Poland's Reports to IASC Working Groups

15 May 2019

IASC Working Group: ATMOSPHERE WORKING GROUP
Country: POLAND
Names of delegate(s): EWA ŁUPIKASZA, ANDRZEJ ARAŹNY

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?
https://icarp.iasc.info/images/articles/downloads/ICARPIII_Final_Report.pdf
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 extend 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)" *(ICARP-3 priority: Understanding extreme weather events that have ecological impact)*.
- Wind conditions over Svalbard in the face of climate change - dynamical downscaling approach.
- 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 ending in 2029) (https://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html).
- Experimental and modelling (CAMS, 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*).

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

- Polar dendroclimatology – dendrochronology has been long considered to be useful in the Polar Regions, however, it has occurred to deliver reliable results.
- 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 and linkages between the climate change in the Arctic and in the Europe and Poland (*ICARP-3 priorities: understanding the impact of Arctic climate change on atmosphere and ocean circulation and connection to global climate system, 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*). 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 CO_2 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, IRENEUSZ SOBOTA
Contributors: Jacek Jania (University of Silesia, Centre for Polar Studies), Krzysztof Migała (Wrocław University), Wiesław Ziaja (Jagiellonian University), Jakub Małecki (Adam Mickiewicz University), Krystyna Kozioł (Gdańsk University of Technology), Bartłomiej Luks (Institute of Geophysics Polish Acadamy of Sciences) and Barbara Barzycka (University of Silesia, Centre for Polar Studies, IASC Fellow).

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?
https://icarp.iasc.info/images/articles/downloads/ICARPIII_Final_Report.pdf
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:

- 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?

- 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.
- Assessment of glacier-permafrost interactions, permafrost thickness and active layer development.
- Interdisciplinary studies on changes of snow properties contributing to evolution of terrestrial, glacial, biogeochemical 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/).

- Studying the secondary cycle of persistent organic pollutants and its changes resulting from climate change, as well as the interactions between microbiological and chemical composition of Arctic cryogenic waters in the context of environmental changes and drinking water quality in the Arctic.

These research topics permeate across various physical spheres (atmosphere, hydrosphere, cryosphere and lithosphere) and also include the human dimension (impact of human activities, usability of water for the people), which feeds the information necessary for understanding the vulnerability and resilience of the Arctic environments. More specificly Poland's major research activities have been summarised in report of the 2nd Arctic Science Ministerial (https://www.arcticscienceministerial.org/files/190402_ASM2_Bericht_V2_bf.pdf)

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

- Studies of the water quality (including water of cryospheric origin) as a part of the problem of water security in the changing Arctic.
- Exchange of knowledge in cryospheric studies and polar/mountain safety between the Arctic researchers and mid-latitudes mountain rescue services (https://www.pkpolar.pl/warsztaty-sniezne-2019/).

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?

- Application of advanced technical solutions in severe polar environments (including ice fields and periglacial areas) also as space analogues in order to testing materials and technical systems (emerging priority of the Strategy for Polish Polar Research). This issue integrates the following ICARP-3 recommendations: development of new technologies to understand the Arctic and the novel exploitation of the harsh Arctic environment as an engineering test site.
- Unification of procedures for measurements and ways to implement the water security to improve the observation quality in the Arctic.
- Studying the state of the cryosphere in the Holocene Climate Optimum as an analogue to the cryosphere evolution under profound recent and future climate changes.
- 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 aiming at a comprehensive understanding of the 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 considerably hinder better understanding of the Arctic coupled physical system and its role in the Global System. To overcome them is among priorities of the ICARP-3. They are as follows:

- 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;
- lack of consistent method of estimation of ice discharge to the Arctic waters and unknown contribution of frontal ablation of glaciers to the total mass balance in Pan-Arctic scale.
- forecasting changes in the chemical and microbiological parameters of water in connection to its sources and the physical properties of various supplies, as well as the practical solutions to accommodate the increasing human pressure in the Arctic (pollution emissions, water supply volume necessary for the increasing population numbers).

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

- 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.
- 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 the standardization of monitoring and observational methods.

IASC Working Group: MARINE WORKING GROUP
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? *https://icarp.iasc.info/images/articles/downloads/ICARPIII_Final_Report.pdf*

Polish oceanographic studies focus mainly, but not restricted, on the Atlantic sector of the Arctic Ocean, Fram Strait, Svalbard, Barents and Nordic Seas. Our work priorities align with ICARP-3 research priorities which include 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, function biogeochemical cycles and contaminants.
Also understanding of Arctic climate processes is the main aim of the current oceanographic and atmospheric studies carried on in the polar region by polish oceanographers. The Institute of Oceanology Polish Academy of Sciences (IOPAN) contributes to this challenge with the strategic research initiative addressing the role of the ocean in changing climate and its effects on the European Seas. Its core activity, the Long-term Monitoring Program AREX, is focused on multidisciplinary observations in areas such as physical oceanography, air-ocean interactions, ocean biogeochemistry and ecology to study the long-term changes of abiotic and biotic Arctic environment. Also hydrography, phytoplankton, zooplankton and benthic monitoring in two Svalbard fjords: Kongsfjorden and Hornsund are among highest priorities.

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 Monitoring Program AREX - every summer since 1987 the large-scale field measurements have been carried out in the Nordic Seas and European Arctic from board of the IOPAN research vessel Oceania. The 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 Institute of Oceanology Polish Academy of Sciences in Sopot.
Multiple programs funded by Polish National Science Centre are on-going with focus on Svalbard fjords, Fram Strait – Hausgarten area and north off Svalbard (e.g. **LARVA** - Linking Annual cycle of Reproduction and recruitment to environmental Variables in Arctic Epifauna, **ABeFun** - Arctic benthos functioning response to climate warming induced changes in warm water advection and food supply, **SeaIceFun** - Benthic fauna functioning in the sea ice zone in the changing Arctic Ocean in spring time; **ecoPlast** - The ecological plasticity of the keystone Arctic zooplankton species, **CoastDark -** Changes in the structure and functioning of pelagic ecosystems affected by water darkening due to glacier/river runoff in the fjords of European Arctic, **CDOM-HEAT** – Source and transformations of Cromophoric Dissolved Organic Matter and its role in surface ocean

heating; **CLIP** - Determination of climate change impact on phytoplankton taxonomy in west Spitsbergen fjords based on pigments in sediments).
Important part of our work focuses on the palaeoceanographic studies (e.g. Holocene history of the Greenland Sea Gyre; Evolution of the Greenland Sea deep Convection since the last glacial; Paleogenetic reconstruction of Atlantic water advection into the Arctic Ocean over the Holocene) and contaminants, including heavy metals, radionuclides and organic contaminants, and microplastic pollution. The **Argo-Poland** project is a polish contribution to the Euro-Argo ERIC European research infrastructure. We deploy 2-3 Argo floats/year in the Arctic – Nordic Seas and Fram Strait region.
International projects including Horizon2020 are now in progress e.g. **Adamant -** Arctic benthic ecosystems under change: the impact of deglaciation and boreal species transportation by macroplastic; **Acces** - Arctic Coasts De-icing Consequences for Marine Ecosystem (Belmont Fund). **INTAROS**: Integrated Arctic Observation System is a Horizon2020 project awarded under EU call for Blue Growth is a part of the EU Arctic Cluster, significantly contributing to the implementation of EU's Arctic Strategy in the current years. IOPAN plays an important role in the INTAROS consortium by leading activities focused on extending and improving the existing in situ observing platforms and networks in the Arctic region.

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

No

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

The emerging issue is to keep monitoring programs funded and continued, as well as increased international efforts in the Arctic Ocean. This will allow for the collection of longer data series necessary for climatic research

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?

The largest difficulties are related to systematic and frequent sampling where employing new technologies and international efforts could be helpful. Sampling over all seasons, mostly in the regions covered by seasonal ice is essential. Putting more focus on the paleo studies is also important.

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

The Euro-Argo ERIC is a good example of international cooperation. Other large international, joined programmes are needed along with access to ice breakers and new technologies. Polar night and deep ocean studies are needed.

IASC Working Group: TERRESTIAL 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 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);
- 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;
- the priorities are described in the document "Strategy for Polish Polar research – a concept for the years 2017-2027", signed by Polish Polar Consortium https://www.pkpolar.pl/eng/strategy/

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, EU H2020 European Commission HORIZON 2020, projects: "Growth-ring record of modern extreme weather phenomena in the Low Arctic (REACT)", "The Importance Of Cryptogams In The Primary Succession Process On Glacier Forelands In Svalbard";
- Arctic terrestrial landscape transformation, including changes in soil environment, in a warming climate;
- Reconstructions and projections of the modern hydrological and hydro-climatic conditions of central and southern Spitsbergen - hydrodynamics of the proglacial rivers;
- Dendrochronology and dendrogeomorphology of Arctic dwarf shrubs as a source of information about temporary changes in terrestrial environments;
- Modern dynamics of periglacial and paraglacial processes (coastal, slope, glaciofluvial, etc.) and their ecological, societal and landscape impacts;

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

- Role of glacier-derived labile nutrients such as Si, Fe, P (dissolved and sediment-bound) in controlling of the biological pump that potentially strengthen the negative feedback effect on the atmospheric CO2;
- Fast modern development of polar dendroclimatology and dendrogeomorphology; Polish researchers belong to the most active group in this field. These research, as a new tool of scientific knowledge, can help to better understand modern impacts of extreme

weather events on terrestrial environment: biotic (tundra greening/browning) and abiotic (eg. activity and intensity of mass movement processes and their possible impact on social sphere);
- Research on the origin and location of new Arctic islands and straits due to glacial recession - linking studies across all spheres: physical spheres (atmosphere, hydrosphere, cryosphere, lithosphere), biosphere and social sphere;
- Better understanding of temporary changes in terrestrial environments based on interdisciplinary and cross-disciplinary studies;

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;

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?

- Improvement of general elaboration of the all research group studying of High-Arctic landscape system transformation under the current climate change;
- Coordinated ecological (e.g. dendrochronological), cryospheric, atmospheric and hydrological monitoring are necessary to improve understanding of Arctic tundra greening/browning and its interactions with modern climate changes;
- Quantitative and qualitative changes in soil environment of the Arctic in a changing climate;

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

- In recent years, there has been a number of successes of international cooperation. Polish Arctic research conducted in the Svalbard are based on one large polar station (Hornsund) and 4 regional field bases operating in the summer period. Currently two of them (Hornsund and Adam Mickiewicz University Polar Station "Petuniabukta") are part of the International Network for Terrestrial Research and Monitoring in the Arctic – INTERACT; Polish researchers participated in international project in Ny Alesud;
- Additionally we have collaborated with variety of international research institutions, e.g. in field of biogeochemistry of nutrients cycling (e.g. University of Bristol, University of Glasgow, University of Oslo and Western Norway University of Applied Sciences, Norwegian University of Science and Technology and Italian universities), in field of ecology and dendrochronology in the Low Arctic (e.g. Université Laval);

IASC Working Group: SOCIAL & HUMAN WORKING GROUP
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 theyare run only in a few insitutions (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 are also some research in polar psychology and history of litarature 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 understaken 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?

- Agnieszka Skorupa, PhD. (University of Silesia) established cooperation with Federal University of Santa Catarina in Brazil in the field of research in polar psychology. She is participating in Brazilian project entitled: Comportamento seguro no trabalho de civis e militares em ambientes polares - Bolsas de Produtividade em Pesquisa - PQ [Safe behavior in civilian and military work in polar environments - Research Productivity Scholarships - PQ - 2019-2022]. The project is financed by: National Council for Scientific

and Technological Development in Brazil. The leader of the project is prof. Roberto Moraes Cruz from Federal University of Santa Catarina. The aim of the research is to compare the factors that influence safe behavior of winterers in Polish Polar Station in Hornsund on Spitsbergen and in Brazilian and Chilean military stations

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.