

WMO-CIMO Testbed for Cryosphere and Precipitation(Sodankylä, Finland)

General Site Information

The testbed is an observatory affiliated to the Arctic Space Centre at Sodankylä (FMI-ASC). FMI-ASC has an exceptionally versatile monitoring program and consequently participates in many observational networks including:

- WMO coordinated GAW (Global Atmospheric Watch)
- GRUAN (Global Reference Upper Air Network)
- SYNOP (surface synoptic observations) and radio/ozone sonde networks
- NDACC (Network for Detection of Atmospheric Composition Change)
- TCCON (Total Carbon Column Observing Network)
- SPICE (WMO Solid Precipitation Intercomparison Experiment)

(please see www-links at the end of this document)

FMI-ASC has a long history for accepting visiting instruments and has decades of experience of hosting the arctic campaigns especially in the frame of EU, ESA and EUMETSAT projects. At present, FMI-ASC executes ground-based observation program serving:

- Operational weather forecasting
- Atmospheric research
- Internationally competitive arctic global change research programme
- Competent technical development and supportive functions
- Satellite data receiving, processing and archiving functions.

Testbed location: 67.36380°N 26.63040°E

Climate Type: Dfc (continental subarctic climate)

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Main activities

Areas of special interests and capabilities

In situ instrument testing

The in-situ instrument testbed activity builds on:

- experience and expertise gained from earlier campaign activities at FMI Sodankylä
- participation in international atmospheric measurement networks.

Upper air observations within the network:

- provide long-term high-quality climate records
- could be used to constrain and validate data from space-based remote sensors
- provide accurate data for the study of atmospheric processes.

Measurement	Instrument	
Altitude positioning	Hydrostatic altitude calculation	
Vertical profile of air temperature, pressure, humidity	Balloon-borne radiosonde RS92 by Vaisala	
Vertical profile of atmospheric humidity	Cryogenic Frostpoint Hygrometer (CFH) in troposphere and stratosphere	
Vertical profile of ozone concentration	Electrochemical concentration cell (ECC) ozone sonde	
Vertical profile of water vapour	Microwave water vapour and temperature profiler manufactured by DA-Design, Finland. The radiometer uses direct detection filterbank technology.	
Total column-integrated amount of water vapour	GPS data	
Total column-integrated amount of ozone	Brewer MK II spectrophotometer at five wavelengths from 306.3 to 320.1nm	
Column-integrated amount of GHGs (CO ₂ , CH ₄ , N ₂ O, HF, CO, H ₂ O, HDO)	Bruker IFS 125 HR, a very high resolution Fourier Transform Spectrometer; A547N Solar Tracker; Three quantum detectors: Si, InGaAs, and InSb photo diodes	
Atmosphere optical thickness (AOT)	Precision-Filter-Radiometer (PFR) Sun photometer and a Kipp&Yonen 2AP Gear Drive suntracker	

Cryosphere and Precipitation

The Sodankylä testbed:

- is a typical representative of the Eurasian taiga belt, characterized by a mosaic of sparse conifer-dominated forests, open/forested bogs and small lakes
- performs routine manual and automated snow measurements
- has hosted several experimental campaigns related to remote sensing of snow cover and the cryosphere
- has Many intensive cryosphere observation areas
- has hosted the main reference microwave instrument of FMI as well as the main snow observations and automatic in situ measurements
- has an weather radar at Luosto that has been operated since year 2000The sampling frequency for precipitation is at least five minutes and fifteen minutes for wind profiling.

Measurement	Instrument
Back scattering and brightness temperature of snow	Snowscat-radiometer working on X to Ku bands actively and on L-, X-, K-, Ka- and W- bands passively
Surface thermal radiation	Elbara II: a L-band interferometer radiometer on a common 5-m platform overlooking the cryosphere observation area
	SodRad radiometers on a common 5-m platform overlooking the cryosphere observation area
Sunlight reflection from the forest area	ASD surface reflectance spectrometer working at frequency of 380-2500nm installed 18 meters above tree-trop level
Derived snow-water equivalence	GWI-based (Gamma Water Instrument) in-situ gamma-ray measurements
Amount, intensity, particle size and velocity of all kinds of precipitation	Laser-based distrometer for particles bigger than 0.16mm in diameter
Microwave radiation flux	Microwave radiometer in 21 and 150 GHz
Ground moisture, temperature, below-surface temperature, snow depth	Moisture sensors, soil temperature sensor and surface condition sensors

Main projects

LAPBIAT Upper Troposphere Lower Stratosphere Water Vapor Validation Project (LAUTLOS-WAVVAP) took place at Sodankylä in January – February 2004 and has the focus of the improvement of water vapour measurement techniques in the Upper Troposphere and Lower Stratosphere (UT/LS). Routine measurements of water vapour with high accuracy at these altitudes are an unsolved problem up to now despite many activities in the past ten years. Therefore, one of the aims of the EU COST Action 723 “The Role of the Upper Troposphere and Lower Stratosphere in Global change” is to improve balloon sounding and remote sensing techniques of water vapour measurements (see <http://www.sat.uni-bremen.de/cost/>).

LAPBIAT Atmospheric Sounding Campaign in January-June 2010 is an example of recent international instrument intercomparison campaigns that took place in FMI Sodankylä. This campaign included radiosonde intercomparisons and various commercial and research grade in-situ instruments were launched with a focus on the comparison of humidity and temperature measurements in the troposphere and stratosphere. The most accurate light-weight balloon-borne water vapor instruments such as FLASH-B (Lyman-alpha fluorescence hygrometer) and the Cryogenic Frostpoint Hygrometer (CFH) were flown in multiple sensor balloon payloads. The new reference radiosonde by Vaisala RR01 was also flown in the same payload with the cryogenic frost point hygrometer and the fluorescence hygrometer. The remote sensing instrument participating in the campaign included a new compact microwave radiometer for water vapor measurement MIAWARA-C developed by the University of Bern.

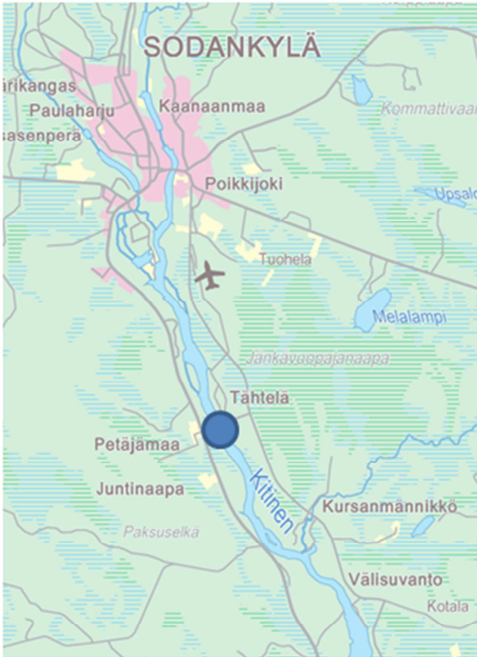
Further information about FMI-ASC research projects is available under

<http://fmiarc.fmi.fi/research/research.php>

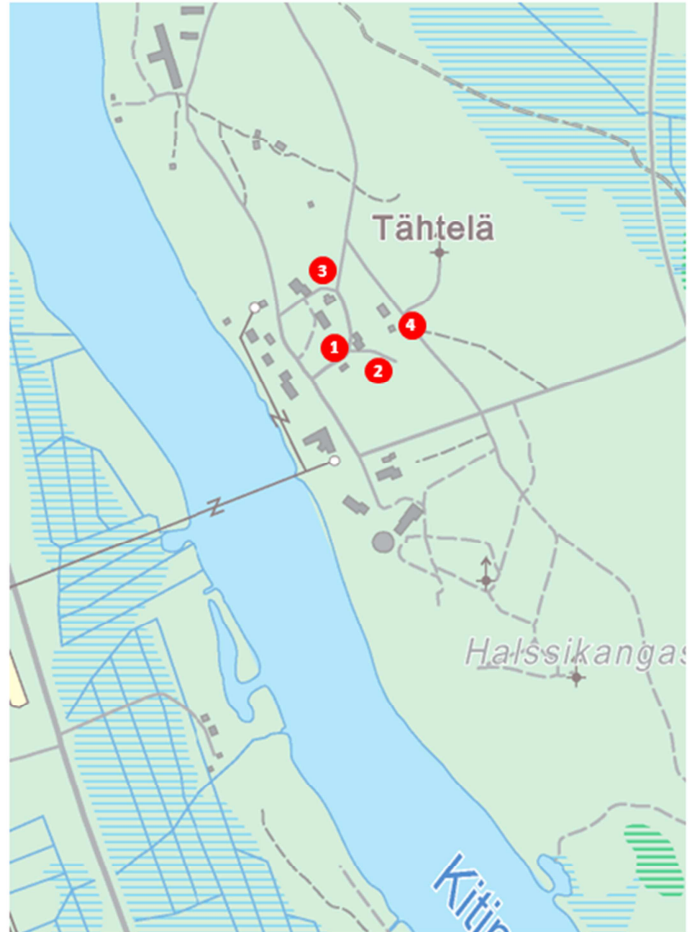
Publication list

Publications using data from FMI-ASC could be found at: <http://fmiarc.fmi.fi/research/publications.php>

Site Maps



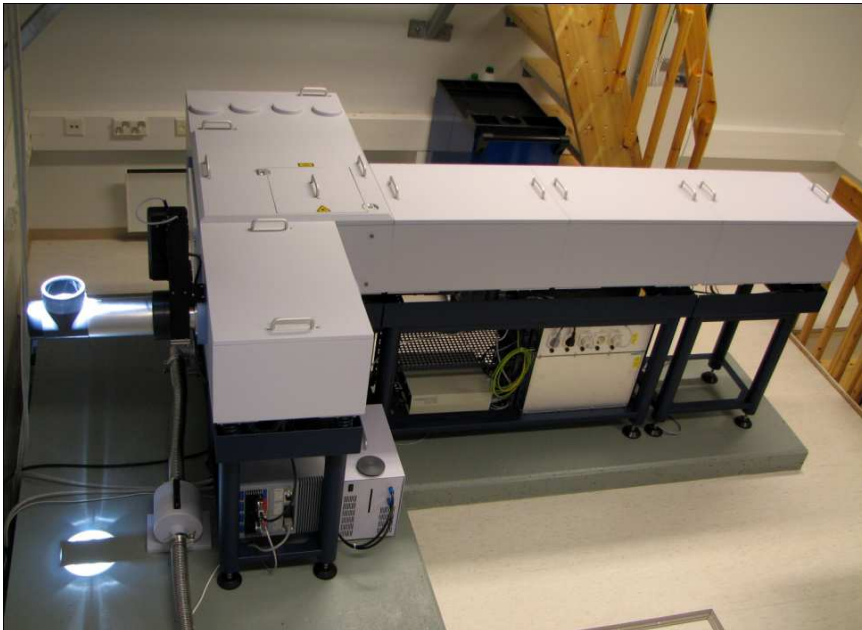
1. Meteorological field, radiation measurements, manual sonde launch, sounding station
2. Radiosonde automated launch, GNSS-IWV
3. Lidar, cloud radar
4. FTIR



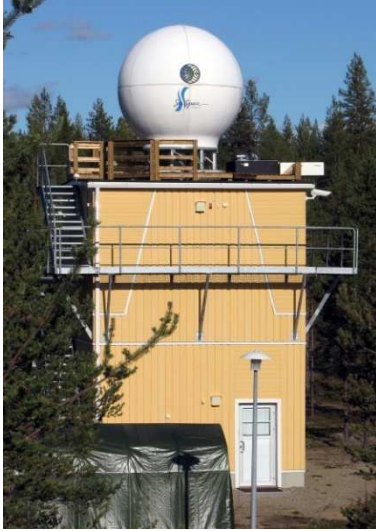
Site Photographs



Figure: Automatic sounding system



Fourier Transform Spectrometer (FTS) participates in the TCCON network.



Satellite receiving station



Solar tracker of the FTS instrument



General view of the SPICE field

Web Links

Recent ancillary measurements at the site are provided at:

http://fmiarc.fmi.fi/recent_obs/recent_obs.php

More information about research projects and related publications is available under:

<http://fmiarc.fmi.fi/research/research.php>

More information on the instruments is available under:

<http://litdb.fmi.fi/>

Links to the participating networks:

- WMO coordinated GAW (Global Atmosphere Watch):
http://www.wmo.int/pages/prog/arep/gaw/gaw_home_en.html
- GRUAN (Global Reference Upper Air Network):
<http://www.gruan.org>
- NDACC (Network for Detection of Atmospheric Composition Change)
<http://www.ndsc.ncep.noaa.gov/>
- TCCON (Total Carbon Column Observing Network)
<http://www.tcon.caltech.edu/>
- SPICE (WMO Solid Precipitation Intercomparison Experiment)
<http://www.wmo.int/pages/prog/www/IMOP/intercomparisons/SPICE/SPICE.html>