

The YOPP Final Summit

Assessing Past and Forecasting Future Polar Prediction Research

Jeff Wilson , Thomas Jung, Eric Bazile, David Bromwich, Barbara Casati, Jonathan Day, Estelle De Coning, Clare Eayrs, Robert Grumbine, Jun Ioue, Siri Jodha S. Khalsa, Jorn Kristiansen, Machiel Lamers, Daniela Liggett, Steffen M. Olsen, Donald Perovich, Ian Renfrew, Vasily Smolyanitsky, Gunilla Svensson, Qizhen Sun, Taneil Uttal, and Qinghua Yang

The Year of Polar Prediction (YOPP) Final Summit

What: One hundred eighty-seven scientists, stakeholders, and representatives from operational forecasting centers and international bodies assembled in person and online to review the accomplishments and impacts of YOPP and make recommendations on prediction-related priorities for future international polar research projects.

Where: Montreal, Canada

When: 29 August–1 September 2022

KEYWORDS: Antarctica; Arctic; Atmosphere-ocean interaction; Forecast verification/skill; Data assimilation; Numerical weather prediction/forecasting

<https://doi.org/10.1175/BAMS-D-22-0282.1>

Corresponding author: Thomas Jung, thomas.jung@awi.de

In final form 20 January 2023

©2023 American Meteorological Society

For information regarding reuse of this content and general copyright information, consult the [AMS Copyright Policy](#).

AFFILIATIONS: **Wilson**—AWI, Angelsea, Victoria, Australia; **Jung**—Alfred Wegener Institute, Bremerhaven, and University of Bremen, Bremen, Germany; **Bazile**—CNRM, Météo France, CNRS UMR 3589, Toulouse, France; **Bromwich**—Byrd Polar and Climate Research Center, The Ohio State University, Columbus, Ohio; **Casati**—Meteorological Research Division, Environment and Climate Change Canada, Dorval, Quebec, Canada; **Day**—European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom; **De Coning**—World Meteorological Organization, Geneva, Switzerland; **Eayrs**—Korea Polar Research Institute, Incheon, South Korea; **Grumbine**—National Center for Weather and Climate Prediction, College Park, Maryland; **Ioue**—National Institute of Polar Research, Tokyo, Japan; **Khalsa**—University of Colorado Boulder, Boulder, Colorado; **Kristiansen**—Norwegian Meteorological Institute, Oslo, Norway; **Lamers**—Wageningen University, Wageningen, Netherlands; **Liggett**—University of Canterbury, Christchurch, New Zealand; **Olsen**—Danish Meteorological Institute, Copenhagen, Denmark; **Perovich**—Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire; **Renfrew**—School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom; **Smolyanitsky**—Arctic and Antarctic Research Institute, Saint Petersburg, Russia; **Svensson**—Department of Meteorology, Stockholm University, Stockholm, Sweden; **Sun**—National Marine Environmental Forecasting Center, Beijing, China; **Uttal***—NOAA/Physical Science Division, Boulder, Colorado; **Yang**—Zhuhai Campus, Sun Yat-sen University, Zhuhai, Guangdong, China

* Retired

The Year of Polar Prediction (YOPP) Final Summit was the final milestone in the World Meteorological Organization's (WMO) World Weather Research Programme's (WWRP) Polar Prediction Project (PPP). The PPP mission was to “promote research enabling improved prediction services for the polar regions,” with PPP running for 10 years from 2013 to 2022 (Jung et al. 2016). YOPP was PPP's flagship activity (Goessling et al. 2016) including a period of intensive observing, modeling, prediction, verification, user engagement and education activities from mid-2017 to mid-2019. This was to be followed by a consolidation period ending in December 2022 to carry out the analysis, synthesize and publish the results.

The YOPP Final Summit was attended by 187 participants from 27 countries (123 in person with another 64 online) to discuss the accomplishments and impacts of YOPP and make suggestions for future international polar research programs building on the PPP. Participants included scientists across a wide range of careers stages, representatives from operational weather and climate prediction centers, international bodies, key user groups, and other stakeholders. Poster presentations and stands included endorsed projects but also new Arctic flagship projects building in part on the legacy of YOPP. An overview booklet of the Polar Prediction Project and the Year of Polar Prediction—including coordination, resource mobilization, research accomplishments (quantitative and qualitative), and science to services was launched at the YOPP Final Summit (Jung and Wilson 2022). The YOPP Final Summit was preceded by a 1-day workshop at McGill University for early-career polar scientists where more than 20 participants had the opportunity to hear from and interact with YOPP senior scientists on scientific as well as career topics.

The summit commenced with background presentations recalling the rationale and drivers for PPP and YOPP and then moved into 3.5 days of plenary and parallel presentation sessions reviewing progress and identifying future challenges for science and services. Brainstorming sessions were held at the end of each day to capture the successes of YOPP, as

of those participating in the YOPP Final Summit, ranging from polar processes through atmospheric and sea ice/ocean forecasting, polar monitoring and observation campaigns to the social sciences enhancing people engagement with prediction services, different groups identified differing success areas. From the brainstorming sessions, it can be seen that YOPP helped to

- obtain a large amount of data that are widely used by many researchers;
- further the use of observations to compare with model data through the YOPPsiteMIP process and links to MOSAiC;
- raise awareness about available products and services, how to use them, and who the end users are (but more needs to be done); and
- train early-career scientists (but more could be done to help train nonscientific stakeholders).

The successes of YOPP from the presentations and keynote presentations included

- a better understanding of the impact of key polar measurements (radiosondes and space-based instruments such as microwave radiometers), and recent advancements in the current NWP observing system, achieved through coordinated OSEs in both polar regions (e.g., Sandu et al. 2021);
- enhanced understanding of the linkages between Arctic and midlatitude weather (e.g., Day et al. 2019);
- advancements in the atmosphere–ocean–sea ice and atmosphere–land–cryosphere coupling in NWP, and in assessing and recognizing the added value of coupling in Earth system models (e.g., Bauer et al. 2016);
- deployment of tailored polar observation campaigns to address yet-unresolved polar processes (e.g., Renfrew et al. 2019);
- progress in verification and forecasting techniques for sea ice, including a novel headline score (e.g., Goessling and Jung 2018);
- advances in process understanding and process-based evaluation with the establishment of the YOPPsiteMIP framework and tools (Svensson 2020);
- better understanding of emerging societal and stakeholder needs in the Arctic and Antarctic (e.g., Dawson et al. 2017); and
- innovative transdisciplinary methodologies for coproducing salient information services for various user groups (Jeuring and Lamers 2021).

The YOPP Final Summit included presentations from, and discussions led by, representatives of key user groups such as SmartICE (<https://smartice.org/>), the International Association of Antarctica Tour Operators (IAATO), DanPilot, and Hurtigruten Expeditions. These users provided valuable perspectives about the use of environmental prediction, and challenges arising in cruise tourism, Inuit community sea ice travel hazards and subsistence activities, ice pilotage, and cargo shipping across the Arctic and into the Southern Ocean. Every day of the summit a “Science to Services” and “Polar Prediction to Societal Implications” session was organized, during which particular insights and challenges were raised and discussed by researchers and stakeholders. There were separate sessions from an Arctic (Canadian or European) or Antarctic perspective, respectively, based on YOPP-endorsed projects and stakeholder experiences. These Science to Services sessions, as well as a Services User Dinner Panel, provided important contextual information for discussing the societal value and legacy of YOPP, as well as future directions (Fig. 2).

can be found on Zenodo (<https://doi.org/10.5281/zenodo.7440072>) and for YOPP at <https://doi.org/10.5281/zenodo.7420919>.

Next steps

Logistical issues, the COVID-19 pandemic, but also new scientific questions (e.g., the value of targeted observations in the Southern Hemisphere), as well as technical issues emerging toward the end of the YOPP Consolidation Phase, resulted in the decision to continue the following three YOPP activities to the end of 2023: (i) YOPP Southern Hemisphere (YOPP-SH); (ii) Model Intercomparison and Improvement Project (MIIP); of which YOPPSiteMIP is a critical element; and (iii) the Societal, Economics and Research Applications (PPP-SERA) Task Team.

The next WMO WWRP Implementation Plan will be considered by the WMO Congress in mid-2023 with an anticipated commencement date of 1 January 2024. The draft implementation plan includes a polar-related research project entitled “Polar Coupled Analysis Prediction and Services” (PCAPS) that will build upon and extend the work undertaken in the Polar Prediction Project and its flagship activity the Year of Polar Prediction.

Acknowledgments. We acknowledge Neil Gordon for verifying the accuracy of this summary. We thank all participants for their contributions and acknowledge the generous financial assistance provided by the PPP Trust Fund contributors (Canada, United Kingdom, United States, Norway, Australia), Alfred Wegener Institute (AWI), Norwegian Meteorological Institute, EUMETSAT, Arctic Passion, MEOPAR, Hurtigruten Expeditions, and all in-kind support. Thanks are also extended to the coorganizers (WMO, AWI, and Canadian Meteorological and Oceanographic Society and Event Managers) and to Environment and Climate Change Canada for hosting the event. Finally our thanks to the YOPP Final Summit organizing committee of Barbara Casati, Thomas Jung, Jim Abraham, Lynn Buckley, Estelle de Coning, Dany Dumont, Clare Eayrs, Gordon Griffith, Nadine Hillenbrand, Jorn Kristiansen, Machiel Lamers, Gita Ljubicic, Greg Smith, Kirstin Werner, Jeff Wilson, and Louraine Youds.

References

- Bauer, P., L. Magnusson, J.-N. Thépaut, and T. M. Hamill, 2016: Aspects of ECMWF model performance in polar areas. *Quart. J. Roy. Meteor. Soc.*, **142**, 583–596, <https://doi.org/10.1002/qj.2449>.
- Dawson, J., and Coauthors 2017: Navigating weather, water, ice and climate information for safe polar mobilities. WWRP/PPP Rep. 5, 84 pp., <https://epic.awi.de/id/eprint/46211/>.
- Day, J. J., I. Sandu, L. Magnusson, M. J. Rodwell, H. Lawrence, N. Bormann, and T. Jung, 2019: Increased Arctic influence on the midlatitude flow during Scandinavian blocking episodes. *Quart. J. Roy. Meteor. Soc.*, **145**, 3846–3862, <https://doi.org/10.1002/qj.3673>.
- Goessling, H. F., and T. Jung, 2018: A probabilistic verification score for contours: Methodology and application to Arctic ice-edge forecasts. *Quart. J. Roy. Meteor. Soc.*, **144**, 735–743, <https://doi.org/10.1002/qj.3242>.
- , and Coauthors, 2016: Paving the way for the Year of Polar Prediction. *Bull. Amer. Meteor. Soc.*, **97**, E585–E588, <https://doi.org/10.1175/BAMS-D-15-00270.1>.
- Jeuring, J., and M. Lamers, 2021: Towards useful forms of co-production in metocean services for the European Arctic. PPP-SERA Special Services Workshop Rep., 32 pp., www.polarprediction.net/fileadmin/user_upload/www.polarprediction.net/Home/Meetings/Reports/Towards_useful_forms_of_co-production_in_metocean_services_for_the_European_Arctic.pdf.
- Jung, T., and J. Wilson, 2022: Year of Polar Prediction—Achievements and impacts. WMO Rep, 48 pp., https://library.wmo.int/index.php?lvl=notice_display&id=22133#Y-zMUnbMKUK.
- , and Coauthors, 2016: Advancing polar prediction capabilities on daily to seasonal time scales. *Bull. Amer. Meteor. Soc.*, **97**, 1631–1647, <https://doi.org/10.1175/BAMS-D-14-00246.1>.
- Renfrew, I. A., and Coauthors, 2019: The Iceland Greenland Seas Project. *Bull. Amer. Meteor. Soc.*, **100**, 1795–1817, <https://doi.org/10.1175/BAMS-D-18-0217.1>.
- Sandu, I., and Coauthors, 2021: The potential of numerical prediction systems to support the design of Arctic observing systems: Insights from the APPLICATE and YOPP projects. *Quart. J. Roy. Meteor. Soc.*, **147**, 3863–3877, <https://doi.org/10.1002/qj.4182>.
- Svensson, G., 2020: YOPPSiteMIP: Year of Polar Prediction site Model Intercomparison Project. *EGU General Assembly*, Online, EGU, EGU2020-11272, <https://doi.org/10.5194/egusphere-egu2020-11272>.