

MEMBER COUNTRY: **RUSSIA**National Report to SCAR for year: **2009**

Activity	Contact name	Address	Telephone	Fax	E-mail	Web site
National SCAR Committee						
SCAR Delegate						
1) Delegate	V.M.Kotlyakov	Russian National Committee on Antarctic Research Institute of Geography, Staromonetny per.29, 109017 Moscow, Russia	7-495-9590032	7-495-9590033	igras@igras.glonet.ru	
2) Alternate Delegate	M.Yu.Moskalevsky	Ditto	7-495-9590032	7-495-9590033	moskalevsky@mail.ru	
Standing Scientific Groups						
Life Sciences Delegate	Igor Melnikov	Institute of Oceanology, Russian Academy of Sciences, Nakhimovsky prosp. 36, 117852 Moscow, Russia	7-495-1292018	7-495-1245983	migor39@yandex.ru	www.paiceh.ru
Geosciences Delegate	German Leitchenkov	VNII Okeangeologia, Angliysky Ave, 1, 190121 St.Petersburg, Russia	7-812-3123551	7-812-7141470	german_1@mail.ru	
Physical sciences Delegate	Klepikov Alexander	Arctic and Antarctic Research Institute, 38, Bering str., St.Petersburg 199397 Russia	7-812-3520226	7-812-3522688	klep@aari.nw.ru	www.aari.nw.ru

Activity	Contact Name	Address	Telephone	Fax	E-mail	Web site
ACE	No					
AGCS	Klepikov Alexander Lagun Victor	Arctic and Antarctic Research Institute, 38, Bering str., St.Petersburg 199397 Russia	7-812-3520226 7-812-3522950	7-812-3522688	klep@aari.nw.ru lagun@aari.nw.ru	www.aari.aq
EBA	No					
ICESTAR	Troshichev Oleg	Arctic and Antarctic Research Institute, 38, Bering str., St.Petersburg 199397 Russia	7-812-3521149	7-812-3522688	olegtro@aari.nw.ru	www.aari.nw.ru
SALE	Popov Sergey Lukin Valeriy	Polar Marine Geological Expedition	7-812-4231858	7-812-4231900	spopov@peterlink.ru	
Expert group on oceanography	Klepikov Alexander	Arctic and Antarctic Research Institute, 38, Bering str., St.Petersburg 199397 Russia	7-812-3520226	7-812-3522688	klep@aari.nw.ru	www.aari.aq
King George Island Action Group	Lagun Victor	Arctic and Antarctic Research Institute, 38, Bering str. St.Petersburg 199397 Russia	7-812-3522950	7-812-3522688	lagun@aari.nw.ru	www.aari.aq
SCAR Database	Russian Antarctic database	Arctic and Antarctic Research Institute, 38, Bering str. St.Petersburg 199397 Russia	7-812-3520226	7-812-3522688	nadc@aari.nw.ru	www.aari.aq

SCAR Standing Committee on Antarctic Geographic Information - SCAGI
savat@aari.nw.ru 8 (812) 352-10-57;

A Brief Summary of Scientific Highlights

Physical Sciences for the period 2008 - 2010

Atmosphere studies

Arctic and Antarctic Research Institute of Roshydromet, St. Petersburg

Current surface meteorology, solar radiation, ozone and upper air dataset of Russian Antarctic Circumpolar network has been completed based on 2010 observation results for all standard measurement programs. Monthly mean values of more than 140 key climatic parameters are presented at www.aari.aq and updated every month. Detailed statistical analysis results for each indicated above time-series are presented also.

During last decade of XXI century surface air temperature over Antarctic Peninsula northern part decreased due to Antarctic Oscillation index *fall* and due to Southern Oscillation index positive values increasing. During total observation period atmospheric warming over Antarctic Peninsula increased. Near the tropopause (250-300 hPa isobaric layer) there was registered the strongest warming in the Earth over North part of Antarctic Peninsula.

In the frames of post-IPY *COMPASS project* three new Russian automatic weather stations were serviced at meteorological place of Leningradskaya, Russkaya and Molodezhnaya stations which were opened after conservation.

Relationship between magnetic activity in the polar cap and atmospheric processes in the winter Antarctica

Arctic and Antarctic Research Institute of Roshydromet, St. Petersburg

O.Troshichev olegtro@aari.nw.ru

There is a close relationships between the polar cap magnetic activity, which is characterized by PC index [*Troshichev et al., 1988; Troshichev et al., 2006*] and some atmospheric phenomena typical of the winter Antarctica, such as? enhancement of cloudiness, sudden warmings of ground atmosphere in the nearpole area, formation of anomalous wind regime above Antarctica. It was shown previously [*Troshichev et al., 2004; Troshichev and Janzhura., 2004; Troshichev et al., 2008; Troshichev, 2008*] that these atmospheric phenomena are controlled by variations of the geoeffective interplanetary electric field impacting the Earth's magnetosphere and correspondingly on the global electric circuit. On the other hand, the polar cap magnetic activity is also determined by the interplanetary electric field influence through the field-aligned magnetospheric currents and electric field in the polar cap ionosphere. The results imply that the PC index, calculated in online regime by geomagnetic data from near-pole station Vostok, can be used to monitor the anomalous atmospheric processes in the winter Antarctica.

Physical oceanography

Arctic and Antarctic Research Institute of Roshydromet, St. Petersburg

For *Synoptic Antarctic Shelf-Slope Interaction (SASSI)* IPY project goals several meridional sections were made from r/v *Akademik Fedorov* in the Amundsen Sea (February 2008) and at the west coast of Antarctic Peninsula (February 2010). The section in the Pine Island Bay, Amundsen Sea, shows significant penetration of CDW to the shelf area. CDW with $+1.0^\circ$ at the distance of 300 km from shelf break is found. Thin (~20 m) surface layer has very low salinity (32.8‰ at temperature -1.6°). Possible cause of the existence of the low saline surface layer is the melt water from outlet glaciers and ice shelves. We consider CDW as possible source of the heat to melt continental ice in the region.

Three high density XBT transects from Antarctica to Cape Town along the CLIVAR SR2 line were made in 2008, 2009 and 2010 to study thermal structure of upper 750 m layer and ocean fronts. This is the input to IPY project *Climate of the Antarctica and Southern Ocean (CASO)* studies through *BONUS/GoodHope* project. Five XBT sections were made in February 2009 in Prydz Bay and Enderby basin for CASO and SASSI and goals.

In the framework of post-IPY *CLICOPEN Project* activities at the vicinity of Bellingshausen station there were continued regular all year hydrology observations. Annual course of sea water temperature profile, salinity, oxygen content and zooplankton community parameters was obtained and compared with available previous observation results. New program for sea ice cover and snow line photo-registration was established at Bellingshausen station. Generalization of four decade (1968-2010) coastal sea ice observations near Southern Shetland Islands demonstrates that annual icy period shortened twice and maximal sea ice cover became three times shorter.

Shirshov Institute of Oceanology of Russian Academy of Sciences, Moscow

Under the *BONUS/GoodHope* project r/v *Akademik Ioffe* made 53 CTD stations along Shackleton Fracture Zone in November 2007 and r/v *Akademik Sergei Vavilov* made 66 CTD stations during the survey in the central part of the Drake Passage in October 2008. It was found that the geostrophic transport of Antarctic Circumpolar Current (ACC) in the Drake Passage is 93 Sv above the barrier dividing Pacific and Atlantic Oceans. 50% of ACC geostrophic transport is concentrated within Subantarctic Front. Low concentrations of dissolved silica observed in the area to the north of Polar Frontal Zone is a limiting factor for phytoplankton growth.

Lake Vostok and Paleoclimate

Arctic and Antarctic Research Institute of Roshydromet, St. Petersburg

The new branch-hole 5G-2 was started at Vostok Station by deviational drilling from depths 3590-3600 m in 5G-1 hole and continued to 3650 mbs (by 23th January, 2010). A considerable amount of replicate core of accreted (Lake Vostok) ice was obtained. In order to document the evolution of accreted ice texture and fabric with depth we performed continuous mapping of the ice grain boundaries and *c*-axis orientation measurements throughout the 5G-1 lake-ice core from 3538 to 3667 m depth, as well as in the depth range 3600-3650 m of the replicate 5G-2 core. The data show that a gradual orthotropic grain growth and the development with depth of preferred horizontal *c*-axis orientation are essential characteristics of either of two distinct accreted ice strata: lake ice 1 (3538-3609 m) and lake ice 2 (below 3609 m). The observed preferred growth of ice grains with *a*-axes oriented along the direction of ice accretion suggests a delivery of supercooled water to the crystallization front likely from the northern part of Lake Vostok.

Several shallow snow cores have been drilled in a distance of up to 100 km from Vostok Station. Data on snow stratigraphy and geochemical content obtained from 3 cores have been used to construct a stacked regional (for the southern part of Lake Vostok) climatic record extended back in time to 350 years. The Vostok's isotope-temperature calibration coefficient have been applied to the newly obtained isotope data from the 3 cores to derive the past changes of air temperature. The new reconstruction confirms the previously discovered local climatic features: domination of 50-year periodicity in decadal and centennial variability, and slight (by 0.5°C), but statistically significant, warming during the three last centuries.

Permafrost studies

Arctic and Antarctic Research Institute of Roshydromet, St. Petersburg

In the frames of post-IPY ANTPAS cluster activities geocryology polygon measurements of permafrost active layer parameters distribution were organized near Bellingshausen, Novolazarevskaya and Progress stations. During 2010 summer season extreme value of permafrost melting layer is 118 cm at King George Island. Russian Antarctic geocryology data are presented at international circumpolar Internet resources <http://www.udel.edu/Geography/calm/data/south.htm> .

Snow accumulation

Modern snow accumulation and discharge of the Eastern Antarctic grounded ice have been estimated.

Alexander Klepikov

Representative to SCAR SSG Physical Sciences

Arctic and Antarctic Research Institute, St.Petersburg

klep@aari.nw.ru

GEOSCIENCE ACTIVITIES IN 2009-2010

ORGANIZATIONS INVOLVED:

Research Institute for Geology and Mineral Resources of the World Ocean, VNIIOkeangeologia (Ministry of Natural Resources and Ecology).
Polar Marine Geosurvey Expedition, PMGE (Ministry of Natural Resources and Ecology).

1. NATIONAL PROJECTS (field activity)

Marine geophysics (PMGE, VNIIOkeangeologia).

Season: February-March 2009

Region: Davis Sea and Labuan Basin (Antarctic margin between 85E and 94,5E; 60S and 64,5S).

Data acquisition: 3000 km of MCS data, 5 000 km of gravity and magnetic data, 26 sonobuoys.

Season: February-March 2010

Region: Terra Adelie Land–George V Land margins and adjacent Australian-Antarctic Basin (Antarctic margin between 142E and 152E).

Data acquisition: About 4000 km of MCS, magnetic and gravity data; 10 sonobuoys.

In both field seasons, MCS data were recorded with a 352-channels digital streamer and airgun array of 2860 cub. in. in total volume.

Airborne geophysics (PMGE)

Season: January-March 2009

Region: North-western Prince-Charles Mts. (between 67.5S and 69.3S; 62E and 63.8E).

Data acquisition: About 4900 km of airborne survey including magnetic and radio-echo sounding (RES) observations

Season: January-March 2010

Region: Princess Elizabeth Land (between 67.8S and 69.3S; 77.6E and 80,8E).

Data acquisition: 6500 km of airborne survey including magnetic and RES observations

Short-range airplane AN-2 was used for data acquisition in both seasons. The RES studies were carried out using a 60-MHz radar. Flight lines were generally oriented north-south and spaced 5 km apart.

Ground-based geophysics (PMGE)

Season: January-February 2009

Region: Continuous RES profile from Vostok Station to Progress Station.

Data acquisition: About 2 300 km of RES observations

Season: January-March 2010.

Region: Continues (zigzag) RES profile from Komsomol'skaya Station to Progress Station.

Data acquisition: 850 km of RES observations

In both seasons, refraction and reflection seismic studies in the southern part of Lake Vostok were conducted (observations along the 70 km-long line with use of explosive as a seismic source).

Geology (PMGE)

Season: January-February 2009.

Region (research): McLeod Massif (geological mapping) and Northern Prince-Charles Mts. (airborne landing for short visits of small outcrops; documentation and rock sampling)

Season: January-March and brief.

Region (research): Vestfold Oasis (geological mapping including detailed studies of Proterozoic mafic dikes).

2. INTERNATIONAL PROJECTS

Tectonic Map of Antarctica (VNIIOkeangeologia, IPY Project)

The first draft of new tectonic map of the Antarctic at 1:10 M scale has been finished and will be presented at the SCAR meeting in Buenos-Aires (see report of 2008 for details of the Project).

Antarctic Bedrock Topography and Ice Sheet, ABRIS – contribution to BEDMAP (PMGE, VNIIOkeangeologia, IPY Project)

New bedrock topography map of the most part of East Antarctica has been compiled in 2010.

See <http://abris.pmge.ru> for more information about the ABRIS Project.

Circum Antarctic Stratigraphy and Paleobathymetry, CASP - subproject of the ACE Scientific Program (VNIIOkeangeologia, PMGRE,).

The set of structural maps (including: total sedimentary thickness, depth to basement, thickness of postrift strata, thickness of glacial marine unit, depth to the base of glacial marine unit and other) has been compiled for the East Antarctic margin from 7E to 142E).

Antarctic Digital Magnetic Anomaly Map, ADMAP (VNIIOkeangeologia & ADMAP consortium).

New Russian marine (about 6 000 km) and German (AWI/BGR) airborne (about 8 000 km of closely spaced) magnetic data collected during the IPY project in the area of southern Kerguelen Plateau have been processed and added to the ADMAP data base.

SCAR Expert Group on Sub-Ice Geological Exploration, SIeGE (VNIIOkeangeologia).

A few small solid inclusions extracted from ice cores of the Vostok Drill hole (depth 3607,5 m) and represented mainly by consolidated siltstones have been studied. Eight small (10-20 mkm across) detrital zircons have been identified and dated using SHRIMP. Obtained ages fall on earlier defined (from 23 zircons and 5 monazites) age clusters 800-1200 Ma and 1600-1800 Ma (see report 2007).

Selected publications

- Kamenev E. N., Glebovitskii V. A., Kovach V. P., Semenov V. S., Alekseev N. L., Sal'nikova E. B., Mikhailov V. M. 2009. Late Precambrian Metamorphic Events in Eastern Antarctica (Northern Prince Charles Mountains, Radok Lake Area, 70° 52' S, 67 ° 57' E). *Doklady Akademii Nauk*, 2009, Vol. 425, No. 6, pp. 10-23
- Mikhalskii E.V., Belyatskii B.V., Sergeev S.A. New data on the age of rocks in the Mirnyi Station area, East Antarctica. *Doklady Earth Sciences*. 2009. V. 426A. No 4. P. 527–531.
- Mikhalsky E.V., Belyatsky B.V., Lepekhina E.N., Sergeev S.A. The Palaeoarchean age, Sm-Nd characteristic and the REE distribution in zircon in granitoid from the southern Prince Charles Mountains (East Antarctica). *Doklady Earth Sciences*. V.433A (in press).
- Mikhalsky E.V., Henjes-Kunst F., Belyatsky B.V., Roland N.W., Sergeev S.A. New Sm–Nd, Rb–Sr, U–Pb and Hf isotope systematics for the southern Prince Charles Mountains (East Antarctica) and its tectonic implications. *Precambrian Research* (in press).
- Mikhalsky E.V., Belyatsky B.V., Roland N.W. 2009. New evidence for Palaeoproterozoic tectono-magmatic activities in the southern Prince Charles Mountains, East Antarctica. *Polarforschung*. V. 78 (3). P. 85–94.
- Leitchenkov G.L., Guseva Yu.B., Gandyukhin V.V., Gohl K., Ivanov S.V., Golynsky A.V., Kazankov A. Ju. 2010. Crustal tectonics and depositional history in the Southern Indian Ocean (East Antarctica: Cooperation Sea, Davis Sea, Kerguelen Plateau). In: Leonov J.G. (Ed.) *Structure and Evolution of the Lithosphere*. Series: Contribution of Russia to International Polar Year 2007/08. In Russian.
- Grikurov G.E., Leitchenkov G.L., Mikhalsky E.V. 2010. Antarctic Tectonic Evolution in the light of modern geodynamic concepts. In: Leonov J.G. (Ed.) *Structure and Evolution of the Lithosphere*. Series: Contribution of Russia to International Polar Year 2007/08. In Russian.

Dr. German Leitchenkov
Representative to SCAR SSG GS

Head of Department of Antarctic Geoscience,
Institute for geology and mineral resources of the World Ocean, VNIIOkeangeologia,
1, Angliysky Ave., 190121 Saint Petersburg, RUSSIA
e-mail: german_l@mail.ru or german_leitchenkov@hotmail.com
Phone: 7(812)312-35-51

LIFE SCIENCES

Zoological Institute of RAS, St.Petersburg and Shirshov Institute of Oceanology of RAS, Moscow

Russian marine ecosystems studies in the Antarctic. The long-term ecological research project “Study of the Antarctic Sea Ice Ecosystems” (SASIE) was continued during the field seasons 2008, 2010. SASIE is a part of the IPY-SCAR cluster project “*Integrated analyses of circumpolar Climate interactions and Ecosystem Dynamics*” (ICED) which is an international initiative aimed at coordinating integrated, multidisciplinary, circumpolar analyses of Southern Ocean ecosystems. The main idea of project is to conduct multidisciplinary observations on composition and structure of biological communities in both pelagic and coastal sea ice in the Southern Ocean, as well as on the sea ice ecosystem dynamic under recent climate change condition.

During the 2008 field season, observations were conducted at Nella fjord (Prudz Bay) nearby the Russian continental station “Progress” (69° 22’ S and 76° 23’ E) located at Ingrid Christensen Coast (Larsemann Hills, Princes Elizabeth Land, Eastern Antarctic). There were collected both sea ice cores and under ice water samples at the profile across the Nella fjord for salinity, mineral and organic compounds measurements and species composition identifications. It was shown that “multifloor” sea-ice-water system is synchronous vertically displaced due to tides up to 2 m, but sufficiently stable during the melting season while the sea-ice cover is “put off” the water-wave mixing. The multi-component system was observed which consists of: (i) ice with fresh and sea water influence, (ii) under ice brackish water layer of 50–60 cm thick, and (iii) sea water layer. It was shown that sea ice flora consists of mainly by dinoflagellate cysts. Marine diatoms were presented only by single cells, this are probably caused by freshening of ice. From December 2008 to March 2009 23 biological scuba diving stations have been done at 9 sections in Nella Fjord within 3-43 m depth. More than 100 samples of macrobenthos, 18 samples of meiobenthos and 11 samples of plankton were collected. 6 species algae and 205 species of invertebrates of different systematic groups and fish have been identified.

During the 2009-2010 season the field observations were continued at the Nella fjord. The main goal is to continue sea ice cores samplings, under ice plankton catches and Niskin bottles time-series in water column from ice to bottom in same geographical location under umbrella of SASIE ideology.

At the *Bellingshausen* station, King George Island, year-round observations of the pelagic ecosystem of the Ardley Bay (part of Maxwell Bay, to the north of Ardley Island) were organized during the IPY period under *CLICOPEN project*. Taxonomical composition, inter-annual and seasonal variability of zooplankton at two sites have been studied. 45 species and forms of 10 taxonomic groups of Protozoa have been identified. During 2009-2010 field hydrobiology observation program the *Salpae* community expansion events were documented as an example of local warming influence on ecosystem dynamics.

Botanical Institute of RAS, St.Petersburg

The new data about the lichenoflora, mosses and soil composition and distribution over Filds Peninsula of King George Island and the Antarctic Peninsula have been found; where 150 species of 52 genera and 25 lichen families were sampled. Systematic description of available Antarctic circumpolar lichen collection was made.

Arctic and Antarctic Research Institute of Roshydromet, St. Petersburg

Lithosols of the King-George Island near Russian Bellingshausen station are described in terms of a humus formation process. The humus state of soils formed under the grass (*Deshampsia antarctica*) and lichen (*Usnea aurantiaco-atra*) are observed. The effect of overmoistening on the processes of organic matter transformation under the grasses was investigated. The higher plants assist to aggregate soil formation in residues of these plants meanwhile the higher nitrogen percentages in them than in lichens doesn't result in increasing humus richness by nitrogen. The intensity of humification is higher in soils under grasses than in soils under lichens which is well expressed in accumulation of humic and fulvic acids groups. All lithosols investigated are characterized by a low degree of humification, small portions of humus connected with mineral part of soils, essential portion of water-soluble fractions of organic matter and low stability of organic matter to the oxidation. In the similar conditions of parent materials, relief and climate during the same period of time the soils with different humus content and composition were formed. This is the evidence of the maximal influence of biochemical peculiarities of plant residues on kinetics of accumulation and transformation of organic matter in Antarctica.

Igor A. Melnikov

Representative to SCAR SSG Life Sciences

P.P. Shirshov Institute of Oceanology, Moscow, Russia

migor39@yandex.ru