



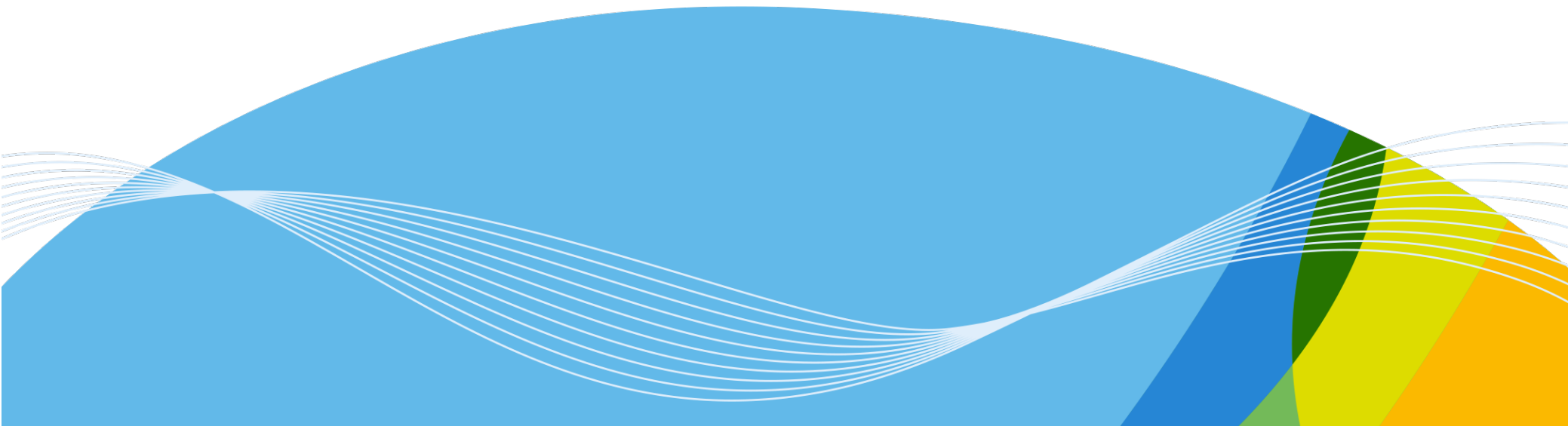
ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

# ERA-CLIM2

European Reanalysis of the Global Climate System

Contribution of FMI to WP3, Earth system observations

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# Task 3.3: Boundary constraints and external forcing

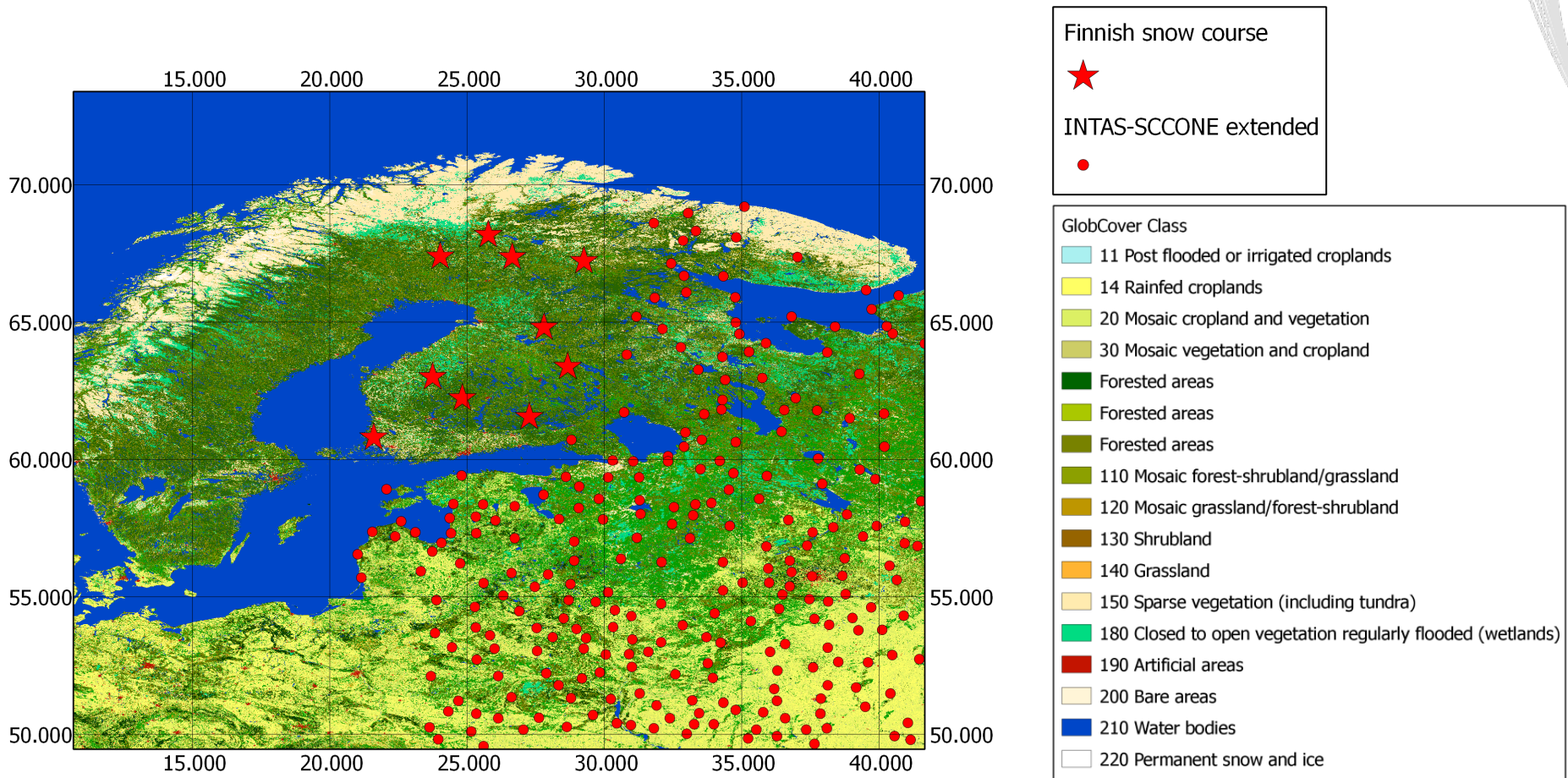
- Global estimates of snow extent and snow water equivalent (SWE) based on GlobSnow
- Development of a consolidated quality-controlled data base of in-situ snow observations in collaboration with NSIDC and RIHMI
- **Deliverables**
  - 3.18 Prototype snow data product (GlobSnow development product) for reanalysis, with documentation (FMI, months 7 to 36)
  - 3.19 Quality controlled version of snow data base (in situ) and snow data product (D3.18), with documentation (FMI, with RIHMI, months 25 to 48)

# FMI contribution

- Compilation of long-term in situ snow observations from different sources (up to ~100 years if possible and where possible)
  - Distributed snow course observations from Eurasia and North America on Snow Water Equivalent (SWE)
  - Point-wise weather station observations on Snow Depth (SD)
  - Prototype product is planned to be released by the end of 2015 (combining Russian, Canadian and Finnish data on SWE from snow courses)
- Development of optimized spatio-temporal snow cover information starting from 1980 based on combined use of satellite data (passive microwaves and optical) and in situ data
  - GlobSnow-type variational data assimilation (method for SWE product)
  - Product neglecting in situ data is also provided

# Snow course observation spatial coverage

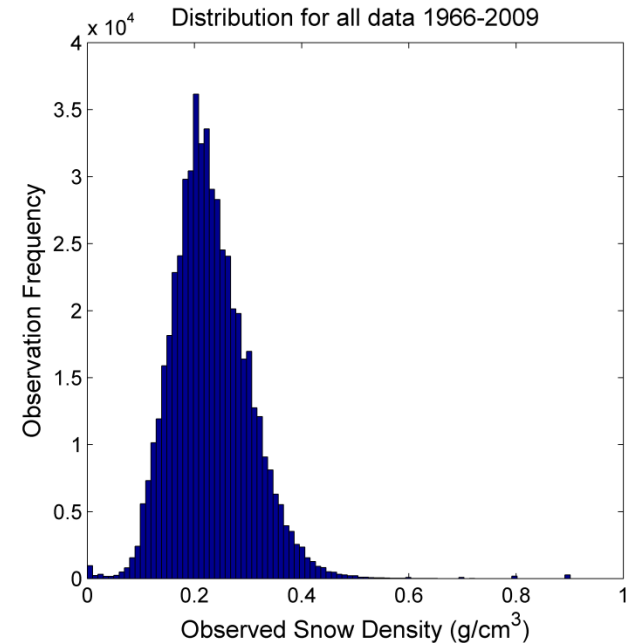
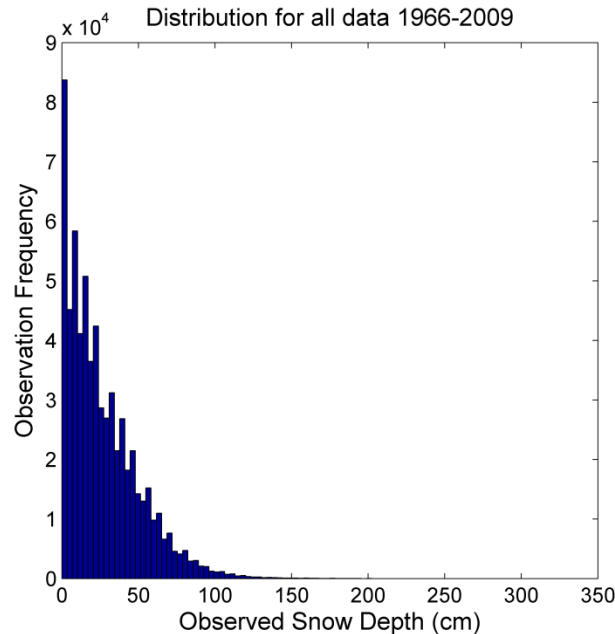
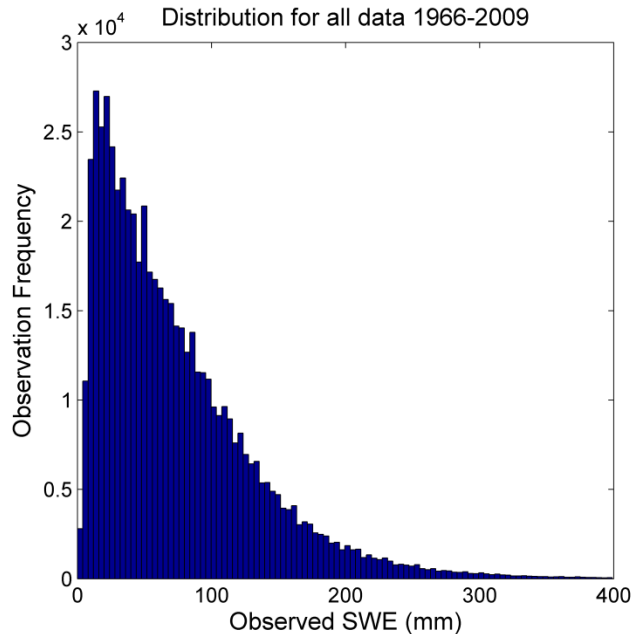
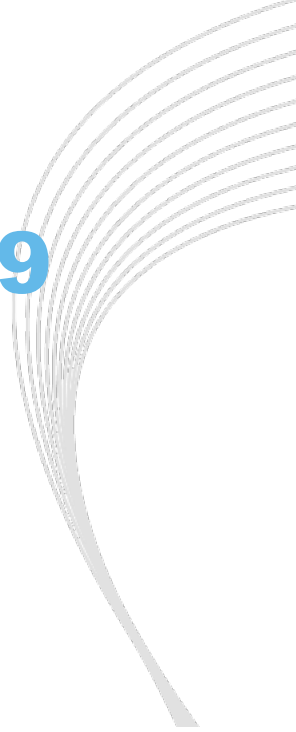
- Example: Distributed snow course observations from Finland and North-West Russia on Snow Water Equivalent (SWE)





# Prototype SWE dataset: Distribution for all data 1966-2009

- Total number of WMO weather stations over 1300
- Time period 1966-2009 (10 stations in Finland until 2014)
- Total number of observations over 700 000
- Variables
  - Snow Water Equivalent (SWE)
  - Snow Dept (SD)
  - Snow Density





# Distributed snow courses

Course	LAT	LON	DOY	SWE	RHO	SD	Julian Day	Year

- Code -99 for missing data
- Separate metadata file
- DOY and Julian day included
- WGS-84 latitude and longitude in decimal degrees

# Development of snow data product (satellite and in situ data)

- GlobSnow development product: combined SE & SWE
- Starting from 1980 based on combined use of passive microwave GlobSnow SWE CDR reprocessed product and optical NOAA Snow CDR and in situ data
  - GlobSnow-type variational data assimilation (method for SWE product)
  - Product neglecting in situ data can be provided as well i.e. GS data with no weather station data as input



# Distribution channels available at FMI

- Sodankylä archive (LITDB)
- FTP site: <http://litdb.fmi.fi/> (ARC database)
  - Erdas Apollo <http://erdas-apollo.fmi.fi/apollo-portal/>
  - EOxServer
    - Application and framework for presenting Earth Observation (EO) data and metadata via different Web Services
    - Open source software written in Python (specified by the Open Geospatial Consortium (OGC))
- The prototype snow dataset for ERA-CLIM2
  - Will consist of 2 files (distributed snow courses and point-wise SD)
  - Total size only ~20 MB



# Erdas Apollo geospatial portal (FMI)



FMI Arctic Research Centre Geospatial Portal

The screenshot displays the Erdas Apollo geospatial portal interface. On the left, there is a 'Map Content' sidebar with a search bar and a tree view of data sources including 'Services', 'Vectors (WFS)', 'Maps (WMS)', 'Coverages (WCS)', 'Coverage Catalog', 'ROOT', 'BALMON', 'GlobSnow', 'snow\_water\_equivalent', 'daily', 'monthly', 'HSAF', 'SnowCarbo', and 'SSPI'. The main map area shows a geographical map of Europe with a search bar at the top containing '1: 23552520' and a 'Current browser language' dropdown. A metadata window is open on the right, displaying the following information:

Metadata	
<b>Name</b>	GlobSnow_SWE_L3B_monthly_198201_v1.3
<b>Title</b>	GlobSnow_SWE_L3B_monthly_198201_v1.3.tif
<b>Abstract</b>	GLOBSNOW FPS Snow Water Equivalent (0.1 deg)
<b>Tags</b>	Snow Water Equivalent (SWE), Snow Water Equivalent, Meteorological geographical features
<b>Node Type</b>	
<b>Registration Date</b>	2013-10-06T02:37:45Z
<b>Owner</b>	admin
Temporal & Spatial	
<b>Temporal Extent</b>	1982-01-01T00:00:00Z/1982-01-31T23:59:00Z
<b>Lat/Lon bounding box</b>	
<b>Native bounding box</b>	-180, 0, 180, 90
<b>Native SRS</b>	EPSG:4326
<b>X Resolution</b>	0.10000000000000002
<b>X Size</b>	3600
<b>Y Resolution</b>	0.1
<b>Y Size</b>	900
<b>Georectified</b>	Yes
<b>Georeferenced</b>	Yes
<b>Pixel Space</b>	No
Bands Description	

At the bottom of the interface, there is a 'monthly' tab selected, and a row of thumbnail images showing the snow water equivalent data for various months. The bottom status bar indicates 'Page 1 of 58' and '10 Items per page'.



# FMI Arctic Research FTP Database

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**DATABASE OF SODANKYLA AND PALLAS MEASUREMENTS**

HOME

SYNOP DATA

CAMERAS

SOUNDINGS

COLUMN DATA

RADIATION DATA

AEROSOL

MICROMETEOROLOGICAL MAST

UPPER ATMOSPHERIC DATA

PALLAS

SOIL

SNOW

HIRLAM

CAMPAING, FUVIRC

CAMPAING, NOSREX

CAMPAING, SNORTEX

SYNOP DATA

**SYNOP OBSERVATIONS / AUTOMATIC WEATHER STATION (AWS)**

PEATLAND AUTOMATIC WEATHER STATION (AWS)

MANUAL SYNOP OBSERVATIONS, DAILY VALUES

MANUAL SYNOP OBSERVATIONS

**AWS:**

<input type="checkbox"/> BOTTOM OF THE CLOUD LAYER	<input type="checkbox"/> BOTTOM OF THE CLOUD LAYER, PREVIOUS 20 MIN
<input type="checkbox"/> BOTTOM OF THE 2ND CLOUD LAYER, PREV. 20 MIN	<input type="checkbox"/> BOTTOM OF THE 3RD CLOUD LAYER, PREV. 20 MIN
<input type="checkbox"/> BOTTOM OF THE 4TH CLOUD LAYER, PREV. 20 MIN	<input type="checkbox"/> AMOUNT OF LOW CLOUDS
<input type="checkbox"/> AMOUNT OF 2ND CLOUD LAYER	<input type="checkbox"/> AMOUNT OF 3RD CLOUD LAYER
<input type="checkbox"/> AMOUNT OF 4TH CLOUD LAYER	<input type="checkbox"/> WIND DIRECTION 10 MIN AVERAGE
<input type="checkbox"/> WIND DIRECTION, INSTANT VALUE	<input type="checkbox"/> RELATIVE HUMIDITY
<input type="checkbox"/> GROUND PRESSURE	<input type="checkbox"/> PRESSURE CONVERTED TO SEA LEVEL
<input type="checkbox"/> PRECIPITATION INTENSITY 10 MIN AVERAGE	<input type="checkbox"/> PRECIPITATION 1 H CUMULATIVE SUM
<input type="checkbox"/> SNOW DEPTH	<input type="checkbox"/> SNOW DEPTH, 10 MIN STANDARD DEVIATION
<input type="checkbox"/> SNOW DEPTH 10 MIN AVERAGE	<input type="checkbox"/> SNOW QUALITY NUMBER
<input type="checkbox"/> TEMPERATURE AT 2M	<input type="checkbox"/> TEMPERATURE AT GROUND
<input type="checkbox"/> DEW POINT TEMPERATURE	<input type="checkbox"/> VISIBILITY 10 MIN, CURRENT VALUE
<input type="checkbox"/> VISIBILITY 10 MIN, PREVIOUS VALUE	<input type="checkbox"/> PRECIPITATION INTENSITY 10 MIN AVERAGE
<input type="checkbox"/> PREVAILING WEATHER CODE	<input type="checkbox"/> WIND SPEED 10 MIN AVERAGE
<input type="checkbox"/> MAXIMUM WIND SPEED DURING 10 MIN PERIOD	<input type="checkbox"/> WIND SPEED INSTANT
<input type="checkbox"/> MILOS ERROR CODE 1	<input type="checkbox"/> MILOS ERROR CODE 2

**METADATA FILE**

**MANUAL SYNOP OBSERVATIONS:**

<input type="checkbox"/> TYPE OF HIGH CLOUDS	<input type="checkbox"/> STATE OF GROUND.
<input type="checkbox"/> TYPE OF MIDDLE CLOUDS	<input type="checkbox"/> AMOUNT OF LOWEST CLOUDS
<input type="checkbox"/> HEIGHT OF LOWEST CLOUDS	<input type="checkbox"/> AIR PRESSURE AT SEA LEVEL
<input type="checkbox"/> TOTAL CLOUDINESS	<input type="checkbox"/> AIR TEMPERATURE
<input type="checkbox"/> RELATIVE HUMIDITY	<input type="checkbox"/> WET BULD TEMPERATURE
<input type="checkbox"/> DEW POINT TEMPERATURE	<input type="checkbox"/> MANUAL PAST WEATHER W1
<input type="checkbox"/> VISIBILITY	<input type="checkbox"/> WIND DIRECTION 10 MIN AVERAGE
<input type="checkbox"/> MANUAL PAST WEATHER W2	<input type="checkbox"/> WEATHER SYMBOL 2
<input type="checkbox"/> WEATHER SYMBOL 1	<input type="checkbox"/> WEATHER SYMBOL 4
<input type="checkbox"/> WEATHER SYMBOL 3	<input type="checkbox"/> WEATHER SYMBOL 6
<input type="checkbox"/> WEATHER SYMBOL 5	<input type="checkbox"/> WW CODE/SYNOP
<input type="checkbox"/> WIND SPEED 10 MIN AVERAGE	<input type="checkbox"/> TIME OF MAX WIND SPEED DURING THE LAST 3 HOURS
<input type="checkbox"/> MAX WIND SPEED DURING THE LAST 3 HOURS	

**METADATA FILE**

# Development of snow data product (satellite and in situ data)

- GlobSnow development product: combined SE & SWE
- Starting from 1980 based on combined use of passive microwave GlobSnow SWE CDR reprocessed product and optical NOAA Snow CDR and in situ data
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# SWE map product

- Spatial resolution of 25 km
- Combining satellite and *in situ* data (passive microwaves and SWE from snow courses as main data sources)

