



Arctic and Antarctic Research Institute of Roshydromet research policies & activities

Russian Federation Arctic Zone development Strategy and national Security provision up to Year 2020

The strategic program includes development of an integrated transport system in the Arctic, establishment of a competitive scientific and technological sector, development of international cooperation and the preservation of the Arctic as a zone of peace.

IASC, AC

The document, guarantees state support to the development of infrastructure for transport, industry and energy, as well as to scientific, scientific-technical and innovational activities.

Strategy on Russia Presence on Spitsbergen Archipelago up to Year 2020

Russian Federation Arctic Zone development Strategy and national Security provision up to Year 2020

Among RF Arctic zone development strategy priorities:

In the area of science and technologies development:

- merger of resources and capabilities of the state, business, science, and education for the development of a competitive scientific and technological sector in the area of the elaboration and implementation of advanced technologies, including the development of new technologies or their localisation for Arctic conditions on dedicated technology platforms basis;

In the area of international co-operation development:

- Regular information exchange on the environment as well as data on the Arctic climate and its changing, the development of international cooperation in the area of hydrometeorological observations of the Arctic climate including satellite observation;
- Complex international environment research expeditions arrangements (ice, seawaters pollution, marine ecosystems) and impact of observed and projected climate changes on the environment

State Science Center Arctic and Antarctic Research Institute



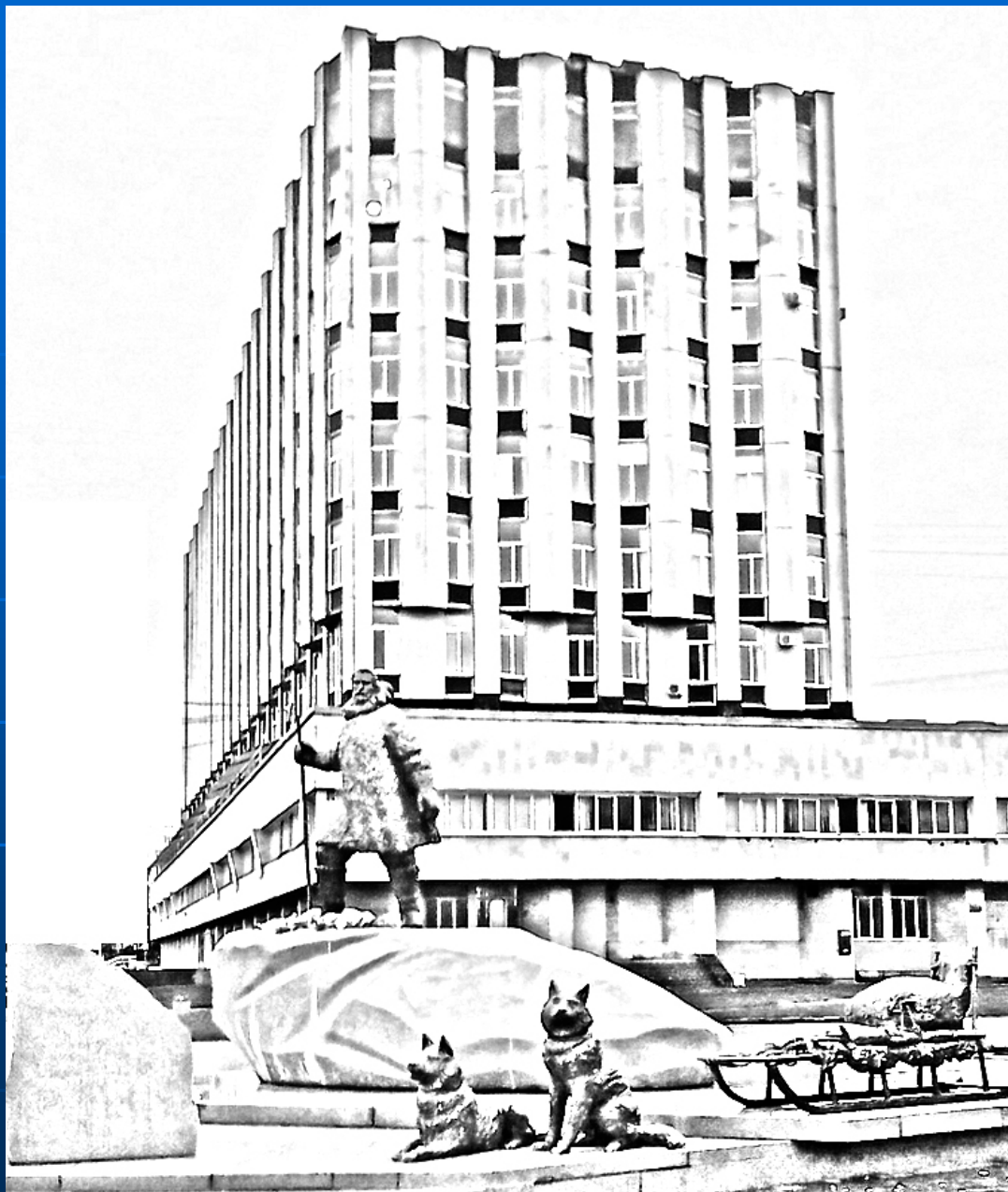
Established in 1920

Currently 986 people are employed in the Institute:

Research and assistant staff – 517 people

Russian Antarctic expedition – 296 people

Research fleet – 173 people





AARI Divisions

- Arctic-shelf Research Laboratory
- Air-Sea Interaction Department
- Southern Oceans Research Laboratory
- Polar Geography Department
- Upper Atmosphere Physics Dep.
- River Mouths Hydrology Dep.
- Long term Weather Forecast Dep
- Sea Ice Regime and Forecast Dep
- WDC-B on Sea Ice
- Sea Ice Regime Manuals Lab.
- Sea Ice Automated Information System Development Dep.
- Sea Ice Thermal Drilling and other Ice Technique Development Lab.
- Young scientists professional development
- Ice Physics Research Laboratory
- Ship Performance in Ice Dep.
- Meteorology Dep.
- Oceanology Dep.
- Measurement Instruments Development Dep.
- Russian Antarctic Expedition
- Arctic High Latitude Expedition
- Operational Centre for Ice and Hydrometeorological Information
- Polar Medicine Centre
- "Otto Schmidt Russian-German Laboratory for Polar and Marine Research"

AARI offers:



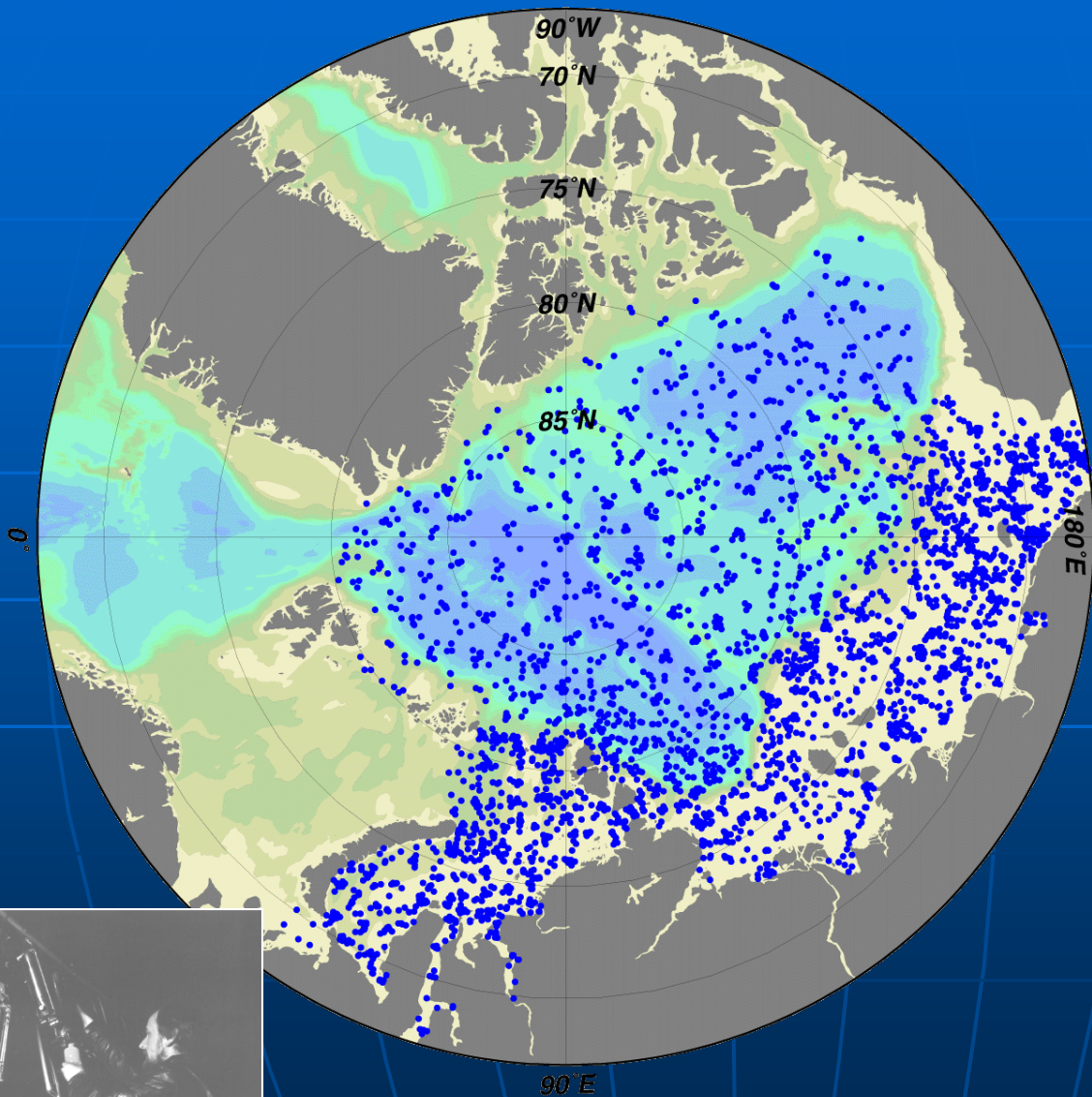
- **Buildings and facilities:**
building on Beringa str., 38,
including ice tanks complex;
geophysical SRS «Gorkovskaya»;
RS «Ladozhskaya»
- **Research fleet:**
Research and supply vessel «Akademik Fedorov»;
Research and supply vessel «Akademik Treshnikov»;
- **Infrastructure :in Antarctic:**
Functioning base: Mirniy, Vostok, Novolazarevskaya,
Progress, Bellingshausen
Abandoned bases: Russkaya, Leningradskaya,
Molodezhnaya

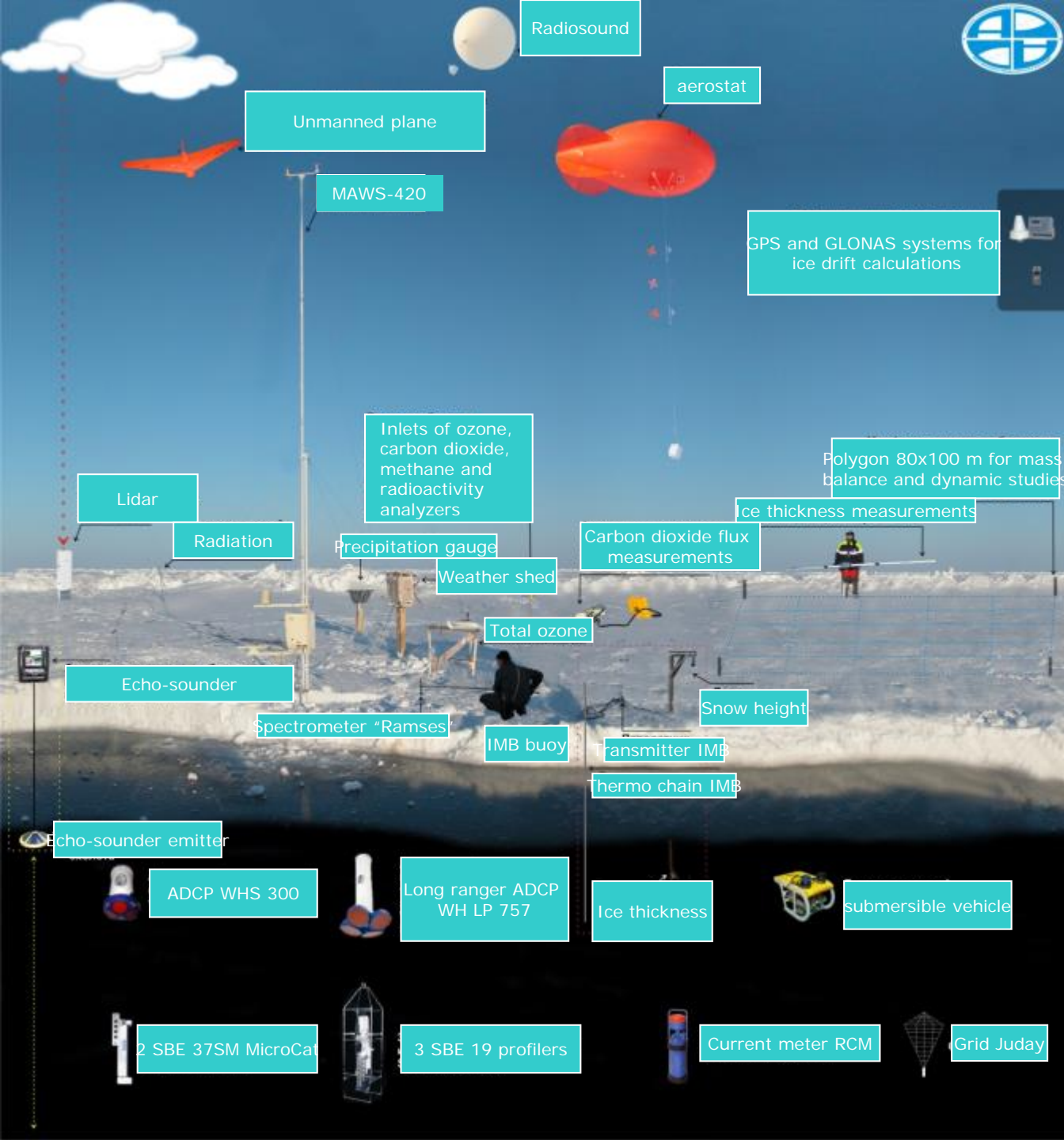
In Arctic:

Spitsbergen Science Center Barentsburg
Research observatory on Baranov Cape,
Severnaya Zemlya archipelago



High Latitude Air born research expeditions "Sever" and "Ice Patrol" ships Hydrographic stations location, 1937-93





Overview of observations at the drifting station “North Pole 35 – 40”:

- structure of low stratosphere and troposphere, including study of ozone layer;
- structure of atmospheric boundary and;
- surface radiation and cloudiness;
- greenhouse gases in atmospheric surface layer;
- spectral and integral albedo;
- turbulent regime of atmospheric and oceanic surface layers
- standard meteorology and radio soundings;
- sea ice structure and physical– mechanical properties;
- ocean thermohaline structure and currents.

"NP" ice camp construction



“AARI Ice Camp” as it was in August, 13-th of 2007

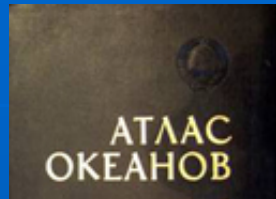


Self driving ice-strengthen research platform for Central Arctic Ocean Studies

Currently in Russia in order to continue the comprehensive observations and research in the Central Basin of Arctic Ocean likes "North Pole" Research stations it was decided to build by 2020 a special self-propelled ice-strengthen research platform, which independently or with an icebreaker assistance could be placed in the selected location



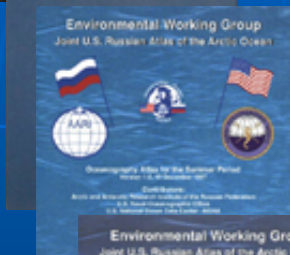
The Arctic Ocean Atlases



**World Ocean Atlas:
The Arctic Ocean, 1980**



The Arctic Atlas, 1985



**Joint US-Russian
Arctic Ocean
Atlas
1997 v1; 1999 v2**



**Joint AARI-IARC
Arctic Ocean
Hydrochemistry
Atlas, 2001**

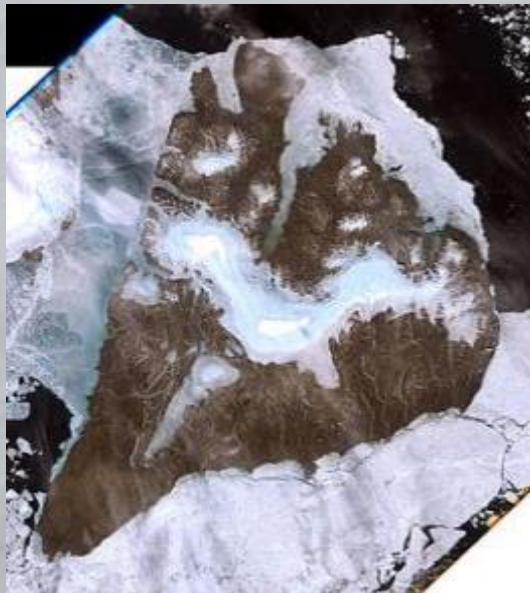


Research station «Ice Base Cape of Baranov» (reopen 2013)



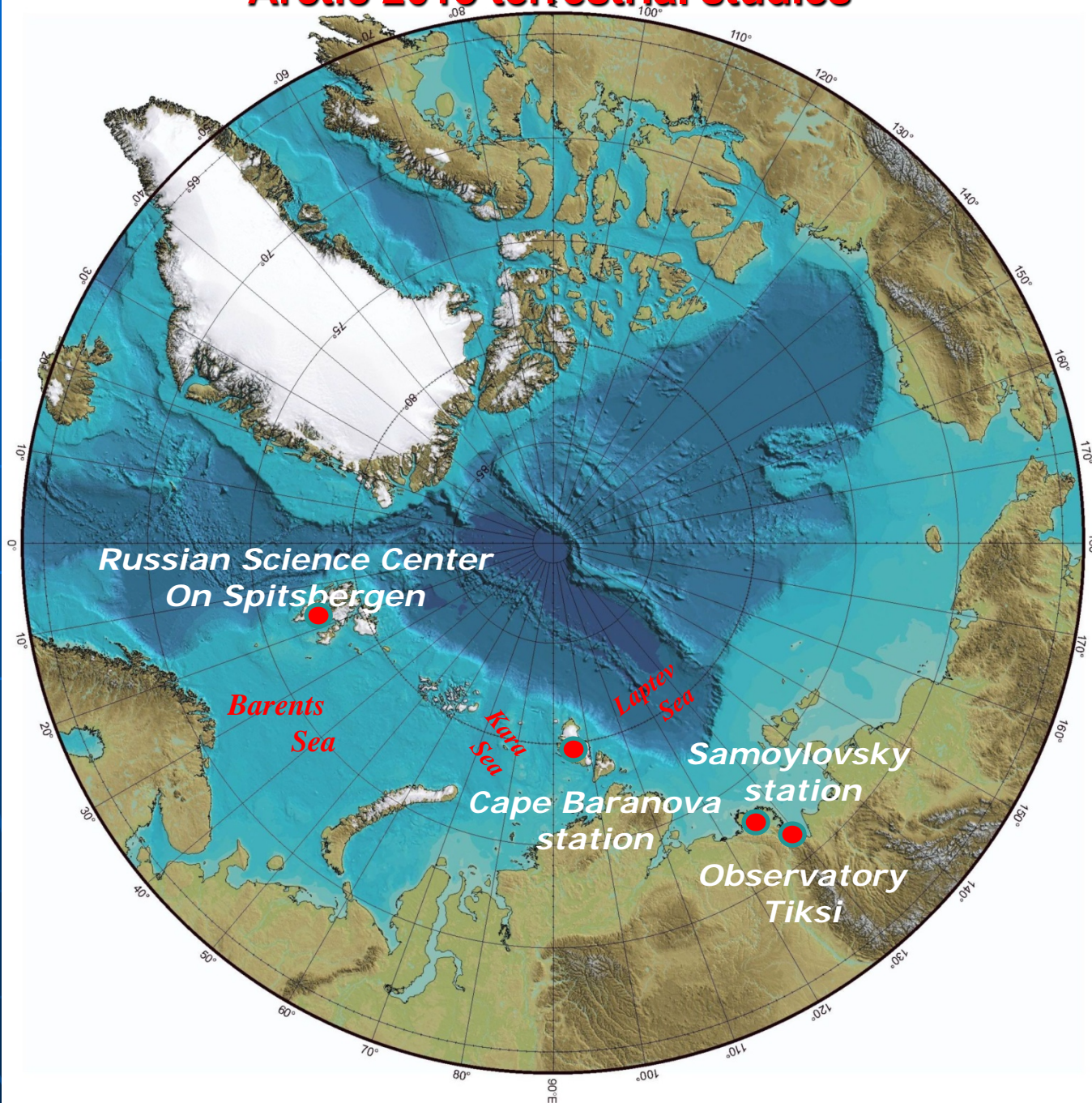
Main directions:

- standard meteorology and radiosoundings;
- surface aerosol, including black carbon;
- surface radiation balance;
- UV radiation, total ozone content and ozone in low stratosphere;
- surface heat balance;
- CO₂ /methane fluxes;
- permafrost and glacier studies
- drifting and fast ice, and icebergs investigations
- Fresh water hydrology and oceanography





Arctic 2015 terrestrial studies



Laptev Sea System studies:

President Vladimir Putin visiting German-Russian research camp on Samoillovski island (Lena river delta) 23.08.2010



Research Station Samoylovsky Island



General plan





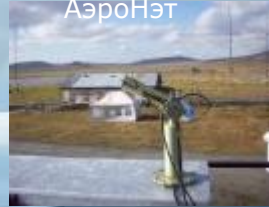
Tiksi Atmosphere Observatory have started observations on:
Solar radiation,
UV-radiation;
Active soil layer temperature regime;
Green houses concentration in atmosphere boundary layer



**Russia President Vladimir Putin
on Tiksi Observatory opening
Ceremony
23 of August 2010**

Tiksi Hydrometeorological Observatory

Радиационные измерения по программам БСРН и
АэроНэт



Измерения по программе Базово-климатической сети



Исследования потока CO_2 и свойств
морского льда на припайном льду
залива Сого



Главное здание ГМО Тикси



Измерения температурного режима
почвы



Мониторинг атмосферных загрязнений,
аэрозоля и парниковых газов в Павильоне
чистого воздуха

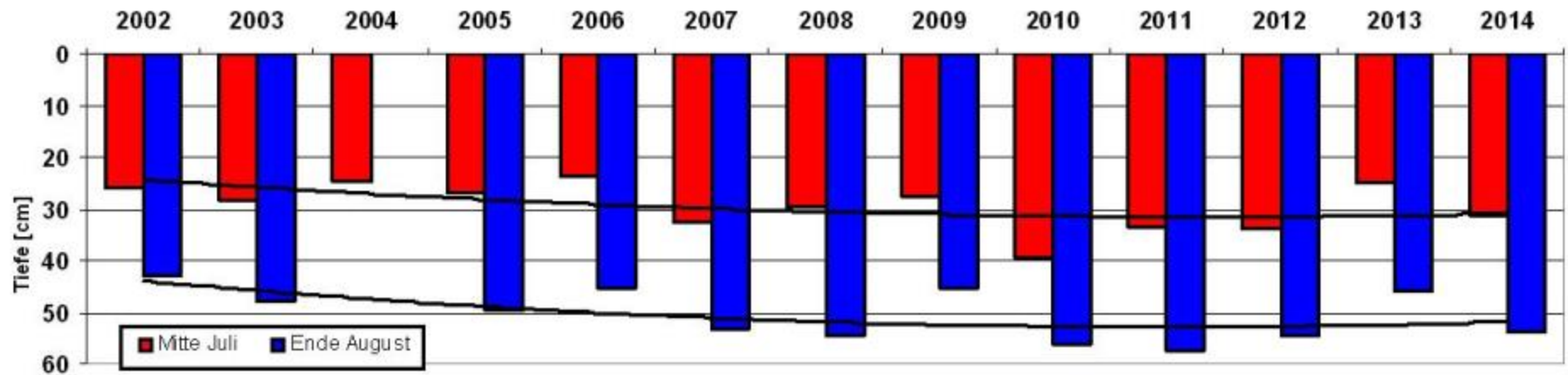
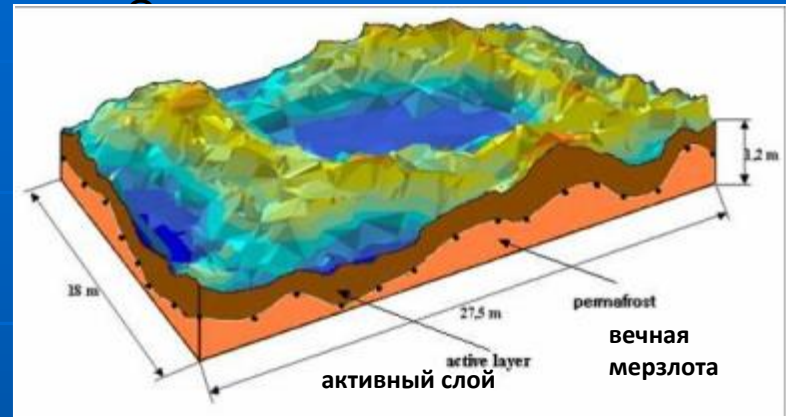


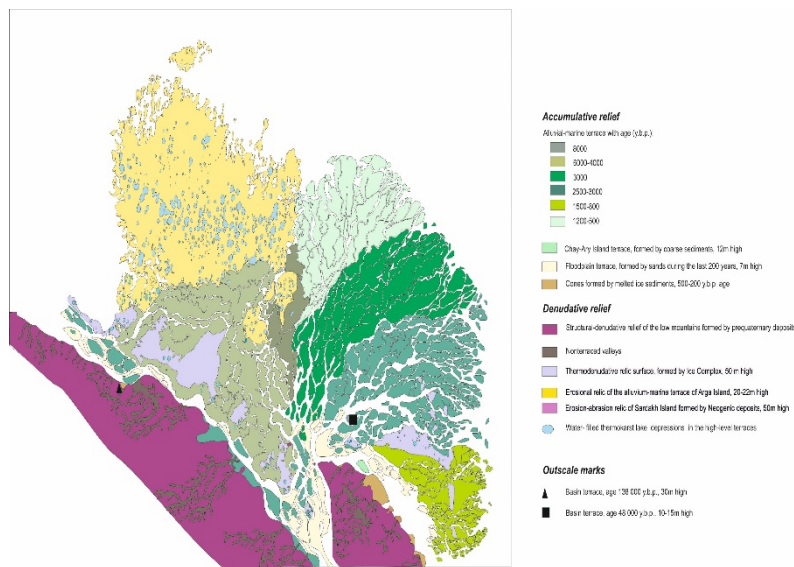
Микрометеорологические измерения в
каменистой тундре



Двадцатиметр
овая башня
для
исследований
турбулентнос
ти и потоков
парниковых
газов (CO_2 и
 CH_4).

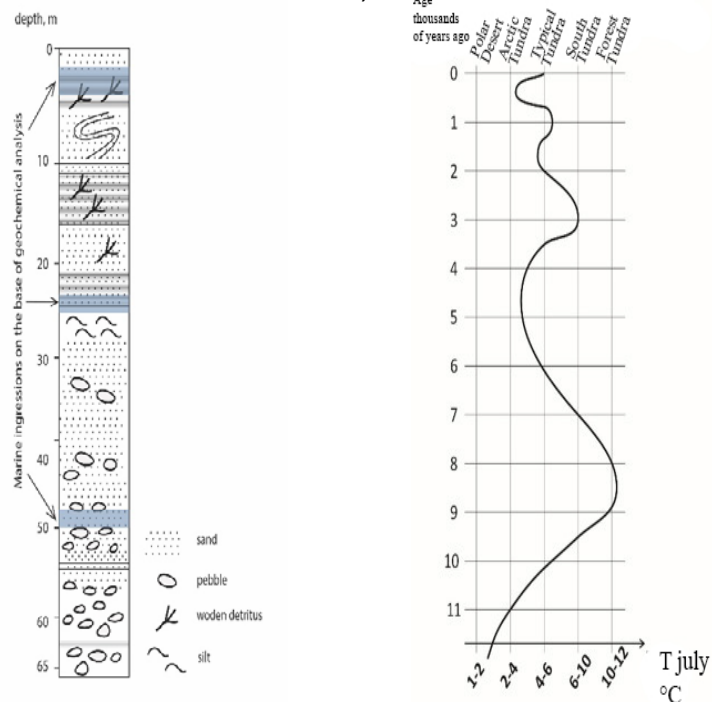
Permafrost active layer monitoring





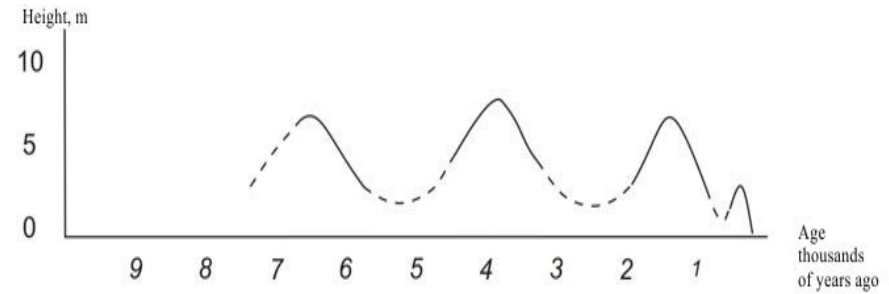
Геоморфологическая карта дельты р. Лены

et.al, 20

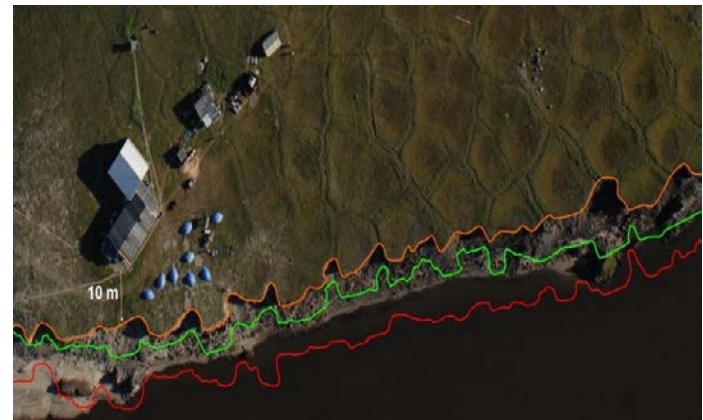


Изучение кернов при глубоком бурении в дельте Лены и регионе

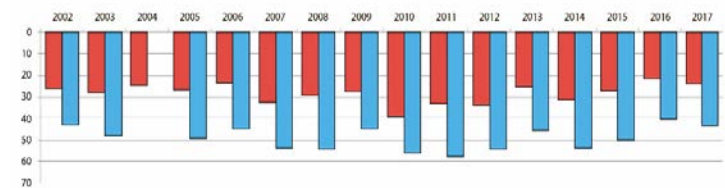
Climate fluctuations in the Holocene



Реконструкция изменения положения уровня моря в голоцене [Bolshiyarov et.al, 2015]



Эрозия, термоэрозия и термоабразия берегов. Положение береговой линии в 2003, 2007 и 2008 гг.



Геокриологический мониторинг деятельного слоя грунта в июле и сентябре

Ship Campaigns



Existing and Potential Long-Term, Distributed ground-based Measurements (Russia and Partners) can offer Observational Support to the PPP and YOPP (prepared by T. Uttal (NOAA))



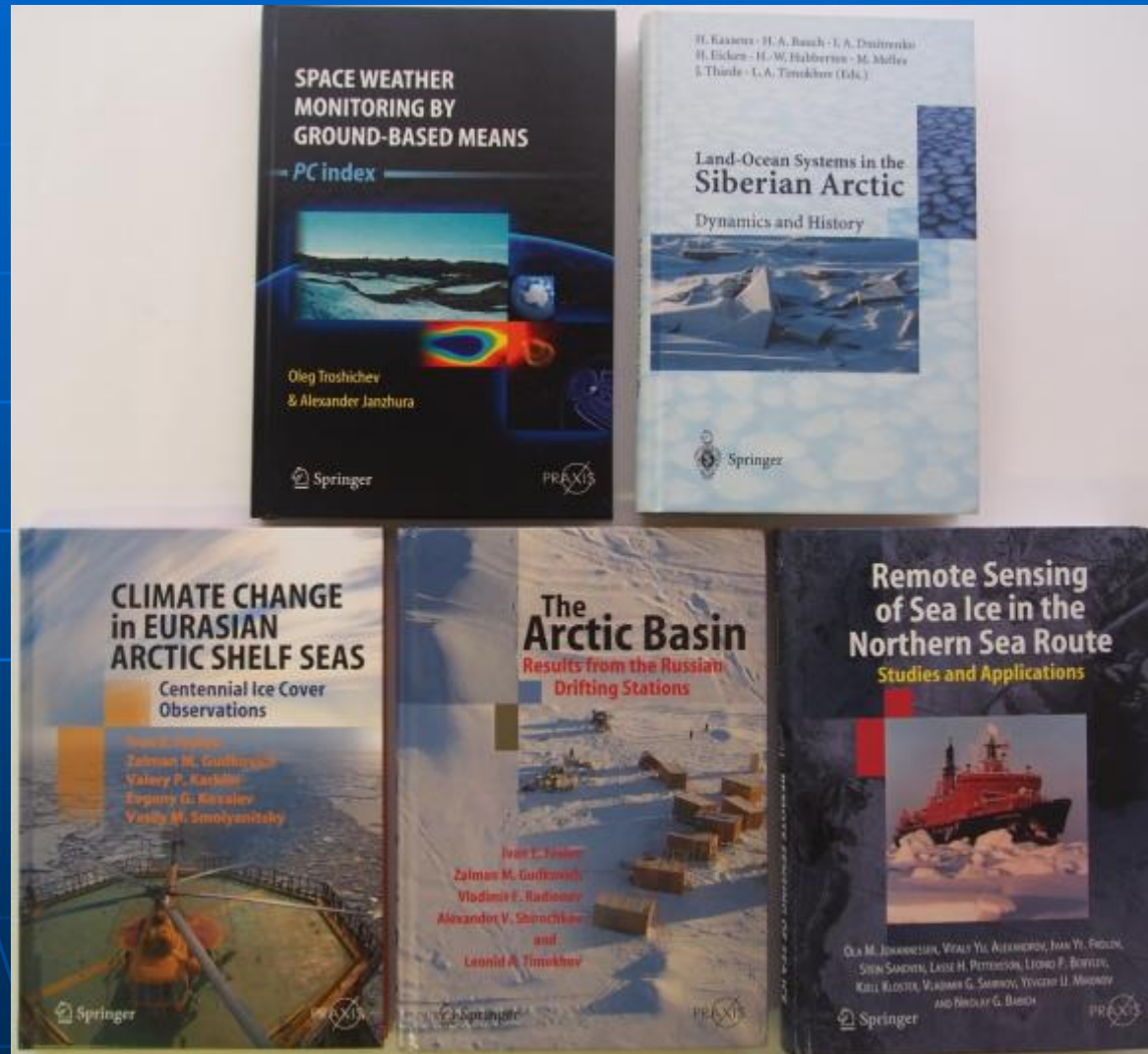
Russian Drift Stations

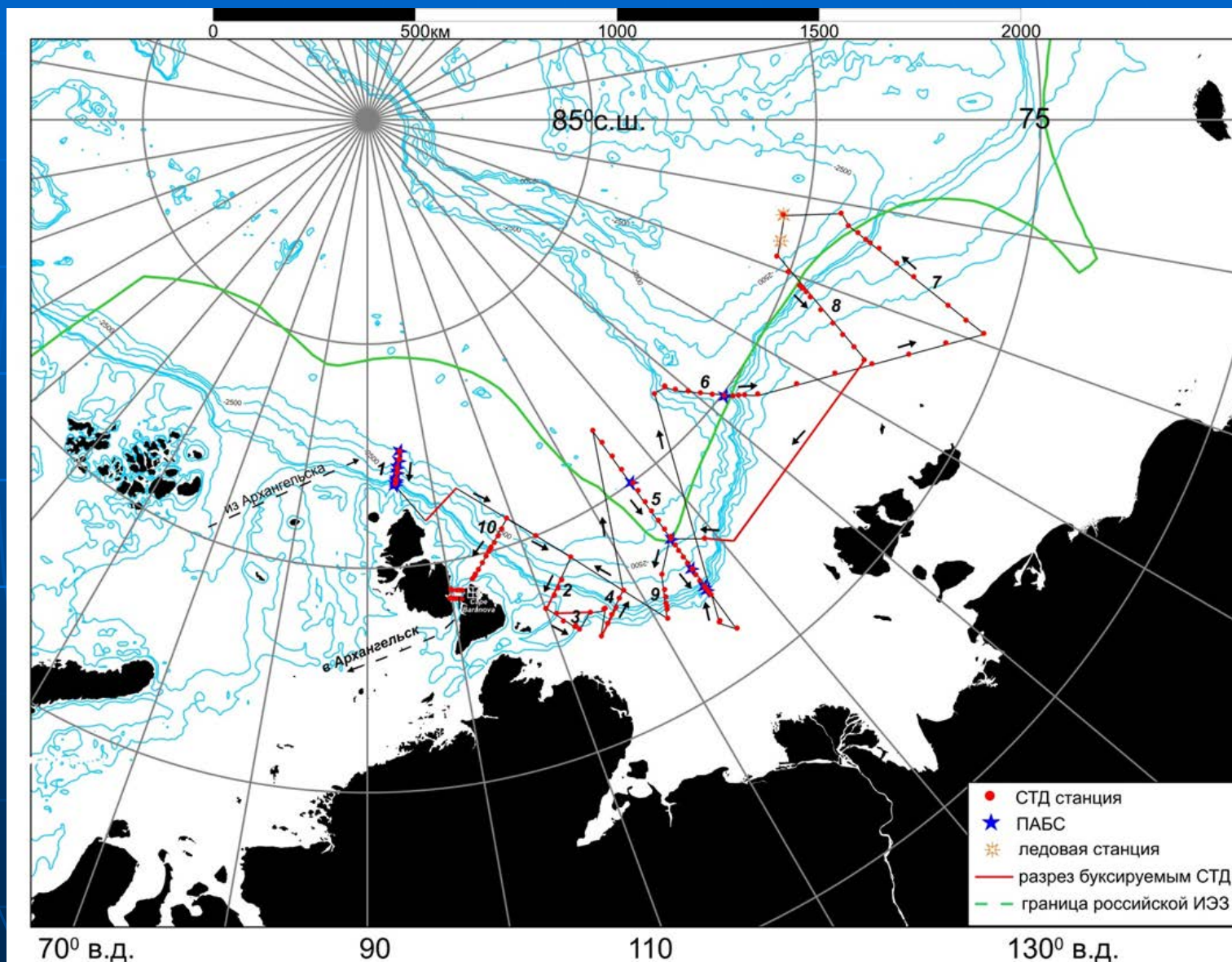


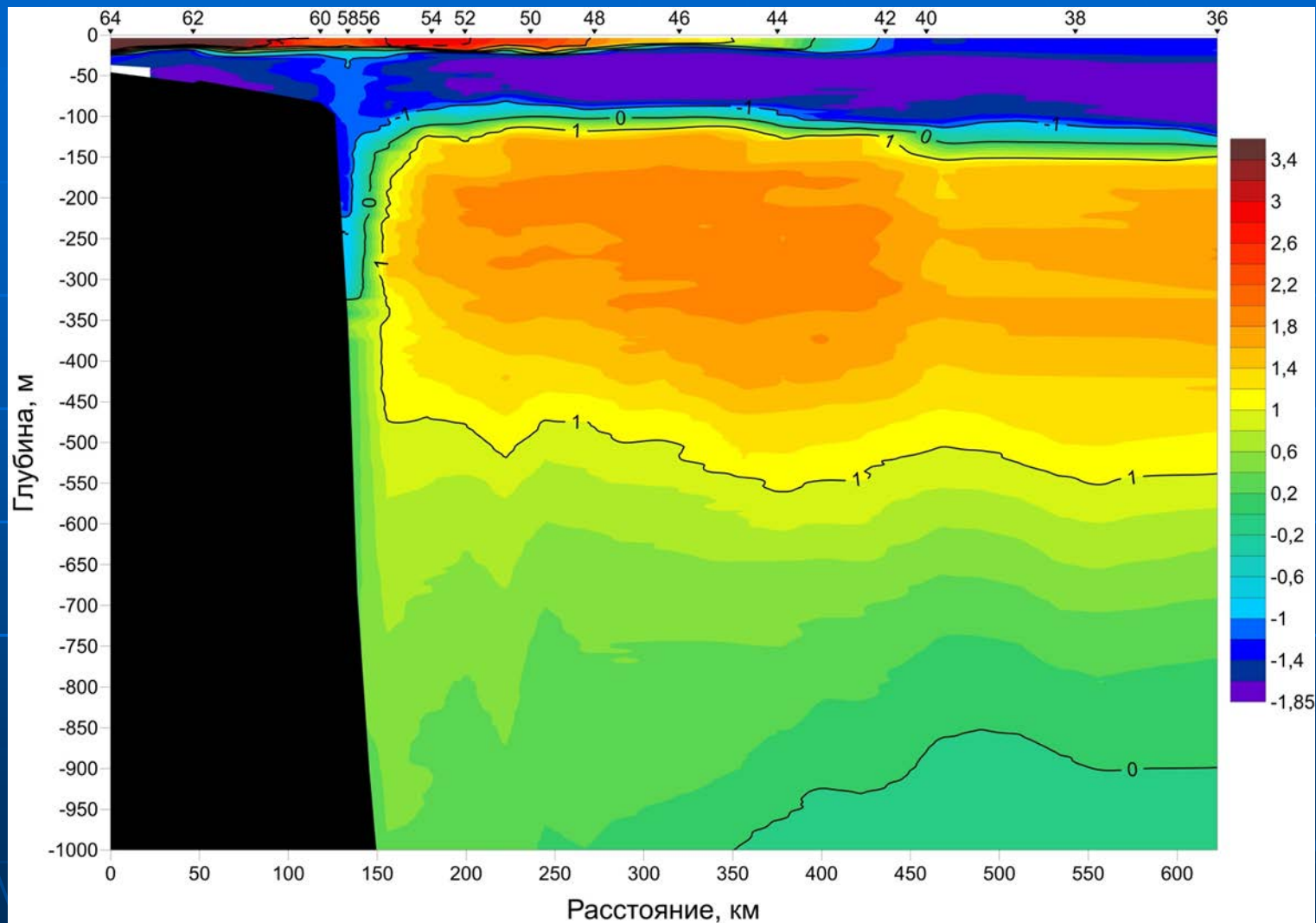
Some Suggestions

- Data from SHEBA and “North Pole” Russian drifting research stations are important for model experiments as a part of the YOPP Preparation Phase, for MOSAiC and future “North Pole” drifting scientific research stations planning.
- An international program of atmospheric observations, executed by Roshydromet (Russia), NOAA (USA) and FMI (Finland) at the Tiksi Hydro-meteorological observatory and possible extended programs at “Ice Base Cape Baranov” in concert with Polar Observatories at Summit, Ny-Ålesund, Eureka, Alert and Barrow (www.iasoa.org) offer YOPP a comprehensive data set on the polar atmospheric and underlying surface in a “picket fence” configuration surrounding the Arctic Ocean.
- The existing network of polar stations and resulting surface and upper air meteorological observations will be essential for YOPP experimental design. Additional financial and instrument support is very important for relevant data quality and value. (For example 4 radiosoundings per day vs the usual 1–2 at Russian polar stations). Additional soundings require additional personnel and sondes.
- Must consider the state of permafrost, fast ice, glaciers, hydrological studies (important for flooding), and atmospheric chemistry in the framework of YOPP.
- Important to develop standard protocols and data formats of data similar to the procedures followed by previous WMO global experiments (For example: GARP Global Experiment)

Recent AARI books printed by “Springer” publishing









THE 1st PHASE

leader: AARI

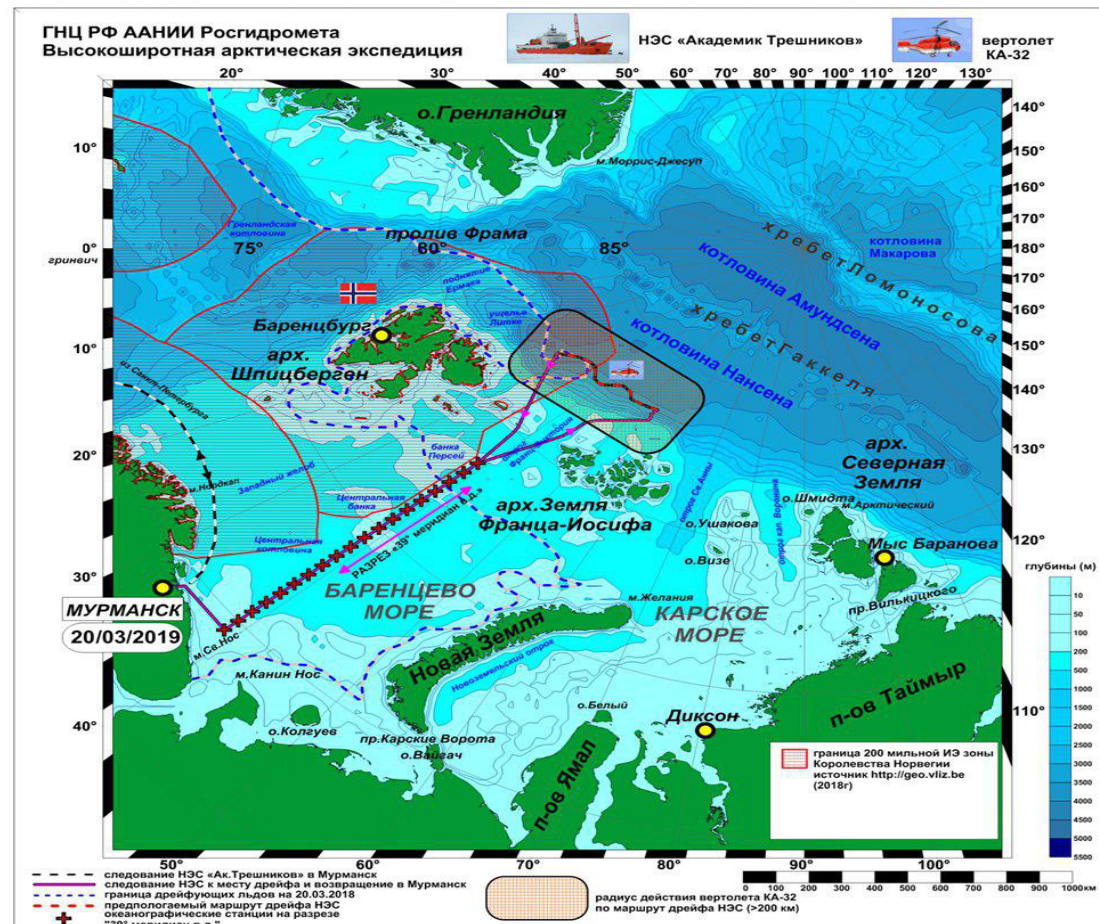
Start: March 20, 2019

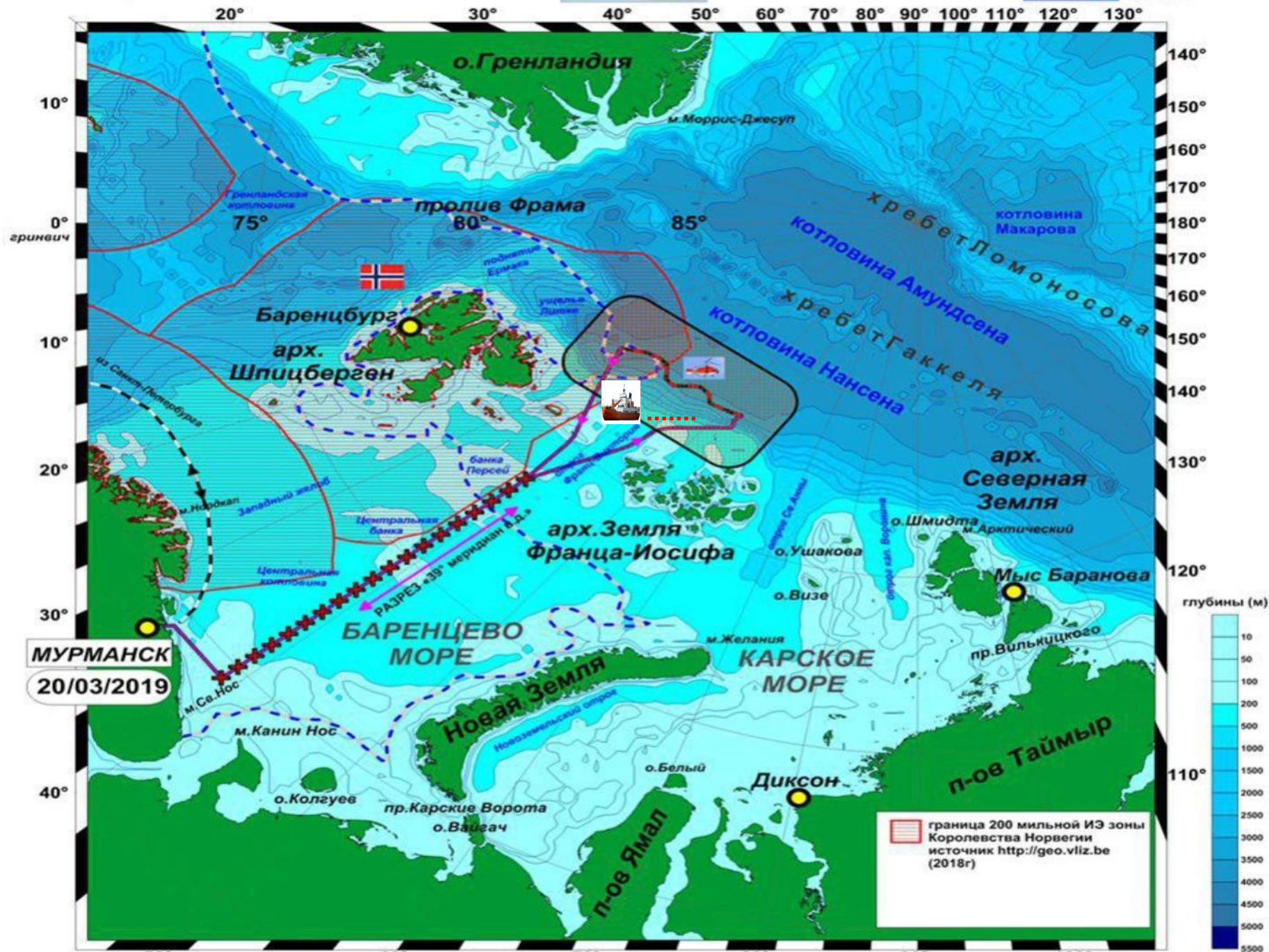
Duration: 70 days

Scientists: 52



- The Seasonal Drifting Research Station «North Pole - 2019» is organized on the basis of research vessel «Akademik Tryoshnikov»
- The vessel has been entered into the drifting ice north of the Franz Josef Land and has started its drift.
- The Research camp on ice was established



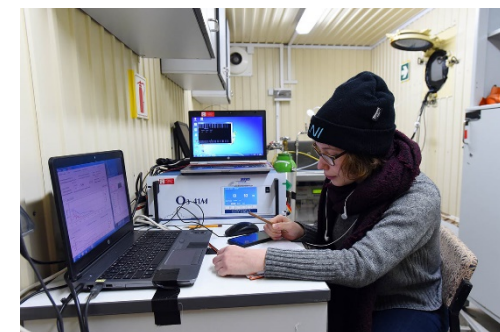
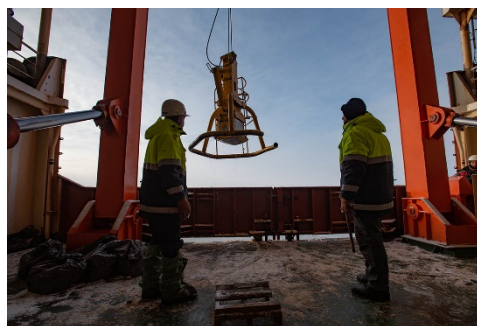


--- следование НЭС «Ак.Трешников» в Мурманск
 --- следование НЭС к месту дрейфа и возвращение в Мурманск

граница 200 мильной ИЭ зоны
 Королевства Норвегии
 источник <http://geo.vliz.be>
 (2018r)

SEASONAL DRIFTING RESEARCH STATION - 2019

Oceanography
Meteorology
Aerology
Ecological Monitoring
Hydro Biology
Geophysics
Geology





Location of Research facilities on Spitsbergen





Russian research activities on Spitsbergen archipelago

are aimed on studies and monitoring of processes and state of Environment in the area of archipelago. 10 institutes from: Russian Academy of Sciences (RAS), Russian Federal Service for Hydrometeorology and Monitoring of Environment (Roshydromet) and Ministry of Natural Resources and Environment (MNR) are carry out research and monitoring of natural processes and state of environment on Spitsbergen. These Institutes are the following:

- **RAS (Moscow):** Institute of Archeology -**IA**, Institute of Geography -**IG**, Seismological Survey –**SS**,
- **RAS (Murmansk), Cola Region Science Center** : Polar Geophysical Institute - **PGI**,
- Marine Biological Institute -**MMBI**, Polar Alpine Botanical Garden -**PABSI**
- **Roshydromet:** Arctic and Antarctic Research Institute -**AARI** (Saint-Petersburg),
- North-West Branch of “Typhoon” Research Centre - **NWT** (Saint-Petersburg),
- “Barentsburg” Environment Monitoring Observatory – **BO** (Murmansk)
- **MNR:** Polar Marine Geological Research Expedition -**PMGRE** (Saint-Petersburg).

Research activities of mentioned above institutes are funded on long-term basis by Ministry of Economy in accordance with decisions of Governmental Interagency Commission on Spitsbergen presence.

Institutes studies are distributed by disciplines as follows:

Geophysics (Upper Atmosphere Physics) – PGI, AARI, BO and SS

Glaciology – IG, AARI

Oceanography – AARI, BO and MMBI

Biology - MMBI, PABSI

Geology - PMGRE, MMBI

Monitoring of pollution – NWT, BO

Archeology, History – IA (field research)

Hydrometeorological research and monitoring – AARI, BO

Under the conditions when the work and research directions of the similar goals in Spitsbergen are carried out by several research institutions it is appropriate and natural to unite the efforts of these organizations within the **Russian Science Center at Spitsbergen**(RSCS) with main aim to coordinate and unify infrastructure use on a voluntary basis and fit research programs of the Roshydromet, Russian Academy of Sciences and Ministry of Natural Resources and Environment.

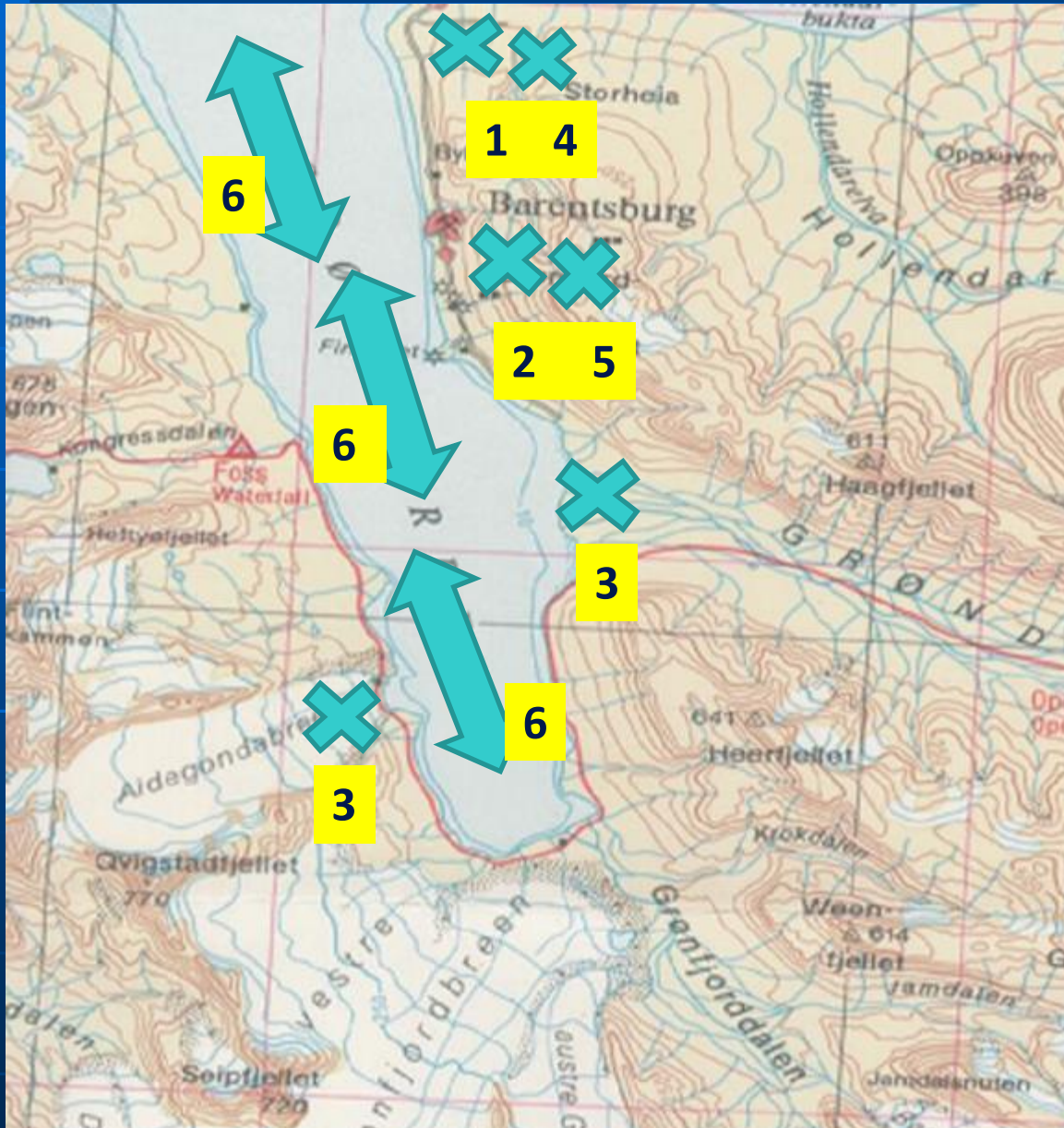
RCN/SSF Strategic Grant

Nummer	Prosjekttittel	Institusjon
246744	Integration of the New Lab Facility for Chemical Analyses in Barentsburg into International Cooperation in the Arctic	NILU – AARI/”Taiphun”
246725	Multi-Instrument Studies of High Latitude Atmospheric Turbulence and Wave Processes	UNIS - Schmidt Institute
246749	A renewed tectonostratigraphic framework of the Southwestern Basement Province of Svalbard	NPI- PMGRE
246726	BRANTA-DULCIS: The effect of nutrient input from migrating birds on the succession of freshwater communities of different ages in Svalbard	NINA – Moscow SU/RAS
246738	Workshop on Norwegian and Russian monitoring and process studies of Svalbard coastal sea ice and snow physics	NPI – AARI/SPb SU
246752	Pollutants and carbonate system parameters in polar environment media: snow-ice-seawater-sediments-coastal discharges	NIVA – Shirshov IO RAS/State OI
246757	Monitoring of arctic infrastructure (MonArc)	SINTEF
BYGGFORSK AVD	TRONDHEIM – “Arcticugol”/ Moscow SU	
246728	Mapping bryophytes on Svalbard as the basis for monitoring and conservation	NTNU – Cola PALBG
246719	NORUSVA: Norwegian - Russian collaboration in Svalbard on freshwater ecology research - strengthening and planning workshop	NINA – RA National Park/Moscow SU
246747	Isfjorden Marine Observatory Svalbard	UNIS – Moscow SU

Infrastructure of Russian Science Center at Spitsbergen



Barentsburg Science Center observation sites location



1. Meteorology

2. Ecology

3. Glaciohydrology

4. Upper atmosphere
and ionosphere

5. Sattelite receiving
station

6. Oceanography

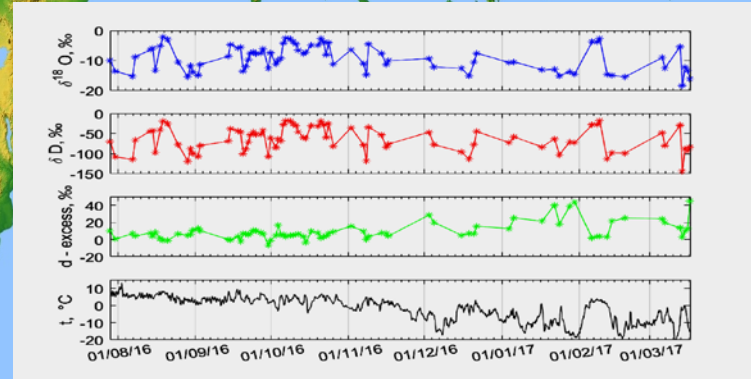
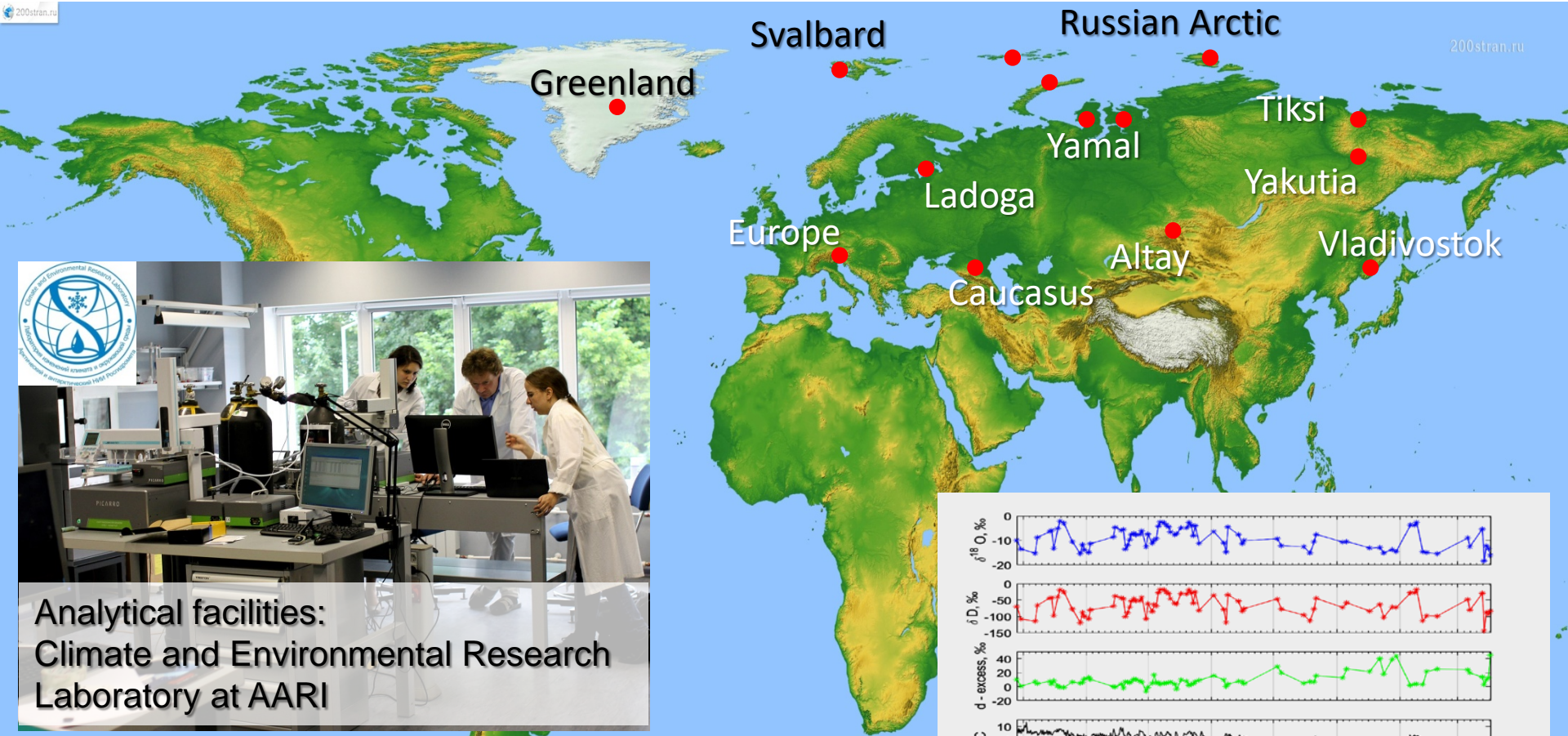
International projects

Russian research community is not a part SIOS for some reason, nevertheless its members are participating in number international projects on Archipelago:

- Integration of the new lab facility for chemical analysis in Barentsburg into international cooperation in the Arctic, BareLab (AARI, RPA “Typhoon”, NILU, NMBU, UNIS) – successfully finished
- Quantifying rapid climate change in the Arctic QUARCCS: regional feedbacks and large-scale impacts (AWI, IFA, AARI) – the field stage finished
- Permafrost thermal state in Svalbard - PermaSval (UNIS, AARI, NMI, IG PAS) – experience exchange including permafrost drilling procedure
- Strengthening cooperation on air pollution research in Svalbard (UiT, UNIS, AARI, AWI, U Perugia, U Valladolid) – field stage finished
- Ny-Ålesund Atmosphere Flagship Program: Further development and strengthening of the collaboration (NPI, NILU, AWI, COPRI, AARI)
- Influence of coastal permafrost thawing on biogeochemistry and pollutants of the sea water (NIVA, UNIS, RPA “Typhoon”, SOI) – lab stage running
- Isfjorden Marin Observatory Svalbard (UNIS, MMBI)
- Arctic Space Training ASTRA (PGI, Institute of Physics of the Earth RAS, Space Research Institute RAS, UNIS, UiT, UiO, Higher School of Economics) – summer school organized
- Mapping bryophytes on Svalbard as the basis for monitoring and conservation BRYOMAP (NTNU, PABGI)

Stable water isotope studies in polar regions

200stran.ru

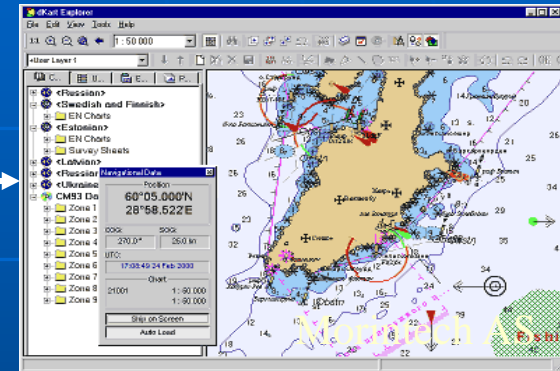


Example: Isotope content of precipitation in 2016-2017 in Barentsburg (Svalbard)

Stable water isotopes monitoring required for the study of the air masses provenance, meteorological conditions at the evaporation site, atmospheric circulation calculations, and paleoclimate studies. The data are used for the meteorological, hydrological, oceanological models.

200stran.ru

Ice Navigation Support





4. Regional Research: Estimation of impact on Arctic Environment.

(Yamal-Nenets autonomous region)

Scientific programs: oceanography, hydrology, hydrochemistry, hydrobiology, limnology, geomorphology and paleogeography, geophysics, biology, botany, microbiology, study of permafrost and soils

Scientific staff: 40 – 60 members of expedition

Scheme of expeditionary operations in 2012



Scheme of expeditionary operations in 2013



5. Education and Professional development



**Norwegian-Russian "Fram" Arctic
Climate Research Laboratory:**
www.fram.ru

**German-Russian Otto Schmidt
Laboratory for Polar and Marine
Research: www.otto.ru**



AARI's Education and Professional Development Division

Recognizing necessity to develop and support new generation of Polar researchers AARI have established new body: Education and Professional Development Division . According to nominations from institute science divisions staff and applications from Saint-Petersburg universities students there is selection procedure for one year AARI's stipend program.

Selected on competition level students are running research projects under divisions control.



AARI's Education and Professional Development Division



Focus on education

Arctic and Antarctic Research Institute



- Hosting the field and lab work of the **UNIS postgraduate course AT-324/824** “Techniques for the Detection of Organo-Chemical Pollutants in the Arctic Environment”, 18 students, 3 assistants, 1 lecturer prof. Einar Jensen, head teacher prof. Roland Kallenborn, April
- Collaboration with UNIS, NMBU, NILU, UiT



Plan: integrated course and academic student exchange program with MSU



Focus on education

- Field course in glaciology and permafrost for Moscow State University, 4 master students, 1 teacher, 1 assistant, August
- 1 bachelor, 5 master and 3 PhD students in research groups



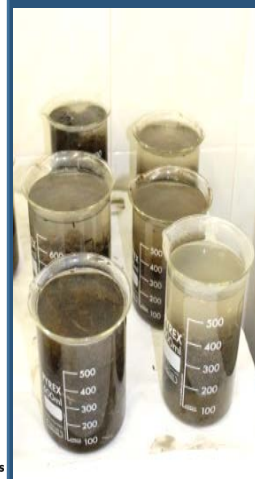
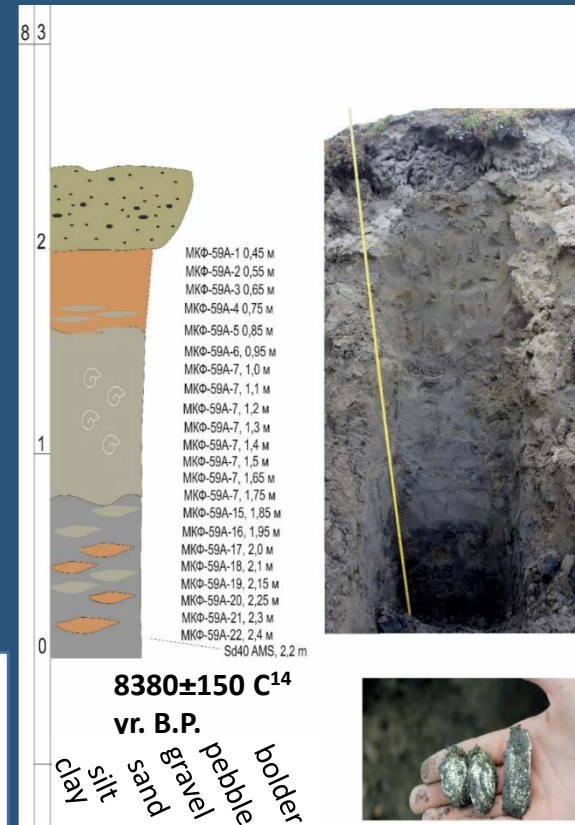
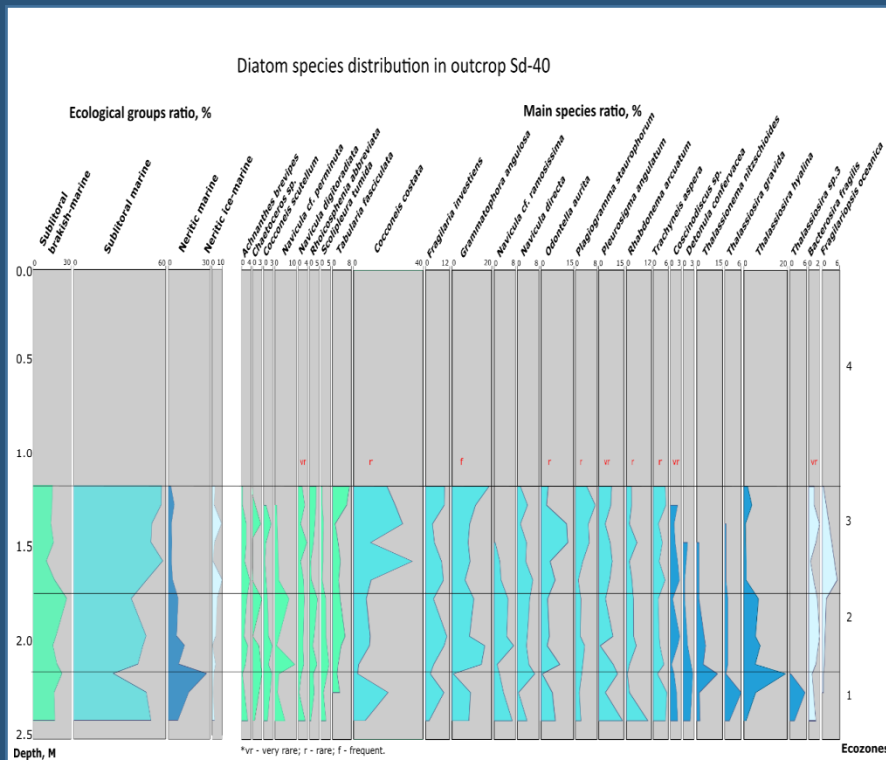
School children, Barentsburg Arctic Russian School – lecture in the lab



Analytical Lab: improving accessibility

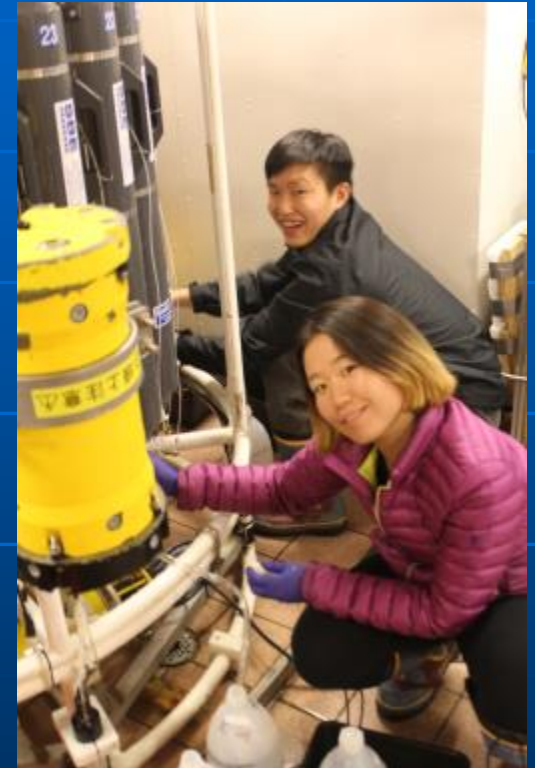
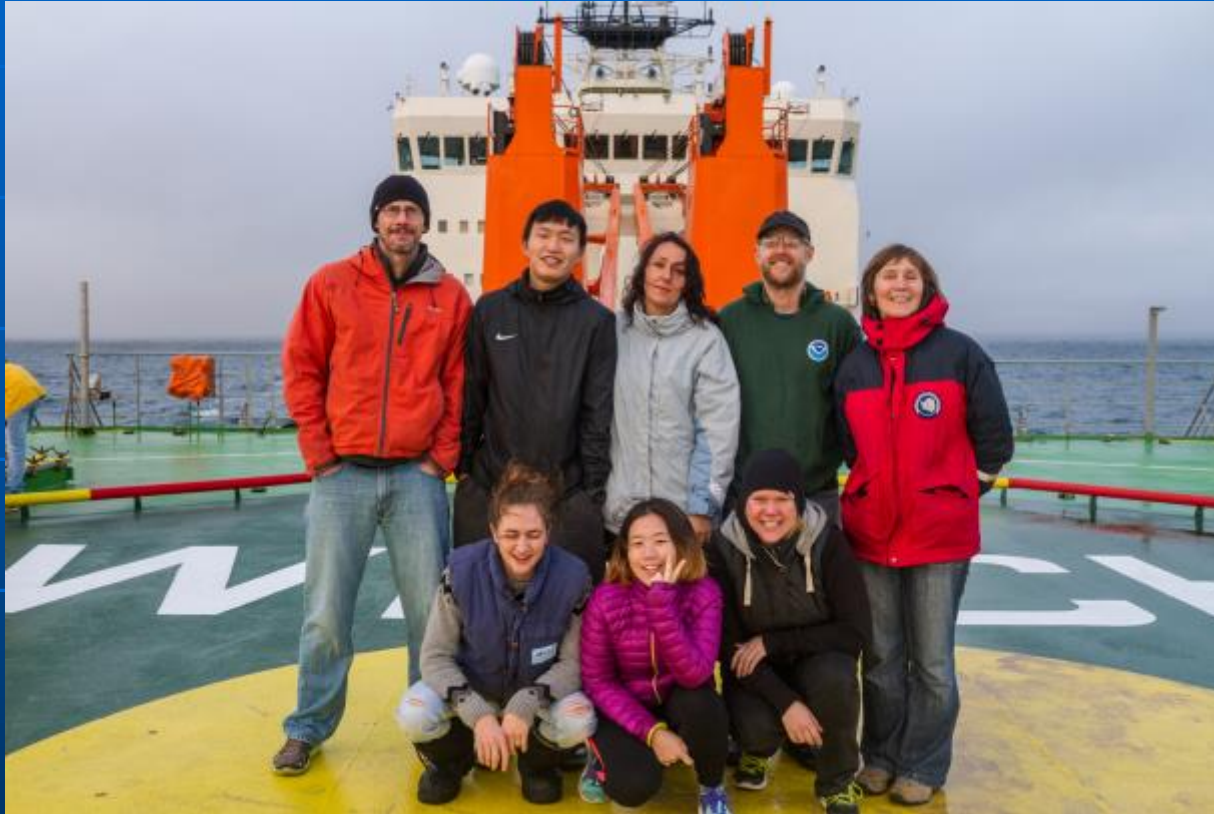
- Analytical support of seasonal research of Russian institutions
- Methods development for analysis of contaminants of emerging concern – platform for future cooperation in environmental chemistry
- Analysis of metals accumulation in marine organisms in cooperation with MMBI
- Lab room and logistics for UNIS PhD student
- Lab and teaching facilities for UNIS students and teachers
- Lab room and equipment for Shanghai Jiao Tong University researchers in hydrochemistry 3.07-04.08
- Intercalibration of trace gases analyzers with UiT team
- Sample analysis for persistent organic pollutants for Akvaplan-niva







Hydrochemistry team of “Nabos 2015” marine expedition on board rv “Akademik Treshnikov”, August-September 2018



Awlap/Nabos 2018 international research team



International research team of NABOS 2006 expedition

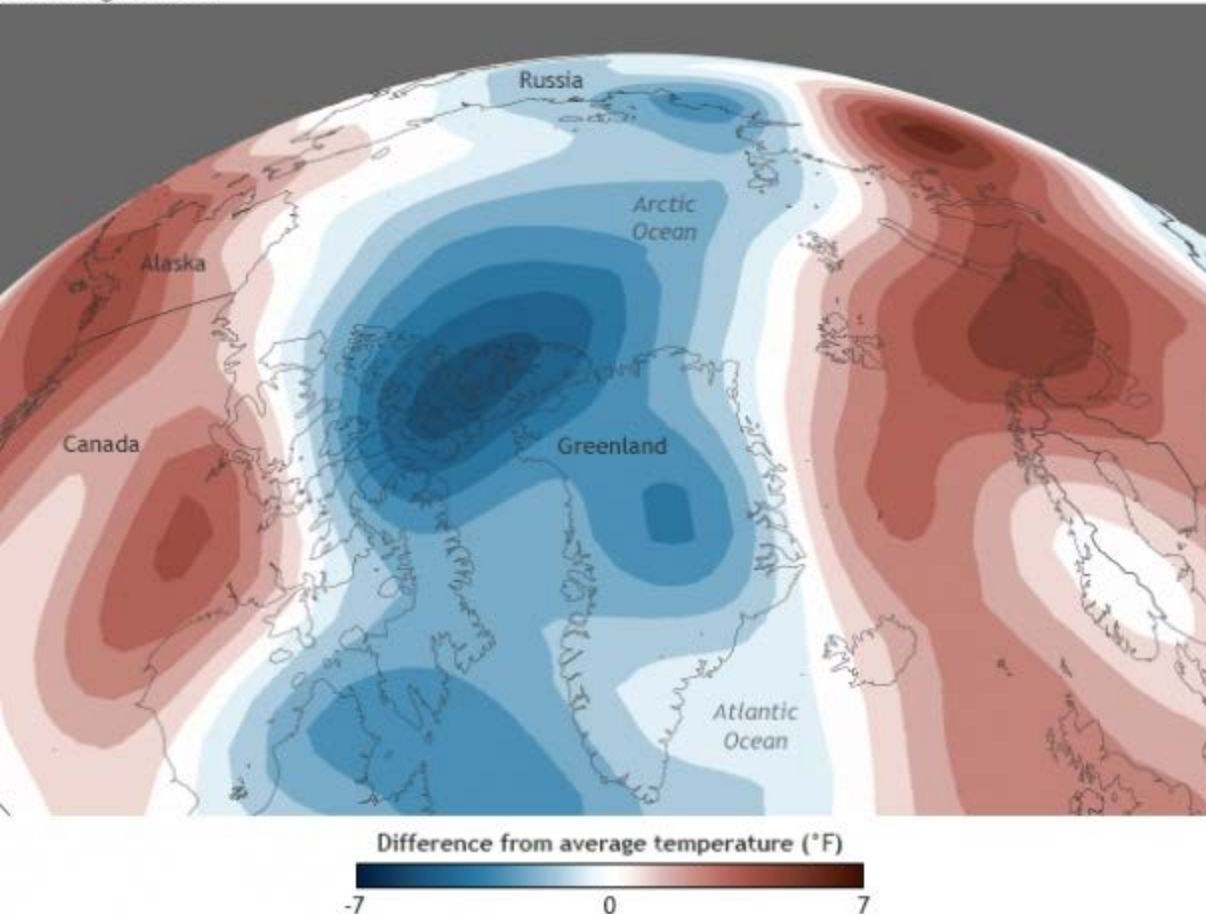


Arctic Report Card as a tool for SSF community integration!!!

Long-term warming and environmental change trends persist in the Arctic in 2013

NOAA's annual [Arctic Report Card](#), introduced in 2006 by the NOAA Climate Program Office, found that cooler temperatures in the summer of 2013 across the central Arctic Ocean, Greenland and northern Canada moderated the record sea ice loss and extensive melting that the surface of the Greenland ice sheet experienced last year. Yet there continued to be regional extremes, including record low May snow cover in Eurasia and record high summer temperatures in Alaska. The NOAA Climate.gov team produced [visual highlights](#) for the report.

June-August 2013



Temperature anomalies for June-August 2013 compared to the **2007-2012 average**.

Many areas of the Arctic got a reprieve from The record warm of the past 6 summers.

Map by NOAA Climate.gov, based on NCEP Reanalysis data from NOAA's Earth System Research Laboratory

[Download here](#) / [Full gallery](#) (Credit:NOAA)

Air Temperature

Clouds & Surface Radiation

Ozone

UV Radiation

Black Carbon

SEA ICE & OCEAN

Sea Ice

Ocean Temperature & Salinity

MARINE ECOSYSTEMS

Sea Ice Biota

Marine Fishes

Benthic Communities

TERRESTRIAL ECOSYSTEMS

Vegetation

Muskoxen

Caribou & Reindeer

TERRESTRIAL CRYOSPHERE

Snow

Glaciers & Ice Caps

Greenland Ice Sheet

Lake Ice

Permafrost

Министерство природных ресурсов и экологии РФ

Федеральная служба по гидрометеорологии
и мониторингу окружающей среды

Государственный научный центр РФ
Арктический и антарктический
научно-исследовательский институт

ОБЗОР

гидрометеорологических процессов
в Северном Ледовитом океане

2015

Санкт-Петербург
2016

МИНИСТЕРСТВО ПРИРОДНЫХ РЕСУРСОВ И ЭКОЛОГИИ РФ
ФЕДЕРАЛЬНАЯ СЛУЖБА ПО ГИДРОМЕТЕОРОЛОГИИ
И МОНИТОРИНГУ ОКРУЖАЮЩЕЙ СРЕДЫ



ГОСУДАРСТВЕННЫЙ НАУЧНЫЙ ЦЕНТР РФ
АРКТИЧЕСКИЙ
И АНТАРКТИЧЕСКИЙ
НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЙ
ИНСТИТУТ

ОБЗОР гидрометеорологических процессов в Северной полярной области

2016

★ Санкт-Петербург, 2017

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ФЕДЕРАЛЬНАЯ СЛУЖБА ПО ГИДРОМЕТЕОРОЛОГИИ
И МОНИТОРИНГУ ОКРУЖАЮЩЕЙ СРЕДЫ



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АРКТИЧЕСКИЙ
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Thank you for Attention !