



IPS-2023

Interdisciplinary Polar Studies
Modular Meeting:
Arctic Amplification-Glaciers-Environment

IPS-2023 REPORT

Interdisciplinary Polar Studies
Modular Meeting in Svalbard:
Arctic Amplification - Glaciers - Environment

30 August – 4 September 2023

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IPS-2023 participants in front of the venue - The University Centre in Svalbard (UNIS). Photo: Piotr Łepkowski

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1. BRIEF

- The IPS-2023 conference was organised by the Centre for Polar Studies, University of Silesia in Katowice, in cooperation with the Institute of Geophysics and Institute of Oceanology, Polish Academy of Sciences, Svalbard Integrated Arctic Earth Observing System (SIOS), University Centre in Svalbard (UNIS), International Arctic Science Committee (IASC), Association of Polar Early Career Scientists (APECS), Polish Polar Consortium and Committee on Polar Research, Polish Academy of Sciences.
- The event was held at the University Centre in Svalbard (UNIS) in Longyearbyen, together with field workshops in Isfjorden and Hornsund Fjord areas on 30 August – 4 September 2023.
- The primary motivation and goal of the IPS-2023 were (1) to strengthen a holistic approach to studies and a better understanding of environmental changes due to the accelerated warming of the Arctic and (2) to prepare the new generation of scientists for creative involvement in the 5th International Polar Year 2022/2033 by active participation in the IASC ICARP IV (2025) process and the ongoing Ocean Decade (2021-2030) programme.
- The event gathered over 60 polar scientists from Canada, the Czech Republic, Denmark, Great Britain, Spain, India, Italy, Norway, Poland, Romania, Sri Lanka, Switzerland and the USA.
- It was one of the meetings to spark creative thinking on interdisciplinary studies and a grasp of the warming Arctic!
- Further information: <https://www.polarknow.us.edu.pl/ips-2022/> and fb: <https://fb.me/e/2ic1fhbo4>



IPS-2023 participants on the Hansbreen, near the Polish Polar Station in Hornsund. Drone photo by Natalia Łatacz



Centre
for Polar
Studies



UNIVERSITY OF SILESIA
IN KATOWICE



Institute of Geophysics
Polish Academy of Sciences



POLISH POLAR
CONSORTIUM



IASC



UNIS
The University Centre in Svalbard



COMMITTEE ON POLAR RESEARCH
POLISH ACADEMY OF SCIENCES



SIOS
SVALBARD INTEGRATED ARCTIC
EARTH-OBSERVING SYSTEM



APECS
Association of Polar
Early Career Scientists

2. FRAMEWORK OF THE IPS-2023 EVENT

2-DAYS OF SCIENTIFIC CONFERENCE

30th August 2023:

- Scientific sessions: **“Amplification of Arctic warming”** (part I-III) with 11 presentations;
- Field security instruction;
- Poster session with 12 presentations.

31th August 2023:

- Scientific sessions: **“Shrinking glaciers and thawing permafrost – Speedup of landscape and seascape changes”** (part I-II) with 9 presentations;
- Scientific session: **“Looking into the future – The IPY 2032-2033 challenge”** with 5 presentations;
- **“Ignite session of discussions on the ICARP IV priority themes”** with moderator, 5 panellists and open discussion.

FIELD WORKSHOPS

- Option 1 **“Hornsund & Isfjorden region”** (1-4th September 2023)
- Option 2 **“Billefjorden & Adventdalen region”** (1st and 2nd September 2023)

The full IPS-2023 programme is available at:

<https://www.polarknow.us.edu.pl/ips2022/IPS-2023-programme-practical-info.pdf>

3. INTERDISCIPLINARY POLAR STUDIES - AN OVERVIEW SUPPORTED BY CONTRIBUTIONS OF PARTICIPANTS

The scientific sessions provided crucial insights into the complex dynamics of the Arctic.

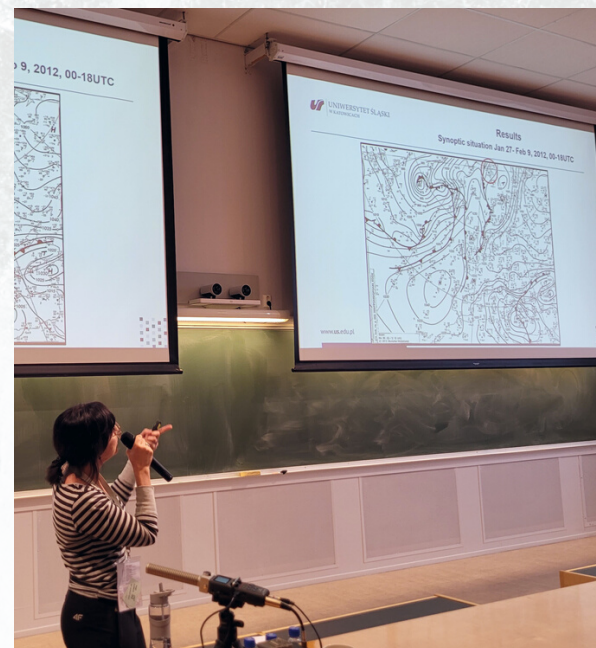
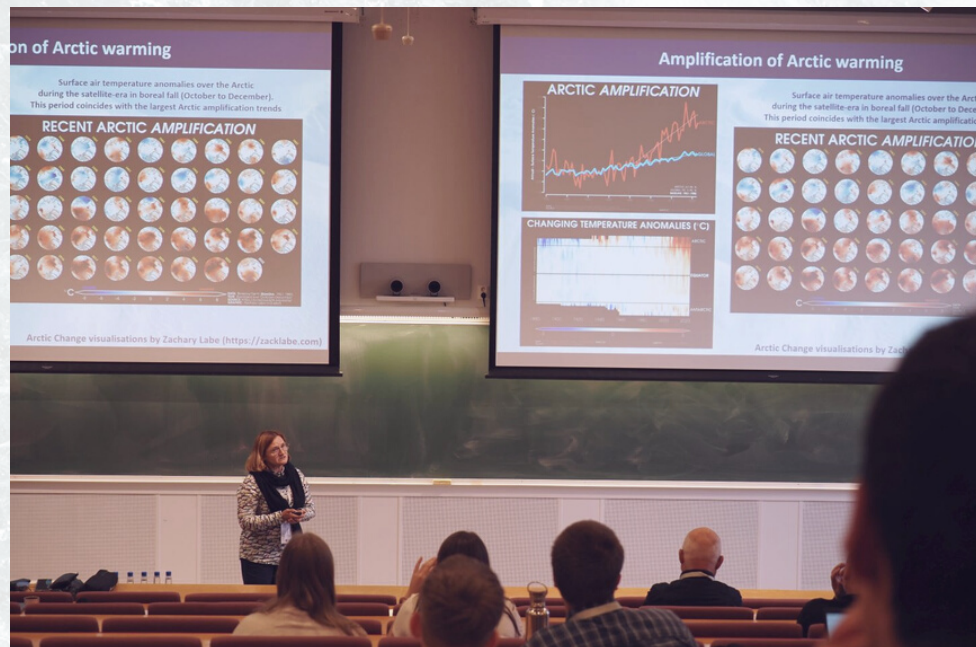
“AMPLIFICATION OF ARCTIC WARMING” SCIENTIFIC SESSION

- The complex interactions and changes occurring in the Arctic Ocean due to temperature anomalies, ocean heat content variations, and their subsequent impacts on sea ice, ocean circulation, and ecosystems (*Agnieszka Beszczyńska-Moeller, Institute of Oceanology, Polish Academy of Sciences, Poland*);
- Potential feedback and impacts of changes in the Arctic Ocean loops show the interconnected and complex nature of the Arctic system, where changes in one component can trigger a series of cascading effects, amplifying the initial perturbation and further impacting the Arctic environment (*Agnieszka Beszczyńska-Moeller, Institute of Oceanology, Polish Academy of Sciences, Poland*);

- Positive salinity anomaly trends in the Norwegian and Greenland seas might be coherent with Atlantification, indicating the increasing influence of Atlantic Ocean characteristics in these regions (*Carolina Gabarró, Institute of Marine Sciences (ICM-CSIC), Spain*);
- The advection of meltwater from sea ice melt and local melting of sea ice plays a crucial role in removing $p\text{CO}_2$ (partial pressure of carbon dioxide) in seawater. This process occurs as seawater begins to uptake atmospheric $p\text{CO}_2$ through the accumulation of meltwater from melt ponds, creating a connection between the atmosphere and the ocean. The onset of sea ice melt leads to lower $p\text{CO}_2$ values in seawater, enabling the uptake of carbon dioxide from the atmosphere (*Josefa Verdugo, Arctic Research Centre, Aarhus University, Denmark*);
- Climate change, leading to increased glacier melting, is expected to create longer near-surface sound channels, causing higher noise pollution in upper water layers and impacting marine mammals' well-being in West Spitsbergen fjords (*Pavani Vithana Madugeta Vidanamestrige, Institute of Oceanology, Polish Academy of Sciences, Poland*);
- In the Arctic region, precipitation patterns are influenced by warming and atmospheric circulation. There's an increase in rainy days and a decrease in snowy days, especially in the southern part, due to warming. Significant changes are observed in September. Mixed precipitation doesn't follow clear trends, varying in different parts of the year (*Ewa Łupikasza, University of Silesia in Katowice, Poland*);
- Evaporation in the Arctic is understudied. In situ measurements show higher rates than literature values (80mm). Current models require calibration for accuracy, especially in sub-zero temperatures, as temperature-based models underestimate and radiation-based models overestimate evaporation (*Nicole Hanselmann, Institute of Geophysics, Polish Academy of Science, Poland*);
- Persistent organic pollutants (POPs) in the Arctic, including emerging contaminants like Per- and Polyfluoroalkyl substances (PFAS), pose significant environmental and health concerns. PFAS contamination from firefighting activities at Arctic airports, such as Svalbard and Ny-Ålesund, has been identified as a major local source, emphasising the need for risk assessment and remediation to prevent further environmental degradation (*Gijsbert D. Breedveld, University Centre in Svalbard (UNIS), Longyearbyen, Norway*);
- Global warming in the Arctic is enabling the invasive alga *Vaucheria* aff. *compacta* to thrive in Svalbard's tidal flat ecosystem. Human travel is aiding its spread. This alga stabilises sediments, protects shorelines, and influences the intertidal system, contributing to the Arctic's greening due to climate change (*Josef Elster, Centre for Polar Ecology, České Budějovice, Czech Republic*);
- Global warming is altering environmental conditions for lichens like *Caloplaca regalis* (Antarctica). They use sugar-based strategies against desiccation. This adaptation reveals their ability to survive in changing conditions, emphasising the importance of understanding these strategies due to climate change (*Aleksandra Andrzejowska, Jagiellonian University in Cracow, Poland*);
- Dendrochronological studies reveal valuable insights into climate sensitivity, biomass production variations, and environmental changes in the Arctic. These studies help understand the complex processes of tundra greening and browning driven by climate change, highlighting the significance of analysing multiple sites and conducting detailed wood anatomical analysis for accurate interpretations (*Mohit Phulara, University of Silesia in Katowice, Poland*);

- The need for further research to understand and quantify various processes in the Svalbard coastal zone, incl. studying weathering and erosion on recently deglaciated rocky coastlines, examining tidal flat systems under intensified sediment supply and reduced sea-ice pressure, describing the stages of coastal evolution in young fjords and bays, monitoring pollution and hazards in coastal settlements and research base areas, and investigating the coastal zone's response to the predicted increase in storm impacts (*Mateusz Strzelecki, The University of Wrocław, Poland*).

Conclusion: The session "**Amplification of Arctic warming**" revealed the interconnected nature of the Arctic system. The discussions underscored the cascading effects of temperature anomalies, ocean heat content variations, and sea ice dynamics on the Arctic environment. Key insights included the potential impacts of changing Arctic Ocean loops, the role of meltwater in carbon dioxide uptake, and the diverse ecological consequences of climate change, from noise pollution affecting marine mammals to the thriving invasive alga *Vaucheria aff. compacta*. The findings emphasized the urgency of further research to comprehensively understand and address the multifaceted challenges arising from climate change in the Arctic.



The first day of the IPS-2023 conference at the University Centre on Svalbard (UNIS). Photos: Piotr Łepkowski, Marta Chmielewska

"SHRINKING GLACIERS AND THAWING PERMAFROST – SPEEDUP OF LANDSCAPE AND SEASCAPE CHANGES"

SCIENTIFIC SESSION

- Global warming is causing substantial changes in Svalbard, leading to increased runoff primarily from glacier melt. This higher runoff impacts fjord circulation, displacing fresh surface water with warmer Atlantic water. These changes affect marine ecosystems, indicating the tangible impact of climate change on Svalbard's hydrology and marine environment (*Jon Ove Hagen, University of Oslo, Norway*);
- The mapping of changing supraglacial hydrology on glaciers is crucial as it enhances our understanding of the complex interrelationship between rising air temperatures, glacier hydrology, dynamics, mass balance, and the potential impact on future sea level rise (*Pénélope Gervais, University of Ottawa, Canada*);
- Glaciers exhibit diverse responses to long-lasting climate changes and demonstrate different behaviours such as threshold-like retreat, rapid retreat after branch disconnection, and regular advances and retreats in response to climate fluctuations and the rapid retreat of tidewater glaciers during warmer Holocene periods, leading to the colonisation of new fjord branches. There is the complexity of glacier evolution in changing climate conditions (*Aleksandra Osika, University of Silesia in Katowice, Poland*);
- The 3D model for marine-terminating glaciers partially reproduces glacier behaviour but doesn't fully match observations, especially at the eastern margin. While adding a 2D fjord model improves results, challenges persist. This indicates ongoing difficulties in glaciological research, highlighting the need for model refinements and improvements (*José M. Muñoz-Hermosilla, Universidad Politécnica de Madrid, Spain*);
- The need to recognize the biogeochemical importance of shale, understand the impact of glacial retreat on nutrients in fjords, acknowledge the changes in groundwater-glacier coupling and sediment redistribution caused by glacial retreat, and recognize the underestimation of geogenic methane out-gassing. These points emphasise the gaps in current knowledge and the importance of studying these aspects for a comprehensive understanding of Earth's systems (*Andy Hodson, University Centre in Svalbard (UNIS), Longyearbyen, Norway*);
- The identification of spatial variability in ground surface temperature (GST) across scales and permafrost detection based on models contributing to a better understanding of permafrost dynamics (*Raul-David Raul-David, Institute for Alpine Environment, Eurac Research, Italy*);
- The effectiveness of drone-based remote sensing in efficiently assessing soil wetness over large Arctic regions, aiding hydrological cycle modelling amid warming conditions (*Abhishek Bamby Alphonse, Institute of Geophysics, Polish Academy of Sciences, Poland*);
- The High Arctic is experiencing advanced environmental-landscape transformation due to faster deglaciation rates, which impact local climate and sea currents and significant changes in regional ecosystems and biodiversity (*Wiesław Ziąja, Jagiellonian University in Cracow, Poland*);
- Studying glacier microbiomes in naled ice bodies during the accumulation season reveals diverse and site-specific microbial communities. Additionally, understanding the influence of local rock chemical composition on water properties is crucial for assessing water quality, ecosystem health, and the broader environmental impact of glaciers (*Sławomir Sułowicz, University of Silesia in Katowice, Poland*).

Conclusion: The session "*Shrinking glaciers and thawing permafrost*" provided comprehensive insights into the profound impacts of global warming on Svalbard's environmental dynamics. The session highlighted the intricate relationships between glacier melt, atmosphere circulation, and marine ecosystems, emphasizing the urgent need for understanding and addressing climate-induced changes. The discussions underscored the challenges in modeling glacier behavior, the importance of recognizing biogeochemical processes, and the advanced environmental transformations in the High Arctic, calling for continued research to enhance our comprehension of Earth's systems in the face of ongoing climate change.

"LOOKING INTO THE FUTURE – THE IPY 2032-2033 CHALLENGE" SCIENTIFIC SESSION

- Marine-terminating glaciers in the Northern Hemisphere, critical for potential sea level rise, have retreated significantly since 2000, primarily due to ice shelf loss. This highlights their sensitivity to climate change and emphasises the importance of international collaborations across disciplines to advance scientific understanding (*Will Kochtitzky, University of New England, USA*);
- Melting glaciers are identified as the source of heavy metal contaminants in the Arctic fjord; heavy metal concentrations in sediments exceed natural background levels, but due to significant dilution in suspended particles, these pollutants do not pose a significant threat to the fjord ecosystem (*Agata Zaborska, Institute of Oceanology, Polish Academy of Sciences, Poland*);
- Atmospheric research in Svalbard is focused on long-term monitoring programs to understand the interplay between atmospheric impurities, climate-induced changes, and their impacts on the Arctic environment (*Paulina Pakszys, Institute of Oceanology, Polish Academy of Sciences, Poland*);
- Understanding the polar environment is vital for space science. The remoteness and harsh Arctic conditions provide an equivalent for extraterrestrial habitats (*Agata Kołodziejczyk, Space Technology Centre, AGH University of Science and Technology, Poland*);
- Environmental changes related to ongoing climate warming pose a risk to Arctic communities, including infrastructure, energy systems and research stations. Therefore, we need to implement long-term adaptation plans bearing in mind the current threats and predictions for the future, such as sea-level rise, permafrost degradation or extreme meteorological events (*Olga Czeranowska-Panufnik, Warsaw University of Technology, Poland*).



Enriching scientific sessions with the knowledge and experience of keynote speakers. A glimpse at Andy Hodson and Jon Ove Hagen. Photos: Piotr Łepkowski

Conclusion: The session **"Looking into the future – The IPY 2032-2033 challenge"** highlighted the vulnerability of marine-terminating glaciers to climate change, emphasizing the need for international collaboration to advance our understanding of these critical components for potential sea level rise. The session also addressed environmental concerns, such as heavy metal contamination from melting glaciers, emphasizing the importance of monitoring programs in Svalbard to comprehend the interplay between atmospheric impurities and climate-induced changes. Furthermore, the discussions underscored the significance of understanding the polar environment for space science and the urgency of implementing long-term adaptation plans to mitigate risks posed to Arctic communities by ongoing climate warming.

POSTER SESSION

- Combine a subglacial-hydrology model, surface melting data, and observations to identify subglacial channels influencing glacier dynamics can improve understanding regarding actual meltwater production and its subglacial distribution (*Eva De Andrés, Institute of Marine Sciences (ICM-CSIC), Spain*);
- Methodologies development connecting physical parameters of human bodies to mental health or easily accessible personal vitamin D measurement in Arctic and isolated environments, using modern technical solutions e.g. mobile app (*Lidia Dyląg & Marta Gajewska & Mateusz Koba, AGH University of Science and Technology, Poland*);
- Identification of the retreat of the ice front as a key factor influencing the Greenland Ice Sheet's dynamic variability and mass loss, with accelerated changes observed from the late 20th century onward (*Eigil Lippert, Technical University of Denmark, Denmark*);
- Using satellite and airborne remote sensing data for estimating the geodetic mass balance of glaciers (case study on Hansbreen) highlights ice mass loss rates and emphasizes the crucial role of frontal ablation as a significant factor contributing to the deglaciation of Svalbard (*Natalia Łatacz, University of Silesia in Katowice, Poland*);
- The accelerated ice-mass loss from the Greenland Ice Sheet, confirmed by examining surface-velocity patterns and the role of surface meltwater, enhances our understanding of how glaciers respond to changing conditions (*Kuba Oniszk, University of Cambridge, UK*);
- Radiocarbon and cosmogenic nuclide dating are effective methods for reconstructing glacier dynamics in the past. During the Holocene, glaciers in Hornsund have been fluctuating synchronically with the rest of Svalbard. However, the uniqueness of Hornsund is connected with switching between a fjord and a strait depending on the dynamics of the Hornbreen-Hambergreen glacier system (*Aleksandra Osika, University of Silesia in Katowice, Poland*);
- The barrier-lagoon systems are one of the most sensitive coastal environments to climate change and associated sea-level fluctuations. Their formation is associated with ongoing retreat of tidewater glaciers. Although widespread in Svalbard, there is a need for thorough investigations into their development and evolution under subsequent coastal processes (*Zofia Owczarek, University of Wrocław, Poland*);
- The observed discrepancies between different surface mass balance models is often related to inaccurate simulations of albedo, which determined the amount of shortwave radiation absorbed by the surface of the ice sheet. New studies on albedo parameterization are vital for the assessments of the ice sheet's contribution to global sea-level rise (*Maxim Shapovalov, University of Oregon, USA*);
- Assessing the capability of surface quasi-geostrophic (SQG) approach to reconstruct the three-dimensional (3D) dynamics in the Fram Strait in 2010-2020. A temporal analysis of the upper ocean currents from satellite data allows monitoring changes in the North Atlantic current at a high temporal resolution and evaluate their potential impacts on Svalbard glaciers (*Marta Umbert, Institute of Marine Sciences (ICM-CSIC), Spain*);

The book of abstracts is available at:

<https://zenodo.org/records/8159108>

4. EMERGING ISSUES OF SCIENTIFIC COOPERATION PLANS BASED ON THE PANEL DISCUSSION "IGNITE SESSION OF DISCUSSIONS ON THE ICARP IV PRIORITY THEMES"

The panel discussions during the IPS-2023 event provided valuable insights into the priorities and challenges of Arctic research, culminating in several key takeaways:

ICARP IV Process and Arctic Research Priorities (Renuke Badhe, Executive Secretary of the European Polar Board (EPB)):

- The ICARP IV Priority Themes sessions highlighted the importance of collaborative prioritisation in shaping Arctic research strategy.
- Engagement of the Arctic research community and iterative refinement are fundamental to ensure the strategy's responsiveness to emerging challenges and opportunities.
- Collaboration involving traditional knowledge, indigenous knowledge, and academic knowledge is crucial for the success of the ICARP process.
- The inclusion of various stakeholders, e.g. policymakers, local communities, and the private sector, is essential for comprehensive research efforts.
- The lessons learned from previous ICARP processes have been considered in planning ICARP IV, ensuring continuity.
- Environmental impact concerns were addressed, emphasising the importance of survey participation.

Knowledge Gaps in Arctic Research (Heikki Lihavainen, Director of the Svalbard Integrated Arctic Earth Observing System (SIOS)):

- Identifying and prioritising research topics in the Arctic requires interdisciplinary collaboration.
- Challenges related to the current political situation in the Arctic were acknowledged, making collaboration more difficult.
- International collaboration, secure satellite observation networks, and data harmonisation are vital for addressing knowledge gaps.
- Cross-cutting, interdisciplinary teams and holistic approaches are needed to understand Arctic and global change.
- Searching for mitigation and adaptation strategies, including geoengineering, is essential.
- Community feedback plays a crucial role in gaining comprehensive insights.

Suggestions for Pivotal Directions of Study in the Main Arctic Research Areas (Agnieszka Beszczynska-Moeller, physical oceanographer with extensive understanding of climate and member of the SAON - Sustaining Arctic Observing Networks):

- Arctic research is increasingly interdisciplinary, focusing on feedback mechanisms within the Arctic system to understand climate change impacts.
- Prioritising research directions is challenging but necessary to unify diverse research efforts.
- Community involvement and the inclusion of traditional knowledge are critical.
- Open data principles, digital initiatives, and a focus on resilience and tipping points are highlighted.
- Long-term observations, interdisciplinary approaches, and local/regional variability are significant.
- The concept of "digital twins" is an emerging direction and the voice of Arctic communities is integral to research decisions.

Challenges and Responsibilities for Young Researchers (Aleksandra Osika, PhD student, representative of ECRs):

- Young researchers face challenges during the early career phase, including extended fieldwork and uncertainties about employment opportunities.
- Environmental impact concerns exist, emphasising the need for sustainable research practices.
- Polar research significantly contributes to our understanding of global climate change and its broader implications.
- Collaboration between scientists and industry is essential to address climate change effects in the Arctic.
- The focus should shift toward practical solutions that benefit indigenous communities in the Arctic.
- Citizen science, involving indigenous communities, plays a valuable role in data collection.

THE AUDIENCE'S INPUT TO THE DISCUSSION

- **Challenges Faced by Young Researchers in Polar Sciences:** The audience raised a question about how young researchers can navigate the challenges of their early career phase in polar sciences. The response acknowledged the difficulties faced by young researchers, including extended fieldwork and uncertainties about employment opportunities. This challenge was not unique to a specific country but was recognized as a shared experience in various countries.
- **Challenges of Long-term Observations:** The audience questioned the key challenges of conducting long-term observations in polar research. The response highlighted the unique challenges of extended observations over 3-4 years and the uncertainty surrounding employment opportunities once research projects conclude.
- **Importance of International Collaboration:** The audience expressed interest in understanding the importance of international collaboration in polar research. The response emphasised that collaborative efforts are crucial due to the global significance of polar regions in climate change, with polar research contributing to a better understanding of Arctic processes.
- **Addressing Environmental Concerns:** Concerns about the environmental impact of polar research were raised by the audience. Scientists acknowledged these concerns and mentioned efforts to reduce carbon footprints, such as using trains for shorter-distance travel and remote sensing technologies.
- **Motivation for Polar Research:** The audience inquired about the motivations for conducting research in polar regions despite environmental concerns. Scientists emphasised the importance of polar research in addressing global challenges, building a base of knowledge, and contributing to societal security.
- **Justification of Environmental Footprint:** Scientists argued that the environmental footprint of polar research is justified by its essential role in understanding global processes and addressing societal challenges.
- **Initiatives to Reduce Environmental Impact:** Measures taken by universities and organisations to reduce the environmental impact of polar research were highlighted, including setting standards for reduced air travel and using technology for remote data collection.
- **Role of Young Researchers in Addressing Environmental Issues:** The audience sought information on how young researchers can contribute to addressing environmental issues in the Arctic through collaboration with industry. The response suggested that young researchers could bridge the gap between science and industry by developing innovative solutions, such as renewable energy technologies.
- **Citizen Science in Polar Research:** The importance of citizen science, especially involving indigenous communities, in collecting data for polar research was discussed. Engaging communities in data collection was seen as a valuable approach to bridge data gaps and gain insights into Arctic changes.

Conclusion: The audience's input during the discussion addressed a wide range of topics, including the challenges faced by young researchers, the significance of international collaboration, efforts to minimise the environmental impact of polar research, and the value of citizen science. The responses provided insights into the complex landscape of polar research and its broader implications for understanding and addressing environmental issues in the Arctic.

In summary, the discussions emphasised the need for interdisciplinary collaboration, sustainability, and community involvement in the context of ongoing environmental changes in the Arctic. These conclusions reflect the overarching themes of the event, which underscore the importance of addressing knowledge gaps and environmental concerns, fostering international collaboration, and considering the needs and perspectives of Arctic communities. These insights will guide future research and policy initiatives in the field of Arctic science.



Igniting the future of scientific collaboration – vibrant discussions during the ICARP IV Priority Themes session. Photos: Piotr Łepkowski, Marta Chmielewska

5. OUTCOMES OF FIELD WORKSHOPS

The main workshop during the IPS-2023 was conducted in Hornsund and Isfjorden regions on 1-4th September 2023. The participants of the workshop had the opportunity to visit the Polish Polar Station together with monitoring infrastructure and the nearby glacier, Hansbreen. The scientific cruise provided insight into glacier fluctuations in 1872-2023 and oceanological monitoring in Hornsund. The last part of the workshop was a visit at the Petuniabukta Polar Station led by the Adam Mickiewicz University in Poznan and the nearby area at the head of Petuniabukta. The final programme of the workshop included following sites and discussion themes:

1. The cultural heritage of Svalbard – what we know, what we do not know and why it matters. Historical records of the first expeditions to Svalbard.
2. Glaciological investigations of Hansbreen. Changes in the glacier system in 1872-2023. Geomorphology of the terrestrial forefield and implications for the glacier dynamics in the past.
3. Polish Polar Station Hornsund and environmental monitoring in south Spitsbergen. Maintenance of the station and research infrastructure.
4. Research cruise to the inner part of the fjord. Hornbreen-Hambergbreen glacier system in 1900-2023. Fluctuations of Burgerbukta glaciers since the Little Ice Age.
5. Oceanological monitoring in Hornsund.
6. Research programs based on the Adam Mickiewicz University Polar Station in Petuniabukta. Monitoring of land-terminating glaciers. Raised marine terraces as a source of data on glacio-isostatic rebound.

The alternative field workshops were organised in Billefjorden and Adventdalen regions (central Spitsbergen) on September 1st and 2nd. Participants visited the Adam Mickiewicz University Polar Station in Petuniabukta. On September 2nd, the participants took part in the field trip to Nordenskiöldtoppen Mountain and had the opportunity to learn more about the nearby glaciers and surrounding environment.



IPS-2023 field workshop in Hornsund Fjord on board of r/v Horyzont II. Photos: Piotr Łepkowski, Natalia Łatacz



Photos: Piotr Łepkowski, Natalia Łatacz





6. CONCLUSION

In summary, climate change, particularly in the Arctic, is driving significant environmental changes and human life conditions. These changes impact various aspects of the region, including glaciers, marine ecosystems, atmospheric impurities, hydrology and biodiversity. The conference findings emphasise the complexity of these interactions and highlight the importance of interdisciplinary research, international collaboration, and long-term adaptation planning to address the challenges posed by ongoing climate warming in the Arctic.

The discussions from ICARP IV Ignite Session and panel discussions underscore the significance of interdisciplinary collaboration, sustainability, and community involvement in the context of ongoing environmental changes in the Arctic. These conclusions reflect the overarching themes of the events, emphasising the importance of addressing knowledge gaps, and environmental concerns, fostering international collaboration, and considering the needs and perspectives of Arctic communities. These insights will guide future research and policy initiatives in the field of Arctic science.

These conclusions encapsulate the essence of the discussions and provide valuable insights that can be incorporated into the official ICARP IV report.

IPS-2023 showed the enthusiasm of young researchers in adopting a multifaceted and holistic approach to studying the rapidly changing Arctic environment and their eagerness to engage in the ICARP IV process and contribute to shaping the 5th IPY program!

The full IPS-2023 programme is available at:

<https://www.polarknow.us.edu.pl/ips2022/IPS-2023-programme-practical-info.pdf>

The book of abstracts is available at:

<https://zenodo.org/records/8159108>

Video-relation of the IPS-2023:

<https://youtu.be/BGmw3aiWLSY>

Photo gallery of the IPS-2023:

<https://www.polarknow.us.edu.pl/ips-2023-conference-and-field-workshops-photo-gallery/>