

IASC Working Group: Atmosphere Working Group

Country: Poland

Names of delegate(s): Ewa Łupikasza, Andrzej Arażny

What are your country's current Arctic research priorities (relevant to your Working Group)? How do these overlap or deviate from the ICARP-3 research priorities?

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The current Arctic research priorities were identified in the Polish Snow Research Programme (<http://www.pkpolar.pl/eng/polish-snow-programme-svalbard/>) and in the "Strategy for Polish Polar Research – a concept for the years 2017-2027, signed by Polish Polar Consortium (<http://www.pkpolar.pl/eng/strategy/>). These priorities include: (i) spatiotemporal changes in precipitation phases (rain, snow, mixed precipitation), their impact on snow cover and relation to atmospheric circulation, (ii) changes in snow cover albedo, its impact on radiation balance and snow cover physics, (iii) changes in extent and thickness of snow cover, the processes involved in development and declining of snow cover, the role of wind in distribution, thickness and metamorphosis of snow cover, (iv) extreme weather phenomena in winter (rainfall, heavy snowfall, high air temperatures), (v) state and chemical composition of the atmosphere including aerosols and anthropogenic pollutants, (vi) weather and climate reconstructions for recent centuries based on early meteorological measurements and documentary evidence. All of these priorities correspond to the following ICARP III priorities: *Assessing and understanding rapid Arctic climate change and Arctic amplification (precipitation phases, snow cover)*, *Linking studies across all spheres: atmosphere, cryosphere, understanding of the physical mechanism of Arctic amplification (albedo)*, *Enhancing our understanding of the fully coupled physical climate system (air pollutants, albedo, snow cover properties and distribution)*.

What are major ongoing and upcoming projects within your Working Group's fields? How do these address the ICARP-3 science priorities?

- INTERACT Transnational Access, International Network for Terrestrial Research and Monitoring in the Arctic (*ICARP-3 priority: Enhancing our understanding of the fully coupled physical climate system*).
- EU H2020 European Commission HORIZON 2020, project: "Growth-ring record of modern extreme weather phenomena in the Low Arctic (REACT)" – *finished in 2019 (ICARP-3 priority: Understanding extreme weather events that have ecological impact)*.
- Reconstructions and projections of the hydro-climatic conditions of southern Spitsbergen (*ICARP-3 priority: Linking studies across all spheres*).
- Source-to-sink pathways of glacier-derived nutrients (Si, Fe, P, N) in Svalbard (SVALNUT); (*ICARP-3 priority: Enhancing our understanding of the fully coupled physical climate system*).
- Maritime Aerosol Network Project (based on agreement with NASA ended in 2029) (https://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html).
- Experimental and modelling (CAM5, NAAPS) research on aerosol optical depth (*ICARP-3 priority: Enhancing our understanding of the fully coupled physical climate system*).
- National research project on "Causes of the early 20th century Arctic warming" (*ICARP-3 priority: Assessing and understanding rapid Arctic climate change*).
- National research project on "Reaction of precipitation phases on current warming in Europe including the Arctic" (*ICARP-3 priority: Assessing and understanding rapid Arctic climate change and Arctic amplification*).

- National research project on linkages between the climate change in the Arctic and Poland – started in 2019 (*ICARP-3 priorities: Improving our understanding of the physical interrelation between the Arctic and the extra-Arctic, connection between Arctic amplification and mid-latitude extremes of episodic nature*)
- Several projects have been submitted within the GRIEG call for Polish-Norwegian research projects financed under Norwegian Financial Mechanism 2014-2021

Is there any new / novel research in your country, relevant to your Working Group, being undertaken that broadens / deviates from ICARP-3 priorities? What & why?

- Polar dendroclimatology – research are being held in Island, Canadian Arctic and Svalbard .
- Reconstruction of the Arctic climate based on the historical sources (early instrumental meteorological observations and documentary evidence) – this delivers direct information on the climate therefore is of utmost significance.

Both points are not mentioned in ICARP-3 priorities.

What are emerging Arctic research issues in within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

Interdisciplinary and cross-disciplinary studies (The impact of air pollution on snow cover. Cloud radiative forcing). Spatiotemporal changes in biometeorological conditions in recent two-three centuries. Causes of the Early Twenty Century Arctic Warming.

What are current gaps in research and/or data within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

Gaps in the Arctic research includes the modelling of future climate in polar regions (*ICARP-3 priorities: understanding the impact of Arctic climate change on atmosphere and ocean circulation and connection to global climate system*). The research that needs to be broaden and intensified concerns historical and current climate change in relation to atmospheric and ocean circulation and reconstruction of the climate of The Arctic and Antarctic within a time horizon of the last 2000 years. Interdisciplinary research and cross-disciplinary research should also be intensified (*ICARP-3 priorities: Linking studies across all spheres: biosphere, and the physical spheres*). Scarcity of data on atmospheric aerosols, from maritime areas in particular. Problems with maintenance of measurements – the available projects are short-lasting which preclude the long-term planning of the field activities. Limited focus on the role of terrestrial system in the CO₂ cycle which would be useful for modelling studies (ICARP III priority concerning enhancing our understanding of the fully coupled physical climate models (atmosphere-ocean-ice) (*ICARP-3 priorities: Linking studies across all spheres: biosphere, and the physical spheres, enhancing our understanding of the fully coupled physical climate system*)).

What are areas emerging issues concerning international science cooperation (e.g., successes, obstacles, best practice)?

Polish scientists perceive international cooperation as fruitful with regard to common papers. They particularly value a full access to the data.

IASC Working Group: Cryosphere Working Group

Country: Poland

Names of delegate(s): Mariusz Grabiec (University of Silesia, Centre for Polar Studies) and Ireneusz Sobota (Nicolaus Copernicus University in Torun, Polar Research Center);

Contributors: Wojciech Dobiński (University of Silesia), Marek Lewandowski (Institute of Geophysics Polish Academy of Sciences), Bartłomiej Luks (Institute of Geophysics Polish Academy of Sciences), Krzysztof Migąła (Wrocław University), Wiesław Ziaja (Jagiellonian University).

What are your country's current Arctic research priorities (relevant to your Working Group)? How do these overlap or deviate from the ICARP-3 research priorities?

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The Polish strategy for polar research (2017-2027) defined the following cryosphere related priorities (<https://www.pkpolar.pl/eng/strategy/>) that are in-line with the ICARP-3 recommendation to boost understanding the Arctic as a part of the Global System:

- Polish Polar Station Hornsund (Svalbard) is carrying long-term research in the fields of meteorology, glaciology, and atmospheric physics, in line with priority #2 „Observing and Predicting Future Climate Dynamics and Ecosystem Responses“. Data are collected and available at <https://monitoring-hornsund.igf.edu.pl>
- Four Polish University Polar stations (Svalbard) are carrying long-term investigations in the field of the most cryosphere components.
- In-depth knowledge of cryospheric components of the polar environment and their functioning as a comprehensive system.
- Better understanding regularities and changes in the Arctic ecosystems as a consequences of ongoing shrinkage of the cryosphere.

What are major ongoing and upcoming projects within your Working Group's fields? How do these address the ICARP-3 science priorities?

- Ongoing: INTAROS EU Horizon 2020 Project tending to establishment of the integrated Arctic Observation System (iAOS) by extending, improving and unifying existing systems in the different regions of the Arctic.
- Current projects are focused on forecasting and climatic modelling, mass balance observations, and role of aerosols in cryosphere development
- Reconstructions and projections of the hydro-climatic conditions of southern Spitsbergen.
- Glacier-ocean-climate couplings manifested in:
 - changes of Arctic glaciers' dynamics, geometry, mass balance and composition of glacial facies derived from remote sensing and long-term glacial monitoring;
 - freshwater production of glacial origin and its input to the Arctic fjord as a small scale model of the Arctic-wide glaciated areas contribution to the sea level rise and freshening of the Arctic seas;
 - complex water drainage in glacier system (including its forefield) derived from *in-situ* studies and numerical modeling;
 - quantitative and qualitative assessment of contemporary landscape and seascape transformation of selected Arctic regions under progressing deglaciation.
- Changes of cryosphere of north-western Svalbard.
- Assessment of glacier – permafrost interactions, permafrost thickness and active layer development.
- Interdisciplinary studies on changes of snow properties contributing to evolution of terrestrial, glacial, biochemical and ecological processes in the High Arctic.
- Assessment and exploitation of cryospheric data sets acquired in long-term monitoring programs running at high quality research platforms (<https://hornsund.igf.edu.pl/en/>, <http://www.stacja.arktyka.com/>, <http://polar.amu.edu.pl/index.php/en/research>), gathered in dispersed repositories (eg. <http://ppdb.us.edu.pl/geonetwork/srv/eng/catalog.search#/home>, <https://monitoring-hornsund.igf.edu.pl/index.php/login>) and integrated into Pan-Arctic observing system (eg. <http://www.intaros.eu/>).

Is there any new / novel research in your country, relevant to your Working Group, being undertaken that broadens / deviates from ICARP-3 priorities? What & why?

- New ideas are related to the building of a network of unmanned, automatic and autonomic geophysical stations, which will collect data from remote and hardly accessible areas.

All new researches were not sufficiently specified in ICARP-3 priorities.

What are emerging Arctic research issues in within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

- Particularly important is proper recognition based on universal (common or jointly developed principles, criteria) relation glacier (glaciation) permafrost.
- Important and newly emerging issue is to understand a role of aerosols and dust deposited on Svalbard in changing albedo and acceleration of snow and ice melt.
- Understanding the factors conditioning changes in dynamics, range, thermal structure, mass balance, glacial zones, drainage system and glacier calving intensity.
- Determining trends of changes in snow cover properties and its environmental effects.
- Recognition of rainfall-runoff transformation processes in Arctic catchments.
- Unification of procedures for measurements and ways to implement the water security as an element of increase of the observation quality in the Arctic.
- Future deglaciation of Svalbard – scenarios, processes, timing and consequences, including ecological, hydrological and geomorphological effects and their impact on human activity.

The last two research issues respond well to ICARP-3 priority tending to the comprehensive understanding atmosphere-ocean-ice network of interactions.

What are current gaps in research and/or data within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

Numerous gaps of knowledge in cryospheric issues considerable hinders better understanding of Arctic coupled physical system and its role in the Global System and to overcome them is among priorities of the ICARP-3. They are as follows:

- there are some conflicts of interests between National Parks of Svalbards and research needs to carry research with a mean of field stationary instruments, as to meteorological stations;
- limited *in-situ* validation and calibration data on glacier mass components, ice thickness and climate from remote areas of the Arctic (e.g. north and east Svalbard, high-altitude areas) impede application of numerical modelling, remote sensing and geophysical approaches;
- uncertain role of snow cover in changes of the Arctic environment and feedbacks with the other environmental components (ocean, atmosphere, lithosphere);
- unrecognized physical and chemical processes ongoing in the Arctic snowpack during melting period, mid-winter thawing and rain events;

What are areas emerging issues concerning international science cooperation (e.g., successes, obstacles, best practice)?

- No specific problems with international cooperation exist. New research, international groups have been recently established and new projects are planned.
- Growing cooperation of Polish researches in the international research initiatives in the frame of H2020 projects (<http://www.intaros.eu/>), Svalbard Integrated Arctic Earth Observing Systems SIOS (<https://sios-svalbard.org/>), SSF Svalbard Strategic Grants, INTERACT (<https://eu-interact.org/>), World Glacier Monitoring Service WGMS (<https://wgms.ch/>), Glaciology Flagship as part of the NySMAC and others.
- The relationship between cryology, hydrology and geology have be clearly defined, as well as the spheres they cover.
- Wide access to data from environmental monitoring.
- Needs of encouragement to share data internationally, since data is not rewarded as much in the scientific community as published articles are. The best practice would be to clearly recognize data contributions and built understanding across the existing datasets, while also attempting to fill the remaining coverage gaps and increase of standardization of monitoring and observational methods.

IASC Working Group: Marine

Country: POLAND

Names of delegate(s): Monika Kędra, Waldemar Walczowski

What are your country's current Arctic research priorities (relevant to your Working Group)?

How do these overlap or deviate from the ICARP-3 research priorities?

- Studies of marine environment carried on by the Polish research groups focus mainly on the European Arctic and subArctic regions: Nordic Seas, Fram Strait, Svalbard fjords, Atlantic sector of the Arctic Ocean (Nansen Basin). The most of Polish research activities in the Arctic is carried out under the strategic research initiatives addressing the role of the ocean in changing climate, its effects on the European seas and changes of the coastal ecosystems in the shelf seas.
- All activities overlap with the ICARP-3 research priorities covered by point 1 (The Role of the Arctic in the Global System) and 2 (Observing and Predicting Future Climate Dynamics and Ecosystem Responses). Polish research priorities align particularly with ICARP-3 priorities focused on assessing and understanding rapid Arctic climate change and its consequences on the ocean circulation and ecosystem functioning, sea ice decrease and cryo-pelagic-benthic coupling, impacts of climate change on the Arctic biodiversity, biogeochemical cycles and contaminants.

What are major ongoing and upcoming projects within your Working Group's fields? How do these address the ICARP-3 science priorities?

- The long-term **AREX** observational program and annual cruises carried out in the Nordic Seas and the European Arctic since 1987 by the Institute of Oceanology PAS in Sopot (IO PAN) with the research vessel Oceania, constitute the main part of Polish activities in the Arctic marine areas. AREX campaigns are focused on multidisciplinary observations including physical oceanography, air-ocean interactions, ocean biogeochemistry and ecology to study the changes of abiotic and biotic Arctic environment. The data collected under the AREX program every summer on the same grid of stations, provide time series of key ocean variables which allow monitoring changes of the Arctic environment. During AREX2019 expedition oceanographic measurements and collection of water samples contributed to several IO PAN statutory research areas and national and international research projects, including: **ARGO-Poland**, Euro-Argo Research Infrastructure Sustainability and Enhancement **EA-RISE** (H20202), Integrated Arctic Observations System **INTAROS** (H2020), Seabird Populations **SEAPOPOP II**, Future Arctic Algae Blooms **FAABulous**, Arctic benthic ecosystems under change: the impact of deglaciation and boreal species transportation by macroplastic **Adamant**, Interannual variability of properties and distribution of deep and intermediate water in the Nordic Seas **DWINS**, Impact of Atlantic Water variability and atmospheric circulation on the changing sea ice cover in the European Arctic **ATAC-ICE**, The development of deep convection in the Greenland Sea since the last glaciation **BaSEAf**, The influence of Atlantic Water on the taxonomic and functional structure of zooplankton in Arctic fjords **Tax4Fun**, Changes in the structure and functioning of pelagic ecosystems affected by water darkening due to glacier/river runoff in the fjords of European Arctic **CoastDark**, The Holocene history of the Greenland Gyre **Wir**, Arctic benthos functioning response to climate warming **AbeFun**, The ecological plasticity of the keystone Arctic zooplankton species **ecoPlast**, and other.

- Kongsfjorden monitoring since 1997 and monitoring of colonization and succession of Arctic benthic hard bottom fauna since 2005 are annually maintained programs mainly covered by statutory funds of IO PAN.
- Since 2013 autonomous ocean and sea ice observations have been collected by IO PAN with 1-3 deep ocean moorings north of Svalbard, in the southern Nansen Basin, in collaboration with the Norwegian projects **A-TWAIN** and **Nansen Legacy** and under the H2020 project **INTAROS**. The main research priority is assessing the impact of warming Atlantic inflow to the Arctic Ocean on ocean-sea ice-atmosphere exchanges and shrinking sea ice cover.
- Ocean observations are also collected by the Institute of Geophysics PAS (IG PAN) from the Polish Polar Station, located in Hornsund (the southernmost fjord at the western Spitsbergen) and operated by IG PAN. Synoptic measurements of the water mass structure and sedimentation processes have been carried out since 2015. Additional autonomous measurements of temperature, salinity, waves, tides and passive acoustic monitoring are carried out by bottom-mounted equipment. The currently implemented projects include (i) Measuring the melt rate of glacier ice with underwater noise and (ii) Research on the impact of underwater calves on the weight loss of glaciers discharging into the sea.
- All Polish activities align particularly with ICARP-3 priorities focused on assessing and understanding rapid Arctic climate change and its consequences on the ocean circulation and ecosystem functioning, sea ice decrease and cryo-pelagic-benthic coupling, impacts of climate change on the Arctic biodiversity, biogeochemical cycles and contaminants.

What are emerging Arctic research issues in within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

- Sustainability of observing efforts is a great challenge. Use of new technologies and development of remote sensing techniques requires joint efforts of industry and scientists.
- Extending mostly physical measurements towards more comprehensive biogeochemical and biological observations.

What are current gaps in research and/or data within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

- Systematic and frequent sampling over all seasons are important.
- Multidisciplinary approaches should be implemented on more regular basis.

What are areas emerging issues concerning international science cooperation (e.g., successes, obstacles, best practice)?

- The large international programs are needed along with access to icebreakers and new technologies capable to operate both under the sea ice and in the marginal ice zone.
- Arctic Essential Variables (AEVs) should be defined. Best practices for measuring AEVs in the Arctic Ocean environment should be established and made available internationally.
- In person meetings are crucial for international cooperation. These will, however, become more challenging due to funding challenges, and current health related concerns, as well as carbon foot print concerns. More efforts should be put into developing online working and meetings options.

IASC Working Group: SOCIAL&HUMAN WG

Country: POLAND

Names of delegate(s): AGNIESZKA SKORUPA (since 2019), MICHAŁ ŁUSZCZUK (since 2014)

**What are your country's current Arctic research priorities (relevant to your Working Group)?
How do these overlap or deviate from the ICARP-3 research priorities?**

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- According to "[Strategy for Polish Polar Research – a concept for the years 2017–2027](#)" main areas of Arctic social sciences and humanities being developed in Poland are research on:
 - *Polish polar policy,*
 - *multidimensional security in the Arctic,*
 - *social dimension of the Arctic's transformation in the context of climate change and globalization.*

All these topics are in line with the ICARP-3 priorities, particularly #3 (Understanding the Vulnerability and Resilience of Arctic Environments and Societies and Supporting Sustainable Development).

What are major ongoing and upcoming projects within your Working Group's fields? How do these address the ICARP-3 science priorities?

- Arctic social science & humanities research in Poland are not very popular and they are run only in a few institutions (Maria Curie-Skłodowska University in Lublin, Jan Kochanowski University in Kielce, Uniwersytet Wrocławski). All of them have been based on individual interests and projects. Most of them are in the political studies and international relations studies. There are also some research in polar psychology and history of literature devoted to Arctic explorations. Very limited scale of the research means that their importance in context of ICARP-3 priorities is low.

Is there any new / novel research in your country, relevant to your Working Group, being undertaken that broadens / deviates from ICARP-3 priorities? What & why?

- Such research have not been identified.

What are emerging Arctic research issues within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

- Such research issues have not been identified in our community.

What are current gaps in research and/or data within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

- Such issues have not been identified in our community.

What are areas emerging issues concerning international science cooperation (e.g., successes, obstacles, best practice)?

- One of most important issues in this context is a project devoted to social relevance of polar research. Last year there was a [conference in Sopot](#) (supported by IASC), now a special issue of "Oceanology" based on the conference papers is in process of making. There are plans for preparing applications to international financing schemes to develop this topic in form of international project.

IASC Working Group: Terrestrial Working Group

Country: Poland

Names of delegate(s): Piotr Owczarek, Zbigniew Zwoliński

What are your country's current Arctic research priorities (relevant to your Working Group)?

How do these overlap or deviate from the ICARP-3 research priorities?

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- The country's current research correspond to [1] key message of ICARP-3 priority connected with interrelation and linking studies of all elements of the terrestrial landscape system: biosphere, social sphere and the physical spheres (atmosphere, hydrosphere, cryosphere, lithosphere); an important research point is determine the role of chemical and physical processes in glacierized basin on negative feedbacks effects associated with bio-essential nutrient transport.
- The research correspond to [3] key message of ICARP-3 joined with understanding impacts of extreme weather events (rapid climate change) that result in temporary changes in terrestrial environments (landscape, tundra biome, geomorphic processes, soils) and have strong ecological impacts;

What are major ongoing and upcoming projects within your Working Group's fields? How do these address the ICARP-3 science priorities?

- Dendrochronology, dendroclimatology and dendrogeomorphology of Arctic dwarf shrubs as a source of information about past and temporary changes in terrestrial environments (several projects implemented at University of Wroclaw, University of Silesia and Adam Mickiewicz University in Poznan).
- Reconstructions and projections of the present-day hydrological and hydro-climatic conditions of southern and central Spitsbergen and hydrodynamics of the proglacial rivers
- Relationships of permafrost with local relief, geological structure and cryosphere components based on geophysical research
- Control of animals over cryoconite hole ecosystems - effects of bioturbation and food choice.
- The Arctic landscape transformation and geomorphic processes activity under the influence of contemporary climate change,
- Impact of ornithogenic biogens on organisms living in the coastal zone of Arctic islands
- Geomorphic processes activity in the Arctic and their relationship with climate change

Is there any new / novel research in your country, relevant to your Working Group, being undertaken that broadens / deviates from ICARP-3 priorities? What & why?

- Identify and explain the process of formation of new Arctic islands and straits due to glacial recession and its possible impact on the terrestrial environment
- Determination of influence of cycle of bio-essential nutrients (e.g. Fe, P) on cycles of other metals (e.g. Al), which may be harmful for biota. Recent research has shown that there is a strong interplay between these nutrients release and Al concentration in glacierised basin worldwide.

- Identifying and developing research on the impact of extreme climate events on the tundra vegetation

What are emerging Arctic research issues in within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

- Insufficient research infrastructure (associated, for example, with sea transport and the lack of a modern research vessel) and financing (e.g. difficulties in obtaining national and international grants)
- Lack of clear mechanisms to support international exchanges of researchers, e.g. for scientific, educational purposes
- Not sufficient cooperation between scientific units

What are current gaps in research and/or data within your Working Group's fields? How do these relate to the ICARP-3 research priorities?

- Lack of comprehensive and complementary multidisciplinary studies (ecological, cryospheric, atmospheric and hydrological) which can improve understanding of Arctic tundra greening/browning and its interactions with modern climate changes
- There is a gap related to bio-essential micronutrients (e.g. Fe, Mn, Cu, Co) release from the glaciers and their impact on the ecosystem

What are areas emerging issues concerning international science cooperation (e.g., successes, obstacles, best practice)?

- Co-authorship of Svalbard Integrated Arctic Earth Observing System reports targeted on environmental monitoring
- Initiation of collaboration with the National Research Council of Italy focused on the cutting-edge analyses of trace metals in meltwaters with application of High Resolution Inductively Coupled Plasma Mass Spectrometry.
- Multidisciplinary research of modern environmental changes in sub-Arctic areas in agreement and cooperation with native people (e.g. in Nunavik)