
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 researsch 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**:

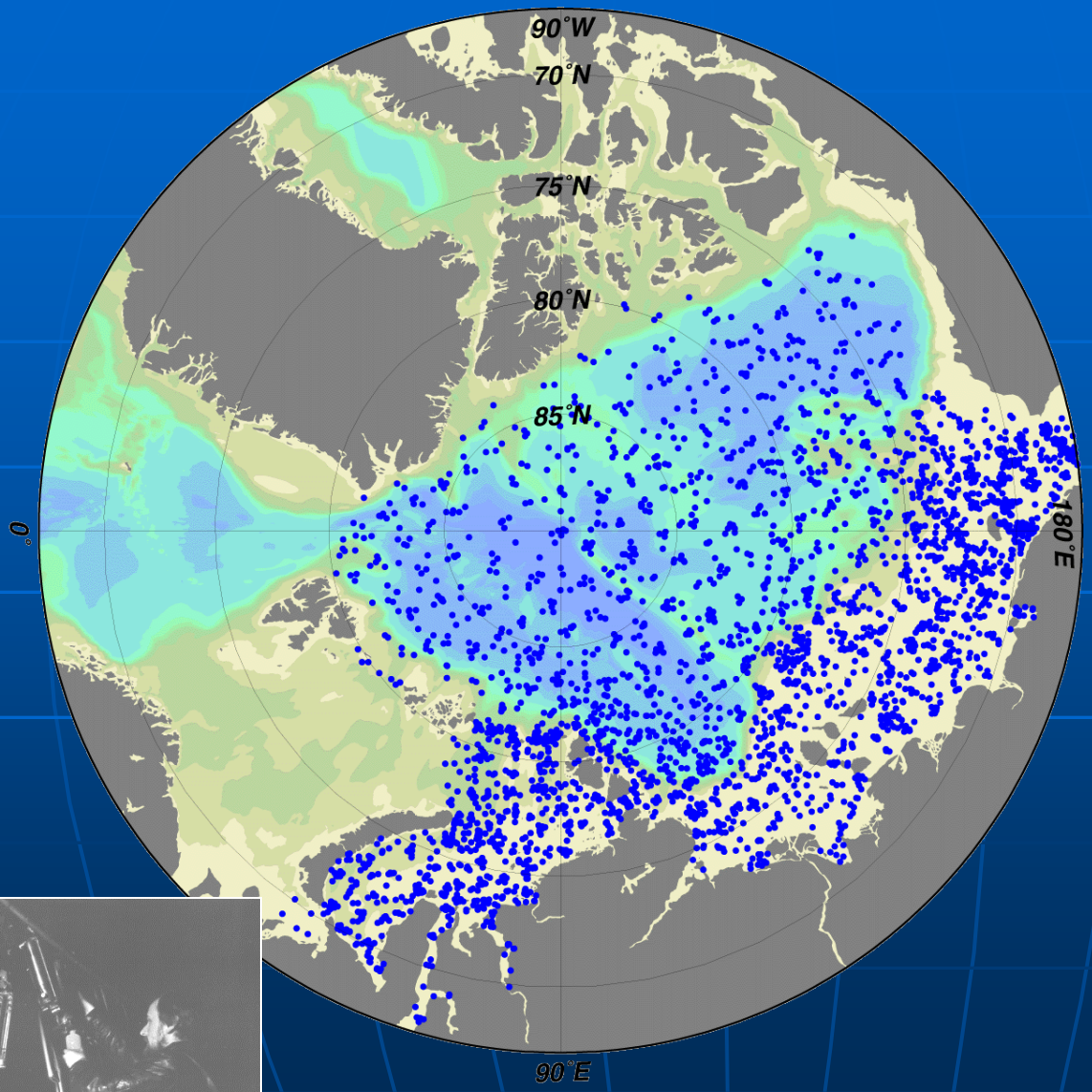
  Functioning bases:

  Mirniy, Vostok, Novolazarevskaya,
  Progress, Bellingshausen

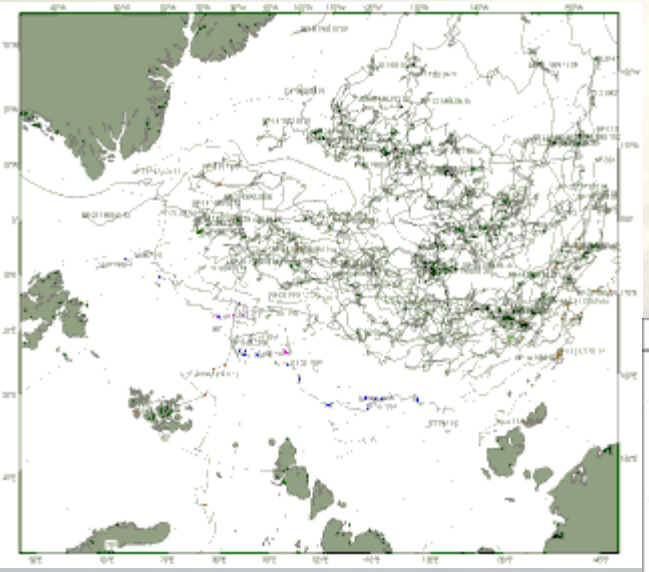
  Abandoned bases:

  Russkaya, Leningradskaya,
  Molodezhnaya

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

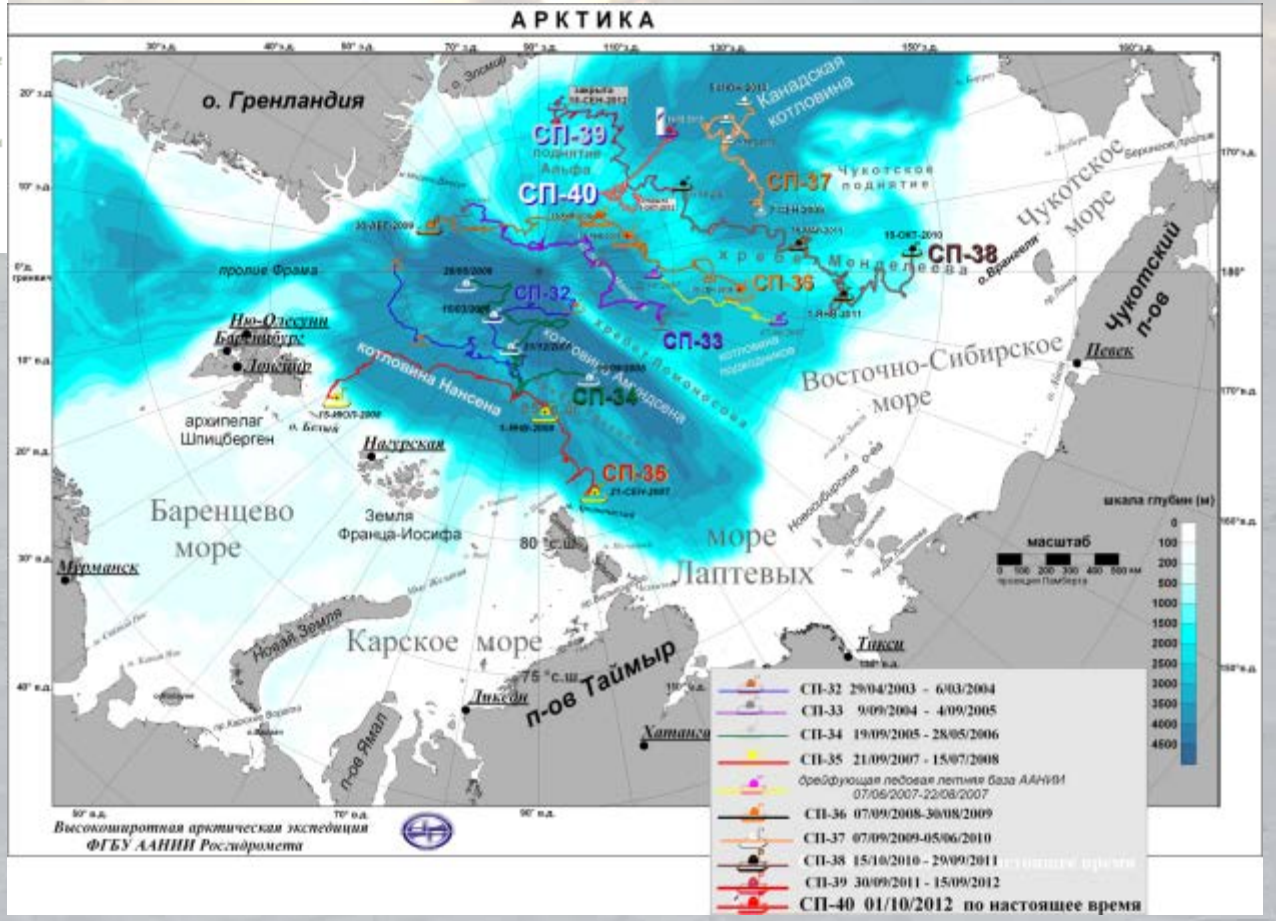


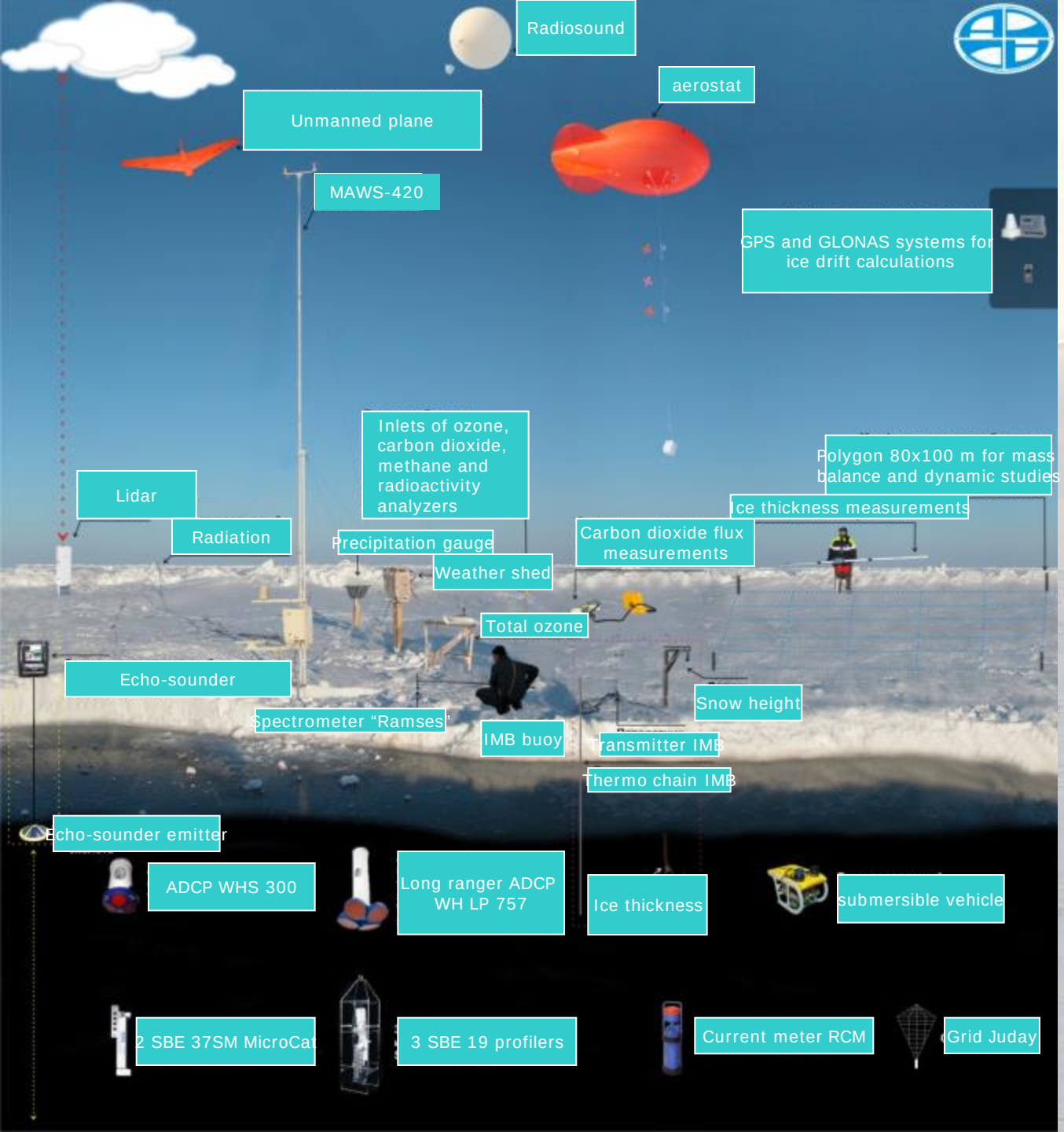
Russian drifting stations in XX and XXI centures



1952 - 1991

2003 - 2013





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

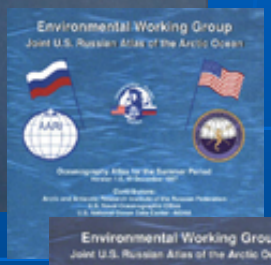
Self driving ice-strengthen research platform for Central Arctic Ocean Studies

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



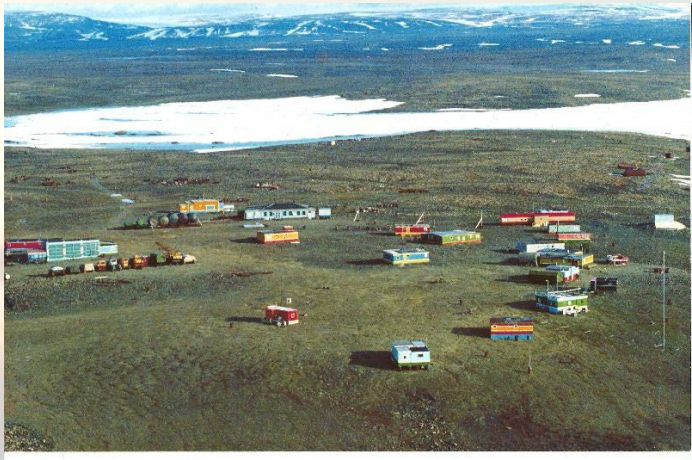
Joint US-Russia Arctic Ocean Atlas
1997 v1; 1999 v2

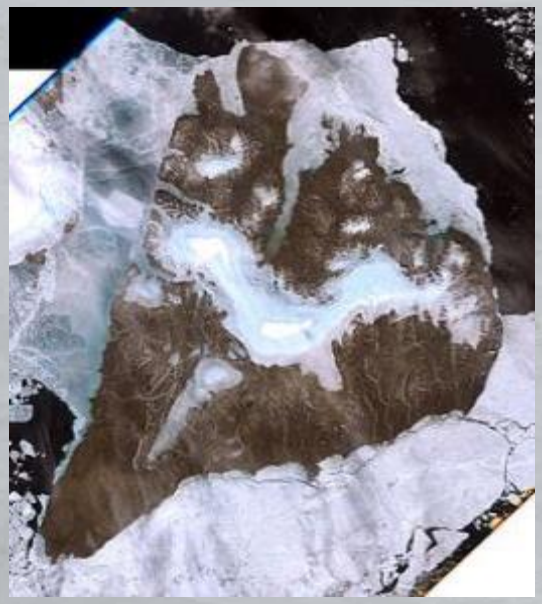
Joint AARI-IARC Arctic Ocean Hydrochemistry Atlas, 2001

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

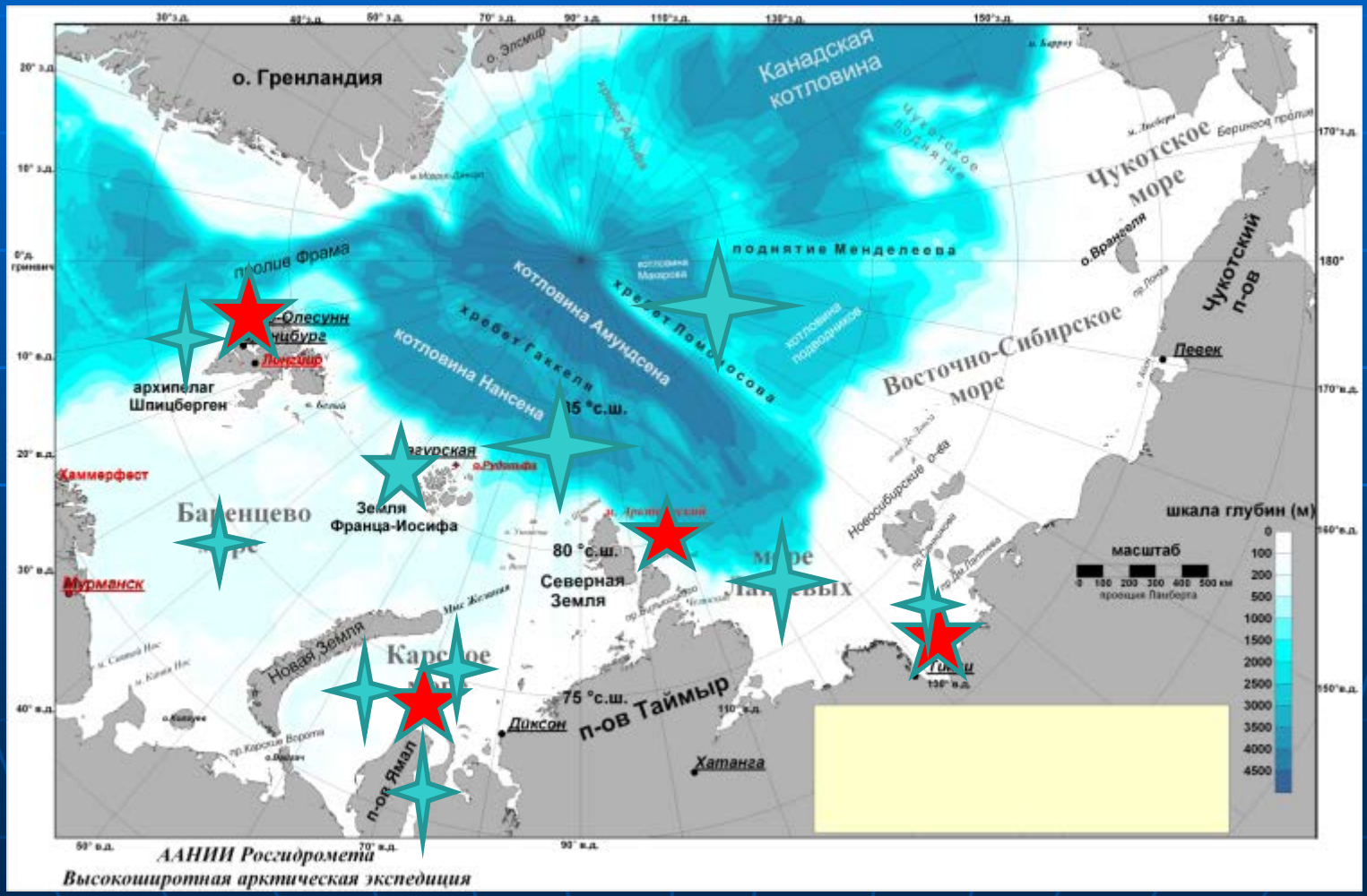
Main directions:

- 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

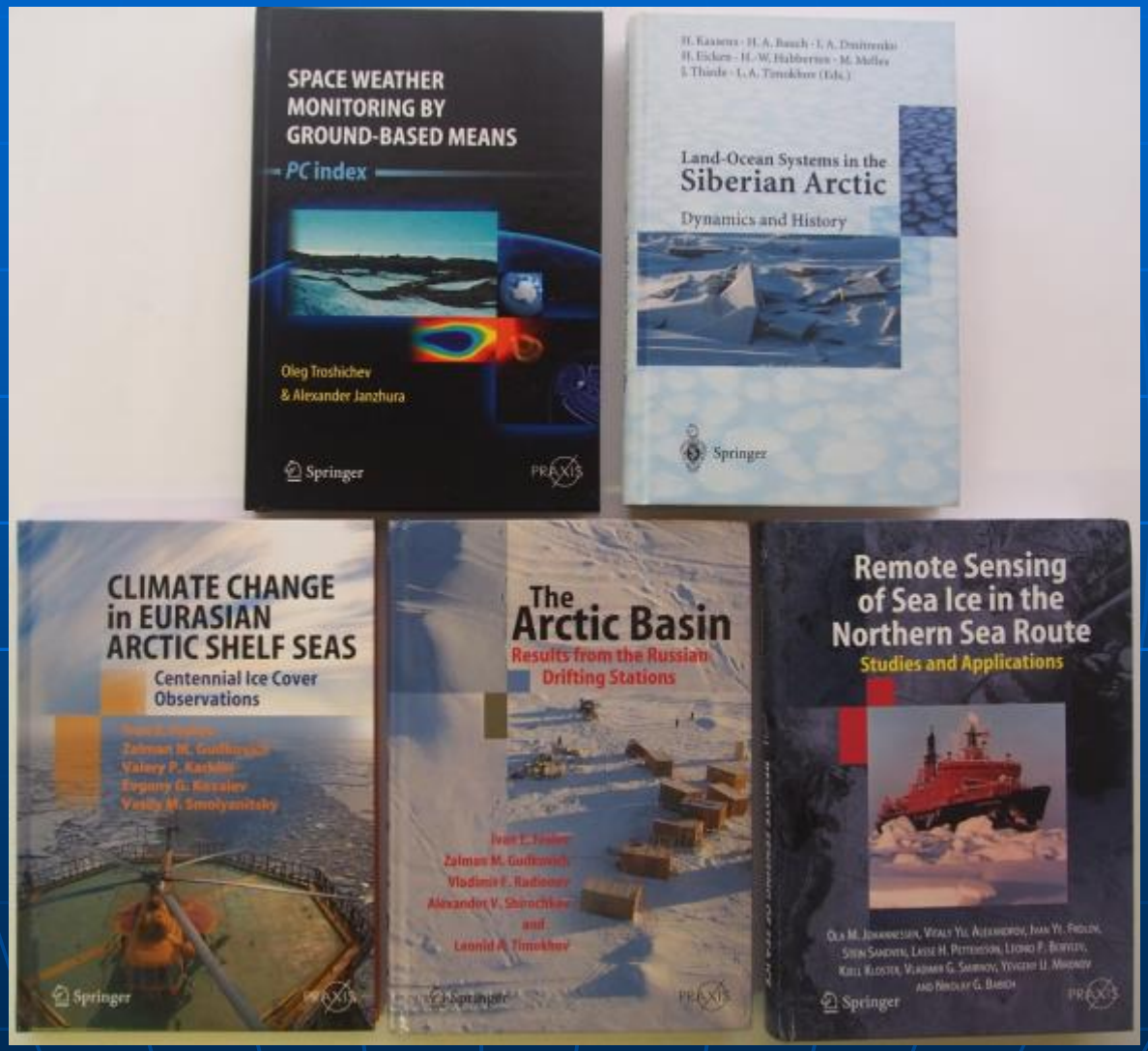




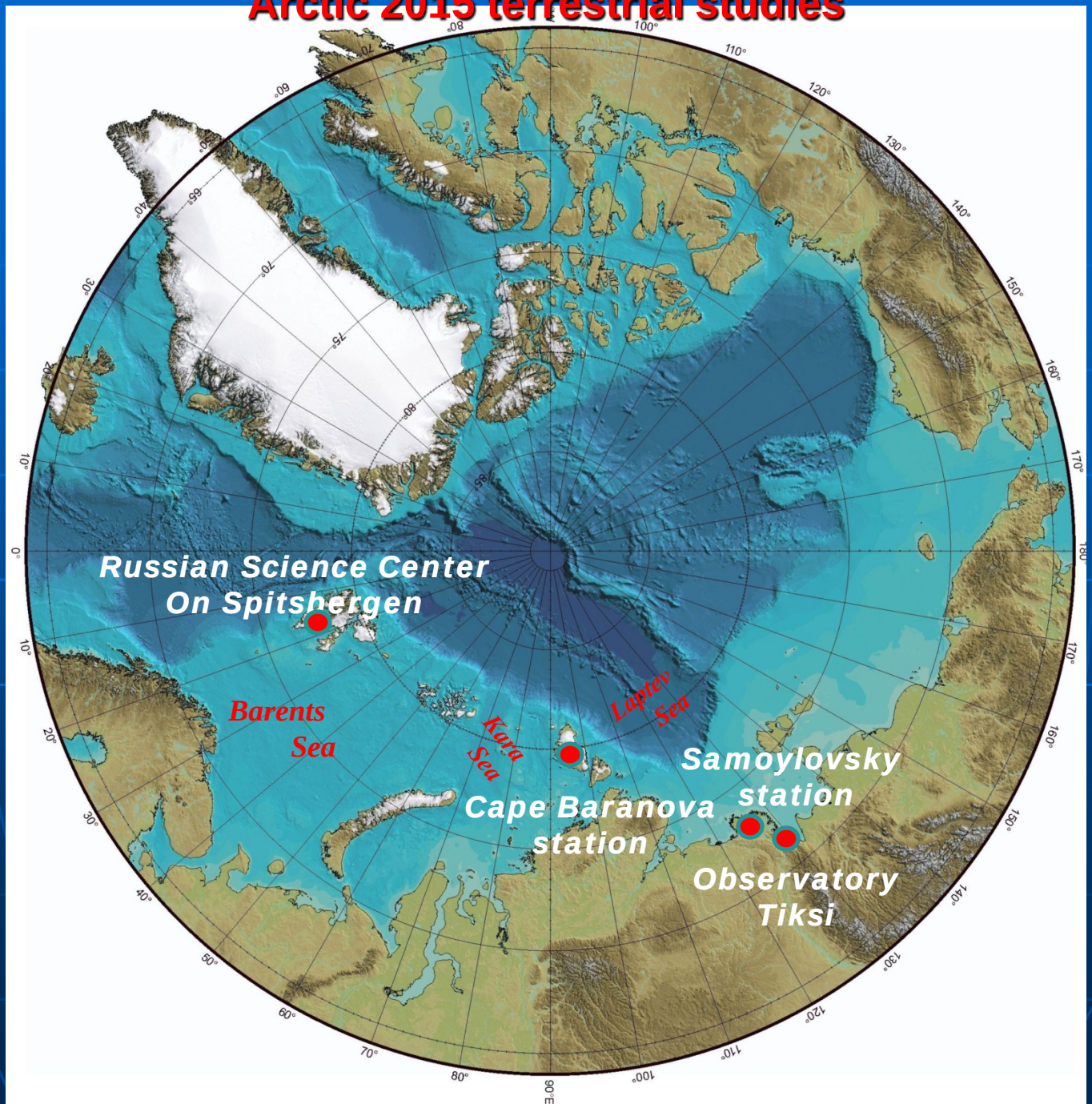
Nowadays main Russian marine and terrestrial research activities



Recent AARI books printed by “Springer” publishing



Arctic 2015 terrestrial studies



Laptev Sea System studies:

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

Research Station Samoylovsky Island

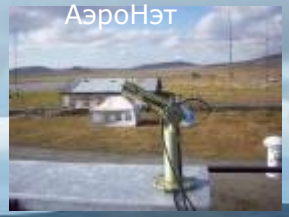
General plan

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 Базовой климатической сети

Исследования потока CO2 и свойств морского льда на припайном льду залива Сого

Главное здание ГМО Тикси

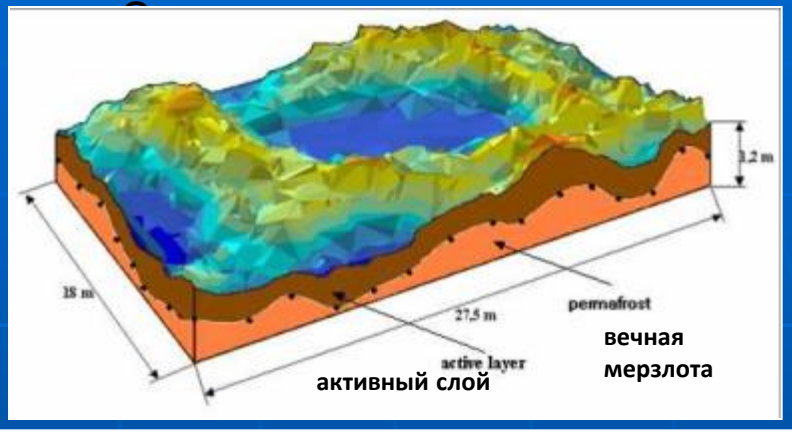
Измерения температурного режима почвы

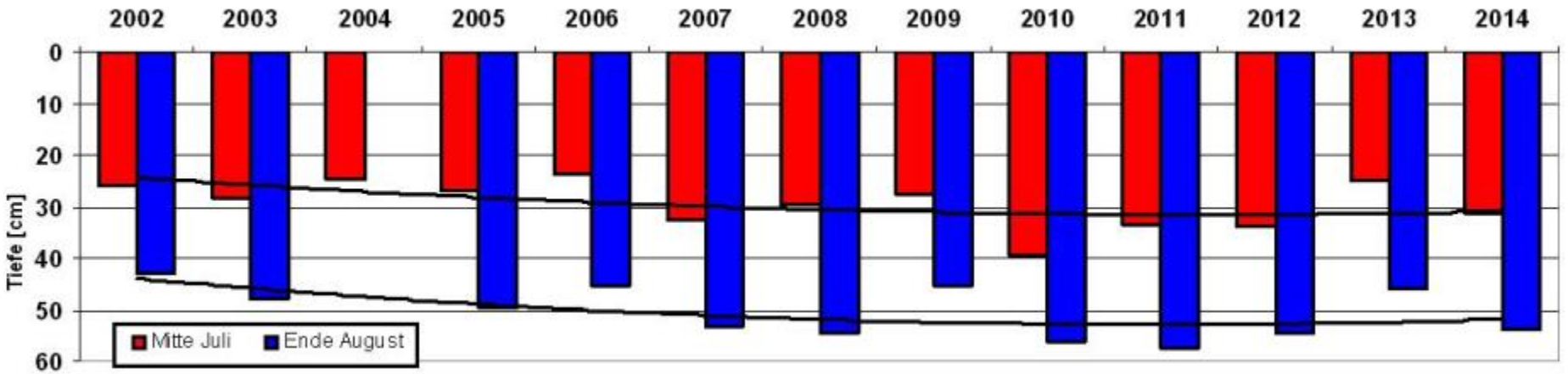
Мониторинг атмосферных загрязнений, аэрозоля и парниковых газов в Павильоне чистого воздуха

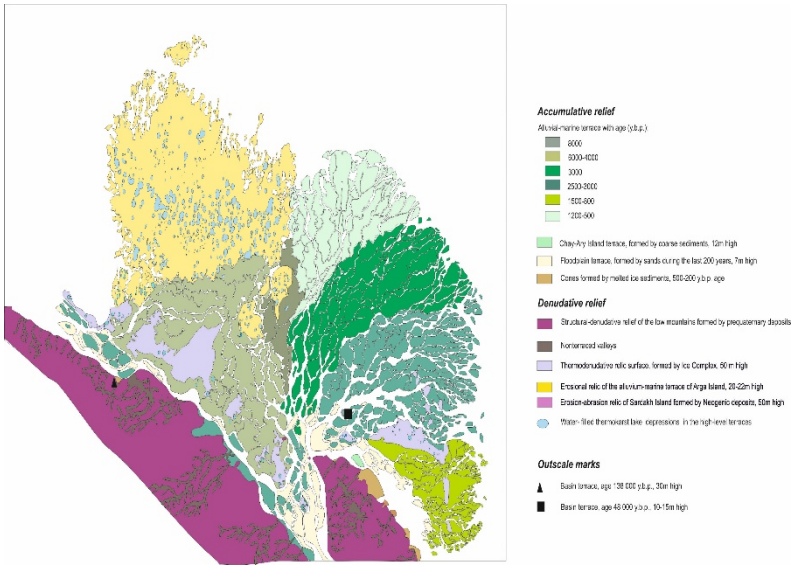
Микрометеорологические измерения в каменистой тундре

Двадцатиметровая башня для исследований турбулентности и потоков парниковых газов (CO_2 и CH_4).

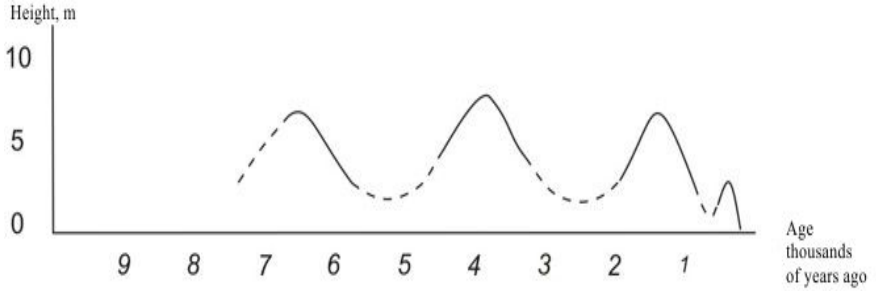
Permafrost active layer monitoring



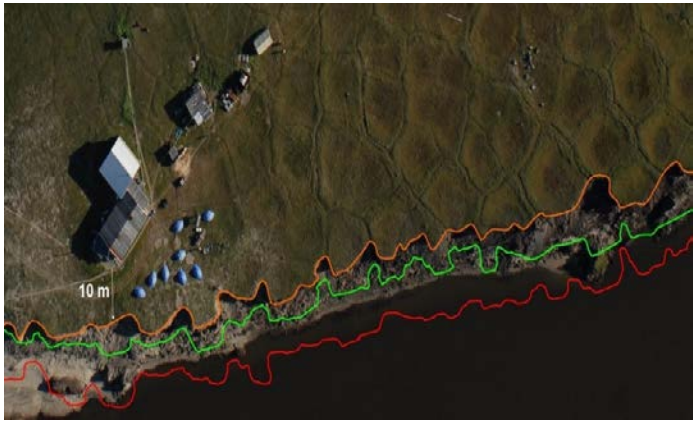




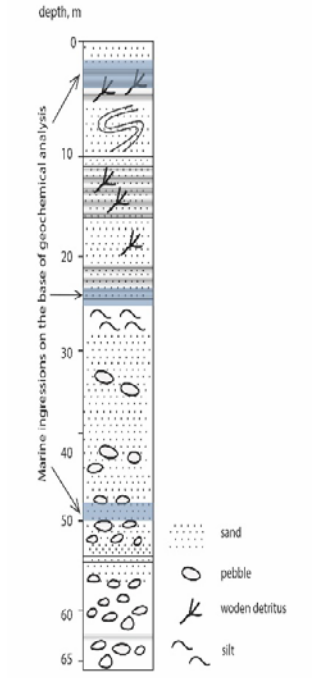
Геоморфологическая карта дельты р. Лены
[Bolshiyanov et.al, 2015]



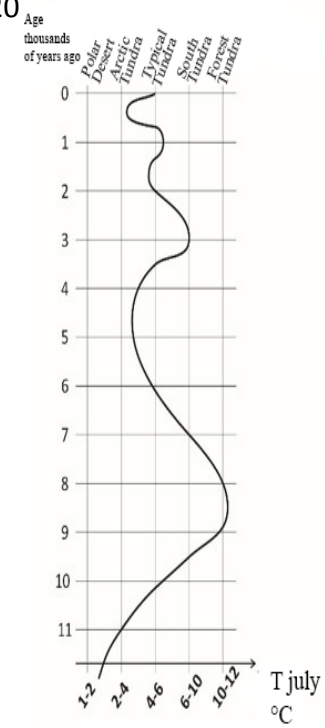
Реконструкция изменения положения уровня моря в голоцене [Bolshiyanov et.al, 2015]



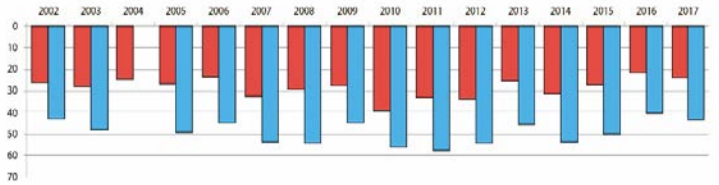
Эрозия, термоэрозия и термоабразия берегов. Положение береговой линии в 2003, 2007 и 2008 гг.



Изучение кернов при глубоком бурении в дельте Лены и регионе



Climate fluctuations in the Holocene



Геокриологический мониторинг деятельного слоя грунта в июле и сентябре

Ship Campaigns

Russian Drif
Stations

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)

Some Suggestions

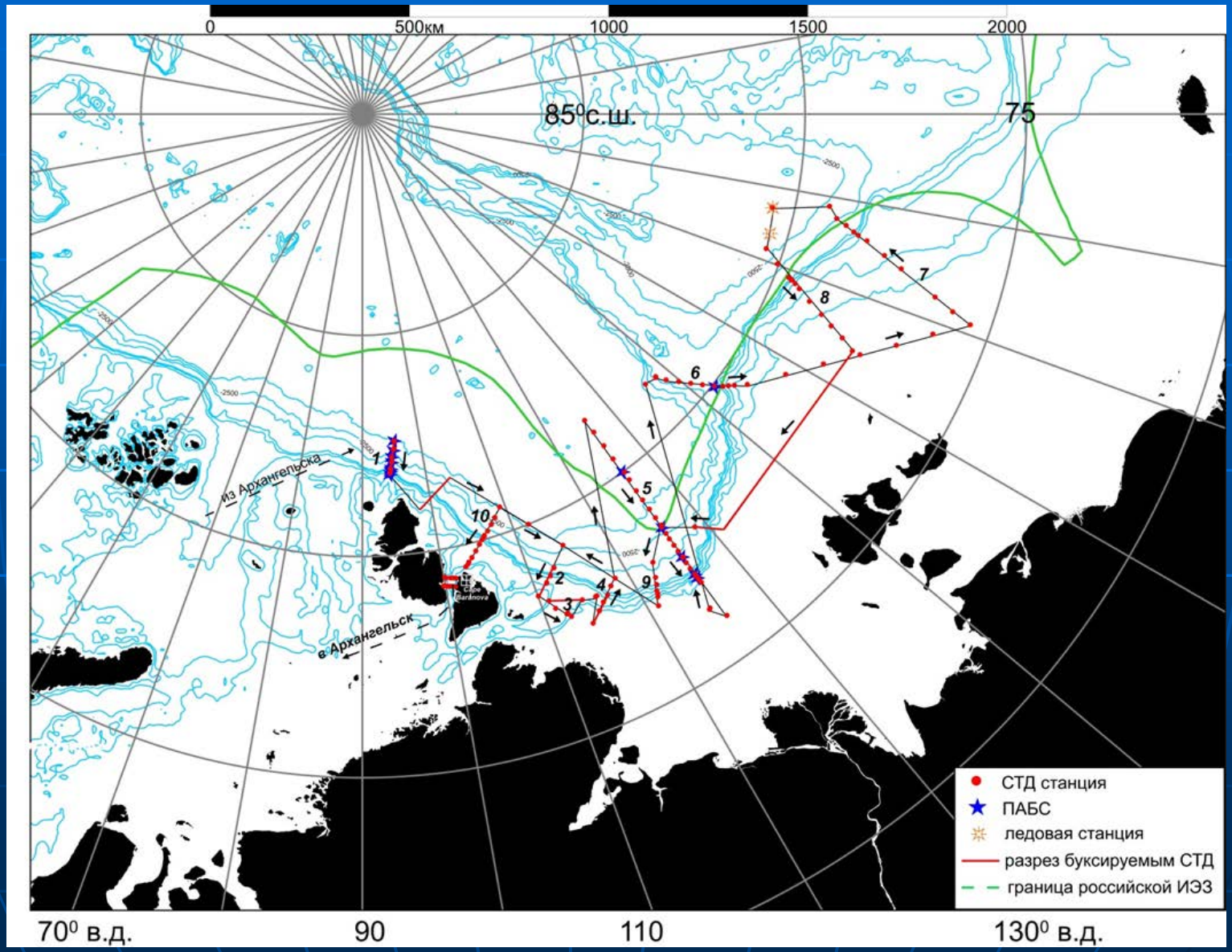
- Data from SHEBA and “North Pole” Russian drifting research stations are important for model experiments as a part of the YOPP Preparation Phase, for MOSAiC and future “North Pole” drifting scientific research stations planning.

- 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)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75
из Архангельска
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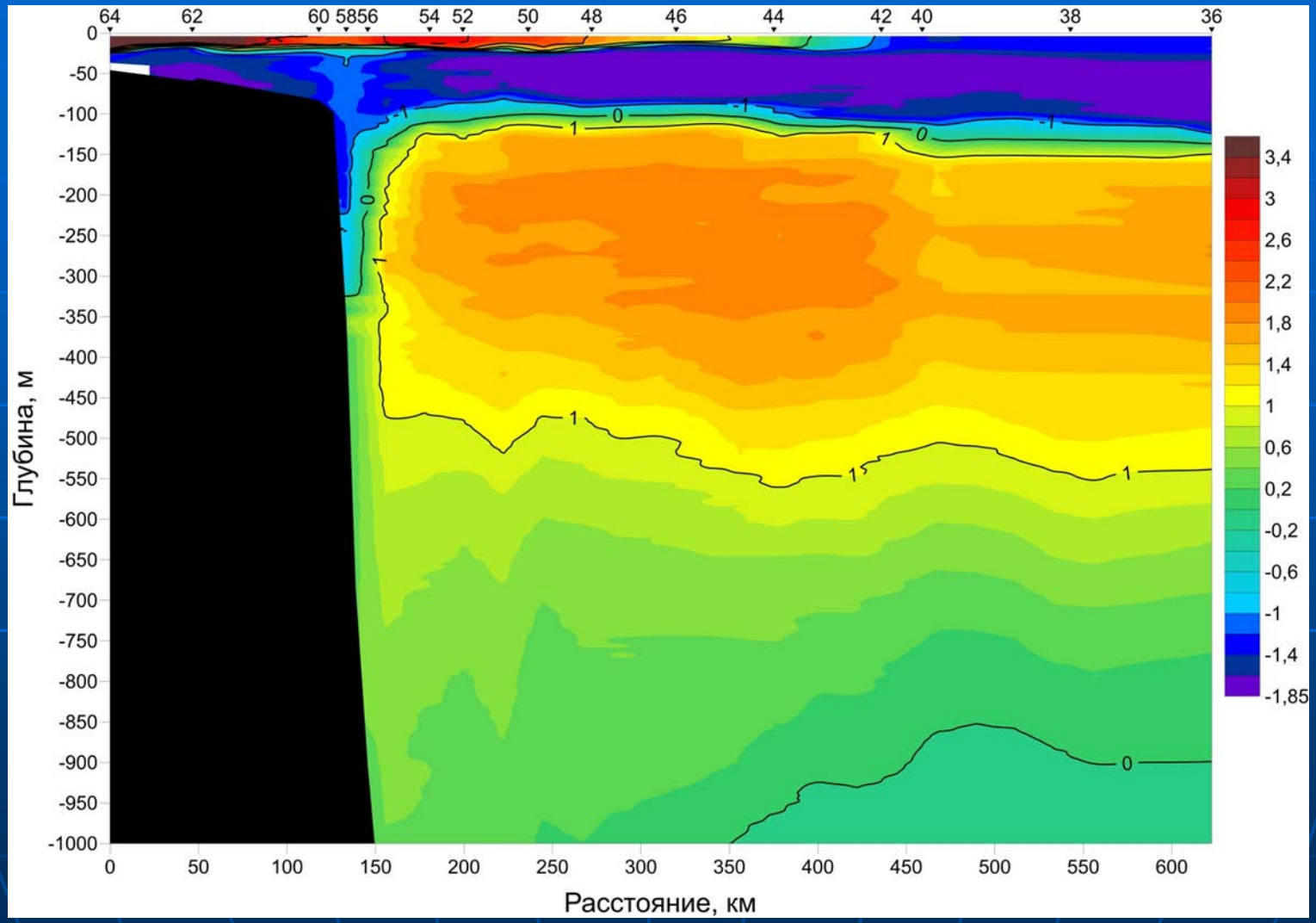
СТД станция
ПАБС
ледовая станция
разрез буксируемым СТД
граница российской ИЭЗ
70⁰ в.д.
90
110
130⁰ в.д.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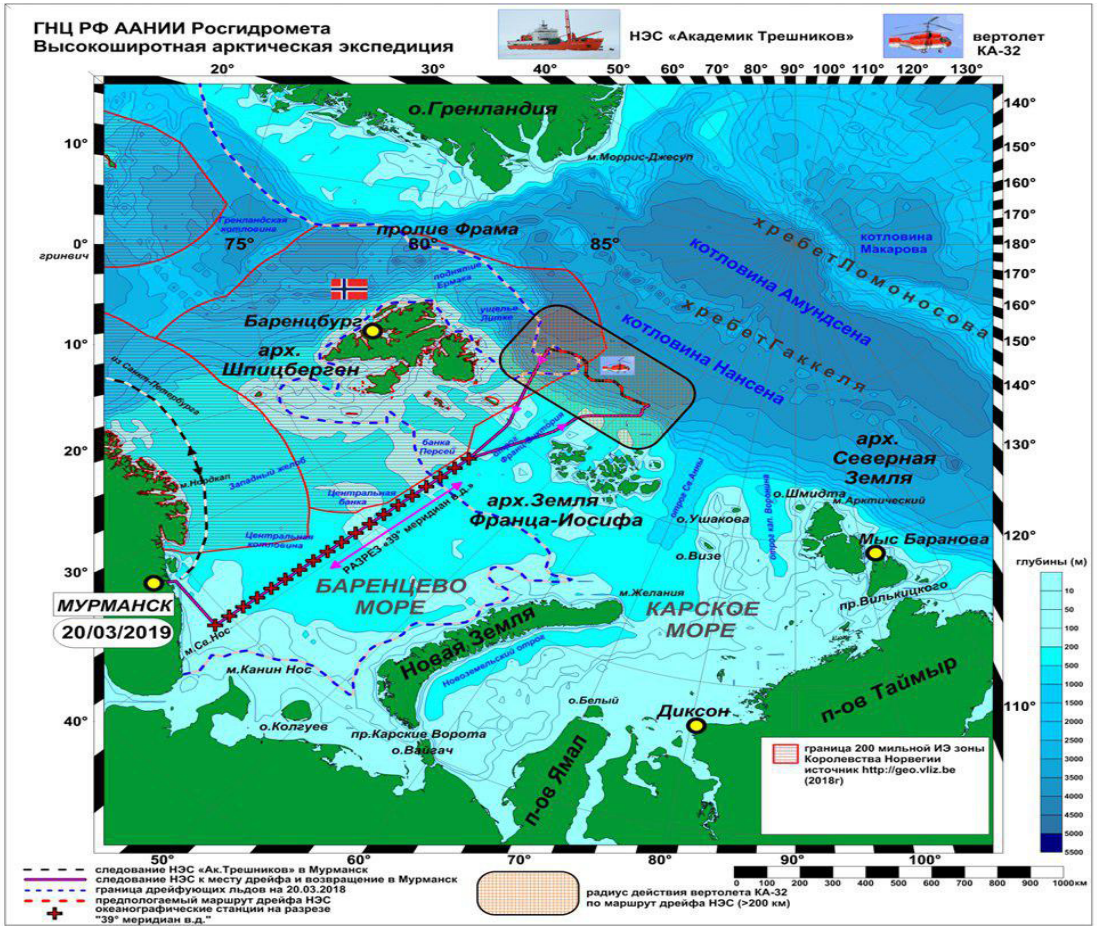
Глубина, м
0 50 100 150 200 250 300 350 400 450 500 550 600
Расстояние, км
3,4 3 2,6 2,2 1,8 1,4 1 0,6 0,2 -0,2 -0,6 -1 -1,4 -1,85

TRANSARCTIC

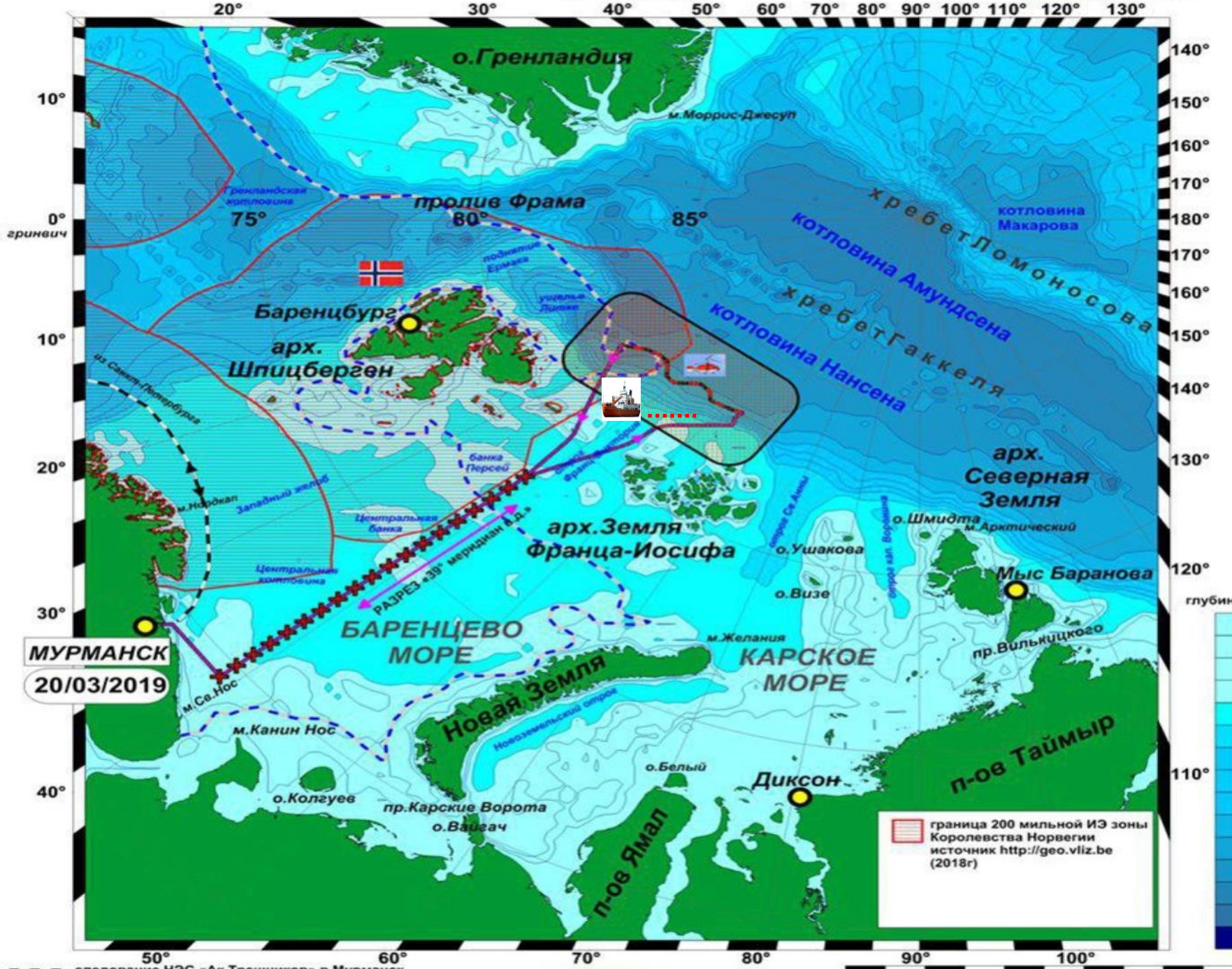
THE 1st PHASE
leader: AARI
Start: March 20, 2019
Duration: 70 days
Scientists: 52

- 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



Высокоширотная арктическая экспедиция

КА-32



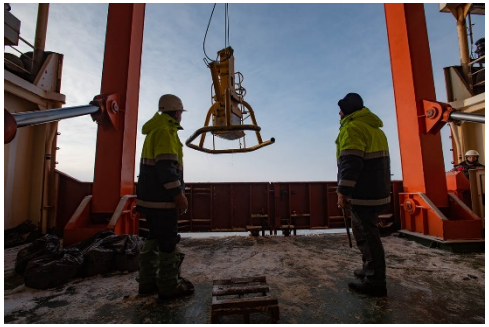
следование НЭС «Ак.Трешников» в Мурманск

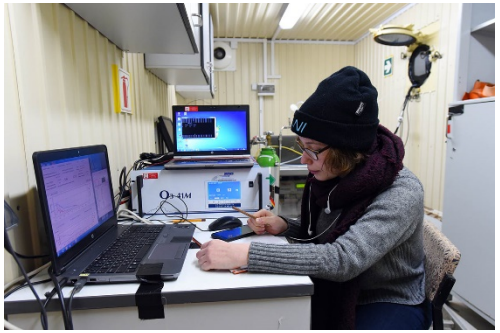
следование НЭС к месту дрейфа и возвращение в Мурманск

TRANSARCTIC

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 Geophyscal 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:

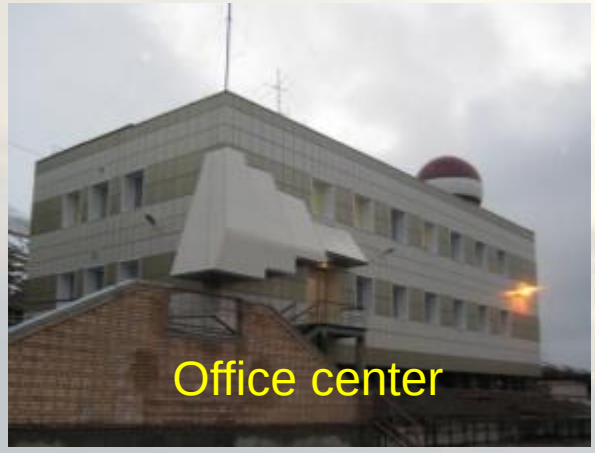
Geophysics (Upper Atmosphere Physics) – PGI, AARI, BO and SS
Glaciology – IG, AARI
Oceanography – AARI, BO and MMBI
Biology - MMBI, PABSI
Geology - PMGRE, MMBI
Monitoring of pollution – NWT, BO
Archeology, History – IA (field research)
Hydrometeorological research and monitoring – AARI, BO

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


Office center


Mobile hats

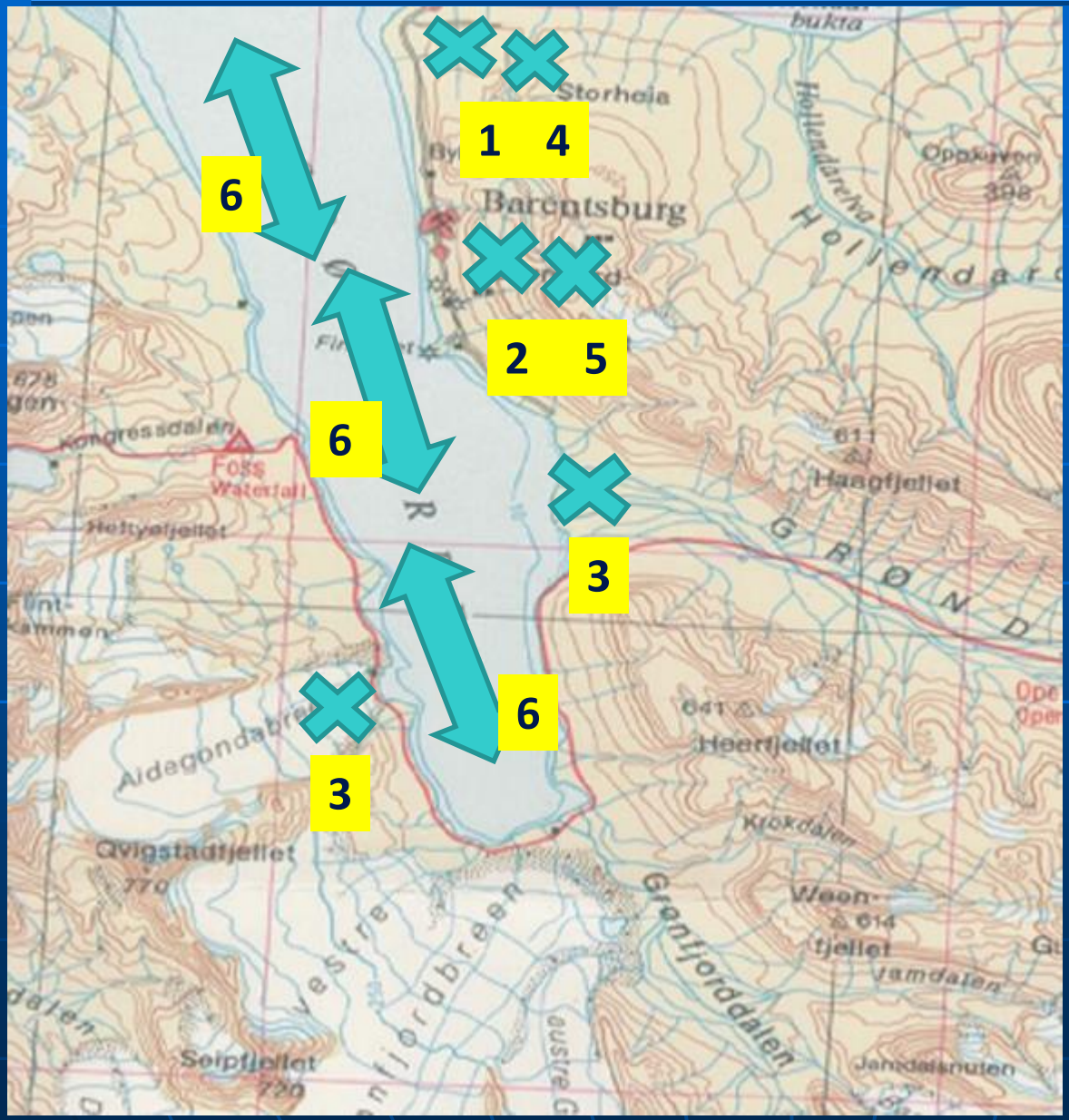

Geo- and Hydrochemical Lab


Analitical Lab


Satellite Receiving Station Antennas


“Barentsburg “ boat

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)

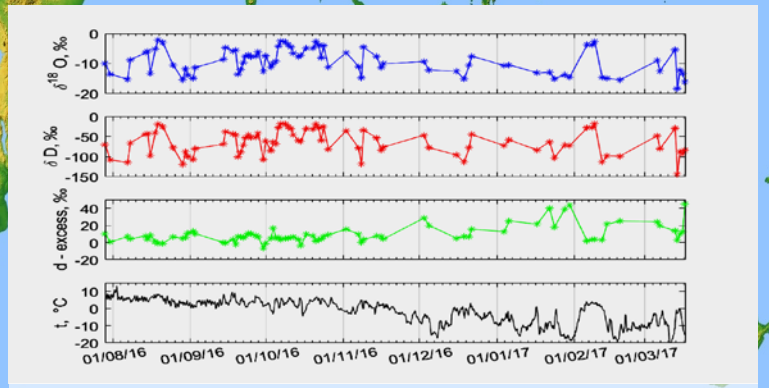
•Arctic Space Training ASTRA (PGI, Institute of Physics of the Earth RAS, Space Research Institute RAS, UNIS, UiT, UiO, Higher School of Economics) – summer school organized

•Mapping bryophytes on Svalbard as the basis for monitoring and conservation BRYOMAP (NTNU, PABGI)

Stable water isotope studies in polar regions

Greenland
Svalbard
Russian Arctic
Tiksi
Yamal
Yakutia
Ladoga
Europe
Altay
Vladivostok
Caucasus
Antarctica

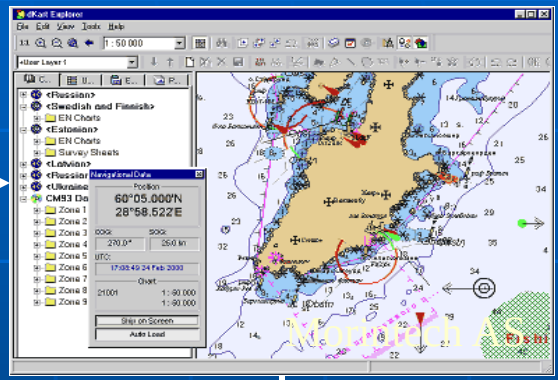
Analytical facilities:
Climate and Environmental Research Laboratory at AARI



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 paleaoclimate studies. The data are used for the meteorological, hydrological, oceanological models.

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 stuff 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

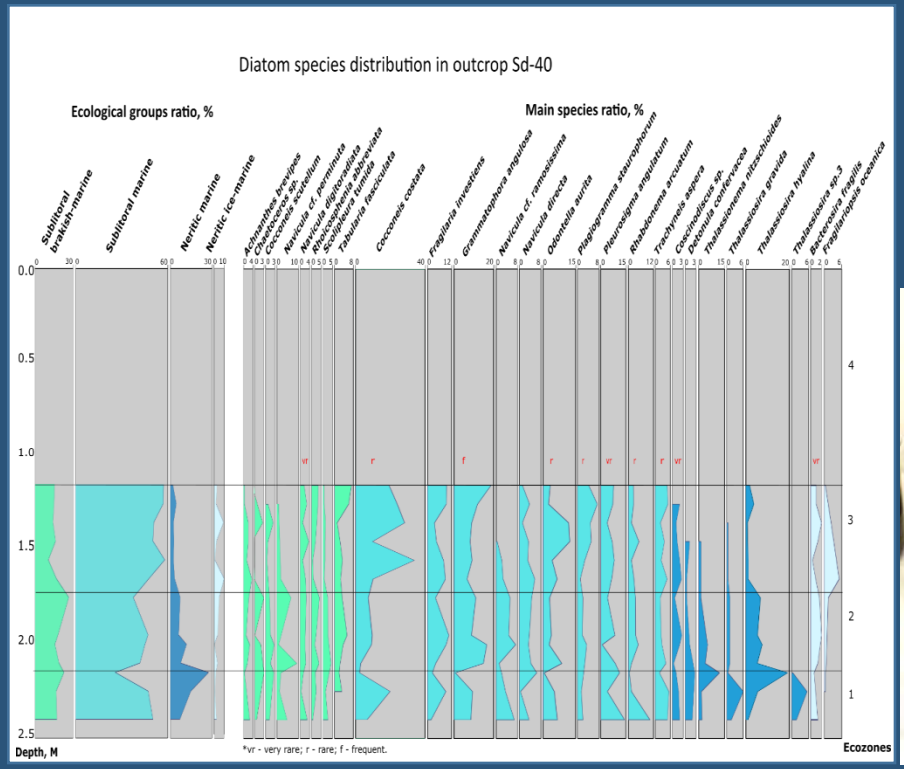
Focus on education

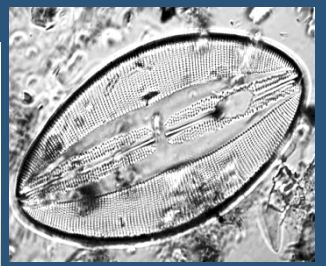
- Field course in glaciology and permafrost for Moscow State University, 4 master students, 1 teacher, 1 assistant, August
- 1 bachelor, 5 master and 3 PhD students in research groups

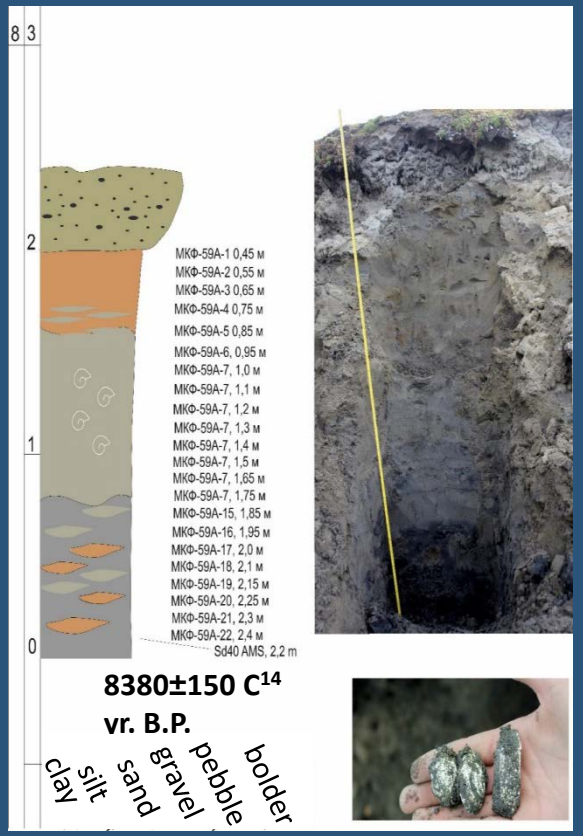
School children, Barentsburg Arctic Russian School – lecture in the lab

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

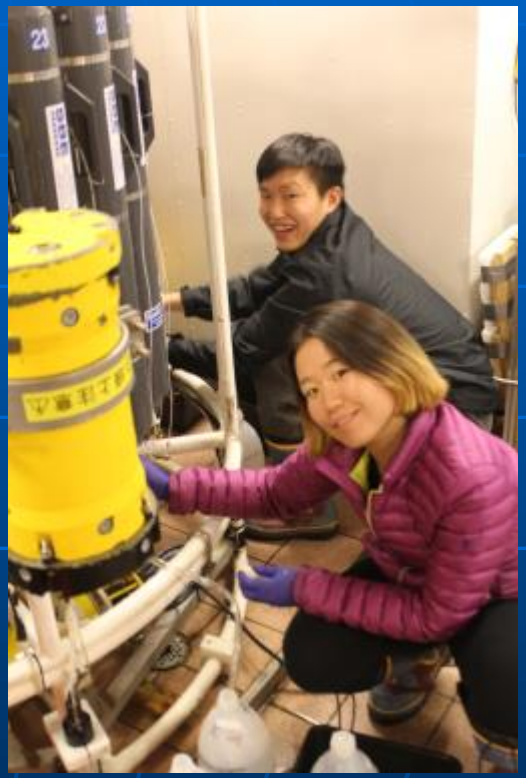






8380±150 C^{14} vr. B.P.

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



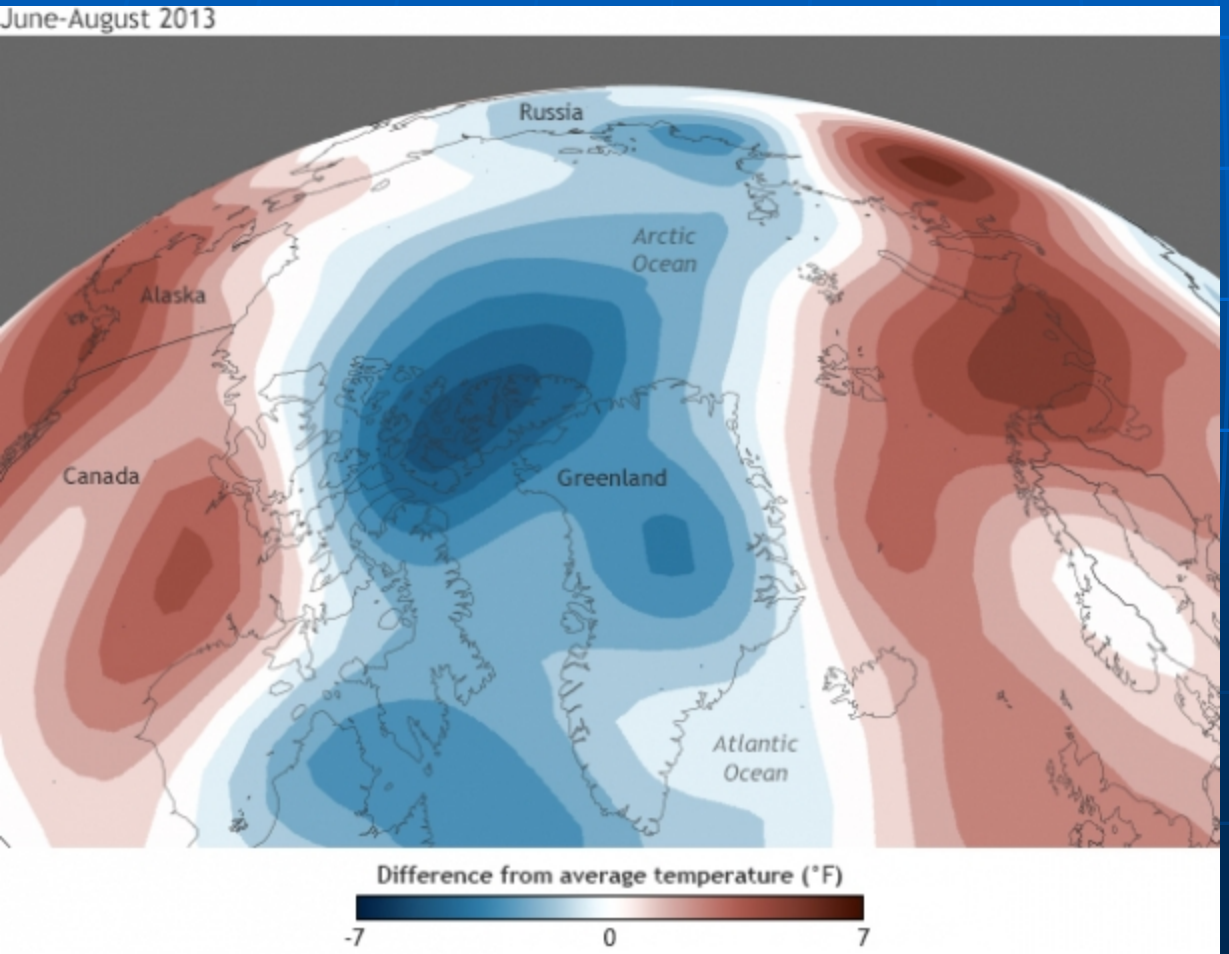
Awlap/Nabos 2018 international research team

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.



*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

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Thank you for Attention !