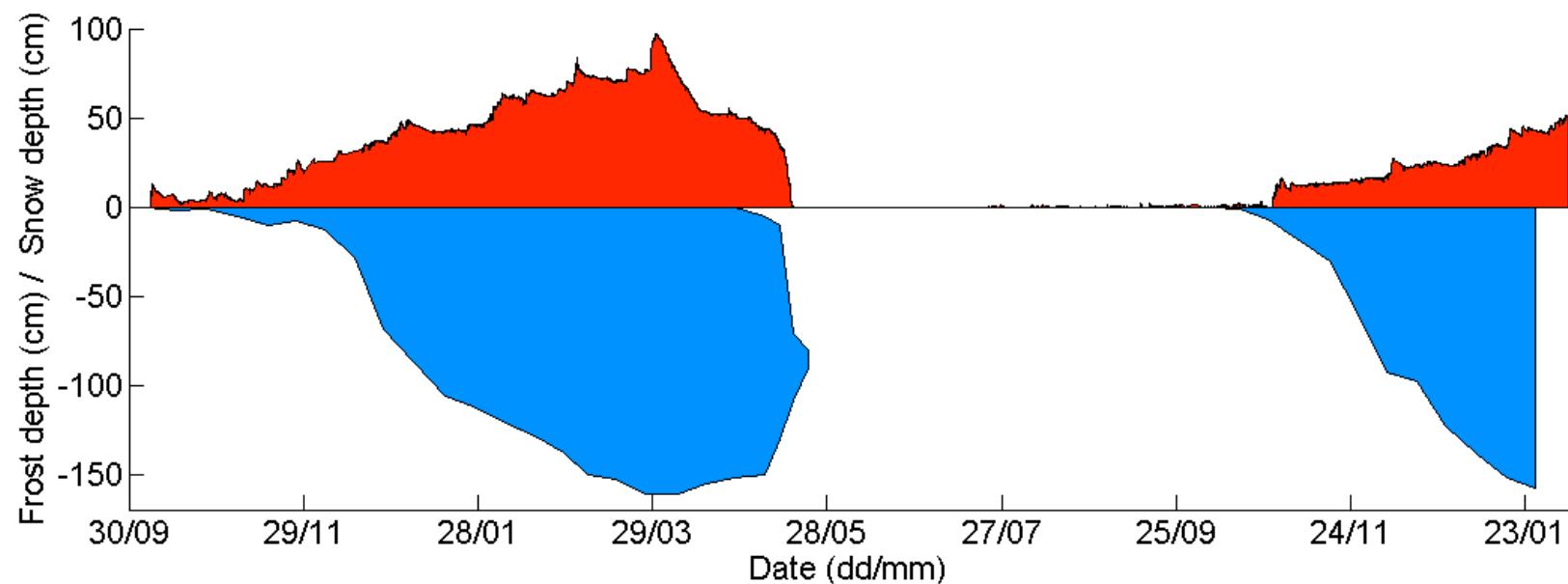
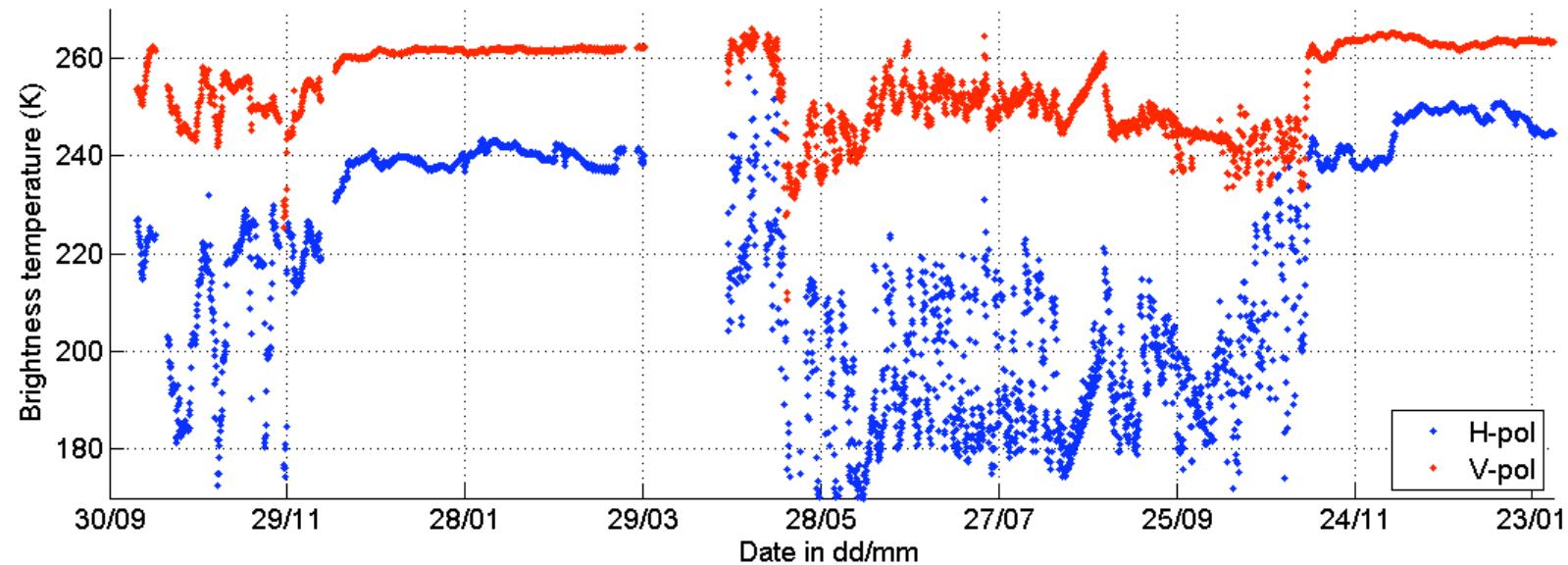




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Time-series example

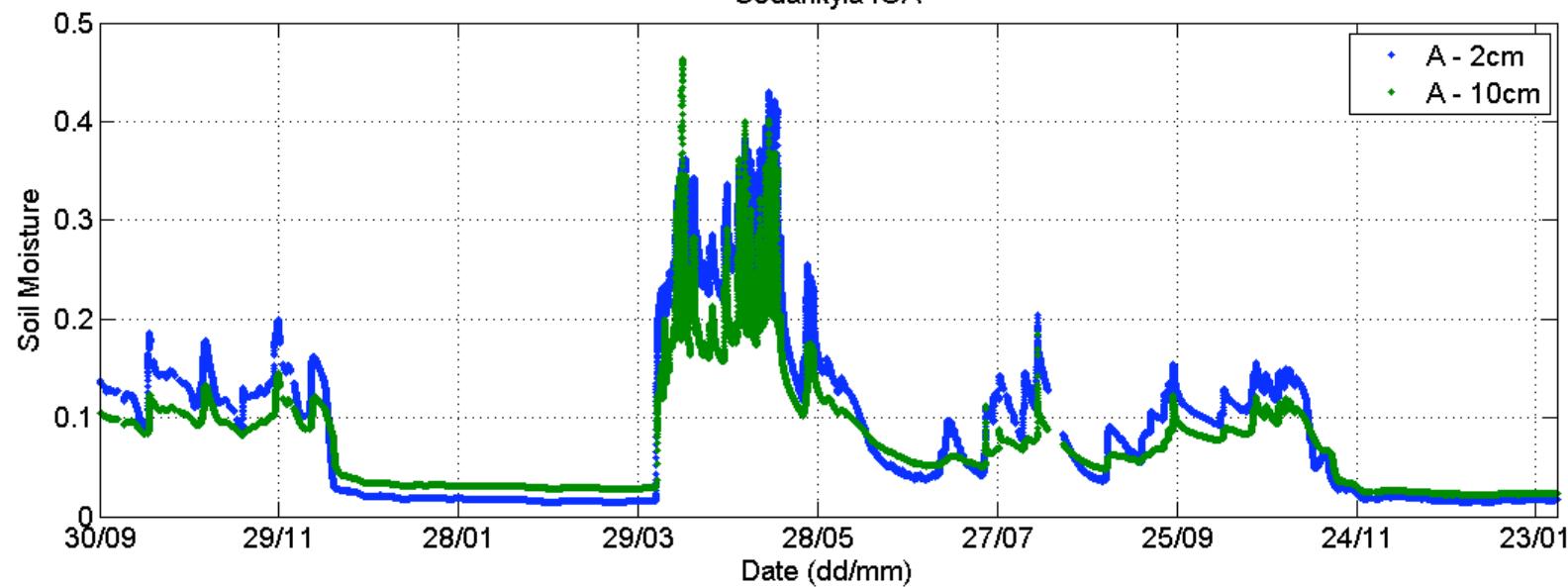
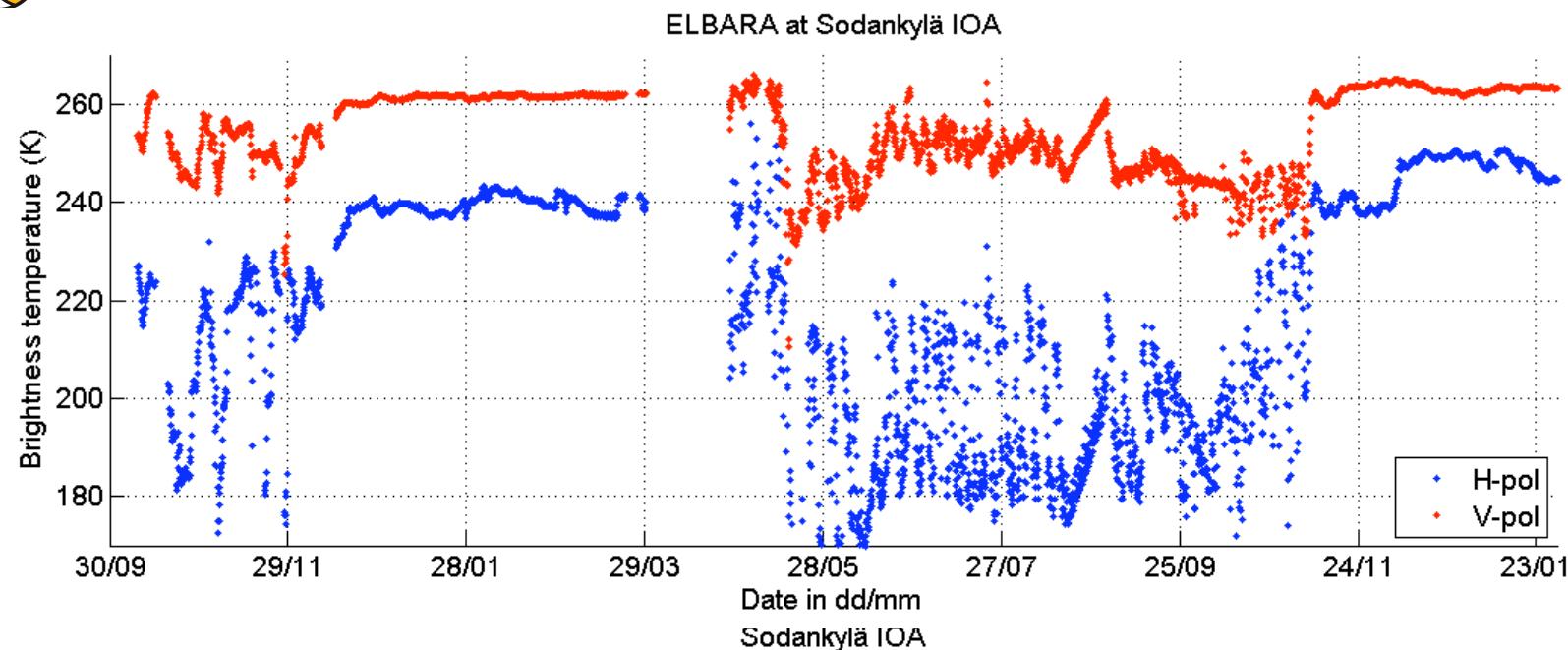
ELBARA at Sodankylä IOA





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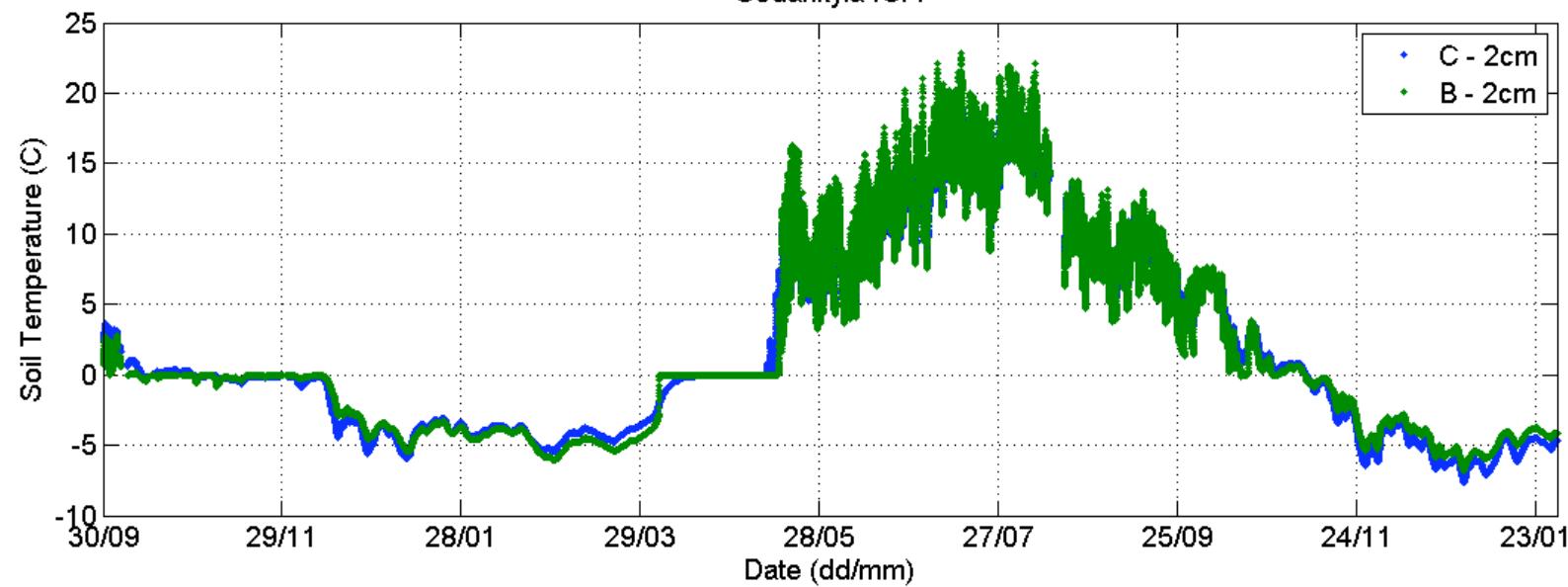
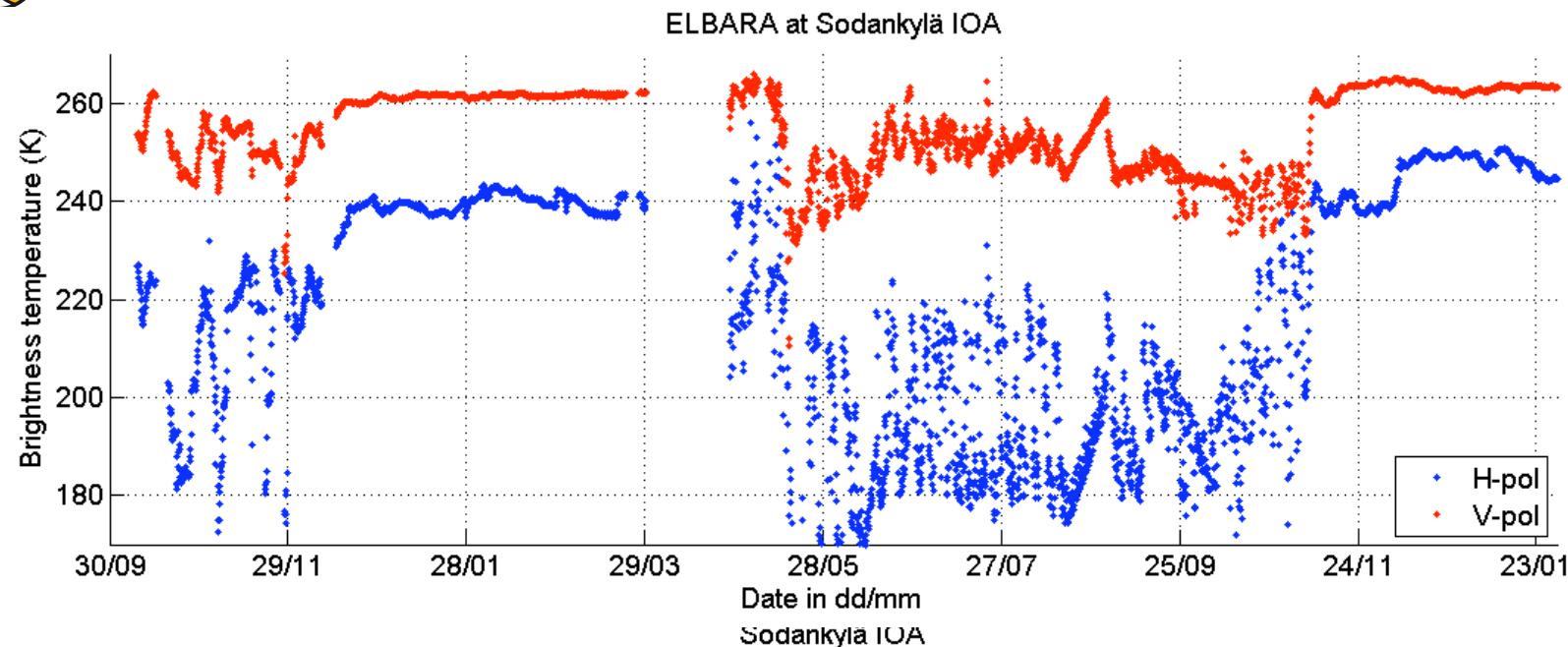
Time-series example





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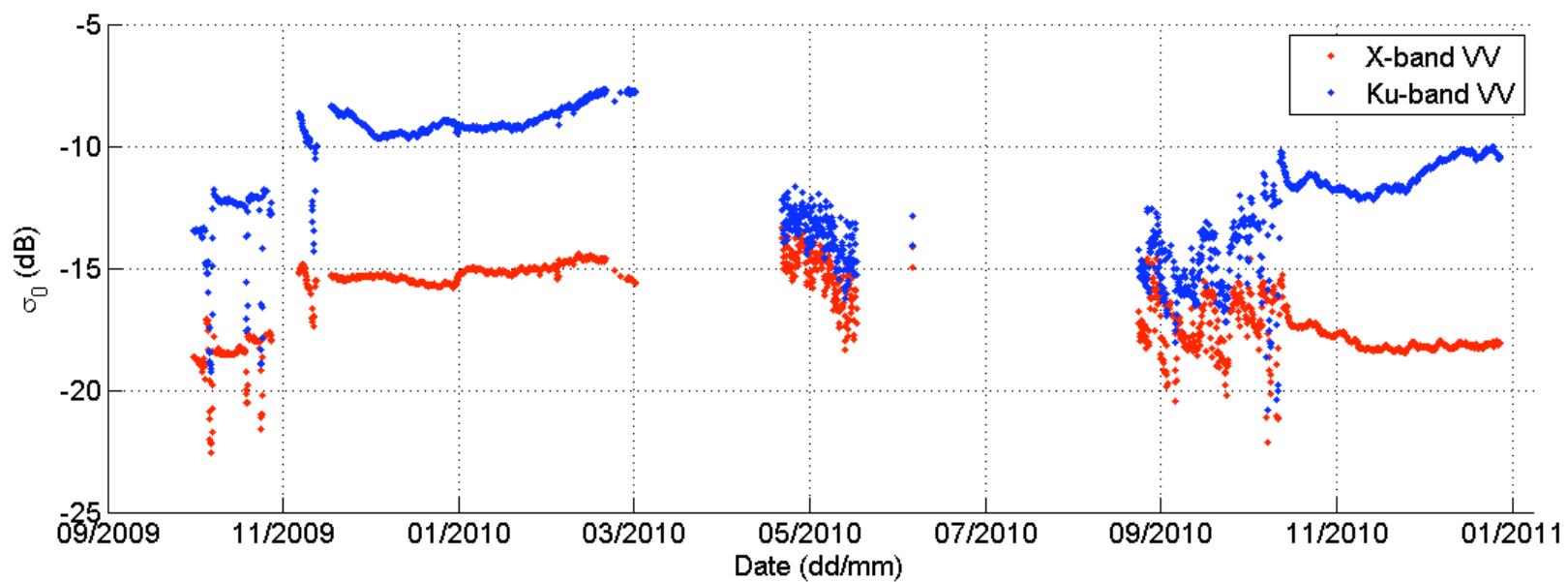
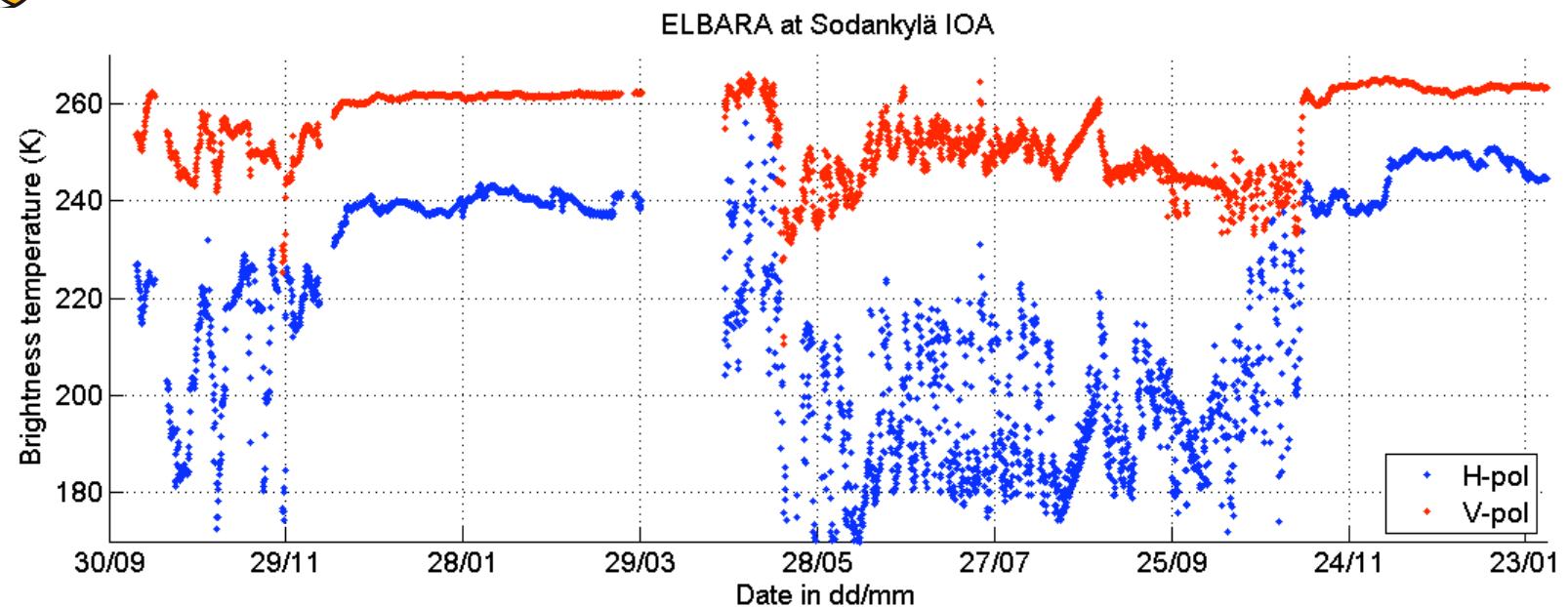
Time-series example





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Time-series example



Thank You for Your Attention!

