

Enhancing Environmental Forecasting in the Polar Regions: A Look into the New WMO WWRP Polar Coupled Analysis and Prediction for Services (PCAPS) Project

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ABSTRACT: The 5-yr (2024–28) World Meteorological Organization (WMO) World Weather Research Programme (WWRP) Polar Coupled Analysis and Prediction for Services (PCAPS) project aims to accelerate research on environmental forecasting and services in the Arctic and Antarctic regions. As climate change intensifies, rapid transformations in the polar regions have complex impacts on local and global socioecological systems, exacerbating existing challenges for residents and operators. PCAPS focuses on enhancing forecast actionability, impact, and fidelity through a multifaceted approach of user engagement, model and service improvements, and impact studies. Key outcomes will include support for improved predictions of small-scale processes, enhanced understanding of observing systems and the utility of artificial intelligence/machine learning (AI/ML) applications, contributions toward the development of a tiered surface observing network, and strengthened cooperation between users, operational centers, and researchers. PCAPS explores approaches to improve forecasts for sea ice, surface wind, visibility, and other key variables, which are essential for developing salient forecasting services that can enhance operational and environmental safety in extreme polar environments. Through collaborations between social and physical scientists, PCAPS also assesses decision-making, risk perceptions, and interactions between forecasters, service providers, and users, including Indigenous communities, and considers political, legal, and economic implications of information delivery. PCAPS is expected to inform WMO’s contribution to the fifth International Polar Year (2032–33), support WMO Strategic Objectives, and build upon previous initiatives such as the Polar Prediction Project.

SIGNIFICANCE STATEMENT: The purpose of the research is to further explore the opportunities and challenges to improve the accuracy, reliability, and usefulness of environmental forecasting services and products in the polar regions using a collaboration between social and physical researchers, operational centers, and users of these polar services.

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1. Introduction: Challenges and opportunities in polar environmental forecasting

Providing and using environmental forecasts for the polar regions continues to challenge major prediction centers and users. This remains true even with recent advances in remote sensing technology, computing, and communication systems. The challenges arise from the remoteness and harshness of the regions and associated operational and environmental risks; the relative sparsity of population; lack of competent human operators to assist in providing observations and to support observation systems; the demand for tailored services that support human activities that are fundamentally different from those undertaken in many other parts of the world (e.g., hunting on sea ice; shipping in ice-strewn waters); and for the Antarctic, the lack of observations, especially over the austral winter, as well as the size and topographical complexity of the continent and variabilities in the surrounding sea ice. Although the Antarctic and Arctic differ fundamentally in their physical settings and cultural and governance systems, both regions depend on environmental services to support safe, efficient, and effective operations. Delivering such services requires accounting for diverse physical processes alongside varying social, political, and cultural contexts that shape risks and user needs.

The forecast elements required by polar users typically relate to local conditions such as surface wind speed, visibility, sea ice thickness and extent, precipitation type and amount, and low-level cloud cover. These elements are highly variable in space and time and are often not explicitly resolved in prediction systems. Instead, they are represented through parameterizations or derived from coarser-scale model output. As a result, forecast information at the local scale often does not adequately capture conditions experienced by users, increasing uncertainty and risk in operational decision-making in polar environments.

In the late 2000s, only a limited number of polar environmental prediction services were available, often focused on specific regions or national programs, and far fewer in scope and maturity than those supporting the midlatitudes. While some dedicated systems existed, for example, over parts of Antarctica, environmental forecasting models generally struggled to provide accurate and reliable information across the Arctic and Antarctic. At the time, the rapid decline in Arctic sea ice cover and thickness was just beginning to capture scientific attention, but the tools to understand or predict these changes were rudimentary at best. Accurate weather and climate predictions in polar regions were considered nearly impossible, leaving communities, industries, and policymakers ill-prepared for the impacts of a changing climate.

Yet, within a few decades, the landscape of polar prediction has been significantly changed. The publication of the final synthesis paper from the Year of Polar Prediction (YOPP) (Jung et al. 2025) documents the breakthroughs made possible by the World Meteorological Organization (WMO) World Weather Research Programme (WWRP) 10-yr Polar Prediction Project (PPP), which ran from 2013 to 2022. Through PPP and its flagship YOPP activities, substantial advances were achieved in environmental prediction and services for these remote and sensitive regions. However, as noted by a wide range of YOPP researchers (Heinrich et al. 2024; Wilson et al. 2023; Mariani et al. 2024; Day et al. 2024; Bromwich et al. 2024; Jung et al. 2025), important challenges remained at the conclusion of PPP. Building on this legacy, the Polar Coupled Analysis and Prediction for Services (PCAPS) project was initiated in 2024 to continue and extend PPP efforts. In this paper, we present the PCAPS project, its ambitions, framework, and the value it offers to both the polar and global communities.

2. What is PCAPS?

PCAPS is the lead polar research project for WMO WWRP for the period 2024–28. Noting the fifth International Polar Year (IPY-5, 2032–33) will take place beyond the official timeline of PCAPS, the project will continue to engage in the planning of IPY-5 until it ceases. WWRP may request that the WMO Executive Council in 2027 approve polar-related research that builds upon and extends the research currently being undertaken by PCAPS into the next WWRP Implementation Plan, which will cover the period 2028–31.

In PCAPS, the term coupled is used broadly to describe Earth system prediction approaches that explicitly represent interactions among atmospheric, oceanic, sea ice, and land components, encompassing both weakly and strongly coupled data assimilation strategies as well as coupled modeling frameworks. The PCAPS project is shaped by the United Nations Sustainable Development Goals (SDGs; <https://www.un.org/sustainabledevelopment/>), the Sendai Framework for Disaster Risk Reduction (<https://www.undrr.org/media/16176/download>), the WMO Strategic Plan for 2024–27 (WMO 2023a) and its related priority areas, the accompanying WWRP Implementation Plan for 2024–28 (WMO 2023b), the call for Early Warning and Early Action for All by the United Nations Secretary-General (WMO 2022), and, ultimately, the rapidly changing conditions in the polar regions. Building on the outcomes from the decadal PPP (Jung et al. 2025), PCAPS differs from the PPP by its much stronger focus on research directed toward improving services through a dedicated collaboration between the physical and social sciences.

PCAPS aims to support informed risk assessment and decision-making by enhancing weather, water, ice, and climate (WWIC) services. These enhanced services are expected to support long-term resilience for polar ecosystems and communities which have been called for in the academic literature (e.g., Heinrich and Norris 2024; Heinrich et al. 2024; Lamers et al. 2024). PCAPS engagement with polar stakeholders takes a collaborative and mixed-methods approach in (i) open sessions that involve stakeholders in focus–group style interactions focused on specific questions, phenomena, or forecasting applications; (ii) conference sessions and online seminars with dedicated plenary discussions and question-and-answer sessions; and (iii) community projects, surveys, interviews, and workshops to better understand user needs, value, and the utilization of environmental forecasting services. Through collaboration with diverse stakeholders, innovative observation methods, and a focus on societal impacts, PCAPS is supporting a more inclusive and sustainable approach to polar research and services.

3. PCAPS: Toward more actionable forecasts for human and environmental well-being in the polar regions

The main goal of PCAPS is to improve the actionability, impact, and fidelity of environmental forecasting for human and environmental well-being in the Arctic and Antarctic regions.

Drawing on recommendations and a gap analysis undertaken during the PPP (Wilson et al. 2023; Heinrich et al. 2024; Lamers et al. 2024), the following four high-level research questions underpin the work undertaken in PCAPS.

- How can we ensure that advancements in environmental forecasts are actionable via collaboration across the social and physical sciences, as well as user and service communities?
- To what extent are enhanced services contributing to safe, sustainable, and equitable outcomes for the various user communities?
- How can forecasting services be enhanced through coupled data assimilation?
- How can observations be more effectively used to improve coupled models and better describe changing climatic conditions?

To address these research questions, the PCAPS project will undertake a comprehensive set of activities that are aligned with five primary objectives to enable the effective tracking of progress toward achieving both the project’s goals and its ultimate outcomes (see Fig. 1). Namely, these objectives are

- **Predict:** Provide more accurate and reliable analyses and predictions.
- **Services:** Enhance environmental forecasting services.
- **Sustainability:** Enable informed decision-making to enhance human safety and reduce risks to polar environments.
- **Partnerships:** Strengthen partnerships through transdisciplinary coordination and cooperation.
- **Inclusivity:** Facilitate inclusivity and capacity development such that a wide range of actors can participate in and benefit from PCAPS.

These primary objectives represent efforts that apply across different temporal and spatial scales, are set in the context of climate change, and meet the evolving needs and capabilities of users and producers. Achieving these objectives will require integrated and transdisciplinary engagement within and across the physical sciences, social sciences, and user communities. As highlighted in Fig. 1, the individual PCAPS objectives are connected with the overarching PCAPS goal, with services addressing actionability, sustainability driving impact, and predict maintaining and enhancing fidelity. In addition, two further objectives—partnerships and inclusivity—have been explicitly named as integrative and fundamental success components for PCAPS which guide the implementation of the first three objectives. Further details on the objectives are provided below.

a. Services. Services focuses on enhancing the use, adoption, and evolution of environmental services and promotes the tailoring of actionable environmental services to meet the requirements of diverse users and decision-makers. The objective builds on the potential of



FIG. 1. Overview of PCAPS’ key objectives in relation to the project’s overall goals.

engaging a variety of user groups in assessments of environmental forecasting services and recognizes the differing needs of users across various parameters and spatial and temporal scales. Interdisciplinary work on this objective is led by social scientists—sociologists, human geographers, and psychological scientists—who use mixed-method approaches, collecting qualitative and quantitative data, to identify common gaps, challenges, and good practices within the research–operations–services value cycle and enhance awareness, knowledge, and usability of current and new products, decision-support tools, and services to users and researchers alike. Hereby, the objective also ensures that PCAPS contributes to the systematic examination of the societal value (Findlater et al. 2021) and impacts of transitioning toward accessible, inclusive, and tailored services, while evaluating the socioeconomic benefits of utilizing environmental prediction information in polar regions.

b. Sustainability. Sustainability emphasizes informed decision-making to enhance human safety and mitigate environmental risk. The associated research within this objective will involve identifying institutional and regulatory barriers and drivers, such as the International Maritime Organization’s (IMO) International Polar Code for Ships Operating in Polar Waters (Polar Code, <https://www.imo.org/en/ourwork/safety/pages/polar-code.aspx>), insurance policies, and SDGs, and examining their implications for the development, delivery, and use of enhanced WWIC services in polar regions. This objective, which employs methods and approaches typically taken in decision science, social psychology, environmental economics, and human geography, also facilitates an exploration of innovative approaches for environmentally friendly, sustained, and targeted observations, including technologies such as community-based monitoring, citizen science, and vessels of opportunity. Additionally, PCAPS assesses the intended and unintended consequences of enhanced environmental services, including increased human activity, environmental impacts, and the sociocultural–behavioral underpinnings of these changes.

c. Predict. Predict aims to provide more accurate and reliable analyses and predictions. This includes advocating for an enhanced observing system, particularly addressing gaps in lower troposphere and surface observations in polar regions, and further improving the use of satellite data for initialization and validation of forecast models. PCAPS works to advance coupled atmosphere, cryosphere, and ocean Earth system models through coordinated community activities, including intercomparison studies, synthesis of results from nationally and internationally funded projects, and targeted workshops, to better represent critical polar phenomena, such as storms, boundary layers, clouds, and sea ice parameters. The project also focuses on improving prediction accuracy and robustness for critical parameters, such as sea ice, surface winds, and visibility forecasts, to better fulfill user needs. Efforts include coordinated predictability studies, the synthesis and assessment of verification results from operational centers, and the promotion of targeted evaluation activities to identify and address model weaknesses.

d. Partnerships. Partnerships seeks to strengthen transdisciplinary coordination and collaboration and expand the community addressing the PCAPS goals. This work involves identifying and selecting partners for collaborative projects to achieve the predict and services objectives and build capabilities. These projects target specific challenges or innovations, such as improving the interpretability of forecasting services or exploring the use of artificial intelligence and machine learning in the value chain. PCAPS is documenting and promoting transferable good practices and services while facilitating improved communication among stakeholders (see further detail in section 5), including academia, operational centers, and users, through updates, newsletters, and dedicated online platforms. The project emphasizes

transforming the environmental services workflow from research to operational services to decision-makers by incorporating good practices.

e. Inclusivity. Inclusivity focuses on facilitating inclusivity and capacity development. All activities related to predict, services, sustainability, and partnerships incorporate inclusivity and capacity development principles across stakeholders, including researchers, users, and providers of polar services. PCAPS explores values and processes for informed decision-making using WWIC services, with a focus on safety, risk management, empowerment, equity, and socioeconomics. The project prioritizes opportunities for involvement, training, and the contributions of underrepresented groups while providing interdisciplinary training, networking, and professional development for early career professionals and user groups. Additionally, PCAPS emphasizes the importance of sharing, learning, and respecting diverse knowledge systems, practices, disciplines, and terminologies. Capacity enhancement and training are viewed as reciprocal processes, fostering mutual benefit among stakeholders.

4. Project structure: Enabling progress toward the PCAPS objectives

Work within PCAPS will be facilitated and overseen by a multidisciplinary, geographically and culturally diverse Steering Group of 14 members, led by two cochairs, one from the natural sciences and the other from social sciences. Members of the Steering Group are involved in, and lead, Task Teams. The PCAPS Steering Group specifically emphasizes integrated disciplinary discussions and collaboration, which also translate into how the different Task Teams are organized. The Steering Group leads and coordinates the overall project.

PCAPS Task Teams are the mechanism through which the wider scientific community can contribute to achieving the PCAPS objectives. The seven Task Teams (<https://www.wwrp-pcaps.net/what-we-do#task-teams>) are typically led by at least one of the Steering Group members and are composed of social and natural scientists volunteering their time with contributions scaled to what is realistic alongside existing work commitments. In most cases, the Task Teams will undertake their work through the coordination and extension of existing activities from different institutions rather than obtaining funding to pursue specific research objectives. Task Teams are focused and time-limited. Participation is based on active engagement and knowledge sharing. Each Task Team has a different purpose and is scoped to ensure alignment with one or more of the high-level objectives detailed above. The Task Teams report to the PCAPS Steering Group (PCAPS-SG).

PCAPS has an International Coordination Office, hosted by the Norwegian Meteorological Institute, that handles a diverse set of responsibilities aimed at ensuring effective project management, collaboration, communication, outreach, and operational efficiency throughout the project.

Participation in PCAPS. The Steering Group is responsible for encouraging individuals, research groups, and, in some instances, funding bodies to contribute to or undertake the activities required to complete the project. While this approach is atypical in the wider scientific community, it has been the common approach within the WMO realm for many years and has resulted in many successful projects such as Alertness (<https://www.alertness.no/>) and the EU-APPLICATE projects (<https://applycate-h2020.eu/>).

The benefits for individuals and organizations contributing to WMO activities arise from the international networks and research communities created through work on common issues. These benefits include the sharing and use of community tools and approaches developed during the activities, opportunities to take on wider international roles in project development, participation in PCAPS-related studies and publications, and the

ability to contribute to the recommendations for WMO-related standards in service development and delivery.

WWRP offers a process through which individuals or research groups already undertaking work relevant to PCAPS or the other WWRP projects may seek endorsement. Endorsement may be granted to existing activities or to projects proposed for funding through non-WMO sources and is awarded through a formal review led by the WWRP Scientific Steering Committee. Decisions are based on clearly defined criteria, including alignment with WWRP objectives, coordination with ongoing WWRP activities, and commitments to data sharing, communication, and reporting.

Developing and maintaining an active PCAPS Endorsed Project Community is a key enabling mechanism for PCAPS (see <https://www.wwrp-pcaps.net/about-pcaps/#endorsedprojects> for more details). It provides a practical means to connect nationally and internationally funded activities to PCAPS priorities, foster two-way exchange with PCAPS Task Teams, and help identify both areas of strength and remaining gaps across the polar prediction research–operations–services value cycle (Fig. 2). Engagement is intended to be flexible and proportional, recognizing that principal investigators contribute primarily through alignment, information exchange, and selective participation rather than unfunded operational tasks.

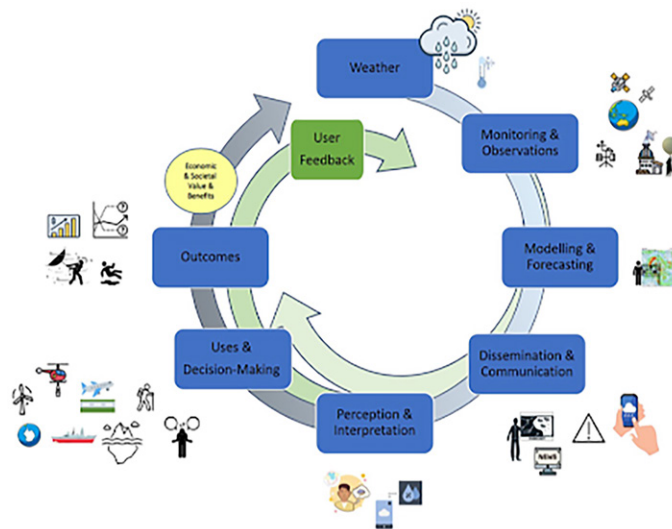


FIG. 2. The environmental forecasting value cycle framework used in the Open Session breakout sessions [adapted from Haupt et al. (2018); see also Jeuring et al. (2025)].

5. What PCAPS offers in the polar context

a. Creating a close-knit community across the entire environmental forecasting value cycle in the polar regions. As depicted in the value cycle diagram in Fig. 2, there are potentially many stakeholders in PCAPS. Some of these stakeholders engage in the implementation of PCAPS by directly contributing to the development and implementation of project activities. Other stakeholders may be less directly engaged in carrying out the project activities but support and interact with PCAPS in other ways, e.g., by contributing to community surveys, engaging in workshops, or participating in the annual open focus-group sessions and breakout-group discussions. Through these mechanisms, stakeholders will not only be kept informed of our activities but will be invited to offer essential input into service design features and their usability. These stakeholders are also considered partners as much as they are likely to be beneficiaries.

The PCAPS stakeholders can be grouped into the following communities, noting that these are not mutually exclusive:

- Academia (natural and social scientists) and research institutions, and funding agencies enabling academic research;
- Operational centres and national (hydro)meteorological and ice-service providers, stretching across the providers and users in Fig. 2, with a focus on providers;
- A diverse range of users from Indigenous, local, and coastal communities in the Arctic through to defence, transport (land, sea and air), fishing, exploitation, tourism, national Antarctic and Arctic programs, researchers;

- Governance structures, within and external to WMO; and
- Industry bodies, stretching across the providers and users in Fig. 2, with a focus on users.

PCAPS users are largely represented by Arctic communities, industry (tourism, fishing, transport), science and research support, and boundary or brokering agencies (institutions that encompass or service more than one specialist field) as well as individuals who enhance communication to the public and enable feedback to be incorporated into the services research, development, and provision. PCAPS holds open sessions or expert-elicitation workshops [the synthesis of opinions of experts of a subject where there is uncertainty due to insufficient data or when such data are unattainable because of physical constraints or lack of resources; Slottje et al. (2008)], in conjunction with each of the annual in-person PCAPS Steering Group meetings. These sessions are hosted in a different country each year, thus allowing different stakeholders to participate in person as well as virtually. The involvement of social and physical scientists, service providers, and users through these workshops and other initiatives will provide a transdisciplinary approach from the stage of defining the problem to forecast production and dissemination, including data collection, analysis, and verification. Together with PCAPS Endorsed Projects, these activities help connect research, operations, and services communities across the polar environmental forecasting value cycle.

b. Showcasing a successful model of transdisciplinary collaboration. Environmental forecasting and, more broadly, polar research are fields that exemplify the necessity of transdisciplinary collaboration and integration (Lamers et al. 2024; Sjöberg et al. 2023; Werner et al. 2016). Both areas are inherently complex, requiring expertise from a wide range of disciplines and stakeholders to address the challenges they present. The challenges range from understanding atmospheric dynamics to predicting the impacts of rapid environmental change on polar socioecological systems and examining how human actors communicate and interact with environmental forecasts. To address these challenges, transdisciplinary collaboration is essential for advancing knowledge, improving predictive capabilities and applications, and informing decision-making. The need for transdisciplinary research and collaboration is further highlighted in the polar regions, which are among the most remote and extreme environments on Earth but have far-reaching implications for global weather patterns and livelihoods worldwide. Interdisciplinary and even transdisciplinary collaborations are essential for understanding these connections (Song et al. 2023).

Environmental forecasting is a prime example of a field that thrives on transdisciplinary collaboration (Haidvogel et al. 2013). At its core, weather prediction relies on atmospheric science, which involves understanding the physical, dynamic, and chemical processes that govern Earth's atmosphere. However, accurate forecasting also requires contributions from other disciplines, including mathematics, computer science, oceanography, and, importantly, the social sciences (Davies et al. 2025) including those from decision science, social psychology, environmental economics, and human geography. Furthermore, the value and societal benefits of environmental forecasts derive from close interactions with stakeholders about the application of predictions and actionable WWIC information in planning, risk management, and decision-making (Fig. 2; Heinrich et al. 2024; Murphy 1993).

Beyond the technical aspects and developments in the field of environmental forecasting, social sciences are increasingly recognized as vital to environmental forecasting. Effective communication of forecasts and warnings is essential for completing the value cycle, saving lives, and minimizing economic losses and adverse environmental impacts. Behavioral scientists and communication experts help ensure that forecasts are presented in ways that are understandable and actionable for diverse audiences, from policymakers to the general public (Demuth et al. 2020).

PPP made the first tentative steps of involving social scientists to work alongside physical scientists to ensure that the bulk of PPP's work, which was directed at improving our understanding and the prediction of physical processes in the higher latitudes, also acknowledged and benefitted the forecasting needs of users in the polar regions. PPP's social science contributors profiled human activities in the polar regions and undertook an extensive user needs assessment. This assessment raised as many additional research questions as it addressed (Heinrich et al. 2024). The PPP social science community also organized the initial polar-focused PPP Open Sessions, in collaboration with polar operators and practitioners in meteorological organizations from around the world (Wilson et al. 2023), and thus laid the foundation for a user engagement approach that PCAPS continues. Some of the social scientists who were involved in the PPP are now shaping how PCAPS is further advancing this emerging transdisciplinary collaboration in the polar context.

c. Bringing users and stakeholders front and centre. One of the main focuses of PCAPS is to further enhance the voices of stakeholders. PCAPS does this by bringing users and stakeholders into the same room as scientific researchers, which is often a key element that is missed in many research projects. Specifically, the PCAPS Open Sessions help to bring together different stakeholders to discuss the challenges in, and possibilities for, improving environmental forecasting in the polar regions. The PCAPS 2025 Open Session in Cambridge, United Kingdom, was attended by nearly 50 individuals in person as well as 15 people online and resulted in a robust discussion that helped to identify practical steps forward to improving polar environmental forecasting. The findings from the 2025 Open Session were published in a recent BAMS meeting report (Jeuring et al. 2025).

d. PCAPS and ECPs. PCAPS prioritizes the participation of early career professionals (ECPs) from developing countries and underrepresented groups, offering interdisciplinary training opportunities such as summer schools, supporting education activities run by other groups, and encouraging ECPs to become involved in the work of the PCAPS Task Teams. In all its activities, the PCAPS Steering Group cultivates an environment of mutual respect for diverse knowledge systems. The PCAPS Steering Group also recognizes capacity enhancement as a reciprocal process, emphasizing and facilitating, where possible, collaborative learning and knowledge exchange among all stakeholders involved.

PCAPS aims to develop an active online community surrounding the PCAPS project by offering a regular stream of digital and in-person communication and where external collaborations and guest contributions are actively encouraged and bolstered from across various career stages. The PCAPS website and newsletter serve as a resource to regularly feature updates on PCAPS' progress, but more importantly, it is a forum where updates from other related projects and guest contributions are shared, helping to bring visibility to important research from around the world.

6. PCAPS paving the way toward improved polar environmental services

PCAPS is designed to strengthen polar environmental services by addressing scientific and technical challenges, as well as the institutional, operational, and societal factors that shape how forecasts are produced, communicated, understood, and used. Through its integrative, transdisciplinary focus on forecasting services and sustainability, PCAPS provides an enabling framework for translating advances in coupled prediction, observations, and emerging methods into services that are actionable, trusted, and relevant in rapidly changing polar environments.

A central contribution of PCAPS lies in how it brings together physical science, social science, operational expertise, and user perspectives across the environmental forecasting

value cycle. By coordinating existing research activities through focused Task Teams, endorsed projects, and sustained user engagement, PCAPS helps align observing strategies, model development, evaluation practices, and service design with real-world decision contexts. This approach supports strategic use of observations, improved representation of coupled atmosphere–ice–ocean–wave processes, and the exploration of artificial intelligence and machine learning methods within forecasting systems. Forecast improvements are considered alongside usability, interpretability, and impact, enabling more actionable decision support for a wide range of users, from local and Indigenous communities to operators, industry, and national polar research programs. By explicitly linking forecasting capability with sustainability considerations, PCAPS also helps assess the intended and unintended consequences of enhanced services for human activity and polar ecosystems.

Beyond its immediate outcomes, PCAPS contributes to longer-term capacity and coordination within the polar prediction community. By fostering transdisciplinary collaboration, strengthening research–operations–services pathways, and promoting inclusive participation, PCAPS helps establish practices that can endure beyond the project’s lifetime. In this way, PCAPS not only advances polar environmental forecasting during 2024–28 but also helps position the community for future international initiatives, including the fifth International Polar Year, and offers a transferable model for improving environmental services in other data-sparse and high-risk regions.

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Data availability statement. Data and software developed during PCAPS will remain the property of the respective projects. However, a requirement for projects to be endorsed by the World Meteorological Organization’s World Weather Research Programme is for endorsed projects to make their data freely available. For further information on data related to PCAPS, please contact the PCAPS International Coordination Office (info@wwrp-pcaps.net) or visit the PCAPS website (<https://www.wwrp-pcaps.net/>).

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