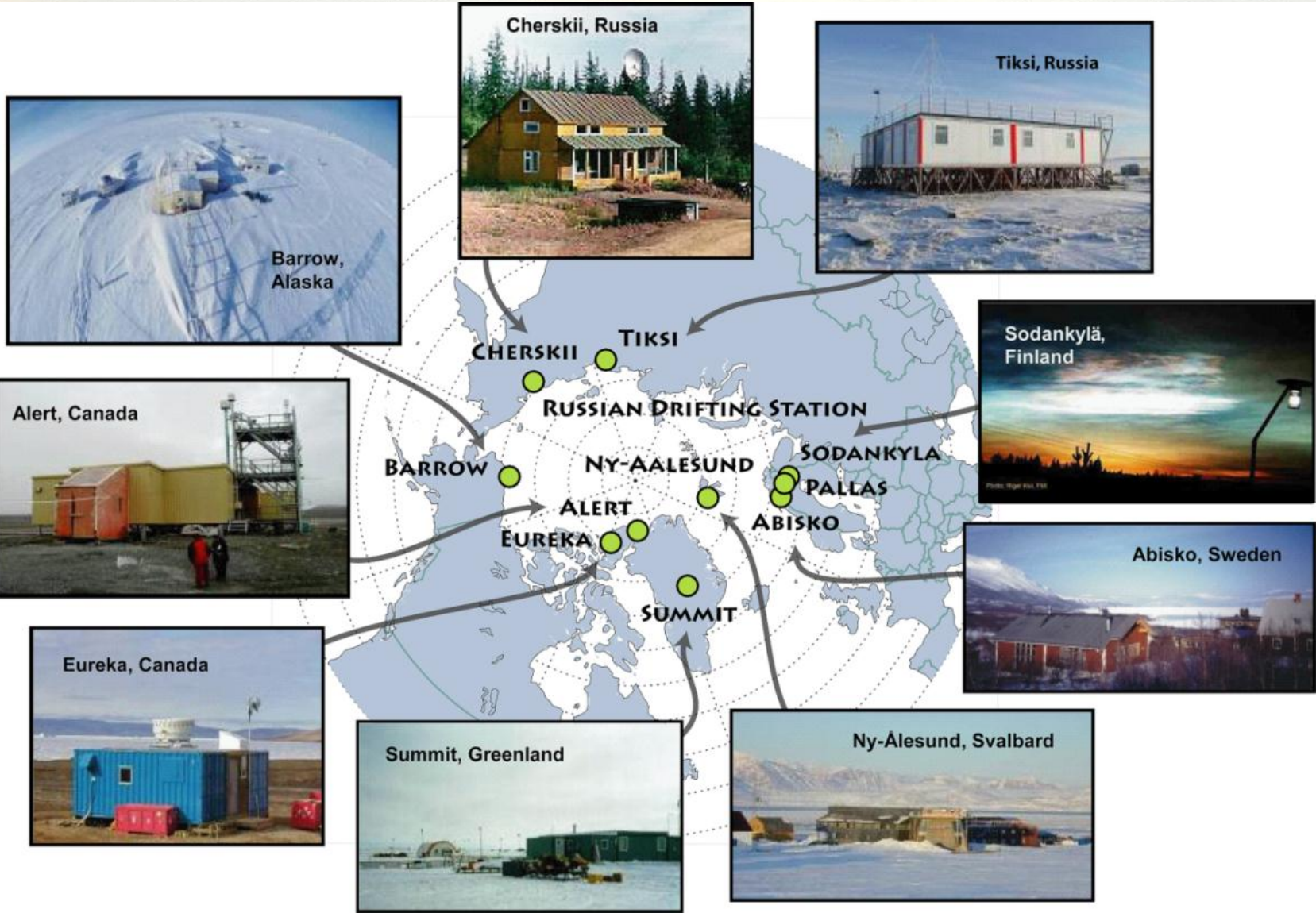




Goals of the Meeting and Review of the History of the Tiksi  
Observatory, Current Infrastructure, and Operation Status

A. Makshtas, (Roshydromet), T. Uttal (NOAA) , T. Laurila (FMI)



**Hydrometeorological Observatory in Tiksi – the key component of created in framework of IPY network of polar observatories**

# Main goals

Organization and collection of long-term weather and climate grade records of the atmosphere and associated land/ocean parameters for development of weather forecast and climate study.

Integration the data of observations and measurements into international observing networks: the Global Atmosphere Watch, the Baseline Surface Radiation Network, the Climate Reference Network, the Global Terrestrial Network for Permafrost and the Micropulse Lidar Network

-

# Participated Organizations

Arctic and Antarctic Research Institute, Russia

Atmospheric Turbulence and Diffusion Division, USA

Center for Environmental Chemistry, SPA Typhoon”, Russia

Earth System Research Laboratory, USA

Finnish Meteorological Institute, Finland,

Institute of Physic of Atmosphere RAS, Russia

Main Geophysical Observatory, Russia

University of Washington, USA

## Main joint projects

	Name of project	Main goal of project
1	<b>Study of surface aerosol</b> ( FMI, ESRL, AARI)	Investigations of atmospheric aerosol in frame of GAW program
2	<b>Unification the data standard meteorological observations</b> (AARI, ATDD)	Creation of homogeneous climatic datasets of meteorological data. Participation in CRN program. Transmission of data to GTS WMO
3	<b>Study of surface radiation balance in Tiksi</b> (AARI, ESRL, FMI)	Creation of homogeneous climatic datasets of radiation data. Participation in BSRN program
4	<b>Investigations of cloudiness</b> (MGO, ESRL, AARI, NESDIS)	Studies of characteristics and temporal variability of polar cloudiness.
5	<b>Monitoring of UV radiation and total ozone content</b> (MGO, ESRL)	Study of UV-radiation intensity in dependence of total ozone content and aerosol optical thickness. Transmission of data to WMO
6	<b>Study of total aerosol in polar atmosphere</b> (AARI, ESRL)	Study of polar atmosphere in frames GAW and AeRoNet programs
7	<b>Surface heat balance, turbulent heat and energy, and CO<sub>2</sub> /Methane fluxes.</b> (IFA RAS, AARI, MGO, ESRL, ATDD, FMI)	Study of air-surface interaction
8	<b>Monitoring of atmospheric pollutions</b> ("Typhoon" , ATDD)	Programs AMAP and Global Monitoring POPs (UNEP) Study of atmospheric pollution in the Arctic.
9	<b>Greenhouse gases in polar atmosphere</b> (MGO, FMI, ESRL)	Monitoring of greenhouse gases in frame of GAW program .

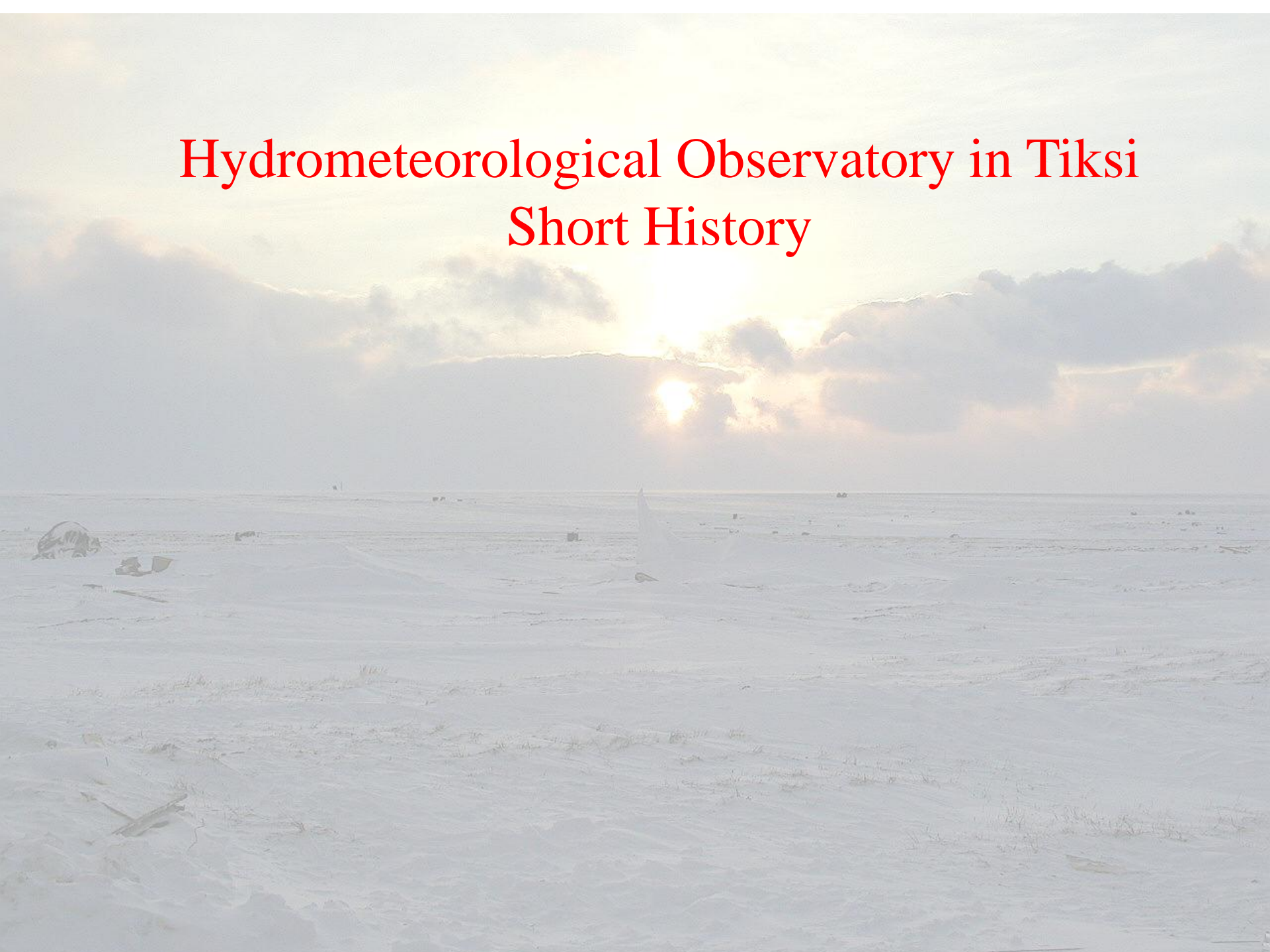
## Main joint projects (continue)

10	<b>Permafrost study in Tiksi area</b> ( AARI, University of Alaska)	Study of permafrost degradation in different landscape zones.
11	<b>Study of precipitation chemistry in the Arctic</b> (MGO, University of Washington).	Data about chemistry of precipitation and tendency its variability.
12	<b>Study of environment and climate changes in the Arctic on human organism</b> (AARI)	Database about functional state of volunteers for future analysis with data of meteorological and geophysical observations

## Observations in Hydrometeorological observatory in frame of GAW

Variable	Method (Instrument)	Period of measurements	Notes	Data submission
Total ozone	M-124, Sun and sky	1972 – 2011	Send to WMO	Voeikov Main Geophysical Observatory
GHG (CO <sub>2</sub> ,CH <sub>4</sub> ) concentration	Flasks sampling	Start: October 2010	<u>Send to NOAA for analysis</u>	Voeikov Main Geophysical Observatory, ESRL
GHG (CO <sub>2</sub> ,CH <sub>4</sub> ) concentration	Continuous measurements: spectroscopy	Start: July 2010 -	Send to WMO 2012	Voeikov Main Geophysical Observatory, FMI, ESRL
Aerosol particles, number concentration and black carbon	Continuous measurements	Start: July 2010-	Send to WMO 2012	FMI, Voeikov Main Geophysical Observatory , ESRL
Chemistry of precipitation : ions sulphate, chloride, nitrate, sodium, ammonium, potassium, calcium, magnesium, pH, conductivity	GAW No. 160	1990 - 2011		Voeikov Main Geophysical Observatory
Surface radiation	Complex of BSRN	August 2010	Send to WMO from July 2011	Arctic and Antarctic Research Institute
Aerosol optical depth (AOD)	Sun photometer CIMEL	August 2010 - 2011	Send to AERONET	Arctic and Antarctic Research Institute, AERONET

# Hydrometeorological Observatory in Tiksi Short History





# Polar station in Tiksi in 2005



# Meteorological and aerological observations on the polar station Tiksi (2005)



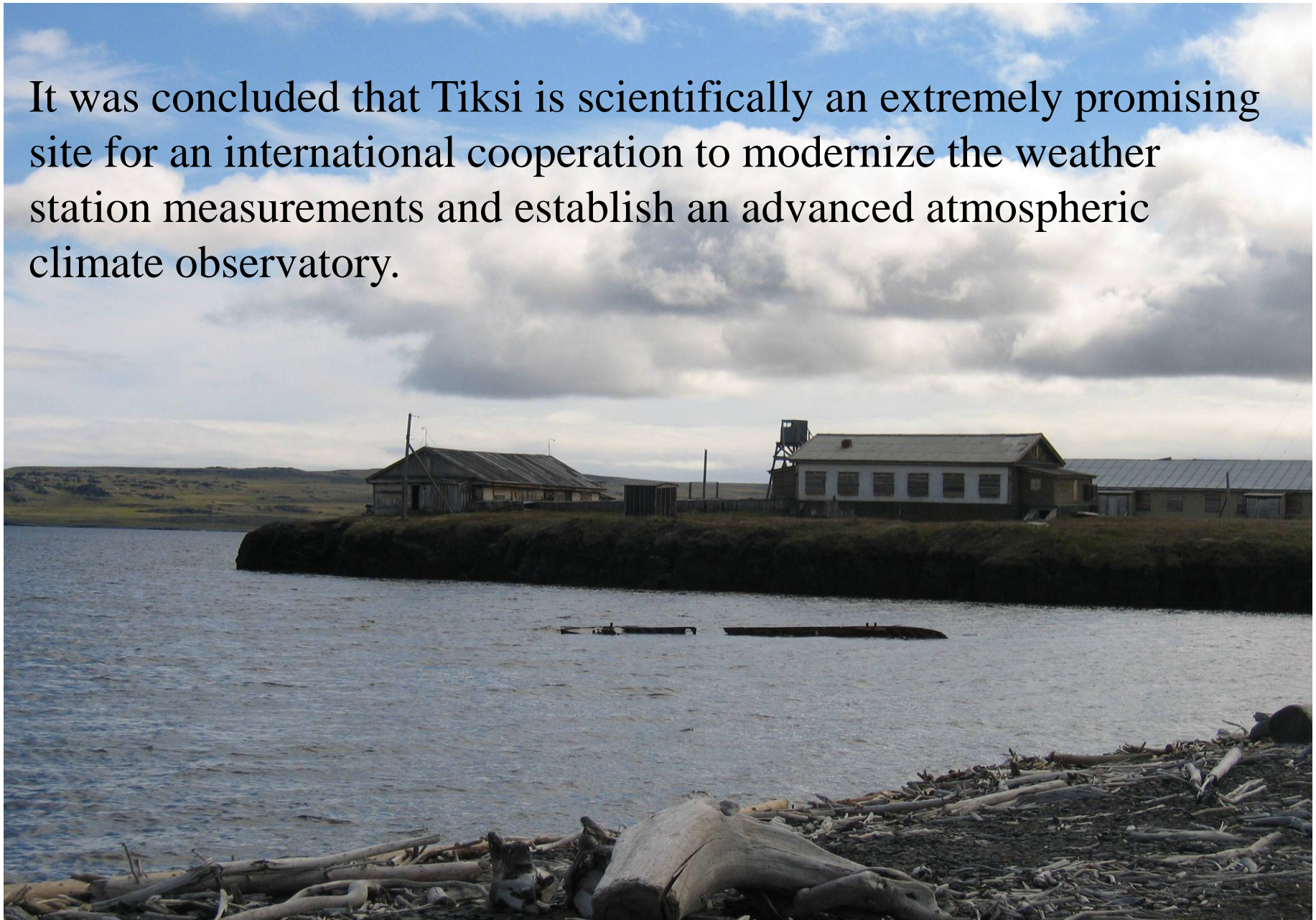
# Measurements in Tiksi before Hydrometeorological Observatory

- Standard meteorological observations (from 1934)
- Radiosoundings (from 1935)
- Total ozone content
- Geophysical measurements of polar ionosphere properties
- Sea level measurements (from 1949)
- Fast ice thickness measurements (from 1934)



First visit of Russian – US – Finland team to the place of future Atmospheric Observatory in Tiksi  
(August 2005)

It was concluded that Tiksi is scientifically an extremely promising site for an international cooperation to modernize the weather station measurements and establish an advanced atmospheric climate observatory.



# The site for satellite validations, greenhouse gases and surface layer studies (2005)





US equipment on the way  
to Tiksi  
October 2009



## Opening of atmospheric investigations in HMO Tiksi August 25 2010





# Hydrometeorological Observatory in Tiksi Infrastructure



The main building of  
Hydrometeorological Observatory





**Clean air facility – for investigations in CO<sub>2</sub> and CH<sub>4</sub>, aerosol concentrations, aerosol size distribution, and aerosol pollution**



# Measurements of turbulent heat fluxes and greenhouse gases in Cabin

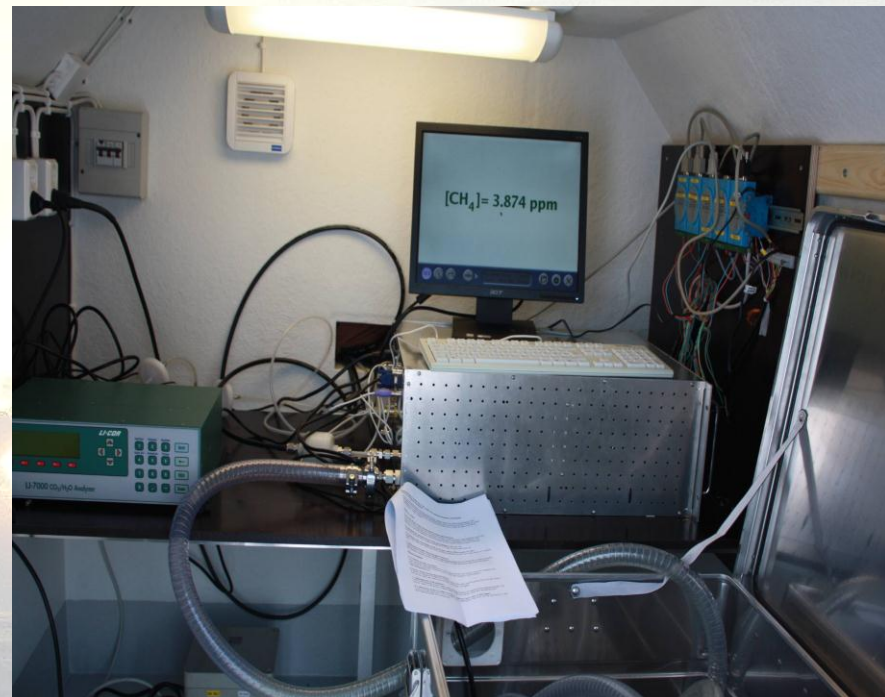
Greenhouse gases and energy fluxes



Main office of HMO Tiksi



Cabin



Clean air facility



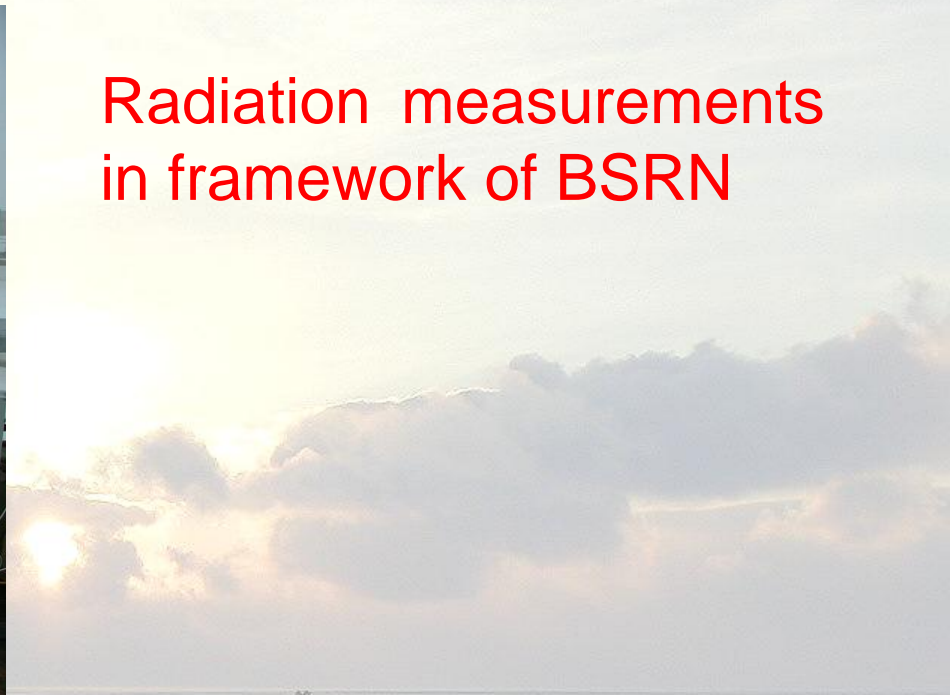
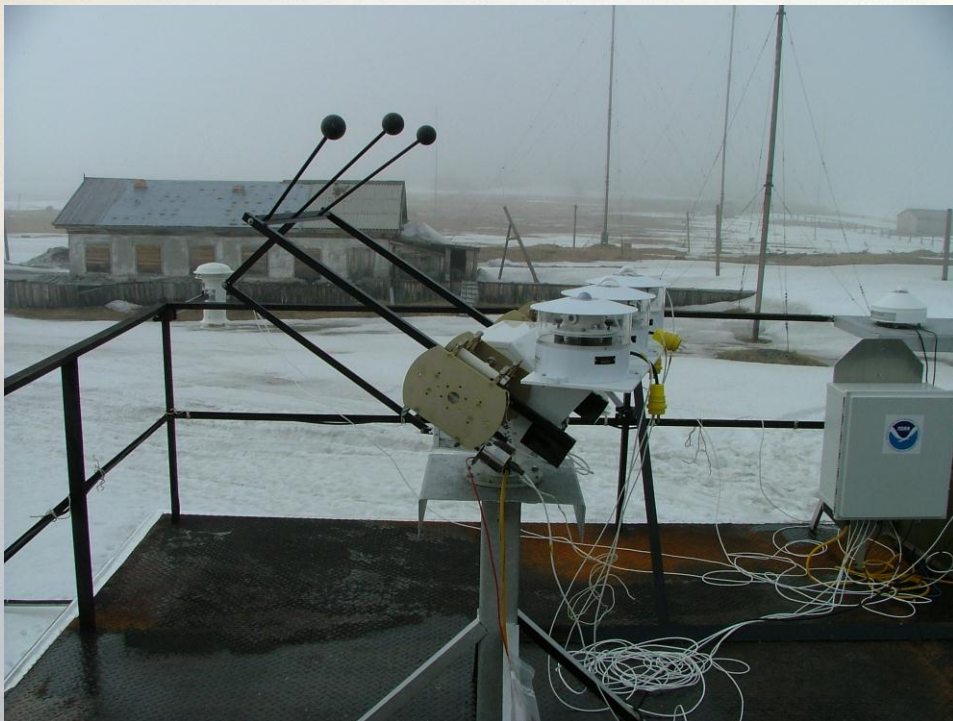
# Installation for persistent organic pollutants measurements



# Combined measurements of total ozone content and UF-radiation

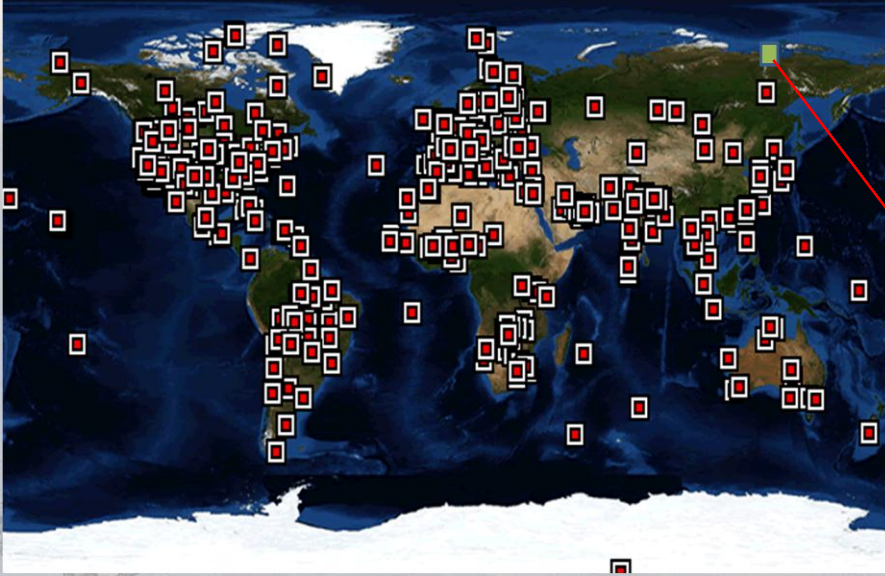


# Radiation measurements in framework of BSRN





Observations of atmospheric  
optical thickness in framework of  
AeroNet  
(solar photometer on the roof of  
Main building GMO)



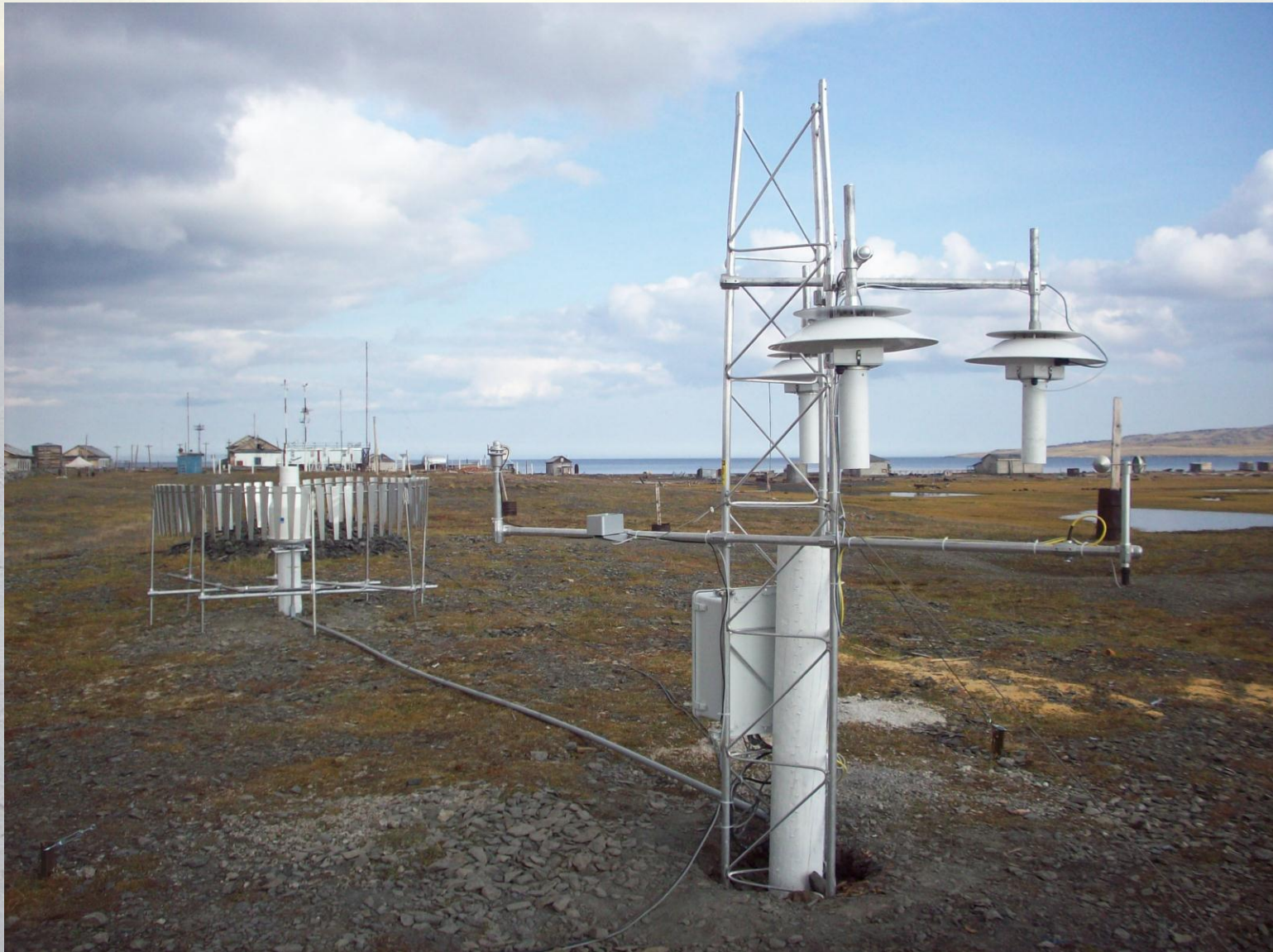
# Measurements of soil temperatures from 0.05 to 3.20 meters



# New radiosounding complex installed by Yacutian management of Roshydromet in September 2010



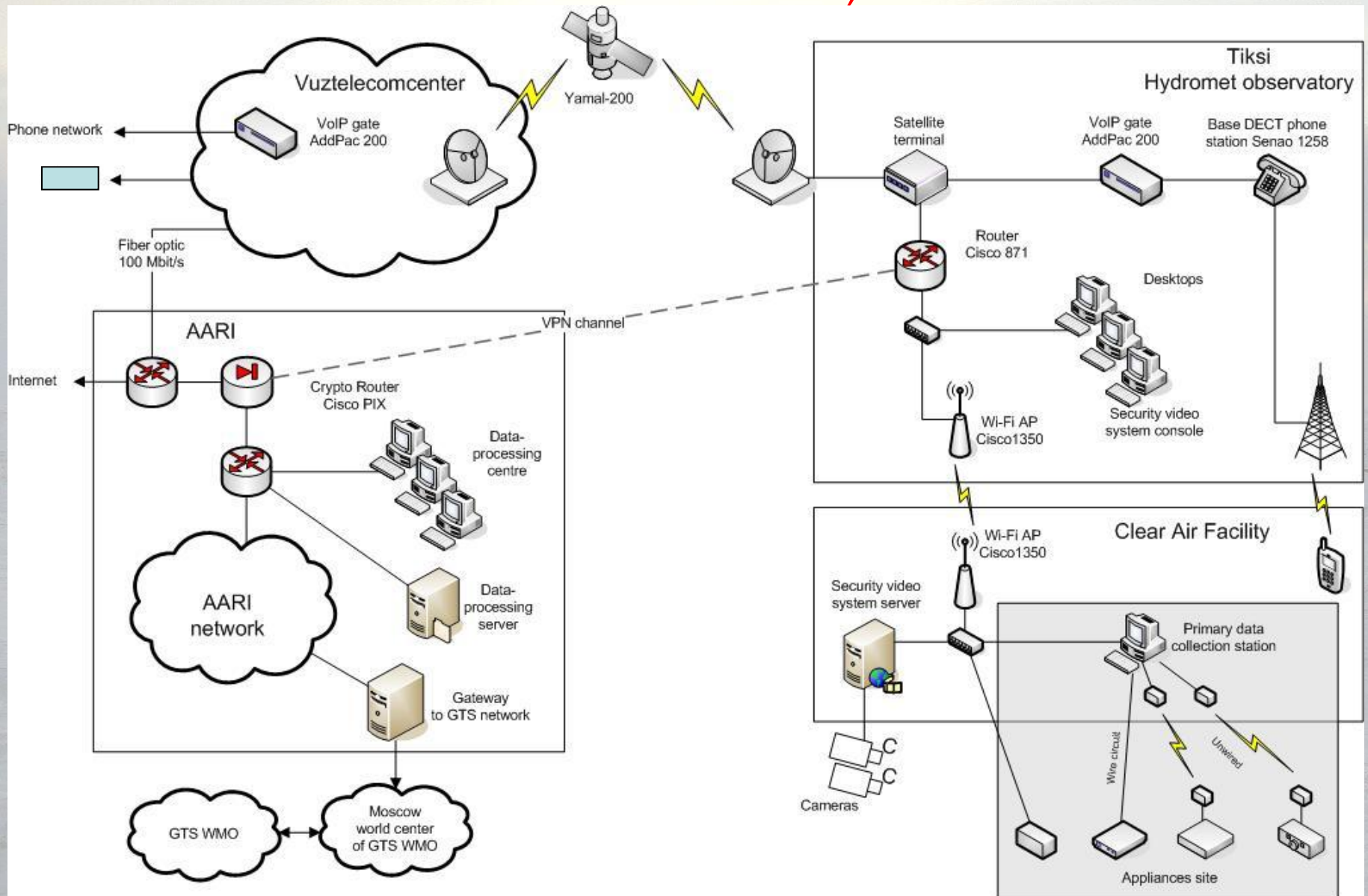
# Automatic meteorological station installed in Tiksi in framework of Climate Reference Network (CNR)



# Tower of twenty meters height for measurements of turbulent heat and CO<sub>2</sub> flux



# Scheme of data transmission from HMO (in operation from October 2009)



# Report of Tiksi Data Center

## Summary of data received from HMO Tiksi in 2011 year.

Radiation BSRN – 8266 files, the total amount of information ~ 99.379 MB  
Radiation BSRN albedo rack – 6047 files, total amount of information 27.946 MB  
Solar fotometer – 8329 files, the total amount of information ~ 10.249 MB  
Aetalometer – 133 files, the total amount of information ~ 11.929 MB  
CRN – 678 files, the total amount of information 15.715 MB  
Standard meteorology – 2936 files, the total amount of information ~ 1.232 MB  
Russian actinometry – 587 files, the total amount of information ~ 184.186 MB  
Soil thermometers – 21 files, the total amount of information ~ 1.228 MB  
Ozonometer – 70 files, the total amount of information ~ 8.899 MB  
CO2 chamber measurements – 28 files, the total amount of information ~ 170.693 MB  
Flux Tower – 8391 files, the total amount of information ~ 10.249 GB  
FMI installations– 3892 files, the total amount of information ~ 7.351 GB

## Summary of data received from HMO Tiksi in January – March 2012 year.

Radiation BSRN – 2348 files, the total amount of information ~ 28.558 MB  
Radiation BSRN albedo rack– 2247 files, the total amount of information ~ 10.247 MB  
Aetalometer – 66 files, the total amount of information ~ 6.078 MB  
CRN - 294 files, the total amount of information ~6.601 MB  
Standard meteorology – 796 files, the total amount of information ~ 134 KB  
Russian actinometry – 33 files, the total amount of data ~ 16.54 MB  
Soil thermometers – 15 files, the total amount of information ~ 0.529 MB  
Ozonometer – 14, the total amount of information ~ 1.530 MB  
Flux Tower – 7775 files, the total amount of information ~ 5.595 GB  
FMI installations– 1051, the total amount of information ~ 2.283 GB

# **TIKSI HYDROMETEOROLOGICAL OBSERVATORY**

## **2012-2013 Baseline Activities**

Process-level science studies of the Arctic atmosphere within the framework of the International Arctic Systems for Observing the Atmosphere (IASOA)

Monitoring within the framework of regional GAW, BSRN and CRN programs in support of the Arctic Council, WMO, IASC, AMAP, SAON

Develop Tiksi regional, mesoscale forecast model (WRF) validated by field data-models of the active layer.

Establish web accessible, real-time data archives (surface and upper level meteorology, black carbon, O<sub>3</sub>, CO<sub>2</sub>, CH<sub>4</sub> concentrations /fluxes, surface heat and energy balances, atmospheric radiation, aerosols and active layer measurements



# **TIKSI HYDROMETEOROLOGICAL OBSERVATORY**

## **2012-2013 Baseline Activities (continued)**

Isotope analysis of precipitation samples - First US non-NOAA (NSF) project

Streamline and operationalize data collection and transfer, real time data processing, quality data control and analysis.

Analysis of air samples for POPs collected in 2010 – 2011 and submission to the AMAP thematic data center

Install new instrumentation for studies of clouds and aerosols

Contribute to development of pan-Arctic FLUXnet

# Implementation Milestones

- Collection of high quality, uninterrupted, standard and research grade meteorology and radiation measurements
- Collection of high quality, uninterrupted measurements of gas, aerosol and chemical constituents of the polar atmosphere
- Installation and configuration of local server (data warehouse) in HMO Tiksi (August – December 2012)
- Establish on-going monitoring of POPs and mercury in atmospheric surface layer (contingent on additional funding)
- Data exchange and joint publications
- Continue scientists and student exchange program.
- Establish structure of agreements for co-financing activities in HMO Tiksi (HMO Tiksi and Tiksi Data Center)
- Update science plan (science steering team)

# New Project Proposals

(contingent on funding)

- **Cloud and Aerosol Studies** - Design and installation of instruments such as ceilometer, lidar, cloud camera, microwave radiometer. Polar clouds are one of the most poorly understood components from point of climate changes and are insufficiently characterized from interpretation of satellite observations
- **Back Carbon Studies** Assess the policy relevant theory that soot content in snow is decreasing snow surface albedo – supplement surface in-situ air sampling with snow sampling
- **Isotopic analysis of precipitation** The data of such investigations will help to understand the trajectories of air masses passed through Observatory region and will give additional information about sources of pollution in the Arctic.

**Thank you for attention  
with hope to future collaboration in  
the Arctic**

