

WWRP POLAR PREDICTION PROJECT (WWRP-PPP)

TWELFTH PPP STEERING GROUP MEETING (PPP-SG#12)

8 -12 MARCH 2021
Virtual/Online

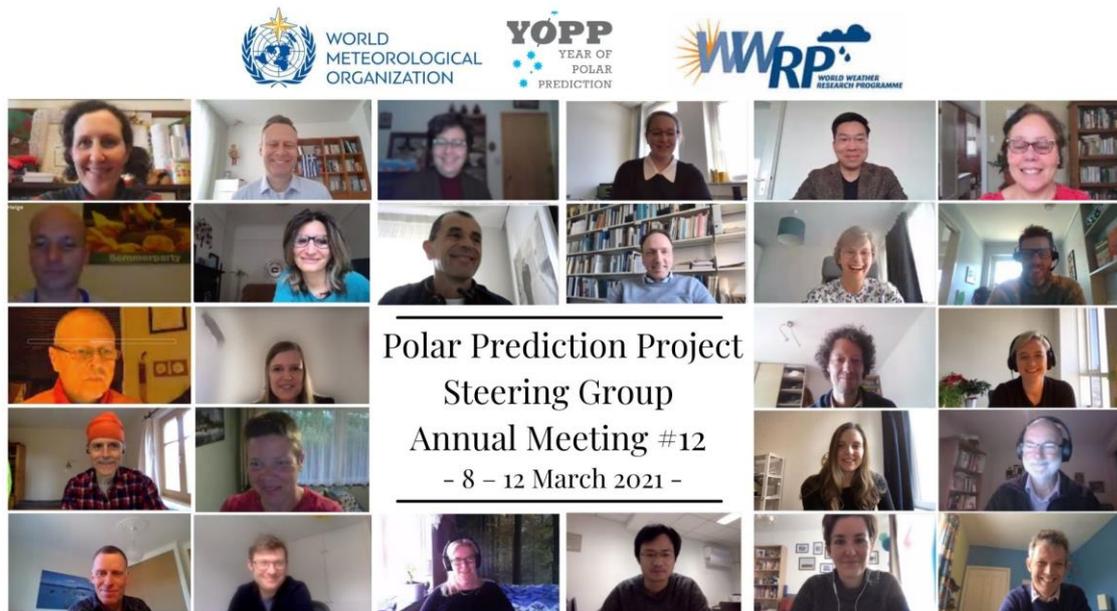


Photo: Sara Pasqualetto (AWI)

Top row (L-R): Barbara Casati, Jürg Luterbacher, Taneil Uttal, Katharina Kirchhoff, Wenchao Cao, Amy Solomon

Second Row (L-R): Helge Goessling, Irina Sandu, Eric Bazile, Thomas Jung, Estelle de Coning, Jørn Kristiansen

Third Row (L-R) Øystein Godøy, Kirstin Werner, Machiel Lamers, Clare Eayrs

Fourth Row (L-R) Siri Jodha Khalsa, Daniela Liggett, Mayleen Schlund, Jeff Wilson

Bottom row (L-R): Steffen Olsen, Jonathan Day, Gunilla Svensson, Qizhen Sun, Sara Pasqualetto, Ian Renfrew

[Note: This session was held as a virtual or online session due to travel restrictions as a result of the COVID-19 pandemic. Sessions were recorded to allow PPP-SG members to review sessions they were not able to attend due to time zone or other demands upon their time.]

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EXECUTIVE SUMMARY

The twelfth annual meeting of the Polar Prediction Project Steering Group (PPP-SG) was held online due to travel restrictions caused by the global COVID-19 pandemic. The session took place from 8 to 12 March 2021 at different times of the UTC day to allow for different time zones of the PPP-SG members' locations. Discussion around each agenda item was kept to a maximum of 90 minutes.

The PPP-SG #12 session specifically focused upon reviewing progress in the Year of Polar Prediction (YOPP) Consolidation Phase: YOPP education activities and plans for the 2022 Polar Prediction Spring School; outreach and communication activities; considering options for the PPP evaluation and suggestions on how parts of the content produced during PPP can be kept publicly available beyond the end of the project; planning for the Targeted Observing Periods during Antarctic winter from mid-April to mid-June 2022; reviewing the outcomes from the Targeted Observing Period in the Northern Hemisphere (NH-TOP1); reviewing plans for activities by the PPP Societal and Economic research Applications (PPP-SERA) group; examining the benefits and outcomes from PPP's collaboration with MOSAiC (Multidisciplinary drifting Observatory for the Study of the Arctic Climate); reviewing progress with the sea-ice prediction activities; reviewing progress with the YOPP Data Portal and the YOPP Supersite Model Intercomparison Project (YOPPsiteMIP); and, planning for the Final YOPP Summit as well as general coordination and administrative matters.

In closing the session, the chair of PPP-SG, Professor Thomas Jung noted that the online format had worked well for much of the discussion while we, however, did not get the added benefits of the many side chats and out-of-session discussions that occurred during face-to-face meetings; it was also difficult to run "brain storming" activities. Additionally, it was challenging to reach out to all PPP SG members and invited guests considering the different time zones of the participants' locations; therefore, recordings of all sessions were provided to all members who had the opportunity to comment and contribute to the discussion of an agenda item at a later stage.

Prof Jung noted his pleasure in the progress to date with PPP and YOPP activities and the very positive outcomes associated with the collaboration of PPP with MOSAiC. Prof Jung stated that the next twelve months would be critical for PPP as individuals and institutions furthered their research and prepared results for publication and discussion at the YOPP Final Summit. Prof Jung also called on all PPP-SG members to seek further support for the PPP Trust Fund to enable the YOPP Final Summit and major activities such as the YOPP Data Portal and YOPPsiteMIP to be successfully completed before the end of 2022.

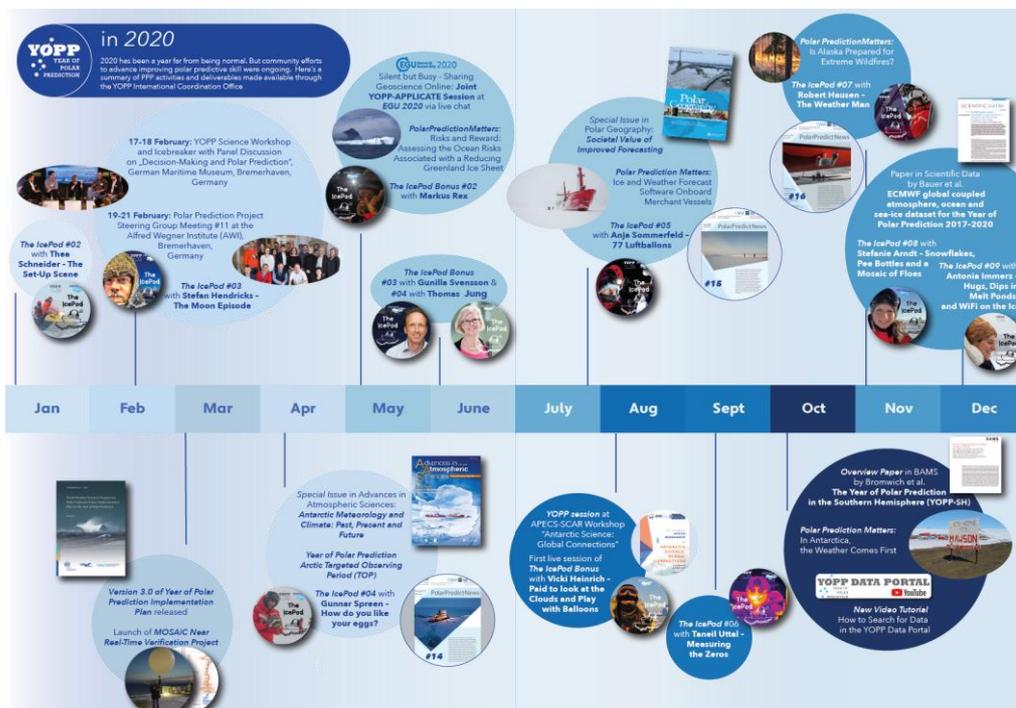
In summarizing the session, Prof Jung recalled that the session had made a range of tactical decisions related to: the YOPP Education activities and the Polar Prediction Spring School; the desirability of continuing the strong partnership with MOSAiC, particularly for YOPPsiteMIP and coupled modelling; to retro-actively define a Special Observing Period (SOP) from mid-December 2019 to mid-April 2020 to act as a focus for collecting the MOSAiC and wider YOPP observation and modelling data for further priority analysis; investigating the option for holding a second Northern Hemisphere Targeted Observing Period (TOP) in-conjunction with the HALO-AC3 campaign in

March and April 2022; request YOPP projects and endorsed projects to check that their YOPP publications are included the YOPP Google Scholar list; to include lessons learnt in the YOPP Evaluation brochure; and consider the number of submissions for presentations at the YOPP Final Summit when confirming the final room bookings to allow as many speakers as possible to present.

1. OPENING OF PPP-SG12

1.1 Welcome

Professor Thomas Jung (Chair of the PPP-SG) opened the session at 1000 UTC on 8 March and welcomed all members and invitees to the twelfth meeting of the PPP-SG. Prof Jung noted that whilst COVID-19 had an impact upon PPP and YOPP, good progress had been made in the twelve months as summarized in Figure 1. Prof Jung noted in particular the excellent progress in Outreach activities with the revamping



of *PolarPredictNews*, the Polar Prediction newsletter and multiple episodes of *The IcePod* podcast highlighting PPP and YOPP related activities associated with the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAic) expedition.

Recalling that PPP finishes at the end of 2022, Prof Jung noted the importance of this PPP SG annual meeting in guiding activities in the last half of the Consolidation phase. With the need to focus on key actions and the impact of COVID in restricting

Figure 1. Overview of PPP/YOPP activities in 2020

travel, Prof Jung grouped the discussion themes of this PPP-SG session under the three following headings (Table 1):

Table 1. Discussion themes for PPP-SG#12

Wrapping up activities	Scientific lighthouse activities	Outreach, education and data access
<ul style="list-style-type: none"> • YOPP Final Summit • YOPP Evaluation • YOPP Legacy 	<ul style="list-style-type: none"> • YOPPsiteMIP • OSEs • MOSAiC-YOPP • SIDFex • YOPP-SH • PPP-SERA 	<ul style="list-style-type: none"> • Education • Outreach • YOPP Data Portal

Prof Jung thanked the International Coordination Office (ICO) for Polar Prediction for their excellent preparations of the online session and wished everyone an enjoyable and successful meeting.

Prof Jürg Luterbacher, WMO Director for Science and Innovation, extended the WMO Secretary General’s and his personal thanks to the PPP-SG for their work and the invitation for him to address this session. Prof Luterbacher noted that following the approval of the WMO Reform Package at the Eighteenth World Meteorological Congress (Cg-18) in 2019, much of 2020 had been spent in the restructuring of the WMO Governance framework and the WMO Secretariat to support the new structures. Figure 3 depicts the new WMO Vision, Mission, Objectives and Strategy.

WMO Vision, Mission, Objectives and Strategy

VISION 2030	By 2030, we see a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic consequences of extreme weather, climate, water and other environmental events; and underpin their sustainable development through the best possible services, whether over land, at sea or in the air <i>(and in space)</i>				
OVERARCHING PRIORITIES	Preparedness for, and reducing losses from hydrometeorological extremes	Climate-smart decision-making to build resilience and adaptation to climate risk		Socioeconomic value of weather, climate, hydrological and related environmental services	
CORE VALUES	Accountability for Results and Transparency	Collaboration and Partnership		Inclusiveness and Diversity	
LONG-TERM GOALS	1 Services  Better serve societal needs	2 Infrastructures  Enhance Earth system observations and predictions	3 Science & Innovations  Advance targeted research	4 Member Services  Close the capacity gap	5 Smart Organization  Strategic realignment of structure and programmes
STRATEGIC OBJECTIVES	<ul style="list-style-type: none"> Strengthen national multi-hazard early warning/alert systems Broaden provision of policy- and decision-supporting climate, water and weather services 	<ul style="list-style-type: none"> Optimize observation data acquisition Improve access to, exchange and management of Earth system observation data and products Enable access and use of numerical analysis and prediction products 	<ul style="list-style-type: none"> Advance scientific knowledge of the Earth system Enhance science-for-service value chain to improve predictive capabilities Advance policy-relevant science 	<ul style="list-style-type: none"> Enable developing countries to provide and utilize essential weather, climate, hydrological and related environmental services Develop and sustain core competencies and expertise Scale up partnerships 	<ul style="list-style-type: none"> Optimize WMO constituent body structure Streamline WMO programmes Advance equal, effective and inclusive participation
FOCUSED ON 2020-23					
	See https://library.wmo.int/index.php?lvl=notice_display&id=21525				

Figure 2. The new WMO Vision, Mission, Objectives and Strategy. In the red box are the strategic objectives of Long-term Goal 3 (Advance Targeted Research).

Prof Luterbacher outlined the new role for the WMO Research Board which replaced the Intergovernmental Commission for Atmospheric Sciences. The move from an Intergovernmental Commission will allow the WMO Research Board to develop much closer links with non-government organisations and institutions such as academia, other international science organisations, and the private sector. Prof Luterbacher noted that the Research Board which leads the WMO Science and Innovation long term goal 3 (Advance Targeted Research) is built around the Global Atmospheric Watch (GAW), the World Weather Research Programme (WWRP) and the World Climate Research Programme (WRCR); it has the Working Group on Numerical Experimentation (WGNE) as well as two Task Teams, one looking at Exascale Computing and Artificial Intelligence (AI) and the other at SARS-CoV-2/COVID-19. The WMO Research Board interacts with the WMO Regional Associations and the two

Technical Commissions regarding requirements and services and with a wide range of co-sponsors to implement the required science and innovation.

Research Board, catalyzing Science and Innovation

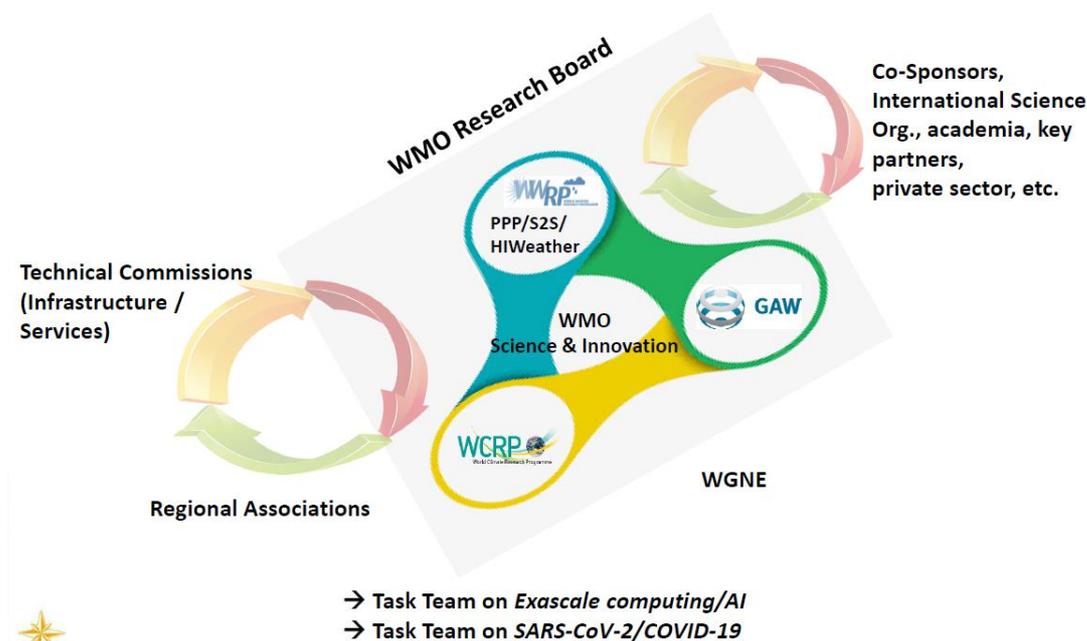


Figure 3. The WMO Research Board and component research programmes

Prof Luterbacher noted that observations and research in the polar regions can be difficult and expensive to undertake but they are very important to understand the processes affecting climate and weather globally. He recalled that PPP had been leading the way in a number of studies looking at interactions between the ocean, sea-ice and atmosphere and that PPP itself was a legacy of the International Polar Year (IPY) in 2007 and 2008. He highlighted that polar regions represent an important testbed for developing and improving the seamless Earth System approach and that WWRP PPP has moved forward in advancing coupled assimilation methods in an operational framework. Together with the World Climate Research Programme (WCRP) communities, PPP is exploiting the Year of Polar Prediction field campaign for modelling improvements. Research results from the YOPP Consolidation Phase could provide key research questions for future Earth System projects.

Prof Luterbacher further recalled that apart from PPP, the WCRP was also continuing its focus on the polar environment through the WCRP Climate and Cryosphere Project (WCRP CLiC) which would benefit from the PPP/YOPP activities. He noted that the end goal of WCRP CLiC was improving our ability to make quantitative predictions and projections of the cryosphere in a changing climate.

Prof Luterbacher also noted that the Climate and Ocean: Variability, Predictability and Change (CLIVAR) was another core WCRP project in-conjunction with WCRP CLiC with the goal to develop (i) tools and methods to observe the Arctic/Antarctic and neighbouring seas and their climate impacts; and (ii) activities to standardize and archive observations of the Arctic/Antarctic and the coupling with other components. In that regard, CLIVAR and CLiC were working with the Scientific Committee on Antarctic Research (SCAR) to provide scientific and technical input into international

research coordination. In a similar light, he noted that a proposal from the Southern Ocean Regional Decade Programme had been submitted to the UN Decade of Ocean Science for Sustainable Development to *“improve understanding of the Southern Ocean and its role in the Global Ocean”*. If successful this would provide further understanding of the polar regions and their impact on global climate including a wide range of stakeholders, policy makers, society and industry.

In closing his remarks, Prof Luterbacher emphasized the importance and relevance of the PPP and its joint elements with the other WMO research programmes. He wished the PPP-SG a very successful meeting and he looked forward to participating in the discussion around many of the agenda items.

Dr Estelle de Coning, newly appointed Head of the WWRP, also thanked the PPP-SG Chair and the PPP-SG for the opportunity to participate in this session. Dr de Coning thanked the PPP-SG for their oversight of the wide range of PPP and YOPP activities in atmospheric research, numerical modelling, user engagement and service definition, outreach and education, publications, and data access and management.

Dr De Coning provided further insight on how PPP fits into the new WMO Science and Innovation Governance Structure. She recalled that PPP was one of three WWRP Core Projects identified in the 2016 to 2023 WWRP Implementation Plan that reports to the WWRP Scientific Steering Committee (WWRP-SSC) who in turn report to the WMO Research Board. The WWRP SSC are encouraging actions which cut across the three research programmes, the two Technical Commissions and support activities in the other WMO bodies. PPP will continue to report to the WWRP-SSC as well as the Executive Council Panel of Experts on Polar and High Mountain Observations (EC-PHORS) although the next meeting of EC-PHORS will be reviewing their Terms of Reference for subsequent discussion by the WMO Executive Council. Dr De Coning noted that through members of its Steering Group, PPP is well placed to provide input into polar discussions with EC-PHORS as well as the Cryosphere Steering Group SG-Cyro.

Dr De Coning recalled that the WMO Research Board has prioritized science activities that underpin services and policy-making through an Earth System approach to improving accuracy in weather, climate, water and environmental information. The WMO Research Board wants the WWRP component research programmes to: work more effectively on the cross-cutting aspects of their activities in order to facilitate the integration of research activities; provide a more holistic view of research; and, improve the attractiveness of investment in research to the funding agencies and stakeholders. Dr De Coning noted that the WMO Research Board wishes to define a roadmap for scientific research for the next 5 to 10 years.

Noting that the current WWRP Implementation Plan ends in 2023, Dr De Coning advised the PPP-SG that each of the WWRP core projects will need to identify the difference they have made to their fields and that the PPP evaluation process was seen as a potential model for the other WWRP projects. Dr De Coning also noted that the WWRP SSC will be hosting a number of small events/online conversations during 2021 for assessment during the September 2021 WWRP-SSC meeting.

Dr De Coning advised the PPP-SG that preliminary discussions in the WWRP-SSC

based around the WMO Strategy as well as guidance from the WMO Research Board indicated that for the period beyond 2023 the following activities would be expected:

- Continuation of the databases for research and operations (S2S and TIGGE, YOPP Data Portal, HIW value chain)
- Creating a path to operations for experimental observations (Science for Services) linked to SERCOM
- Advancing the implementation of the value cycle for impacts (social science), including uncertainty, linked to SERCOM
- Research to enhance the Seamless Earth System Modelling / Obs /Prediction (link to INFCOM), including novel observations
- Exploit new technology (Artificial Intelligence (AI) /Machine Learning (ML) /Exascale computing)
- Studies of the urban environment (Paris Olympics 2024), Aviation (2025)

Dr De Coning advised the PPP-SG that WWRP, WCRP and GAW would need to demonstrate to the WMO Research Board their relevance in a changing society and their ability to provide tools and underpinning knowledge to assist decision making for climate, water, weather and environmental services and operations. She continued noting that planning for the future will also require resource mobilization through combining the various research streams to strengthen research/funding proposals and show a unity in the science whilst at the same time acknowledging the diversity of interests required by funders and stakeholders.

In closing, Dr De Coning wished the PPP-SG success in this meeting and that she along with Dr Wenchao Cao would be participating in as many of the sessions as possible.

Dr Kirstin Werner, Director of the International Coordination Office of the PPP which is located at the Alfred Wegner Institute in Bremerhaven Germany welcomed everyone to the session. Dr Werner noted that 8 March was International Women's Day, and it was very pleasing to her to see the major role women were playing within the PPP-SG and driving the science and services forward. Dr Werner briefed the PPP-SG on the logistics for the meeting and support available if people were having trouble connecting to any of the sessions.

2. Purpose of the Meeting & Adoption of the Agenda

The PPP-SG Chair Thomas Jung recalled that this 12th session of the PPP-SG would specifically focus upon reviewing progress in the YOPP Consolidation Phase, refining plans for the 2022 YOPP Polar Prediction School, refining plans for the PPP evaluation, reviewing outcomes from the Northern Hemisphere Targeted Observing Program (NH-TOP1) and collaboration with MOSAiC, reviewing progress with YOPPsiteMIP and the YOPP Data Portal, planning for the Final YOPP Summit as well as general coordination and administrative matters. The Chair asked if there were any changes or adjustments to the agenda; receiving no comments the Agenda was adopted as circulated (see Annex I).

2.1 Working Arrangements

The PPP-SG agreed that the working arrangements proposed by the ICO would be adopted.

3. EDUCATION

Dr Clare Eayrs, YOPP Education Task Team lead, provided the PPP-SG with an update of YOPP Education activities in 2020 and plans for the coming 21 months including the 2022 YOPP Polar Prediction School and the YOPP Final Summit Fellowship program.

Workshops

The major activity in 2020 was for the Early Career Researchers (ECR) workshop which was part of the SCAR Online meeting from 3 to 7 August 2020. This was originally to be a face-to-face workshop in Hobart, Australia, but the meeting was cancelled due to COVID-19 travel restrictions. The workshop included: a live session of *The IcePod* where Vicki Heinrich from Australia was interviewed about her experience as a weather observer in the Antarctic; and, a series of presentations by researchers associated with YOPP-SH (see <https://player.vimeo.com/video/455682238>). Ten people from PPP-SG and the ICO assisted Dr Eayrs organise and run this workshop. A total of 100 participants attended the two sessions.

Dr Eayrs advised the PPP-SG that another online ECR workshop was planned for the Arctic Science Summit Week of 20-26 March 2021. She reminded the PPP-SG that they had agreed for the PPP Trust Fund to pay the registration fees for a number of the participants and for the lecturers. The payment was organised via the WMO Secretariat. More than 100 participants are expected over the three sessions. The three sessions planned for the workshop are:

1. Home Office (Fatigue) and Zoom Networking – COVID-19 and ECRs. A range of speakers including Kirstin Werner and Daniela Liggett;
2. The 4 Essential Cs - Coordination, Communication, Community, and Collaboration. A range of speakers including Kirstin Werner;
3. Predict and Predictability – The Arctic YOPP. A wide range of speakers including Thomas Jung, Jorn Kristiansen, Gunilla Svensson, Machiel Lamers and Øystein Godøy.

Hackathon

Dr Eayrs recalled that the YOPP Education Task Team had suggested the possibility of holding an online event similar to a Hackathon as part of the build up to the Abisko 2022 Polar Prediction School. In the ensuing discussion, the PPP-SG noted the potential benefits of an activity such as this to promote the use of the YOPP Data Portal and the underlying data, and possibly the YOPPsiteMIP code if it was available. On the other hand, the PPP-SG considered that there was insufficient time or expertise in the PPP Steering Group to develop this activity for delivery in late 2021 without compromising other key elements of YOPP. On this basis, the PPP-SG decided not to pursue a YOPP Hackathon but did note the desirability of identifying some easy-to-use YOPP datasets that could be used during the Polar Prediction School and/or promoted to universities and other groups organising hackathons or science challenges.

YOPP 2022 Polar Prediction School

Dr Eayrs advised the PPP-SG of progress in planning for a 2022 Polar Prediction School at Abisko research station in Sweden. The facility needs to be booked in April

or May 2021 and a program needs to be developed based upon feedback from previous courses, availability of lecturers and budget. Dr Eayrs reminded the PPP-SG that a decision needs to be made about when to advertise the School and how to select the students. This matter was discussed at some length with the following conclusions and actions.

Date:	early April 2022 (to be confirmed in discussions with Abisko)
Student numbers:	around 30
Registration fee:	a fee of around EUR 600 was charged in the past with the fee being waived for some students
New topics:	Include material on Antarctica and social sciences related to users and services
Additional Sponsors:	Dr Eayrs with support from ICO and Prof Svensson to approach IASC and SCAR regarding potential sponsorship of the workshop and students. Possibility of some of the EU projects linked to PPP/YOPP having some funding (INTERACT - Jonny Day to follow up)
Polar Prediction School video	No funding allocated but participants and lecturers encouraged to shoot video and share with ICO for potential inclusion in Final Summit video
Previous lecturers	Ian Brooks, Gunilla Svensson, Matthieu Chevallier (no longer available), Anna Fitch, Martin Hagman, Anna Hogg, Thomas Jung, Erik Kolstad, Linus Magnusson, Donald Perovich, Jonny Day, Jessica Rohde, James Screen and Doug Smith. For consideration: Jerry Zhou (Antarctica), Matt Shupe (MOSAIC), Amy Solomon (sea-ice)
Leads for program and lecturer selection:	Dr Eayrs and Prof Svensson with support from Dr Day

May 2022 Final Summit Fellowship Program

Dr Eayrs recalled the discussions at PPP-SG#11 on the desirability of including a fellowship program for Early Career Scientists as part of the YOPP Final Summit. The goal of the fellowship programme would be to recognise excellent work by the awardees and provide them networking and visibility opportunities during the Final Summit with activities such as the award ceremony, fireside chats with senior figures in the field, an opportunity to present their work as part of a plenary session, potentially to act as session chairs or co-chairs for some sessions and inclusion in any Final Summit video. PPP-SG#11 had recommended supporting up to five fellows (total of no more than CHF 15,000) from the PPP-SG trust fund and encouraging IASC and SCAR to also support some fellows.

PPP-SG#12 confirmed their support for a fellowship program for the Final Summit and thanked Dr Eayrs for her work to date on this issue. In the ensuing discussion the following points were agreed.

Budget	Keep to a total of CHF 15K or less
Number of fellows	PPP to support at most 4 with opportunity for IASC, SCAR to also nominate and support additional fellows but keep overall numbers to 6 or so
Fellowship package	Flight, accommodation and registration
Definition of ECR	Less than five years since having a PhD awarded, taking account for timeout for family or other reasons
Activities	Award ceremony "Fireside chat" with senior figures Presentation of paper in plenary session Potential for chairing or co-chairing of some sessions Feature in Final Summit video ECR "night" on the Wednesday with informal activities
Selection criteria	Made a significant contribution to one or more of the key YOPP areas
Considerations for selection	Gender balance Regional balance Discipline
Timeline	Advertise in June 2021, preferably with the Polar Prediction School; Deadline for applications mid-September Final Decision made by mid-December
Selection process	Still to be finalised, if we have co-sponsors we will need to coordinate with them. Initial thoughts. A small committee (ICO, Dr Eayrs, one or two others) to review applications for eligibility and rank them. The ranked nominations provided to co-sponsors and PPP-SG#12 for review and decision. All eligible applications to be provided to the PPP-SG and co-sponsors along with the ranking system and results.
Initial call for nominations	Dr Eayrs with ICO

Evaluation and Success Stories from YOPP Education

In preparation for the discussion on YOPP Evaluation and success stories, Dr Eayrs recalled that previous PPP-SG sessions had already identified a number of indicators. After further discussion, the PPP-SG identified the following potential indicators and success stories for inclusion in the YOPP evaluation work:

- Number of students applying for and participating in the Polar Prediction Schools and perhaps some indication of the uniqueness of the Polar Prediction Schools
- Selecting a number of Polar Prediction School students/alumni to see what they have contributed to YOPP and how their engagement with the Polar Prediction School has helped in their careers. Selection of a few key students/alumni would put a human face to the story and potentially

showcase future leaders

- Participation of ECRs in PPP/YOPP workshops as part of conferences and the PPP-SG#10 workshop in Helsinki
- Identification of how many PhD and postdoctoral positions were funded in YOPP-related projects (via YOPP-endorsed project survey)
- Identification of how many PhD and MSc theses used YOPP data (via YOPP-endorsed project survey)
- The number of Polar Prediction School participants and ECS who have published or authored/co-authored YOPP publications

Decision

- Not to hold a YOPP Education Hackathon
- Need to have the selection of YOPP Final Summit Fellows completed by early December 2021

Actions

Description	Who	When
PPP-SG to advertise the availability of YOPP Data sets for upcoming Hackathons	PPP-SG & ICO	Apr-21
Approach IASC and SCAR to see if they wish to sponsor an ECR to the Final Summit and for Polar Prediction School	ICO or Clare?	May-21
Ask IASC and SCAR if they wish to be part of the selection process for the Fellows	ICO or Clare?	May-21
Include a question in the Final Summit Fellowship application about what YOPP has done for the applicants and which projects they have been involved in	Clare	May-21
Clare and Gunilla to coordinate with Abisko re setting of final school dates also taking into account availability of preferred lecturers	Clare / Gunilla	Jun-21
Clare and Kirstin with assistance to vet the fellowship nominations and then present rated list to the PPP-SG for approval	Education TT	Jun-21
Review the evaluations from the previous schools re suitability of lecturers and topics	Clare / Gunilla / Jonny	Jun-21
Discuss with the organisers of the HALO-AC3 aircraft field campaigns options for potential lecturers	Jonny / Gunilla	Jul-21
YOPP Education TT to propose criteria for Final Summit fellowship selection to PPP-SG for approval	Education TT	Aug-21
Ensure video and still photographs taken at Polar Prediction School for publicity and records	Clare	Apr-22

4. OUTREACH

Dr Kirstin Werner, Director of the ICO and lead of the Communication, Outreach and Education TT, briefed the PPP-SG on actions taken during 2020 and plans for Communication and Outreach in the remainder of the PPP Consolidation Phase. She thanked the PPP-SG and their institutional colleagues for their support during the year as well as that of the ICO, particularly Ms Sara Pasqualetto, Ms Katharina Kirchhoff and the interns who had worked tirelessly behind the scenes to make everything work.

Dr Werner recalled the goals of YOPP Communication and Outreach: promoting

YOPP findings, data and recommendations through knowledge transfer (how YOPP is making a difference); telling success stories from YOPP (what are the societal benefits from YOPP); encouraging Community Engagement and Network Formation (essentially the knowledge gain and transfer from science, services and users); and, Coordination of YOPP Task Teams and YOPP-endorsed projects.

Dr Werner informed the PPP-SG that a multi-channel approach of communication and storytelling was being used. This approach actively included PPP/YOPP scientists in the various digital communication channels giving their personal impressions and providing social and physical science research-based information. The channels include: email, office@polarprediction.net and mailing lists (PPP general, YOPP-SH, YOPP-endorsed etc.); website, www.polarprediction.net; newsletter PolarPredictNews <https://www.polarprediction.net/news/polarpredictnews/>; blogs, <https://blogs.helmholtz.de/polarpredictionmatters/>; social media, Instagram, @polarprediction; twitter, @polarprediction; and podcast, *The IcePod*, <https://icepodcast.home/blog> or via your preferred podcast provider. See Table 2 for the 2019/2020 and 2020/2021 statistics. On behalf of the PPP-SG, Prof Renfrew thanked Dr Werner and her colleagues for the great work on the *PolarPredictNews* newsletter and suggested that it could be submitted for an award for non-professional journals. The PPP-SG agreed with this suggestion and tasked themselves to identify any suitable opportunities.

Table 2. Communication channel statistics for 2019/2020 and 2020/2021

Channel	February 2020	March 2021	Comment
Mailing lists <ul style="list-style-type: none"> • PolarPrediction • YOPP-SH 	651 subscribers 62 subscribers	671 83	(35 new, lost 15) (23 new, lost 2)
Email Campaigns via Mail Chimp	38 email campaigns with approximately 200 users opening email		45 links / mail opened
polarprediction.net Website <ul style="list-style-type: none"> • Pageviews • Downloads • Key activities • Data 	17,661 2,266 904 410	15,924 1,980 1,762 775	Key activities inc. SOP, Sea-ice prediction and verification, YOPPsiteMIP and YOPP Endorsement Data. Link to YOPP Data Portal, YOPP Explorer and YOPP Observations layer 2020 statistics from March 2019 to February 2020, 2021 statistics from March 2020 to February 2021
<i>PolarPredictNews</i> A total of 17 editions with 4 editions since April 2020.	650	970	An increase of 41% in 2020. Relaunched in 2020 with a new design featuring Top Stories and “Art & Science”. A native English speaker is now reviewing all articles and

			providing suggestions for language.
<i>Polar Prediction Matters</i>			
<ul style="list-style-type: none"> • Posts • Pageviews 	15 posts 2,336	19 posts 2,520	31 Authors, 23 institutions and 19 blog posts
<i>The IcePod</i>		Ranked in the top five science podcasts in Germany for 306 of 464 days it has been available.	2 trailers, 10 full episodes, 4 bonus episodes. Available via Spotify, Apple podcast and radio station RadioWeser TV 8,480 downloads
Twitter			More than 1,000 views/ day
<ul style="list-style-type: none"> • Followers • Tweets 	1,570 1,691	1,934 2,090	

Dr Werner presented the communication and outreach milestones and major activities for the remainder of the Consolidation Phase as depicted in Table 3 below.

Table 3. Major Communication and Outreach activity areas for the remainder of PPP/YOPP

Year		Event type
2021	Arctic Frontiers- Polar Prediction Session and Panel Discussion. 3 February	Online
2021	PPP-SG#12. 8-12 March	Online
2021	Arctic Summit Science Week (ASSW) YOPP/APECS/YESS Workshop. 21-22 March	Online
2021	PPP-SERA meeting. 12 – 16 April	Online
2021	YOPP-SH. 24-25 June	Online
2022	Antarctic Winter SOP. mid-April – mid-June	Field
2022	Polar Prediction School at Abisko, Sweden. April, dates to be determined	Face to face
2022	YOPP Final Summit. 2 – 5 May, Montreal, Canada	Face to face
2022	PPP-SG#13. Date, place and type to be determined	
Ongoing		
	Outreach for YOPP related publications	
	Support of other meetings and partner activities including YOPP endorsed projects	
Focus areas		
<i>The IcePod</i>	Season 2: will focus on User Engagement With suitable support it may be possible to create Season 3 using interviews to be conducted during the YOPP Final Summit.	

PolarPrediction-Matters	Will also look at new areas such as Tourism	
PolarPrediction-News	Continue with new format	
Twitter	Maintain and increase presence, increase promotion of YOPP and engage users in dialogue	
Videos	It is highly desirable to collect videos etc from PPP/YOPP activities such as the Spring School and potentially interviews or reflections of key people at workshops that could be used as part of a YOPP Final Summit video if funds are available.	

Regarding PPP/YOPP Evaluation, Dr Werner recalled that the PPP-SG had suggested the following as success stories: the increase of awareness of PPP over time and the growth of the PPP community itself; in 2016, few people were aware of PPP now many people are aware of it and it has been used by the US and the EU as part of funding calls; the *PolarPredictNews* and *The IcePod* have both received very favourable feedback, in fact during the MOSAiC period, the PPP Instagram account and *The IcePod* were updated more frequently than the official MOSAiC Instagram account and were referenced more frequently. Dr Werner reminded the PPP-SG of crucial need to be self-critical in our assessment as well as identify areas of PPP/YOPP that could have been improved.

Regarding indicators, Dr Werner recalled that the PPP-SG had suggested indicators as per table 4.

Table 4. Proposed quantitative and qualitative indicators for PPP/YOPP evaluation

Quantitative	# followers and interaction on social media # downloads and clicks on PPP Website/ <i>PolarPredictNews</i> # downloads of <i>The Icepod</i>
Qualitative	Survey to YOPP-endorsed projects w/ dedicated questions about YOPP Outreach & Communication Watch out for ratings or reviews from various sources

Dr Werner briefed the PPP-SG on the potential to use network analysis based around one or more of publications, social media and the YOPP-endorsed projects survey to demonstrate how PPP has grown and strengthened collaboration and communication on environmental prediction in the polar regions. Dr Werner used an example from ArcticNet in Canada that illustrates how the growth and strengthening of interactions between a range of sectors in Canada over more than 15 years, see Figure 4. Dr Werner advised the PPP-SG that the ICO were investigating groups who may be able to carry out this analysis for PPP and potential costs. Dr Grumbine advised Dr Werner that springy.js (<http://getspringy.com/>) is a handy way to produce these connectivity graphs, assign weights to connection (maybe by size of group) and then it executes a minimization algorithm to produce graphs like those shown. Dr Werner agreed to investigate this further.

NETWORKING AND PARTNERSHIPS

Network analysis: densification of ArcticNet and integration of partners over time

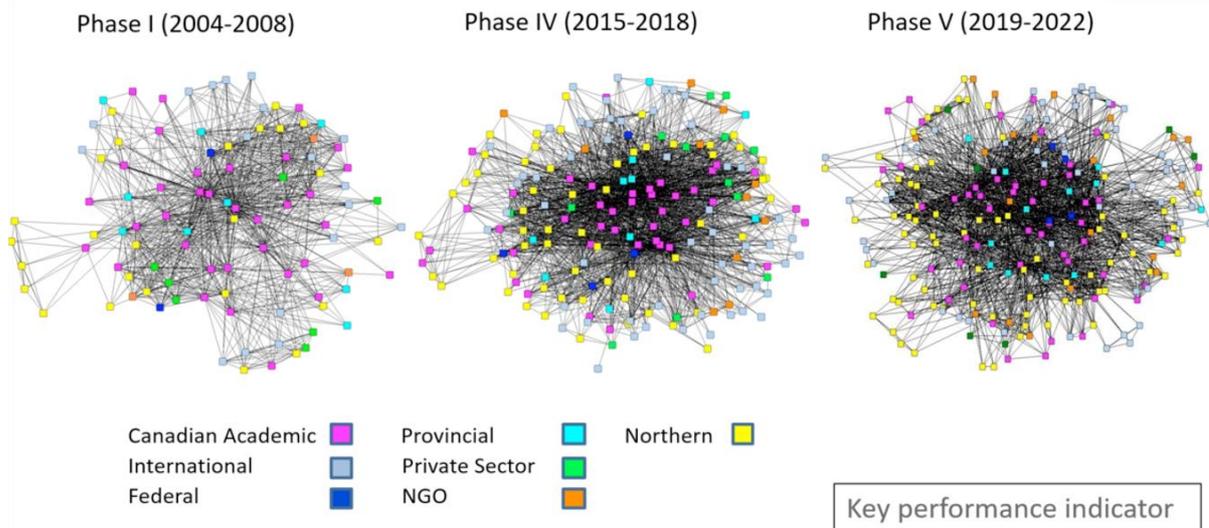


Figure 4. Example of Network analysis from ArcticNet in Canada showing the strengthening of collaboration and communication between entities over time. Provided by Leah Ann Braithwaite (ECCC), personal communication.

To complete the discussion, Dr Werner raised the following questions related to how Communication and Outreach could contribute to the PPP/YOPP Legacy. The ensuing discussion touched on what to do with the PPP/YOPP documentation contained on the website/the newsletter/the blog, what to do with the PPP community (i.e., the community connected via the email groups and social media), collecting video and images for use at the YOPP Final Summit and potentially inclusion in a Final Summit Video and options for producing a PPP book using some of the above material plus material from the Final Summit.

Regarding the documentation, it was suggested that some of the following may be suitable

- Maintain PPP Website as archive with all products and deliverables
 - Move/link parts (e.g., publications etc.) to WMO pages so it could be updated.
- Dr De Coning noted that there are few resources in WMO to take this aspect on.

Regarding continuing the PPP community, it was not clear if there was any one person or group who could actively continue contributing to and monitoring the PPP mailing list. Dr Werner suggested that YOPP-SH may be able to keep those aspects of PPP related to the Antarctic active whilst YOPP-SH is still current until 2024. It was also suggested to maintain an early researchers' network on polar prediction, maybe in collaboration with APECS. The PPP-SG noted with pleasure the development of the vibrant community but had no suggestions for how to continue it when funding stopped.

Regarding the proposal for a Final Summit video, the PPP-SG agreed that it would be a good thing to have but at this stage it was not clear how it would be funded and organised and who would actually do it. Dr Jung noted that the ICO and others such as endorsed projects could contribute material towards such a video but would not have the manpower to actually make the video.

Regarding the proposal to produce a publication based around PPP, Dr Jung agreed that it made a lot of sense to take the “crème de la crème” of material from the website, the blogs and *The IcePod* to make a digital book and for some of this material to also go into a hardcopy book. Dr De Coning advised the PPP-SG that the WWRP S2S and HIW projects were also considering publishing books as part of their legacy material. Dr Khalsa cited an e-book published <https://issuu.com/> as one potential model with an example <https://issuu.com/paulvanschaik/docs/urbanhub20-vuca3/1?ff> but he was not aware of costs and how long the material would remain available.

In closing this agenda item, Prof Jung thanked Dr Werner, Ms Sara Pasqualetto, Ms Katharina Kirchhoff and the ICO interns for their work and encouraged all of the PPP-SG members to submit material to the ICO for the various communication and outreach channels.

Actions

Identify who could be suitable video producers for Final Summit	Barbara / Estelle / ICO	Mar-21
Investigate whether springy.js (http://getspringy.com/) can provide some information regarding the network analysis	ICO	Jun-21
Find out what award the NERC newsletter won and whether <i>PolarPredictNews</i> would be eligible	Ian Renfrew	Jun-21
Further examine options for taking material from Polar Prediction Matters and the website for either a hard copy or digital book	ICO	Feb-22
Investigate whether there is an option to maintain a polar prediction ECR network past the formal end of YOPP.	ICO and Clare Eayrs	Sep-21

5. Observing System Experiments

1. Observing System Experiments

Dr Irina Sandu, lead of the Numerical Experimentation Task Team, recalled the work undertaken by ECMWF, ECCC, the Norwegian Meteorological Institute and DWD on a multi-centre comparison of the impact of Arctic observations on Forecast Skill. The aim of the OSE was to test the impact of different observations from the polar regions by removing different observing systems north of 60N and south of 60S then looking at the % increase in forecast error in both the Arctic and the Northern Hemisphere mid-latitudes. Results were obtained using four different NWP systems, three global (ECMWF, ECCC and DWD) and one regional (MetNo). The impact in the Antarctic and Southern Hemisphere mid-latitudes was not analysed in these OSE.

This work provided five major conclusions:

1. The complementary impacts from different observing systems.
Results show that all observing systems are complementary since there is an increase in forecast error when each observation type is removed. There are impacts from conventional data in the troposphere and on stratospheric wind, microwave data in the troposphere particularly at 500 hPa, Infrared data in the troposphere, GPSRO on the upper-troposphere-lower-stratosphere, and AMVs on near-surface variables.
2. The relative impact of observing systems is seasonally dependent.
In the ECMWF system, the microwave data appears to have a larger impact than the conventional observations in the summer months and this is reversed in the winter months with the conventional observations (radiosondes) having the largest impact. The differences between summer and winter seasons are likely related to the use of microwave sounder data over snow/sea-ice. There are difficulties in using tropospheric microwave sounding data in winter and this is shown by comparing the number of assimilated microwave observations in summer and winter, which indicates that less observations are used in winter. This is likely because of higher errors in modelling the surface and the radiative transfer (which are needed to transform temperature and humidity in microwave radiances).
3. The relative importance of observing systems is dependent on how the observations are used in the NWP suite.
This was tested by comparing the medium-range forecast scores of ECMWF to ECCC for the common winter 2017/18 period. The comparison shows that the individual impact of infrared and microwave satellite observations is smaller for ECCC than for ECMWF, likely due to differences in the usage of observations. For example, in terms of the microwave data ECMWF uses data from more instruments, and more data over land and sea-ice and in cloudy regions (the latter due to all-sky) than used by ECCC.
4. Current polar observing systems increase the predictive skill in the Arctic and Northern Hemisphere mid-latitudes.
This was determined by examining the standard deviation of forecast error in the Arctic and Northern Hemisphere mid-latitudes as a result of withholding some of the Arctic observations.
5. There is a clear benefit for regional NWP skill in the Arctic from the assimilation of Arctic observations in the global models used to create the lateral boundary conditions for the regional Arctic models as well as assimilating the same observations in the regional models.

Dr Sandu noted the Quarterly Journal of the Royal Meteorological Society (QJRMS) would be publishing a special collection of papers examining the impact of polar observations on predictive skill. The call for papers was open until the end of 2021, see <https://www.ecmwf.int/en/about/media-centre/science-blog/2021/new-insights-polar-observing-systems-using-numerical-models> for further details.

Dr Jung thanked Dr Sandu for her summary of this very important work and encouraged the PPP-SG to bring the QJRMS special collection opportunity to the

notice of their institutions. Recalling that the earlier OSE work from ECMWF et al. did not look at impacts in the Southern Hemisphere Dr Jung invited Dr Eric Bazile from Météo France to brief the PPP-SG on some OSE work he had led for the Antarctic.

Dr Eric Bazile briefed the PPP-SG on some OSE work that Météo France had undertaken in the Antarctic based around the Antarctic Summer SOP (23 November 2018 to 15 February 2019). During this time many of the permanent stations in Antarctica increased the number of radiosonde flights/day from two to three or even four. This increase in radiosonde flights allowed Météo France to run an OSE with the ARPEGE-SH 4DVar T1198 modelling suite with the stretching pole at Dome C. The model has 105 vertical levels and a horizontal resolution of around 7.5km at Dome C. In the OSE the usual radiosonde flights were used and compared with results from runs where all available extra radiosonde and standard flights were used. Typically, flights are undertaken at 00 and 12 UTC with only one or two stations undertaking radiosonde flights at 06 or 18 UTC. Detailed analysis at specific stations showed the extra flights improved the first guess forecasts and identified warm biases in the model at some locations. Overall, the OSE showed that:

- the additional radiosondes improved the ARPEGE assimilation cycle with a better first guess of the analysis for the next model run;
- identified different model bias in the diurnal behaviour of the model;
- that the addition of the extra radiosondes leads to an improvement in the forecast skill which is significant for temperature and wind, however, only out to a 12h lead time. Nevertheless, against the ECMWF IFS analysis, the positive impact is statistically significant but small.

Dr Jung thanked Dr Bazile for the presentation and work. He asked if there were plans for the work to be published which Dr Bazile confirmed would occur. Dr Jung noted that it was important for PPP to provide the countries and institutions who had undertaken additional radiosonde and other observations for any of the SOPs feedback on how their observations were being used and what results were being achieved.

Dr Jung then invited Dr Sandu to make a short presentation on behalf of Dr Francois Massonnet from University College Louvain (Belgium) regarding the forecasting of seasonal sea-ice extent using satellite estimated sea-ice freeboard measurements.

Dr Sandu noted that this work was undertaken as part of the APPLICATE H2020 project (a YOPP-endorsed project). The goal of the experiment was to demonstrate the feasibility of assimilating sea-ice freeboard observations into the Earth System Model EC-Earth3 for ensemble predictions of minimum seasonal sea-ice extent. Predictability studies carried out in the 2010s highlighted that late-summer sea-ice areal properties could be predicted skilfully with lead times as early as the preceding Spring, provided that some information on sea ice thickness was known.

With the advent of near-real time satellite products of sea ice thickness, seasonal prediction of Arctic sea ice is now becoming a practical reality. However, how to use and assimilate these observations in dynamical Earth System Models remains a challenge. In particular, there are two issues pending:

Issue #1: the first issue is related to the observational data itself. Satellites do not

measure sea-ice thickness directly; instead they measure sea ice freeboard, which is the height of the sea-ice floe above water. In order to convert freeboard to thickness, a number of assumptions need to be made regarding snow depth and density (among others), but these geophysical variables and parameters are, in fact, poorly constrained.

Issue #2: the second issue is related to the fact that no matter how good your initial state is, a fraction of the signal to be predicted will never be predicted, because small errors tend to amplify quickly and propagate through the whole climate system, including the sea ice. Dr Sandu noted that we cannot do much about this second challenge, except running ensembles to sample all plausible trajectories of the climate system between initialization time and the target time.

The work focused on the 2012 Arctic summer season which witnessed the all-time record low sea-ice extent in the Arctic. Two experiments were run, each consisting of a 50-member ensemble to address issue #2. The first experiment did not include any satellite data on sea-ice freeboard whilst the second experiment used the satellite-based sea-ice freeboard to estimate sea-ice thickness. By changing the initial state in the model through introducing a more realistic estimate of sea-ice thickness, an improvement in the predicted sea-ice extent throughout the 2012 summer season was observed. Not all the bias was removed but the assimilation produced lower sea-ice extent than in the uninitialized simulation. This work shows promise for the task of seasonal prediction of Arctic sea ice which is a key area of polar research given the growing activity in the region and increasing interest from stakeholders.

Dr Jung thanked Dr Sandu for making the presentation on Dr Massonnet's behalf and he looked forward to seeing further results on this important topic.

In closing this session, Dr Jung noted that the YOPP OSE activity can be seen as a success on a number of fronts from publications to pioneering a coordinated approach for OSEs between NWP centres and between global and regional models.

Actions

Write up the ARPEGE work for publication	Eric Bazile	May-21
Write to all institutions who provided additional Radiosonde flights and data for the SOPs to thank them for their efforts and provide some early feedback	ICO with Irina and Eric	Aug-21

6. YOPP Data Portal

Dr Øystein Godøy from the Norwegian Meteorological Institute briefed the PPP-SG on the current status and future plans for the YOPP Data Portal hosted by Met Norway (<https://yopp.met.no/>). He recalled that the purpose of the YOPP Data Portal was to provide an overview of, and wherever possible, access to, datasets relevant to YOPP. The datasets included real-time data streams obtained via the WMO Information System (WIS) and archived data. Dr Godøy reminded the PPP-SG that the YOPP Data Portal acted as the central discovery metadata repository which harvested metadata from the various contributing data centres. The actual data is held at the

contributing data centres who are considered authoritative for the datasets they hold. Data access and data constraints are determined by each of the data holders. Dr Godøy noted that for full integration between the portal and the contributing data centres it was necessary to achieve standardisation of the data documentation as well as the discovery metadata interfaces and data access interfaces.

Dr Godøy noted that the YOPP Data Portal provided three main functionalities for users: a search function based upon the harvesting of the metadata from the contributing data centres via the standard protocols of OAI-PMH, OGC CSW and OpenSearch; where allowed, access to the remotely held data via the OPeNDAP protocol preferably in the format of NetCDF/CF with ACDD; and visualisation of the underlying data using OGC WMS and OpenDAP, although this functionality is limited at the present time.

The PPP-SG were further informed of that the YOPP Data Portal is up and running with the following functionality:

Table 5. Functionality of the YOPP Data Portal in March 2021

Functionality	
Search	Based upon SolR an open-source search platform built upon Apache Lucene webserver, Facet support (a means of helping the user narrow down their search) is partially implemented.
Download	Can download single products or multiple products where the underlying data centre provides access
Visualisation	Gridded data sets can be visualised but no support for vertical levels yet Time series are working Profiles in beta stage
Manual entry of metadata	A metadata collection form is available
Guidance documentation	Concept document available Interoperability guidelines available Contact form available
Announcements	New datasets announced on the front page
Tagging	Tagging is activated to allow users to download all articles or announcements related to a specified topic
User experience	Possibility to add helper scripts that can guide the user in certain functions or searches. Currently not implemented
Data on Met No data server	Source WMO GTS <ul style="list-style-type: none"> • Arctic Resolution 40 weather stations and radiosondes stored locally to NetCDF/CF served through OPeNDAP • Weather station data is aggregated into time series • Radiosonde data is stored locally • Moving surface stations (ships) data is stored locally

Dr Godøy advised the PPP-SG that there were currently 723 (parent) datasets in the YOPP Data Portal catalogue, where a parent data set could be a station or a moving ship. Every parent dataset may have many children or sub data sets and cover all or part of the YOPP period (2017–2019). At the time of PPP-SG#12, there were no MOSAiC datasets registered in the portal and the connection with the Japanese Polar

Institute (NIPR) was broken. Work was underway to automatically harvest metadata from the US Navy Global Prediction Systems - Earth System Prediction Capability (Navy ESPC) and allow access to the underlying data. In terms of users, Dr Godøy informed the PPP-SG that there were 48 registered users and realistically around 400 unregistered users each month. The number of unregistered users was actually much higher but Dr Godøy indicated that many of the additional unregistered users were most likely robots. Dr Godøy noted that there were definite peaks in the use of the Portal prior to major YOPP-related meetings. In response to a question, Dr Godøy noted that it would be possible to get a lot more insight into user behaviour on the Portal using Google Analytics but this would need careful consideration before being introduced.

In terms of future upgrades to the Portal, Dr Godøy reminded the PPP-SG that there was no specific budget for this major part of YOPP. It was being provided by Met Norway on a best effort basis with YOPP benefiting from a number of other major projects Met Norway is supporting in this area. Thus, improvements to functionality relies on similar functionalities being required in the other projects. Fortunately for YOPP, these projects will fund a major hardware and software upgrade of the entire system in the first half of calendar 2021 which will include improvements to the interface, underlying data structures and searching capability as well as improvements in the visualisation. Thus, the YOPP Data Portal should remain available as a separate entity for some years to come. After this, if no new funding is identified the metadata catalogue will be migrated to the Arctic Data Centre catalogue.

Dr Godøy concluded his presentation noting that the major limitations on the YOPP Data Portal were not on the hardware or software but on the numbers of users contributing metadata to the site and their limited understanding of metadata. Thus, there needed to be more awareness raised on the benefit of comprehensive abstracts describing the data collection and the application of keywords identifying the underlying variables. Improving the quantity and quality of the metadata on the site would improve the search results and the ability to identify the most appropriate datasets for use. Dr Khalsa supported Dr Godøy's comments on the need for improved metadata but also reminded the PPP-SG that this was an evolving concept and the curation of data had not always been in the forefront of individuals and funding agencies' minds in the past, however this was gradually changing now. If we were commencing PPP again one of the first things to obtain funding for would be the development and ongoing maintenance of the YOPP Data Portal.

In the ensuing discussion, Dr Godøy advised the PPP-SG that it would be possible for the YOPPsiteMIP master table of variable names (the 'Hartten-Khalsa' table) to be hosted on the Portal. It would also be possible to include a layer in the search map that showed where YOPP sites were located based around some work done within the ICO. The Portal could also provide links to Githubs that held code people were using to access and manipulate data identified via the YOPP Data Portal. In response to questions regarding delays in correcting errors detected in metadata, Dr Godøy advised the PPP-SG that it had been extremely busy in the preceding months but he and his staff were starting to catch up on the backlog. He apologized for any inconvenience and assured the PPP-SG that these matters would be dealt with in the near future. Dr Jørn Kristiansen noted that Met Norway were continuing to share

radiosonde data for YOPP sites after the end of the SOPs but there had been some delays in their processing. This matter should be addressed in the near future. In response to a question from Dr Khalsa about the possibility of visualising the model and observational data from YOPP Supersites, Dr Godøy advised the PPP-SG that this would be possible but it would require some funding support to make it occur in 2021 and it would need to come at a time when overall workload was dropping.

In closing this session, Prof Jung thanked Dr Godøy and Dr Siri Jodha Khalsa for the presentation and their contribution to this very important activity. Prof Jung suggested there were a number of success stories around the YOPP Data Portal and he anticipated some text and use indicators along with announcement of key data sets would be included in the Final Summit brochure.

Actions

Investigate why MOSAiC data is not visible to the YOPP Data Portal via PANGAEA	ICO/Øystein Godøy	May-21
Investigate whether the master MODF/MMDF table and toolkit source code should be included in the YOPP Data portal. Similar action under YOPPsiteMIP	Siri Jodha Khalsa, Øystein Godøy and Taneil Uttal	May-21
Investigate whether Met Norway has access to Google Analytics and on balance whether it is worthwhile installing	Øystein Godøy	Jun-21
Investigate what statistics can be derived from the YOPP Data Portal (click throughs to data centres, which are the key data centres people are accessing, what is commonly searched for)	Øystein Godøy, Siri Jodha Khalsa, ICO	Jun-21
Encourage YOPPsiteMIP team to develop and share sample code for accessing and displaying YOPP Data from SOPs and share with Education TT	Taneil Uttal, Gunilla Svensson, Clare Eayrs	Aug-21
Investigate whether new YOPP Data Portal can display the Google Map layer which indicates the additional SOP data	ICO, Øystein Godøy	Aug-21
Recommend how people can link GitHub code to the Portal	Øystein Godøy, Siri Jodha Khalsa, Taneil Uttal, Gunilla Svensson	Sep-21
Develop an estimate of how much and what sort of operational and research data is not going into the GTS	Jonny Day, Irina Sandu, ICO	Mar-22

7. YOPP-SH

Prof. David Bromwich, lead of the YOPP-SH Task Team, briefed the PPP-SG on YOPP-SH activities since PPP-SG#11 and plans for the remainder of the YOPP Consolidation Phase. One of the highlights of 2020 was the publication of the SOP-SH1 activities of YOPP-SH in the Bulletin of the American Meteorological Society (BAMS), see <https://journals.ametsoc.org/view/journals/bams/101/10/bamsD190255.xml>.

David Bromwich noted the many authors to the paper and thanked all for their contributions in getting this paper published. The paper concluded that the summer predictive skill for Antarctic latitudes is significantly poorer than that for the Arctic, confirming the need for the YOPP-SH effort. With no indigenous population, environmental forecasts primarily support operational and scientific activities, and surface wind forecasts are of most value. Observing system experiments have had limited initial success in improving predictions of surface winds, perhaps indicating that model boundary layer schemes need focused attention via YOPPsiteMIP. The authors further conclude that efforts by the Antarctic research community have led to a successful YOPP-SH in the summer, and attention is now turning to the colder part of the year anticipating year-round research in the Antarctic. David Bromwich advised the PPP-SG that he and Dr Eric Bazile were intending to submit papers to the QJRMS special edition on OSEs based upon the work undertaken around the SOP-SH1.

David Bromwich recalled that PPP-SG#11 had discussed the option of holding a second Special Observing Period (SOP) in the Antarctic to capture the winter freeze up and extension of the sea-ice. He advised the PPP-SG that planning for this winter SOP was well underway and that it would most likely take a regionally focused approach using the philosophy of the Targeted Observing Period aligned to the MOSAiC ice drift in the Arctic in 2020. Letters had been sent to countries participating in Antarctic activities to alert them to the SOP and requesting their assistance for additional radiosonde and other observations. David Bromwich noted his pleasure at the large number of offers of support for the work.

At this stage it appears that the SOP will focus on at least two, possibly three geographic regions: the Antarctic Peninsula; the greater Ross Sea and part of West Antarctica; and, possibly East Antarctica. The foci for each region will be slightly different according to the observational capacity of stations in the region and the research priorities of the group coordinating that region. It is hoped to capture up to four events of interest in each region. Forecast sensitivity to observation tests for representative events will be done ahead of time to plan the observational strategy. Firm dates for the SOP have not yet been set but it is expected to run from mid-April 2022 to mid-June 2022 with additional observations taken prior to and during when the appropriate weather phenomena/conditions are forecast to occur. The online YOPP-SH meeting on 24 –25 June 2021 will finalise commitments and dates for the SOP.

David Bromwich advised the PPP-SH that he had been successful in getting support from the Byrd Polar and Climate Research Center to take over the administrative support of YOPP-SH after PPP completes in December 2022. At this stage, there will only be limited administrative support and thus he welcomed suggestions from the PPP-SG on any options to identify some small funding to help obtain some further administrative support after this time. In closing, David Bromwich noted that the BAMS paper provided some success stories for inclusion into the YOPP Final Summit brochure along with details of the additional observations etc.

Prof Jung thanked Prof Bromwich for the update on YOPP-SH activities and particularly for identifying an option for YOPP-SH support post December 2022. Prof Jung noted that it was not clear how YOPP-SH would report back to WMO once PPP finished but this would be raised at the coming EC-PHORS session. Following a short

discussion regarding the YOPP Final Summit brochure, the PPP-SG decided not to separate the Antarctic and Arctic when reporting results.

Actions

PPP-SG and ICO to investigate options funding options to support YOPP-SH coordination past December 2022.

Prof Bromwich and Dr Bazile to submit papers for the QJRMS special collection.

8. PPP-SERA

Dr Machiel Lamers, co-lead of the PPP Societal and Economic Research and Applications (SERA) Task Team, provided the PPP-SG with an update of activities of PPP-SERA, plans for the remainder of the Consolidation Phase, input into the YOPP Final Summit, and suggestions for evaluation indicators and for the PPP/YOPP legacy.

Dr Lamers recalled that the goals of PPP-SERA are to identify the need for and the use of environmental information in polar regions and identify the types of decision-making processes by a diverse range of actors and users of environmental information. Furthermore, PPP-SERA team members and contributors are investigating the communication between providers and users of polar weather and ice information. These goals are carried out through building of communities via dedicated workshops and sessions at conferences and other meetings. Dr Lamers noted that although PPP-SERA were not able to carry out the face-to-face workshops they had planned for 2020, they had been busy publishing and running online workshops. The Journal Polar Geography (Volume 43, Issue 2-3 (2020) <https://www.tandfonline.com/toc/tpog20/43/2-3>) had recently published a special edition addressing the Societal Value of Improved Forecasting that included eight PPP-related papers. In addition, *PolarPredictNews*, the Polar Prediction newsletter #17 (February/March 2021) features four articles provided by PPP-SERA members.

Dr Lamers noted that the annual PPP-SERA meeting scheduled for April 2020 had been cancelled as had the Special Services workshop planned around the SCAR meeting in Hobart in August 2020. Two online Special Service Project workshops had been carried out:

- Arctic Change 2020 Session in Canada in December 2020 with sixty online participants and four presentations addressing the topic of “Tailoring Polar Weather, Water, Ice and Climate Information and Services to Address Diverse User Needs”. The discussion focussed around the importance of engagement with indigenous representatives to enhance WWIC services and service provision to ensure safe local mobility in the Arctic.
- PPP-SERA Special Services Projects Workshop on Co-Production in the European Arctic in January 2021 with 30 online participants and five presentations addressing the topic of co-production. The discussion focussed around the enabling factors, benefits and challenges of co-production in developing WWIC services. The report is available [here](#).

A third online workshop is planned for Russia in June 2021. PPP-SERA will hold an

online meeting in April 2021 and would like to hold a face-to-face meeting around the YOPP Final Summit. Dr Lamers further noted that there were postponements in key PPP-SERA-related projects due to COVID-19.

Dr Lamers advised the PPP-SG that the YOPP Final Summit had been discussed within PPP-SERA and offered the following recommendations:

- There should be genuine representation of social science research and stakeholder involvement to reflect the diversity of the PPP projects;
- Where possible, there should be a series of presentations and panels focusing on the use, implications and societal value of polar prediction. One way to do this would be in the form of paired keynote presentations (researcher/stakeholder) where science topics were linked to potential beneficiaries of the theme such as small communities in the Canadian Arctic or Alaska, cruise or cargo shipping in the European Arctic or science logistics in Antarctica. PPP-SERA will use their strong connections with users to propose a programme;
- Funding is identified to allow PPP-SERA to meet around the YOPP Final Summit which will assist ensuring a strong PPP-SERA presence at the Final Summit.

Regarding evaluation of PPP/YOPP, on behalf of PPP-SERA, Dr Lamers offered the following suggestions for indicators: # workshops/meetings; # of diversity of stakeholders/sectors; # of publications; the use of network analysis perhaps built around co-authorship of papers, meeting participants, social media or even the changes in content and focus of the mind maps used to plan and run the PPP-SG meetings; and, qualitative indicators such as testimonials. Regarding success stories, Dr Lamers requested that the PPP-SG provide PPP-SERA some clarification on what was meant by success and how would it be judged and in what format the success stories were requested. The PPP-SERA would then look for suitable success stories at their April 2021 meeting.

Regarding PPP-SERA legacy, Dr Lamers noted that PPP-SERA considered the following as potential legacies of their work:

- In terms of co-production of services, more involvement between the natural and social scientists and the users in the development of weather, climate and sea-ice services. In the short term, this was evidenced by the involvement of PPP-SERA in the 2022 Abisko Spring School and the inclusion of users in the Final Summit keynote addresses; in the longer term, it would be further collaborations at the institute level between the service providers, the social scientists, and the users.
- In terms of maritime education, the legacy would be raising the awareness of the WMO and IMO communities to the need for strengthening the content and rigour of the polar maritime training for mariners, enhancing the Polar Code and requirement for mariners in ships operating in polar waters to be better trained in weather, water and sea-ice aspects as well as use of the new digital aids on board the ships.

Prof Jung thanked Dr Lamers for his presentation and opened the floor for discussion. Regarding the recommendation to pair natural science and social science/users as keynote speakers during the YOPP Final Summit, the PPP-SG

supported the concept but were unsure how it would work exactly. The PPP-SG noted that the terms researcher/stakeholder were relative terms and thus some of the pairings could be observationalists with modellers and modellers with forecasters etc. Suggestions for keynote speakers were made with the PPP-SG requesting the YOPP Final Summit Committee to take the recommendations from PPP-SERA into account when further developing the Summit program.

Regarding the evaluation/legacy discussion, the PPP-SG noted the importance of identifying/featuring some or all of the following aspects:

- Areas of PPP/YOPP research that have led to, or are expected to lead to in the short term, changes in services.
- How did YOPP stimulate national and international research funding?
- How much did YOPP cost? From a management perspective using the WMO Trust Funds and AWI's direct contributions as a starting point and from the wider perspective of the YOPP endorsed projects.
- Bibliometric analysis of YOPP/PPP publications, include requests for publication details in the YOPP-endorsed project survey and call for nominations of publications for the YOPP google scholar account;
- The Maritime Education Project – this has tangible outcomes and there is a well-placed “champion” to drive it. This activity could carry on past the end of 2022.

Prof Jung thanked Dr Lamers for his presentation and concluded the session.

9. MOSAiC, NRT Sea Ice Verification and NH-TOP results

9.1 MOSAiC

Dr Matthew Shupe, co-coordinator of the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) addressed the PPP-SG on the topic of “Perspectives on a Successful Partnership – PPP and MOSAiC” following the completion of the MOSAiC field campaign.

Dr Shupe provided the following summary of the MOSAiC field campaign: MOSAiC Year – many challenges with distinct successes; the Arctic sea-ice was thin and dynamic with RV Polarstern well placed to observe the changes; there was a huge amount of science undertaken across many disciplines; broad participation from national and international research institutes, a great deal of interdisciplinary work and extensive media and outreach campaigns; it included a lot of capacity building as a new generation of field scientists were trained and methods of carrying out research on thin sea-ice were tested; and MOSAiC will result in a legacy of data for all to use. Dr Shupe advised the PPP-SG that in his opinion the PPP-MOSAiC interaction has been highly successful helping both projects.

Dr Shupe informed the PPP-SG that PPP had assisted MOSAiC in the design, preparation, implementation, assessment, analysis, impact, education, and communication activities. Prof Jung noted that MOSAiC had been very beneficial for PPP as well, the Year of Polar Prediction actually became two years due to the delay in MOSAiC and thus it has been possible to collect YOPP-related data over a much

longer period than originally planned. The presence of MOSAiC in the central Arctic was particularly useful for the Targeted Observing Period in April 2020 as well as acting as a focus and test bed for the sea-ice forecasting. Drs Jung and Shupe agreed that flexibility, cooperation and partnership were key features of the relationship between the two projects.

Dr Shupe provided some examples of the PPP-MOSAiC interactions:

- MOSAiC followed PPP by including the coordination of collocated model and observational data from the start of the project.
- PPP helped MOSAiC to define the priority processes (stable boundary layers, mixed phase clouds, precipitation, ice-ocean dynamics and small-scale sea-ice processes) to observe and resulted in MOSAiC carrying out the most comprehensive Central Arctic observation program ever undertaken.
- The priority processes helped to define the length scales for the distributed observation network where sensors were placed at different distances from the ship to support investigation into the different scales of the priority processes. The concept worked very well for the first two legs of MOSAiC but in early spring, changes in the sea-ice dynamics of the floe severely damaged the network taking out key stations.
- RV Polarstern contributed four radiosonde releases per day from the normally data sparse central Arctic with a total of 1574 radiosondes launched during the field campaign from the ship. These radiosondes will complement the Arctic wide data for assimilation studies to be undertaken as part of PPP.
- MOSAiC contributed detailed multi-sensor observations to the two 2020 Targeted Observing Period events, which captured the first significant warm air intrusions over the ship, led to surface glazing (slight melt) and were a big step in the seasonal transition towards the spring melt at the ship.
- The YOPP SIDFex sea-ice forecasts provided essential support for operational decisions related to the ship and the ice floe, especially in late spring.
- Some MOSAiC participants have adopted the YOPPsiteMIP Merged Observatory Data File format for the MOSAiC observations as it will allow direct comparison with the collocated model data.
- The YOPPsiteMIP and wider PPP concept of collocated model and observations will allow detailed investigation of model bias and model success when comparing the climate and weather model output with the detailed observations taken during MOSAiC

In the ensuing discussion the following observations and comments were made:

Data availability	MOSAiC data will be publicly available from 1 January 2023 at the latest. Some data is already publicly available but may not have been fully quality controlled and assured. Attribution of the data sources will be a major requirement for people using MOSAiC data. MODF's with key atmospheric and sea-ice data are required for the YOPP Processes Task Team activities.
Data analysis	Like many field campaigns, much of the MOSAiC funding was focussed upon collecting the field data, and probably not enough funding has been secured to allow all of the data to be fully analysed, moved to MODF and MMDF format and

	<p>kept accessible for years to come. Further interactions with the funding agencies are required to improve this aspect. Some further coordination is required to minimise duplication of effort when doing the quality assurance etc, however some duplication may be acceptable as it provides an independent check on the quality assurance processes.</p> <p>New work with coupled models will challenge the current MOSAiC structures, which are set up along discipline lines but efforts are being made to increase communication between teams across discipline boundaries. There is already some interdisciplinary mixing between the teams, and the MOSAiC observation strategy was developed with the idea of co-located observations between the disciplines in mind.</p>
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In closing the discussion, Dr Shupe thanked the PPP-SG for their support during and prior to MOSAiC and he looked forward to working further with PPP/YOPP in the months to come, particularly on the modelling and YOPPsiteMIP activities. Dr Shupe noted that one of the big challenges for both YOPP and MOSAiC would be keeping the communities together and working on the data that has been amassed.

Actions

Develop an estimate of how much and what sort of operational and research data is not going into the GTS	Jonny, Irina, ICO	Mar-22
Continue strong collaboration and partnership with MOSAiC particularly related to coupled modelling and YOPPsiteMIP		Apr-21

9.2 MOSAiC Near-Real Time (NRT) Sea-Ice Verification

Dr Amy Solomon briefed the PPP-SG on the topic of "Improving short-term forecasts of the Arctic ocean-sea ice-atmosphere coupled system using observations from the MOSAiC Campaign". The goals of the MOSAiC Near Real-Time Verification team are to improve the simulation of coupled processes unique to the Arctic using observations taken during MOSAiC.

The project has two phases, the first phase focusses on priority coupled processes which are:

- The persistence and maintenance of mixed-phase clouds;
- The representation of the stable boundary layer;
- Atmosphere-snow interaction; and
- Ocean-sea ice-atmosphere coupling.

Short-term forecasts are used in this project to identify potential errors in the representation of "fast" processes that cause biases in climate model projections of Arctic climate change. The following models are providing the short-term forecasts for this project:

- NOAA-PSL Coupled Arctic Forecast System (CAFS);

- ECMWF Integrated Forecasting System (IFS);
- MétéoFrance Action de Recherche Petite Echelle Grande Echelle (ARPEGE-GELATO);
- MetNo Applications of Research to Operations at Mesoscale (HARMONIE-AROME);
- US Navy Earth System Prediction Capability Model (Navy-ESPC);
- DWD Icosahedral Nonhydrostatic Model (ICON);
- AWI Downscaled ICON Forecasts; and
- Russian Hydromet Forecast System (SL-AV).

The second phase of the NRT activity is focussing on forecasting of key event types such as: precipitation events; storms/cyclones; lead formation; high-wind events; and moist/warm air intrusions/atmospheric rivers.

Dr Solomon advised the PPP-SG that the work was ongoing and good progress was being made. She further advised the PPP-SG that the work was being coordinated with the YOPP Sea-Ice Task Team and the YOPP Processes Task Team. Dr Jung thanked Dr Solomon for her presentation and opened the floor for discussion. The following key points were made during the discussion:

- The importance of getting the quality controlled and assured data out in suitable formats for use by the wider community as soon as possible;
- The importance of vertical resolution in the snow and lower levels of the atmosphere for weather and climate models to best approximate the processes;
- The importance of the co-located observations for the different disciplines in MOSAiC to enable work on coupled models;
- The need to compare and contrast observation and model data from land and sea-ice sites to test the importance of how the different fluxes are handled;
- The importance of the distributed MOSAiC observation network to cover the different scales of processes and allow testing on more than one model grid box;
- Learning from the SHEBA experiences, MOSAiC coordinated the observational campaign with the modeling community during the planning stages of the campaign. This started the dialogue about what modelers need to improve climate models and forecast systems used to study the Arctic before the campaign, not after the observations were collected. Modelers have stressed that the MOSAiC observations need to be made available to the modelling community in a dataset specifically designed to evaluate models and that this needs to be made available in a timely (within a few years) manner.

Dr Jung closed the session thanking Dr Solomon for her presentation and ongoing work.

Action

Promote the availability and use of the sea-ice drift forecast and observation files	ICO	Jun-21
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9.3 Arctic Targeted Observing Period (NH-TOP) results

Prof Gunilla Svensson with the support of Ms Taneil Uttal briefed the PPP-SG on the results of the Targeted Observing Period (TOP-NH1) associated with the MOSAiC

campaign. Prof Svensson recalled that the early TOP planning had identified the opportunity for a number of intensive observation campaigns to take account of the presence of RV Polarstern in the Central Arctic but also MOSAiC aircraft campaigns and some additional science and resupply cruises. The aircraft campaigns and the other science cruises were eventually cancelled due to COVID-19; therefore the TOP campaign reduced to the 12th to the 22nd of April 2020 based around RV Polarstern.

During the TOP, a total of 50 additional radiosondes were launched from RV Polarstern (3-hourly) as well as at the land stations of Eureka, Keflavik, Egilsstaðir, Sodankylä, Ny-Ålesund, Tasiilaq, Bear Island, Andoya and Jan Mayen.

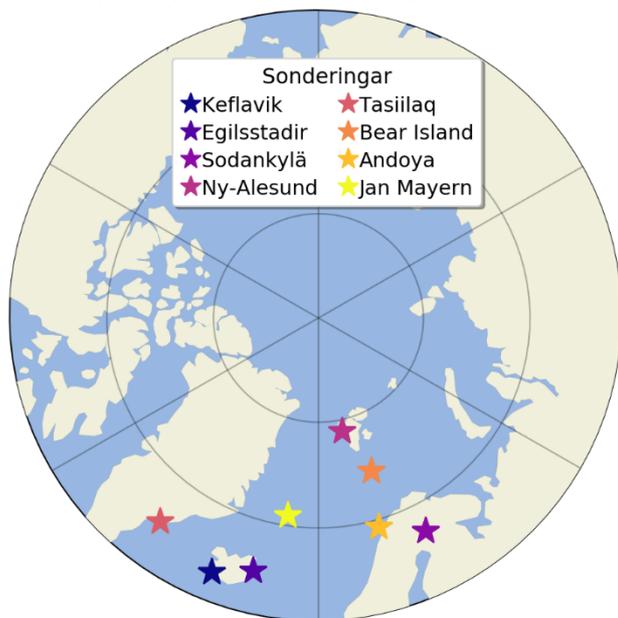


Figure 5. Locations of the additional 50 radiosonde launches for the TOP period

The TOP captured two warm air intrusions into the Central Arctic (Figure 6) and signalled the start of the spring melt. The actual melt onset occurred some three weeks later but this TOP period was the first time since late 2019 that the net incoming surface radiation was positive.

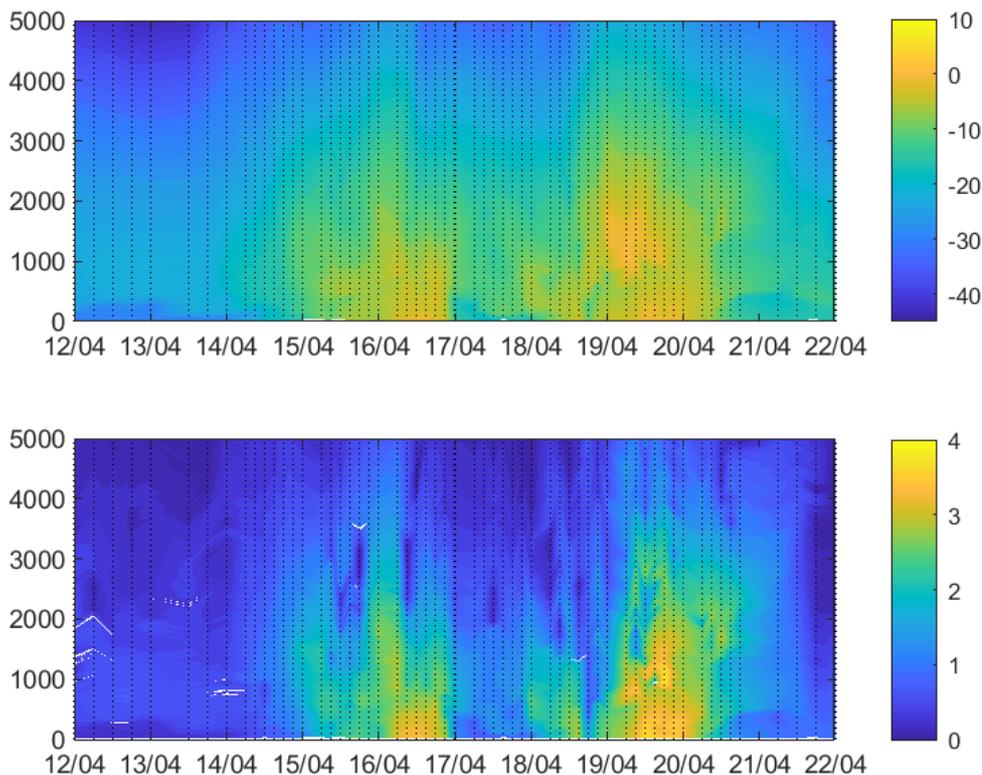


Figure 6. Profiles of temperature (top) and specific humidity (bottom) observed at RV Polarstern's location during the TOP.

In addition to the surface and radiosonde observations, data from the ECMWF ERA5 reanalysis system has also been collected. Back trajectories from RV Polarstern's location are being calculated from the ERA5 data set to allow comparison of the ERA5 and IFS forecasts with radiosonde profiles from the appropriate upwind stations using Lagrangian analysis and processes. A publication describing the organisation of the experiment, trajectories and large-scale structure is in preparation.

Prof Svensson further advised the PPP-SG that she is proposing to organize a model intercomparison on the TOP at the next MOSAiC near-real time verification (NRV) meeting; and she anticipated the first results would be discussed during the Final Summit. Prof Svensson expected that the TOP would result in a comprehensive and accessible database of radiosonde soundings, and model and observation data from MOSAiC, COMBLE and YOPPSiteMIP sites.

Prof Svensson informed the PPP-SG that as a result of the preliminary investigation of the TOP data, a number of other considerations had arisen:

- Firstly, the TOP concept was successful and Prof Svensson proposed that the PPP SG considers holding a further TOP campaign from 7 March 2022 to 17 April 2022 to coincide with the HALO-AC3 field campaign to take advantage of the numerous dropsondes that will be released as well as the other observations of ocean and sea ice.
- Secondly, Prof Svensson and Ms Uttal also proposed that the period of 15 December 2019 to 24 February 2020 be retrospectively identified as a Special

Observing Period (SOP-NH3) as during this time, the observations around the RV Polarstern were stable and continuous; the MOSAiC distributed network (observatories at different distances from the central observatory at RV Polarstern's location out to 50 km) was in place; the data quality control will therefore be more straight forward for many of the variables (no redeployment of instruments or tilting observation platforms); there was no solar input at RV Polarstern's location during this period which eliminates several degrees of freedom in process studies; the deep Arctic winter is the most under-observed for the Central Arctic Ocean; and the 2019/2020 Arctic winter was characterised by an unusually persistent and strong Polar vortex; and

- finally, Prof Svensson noted that at this stage of the PPP Consolidation Phase, there may be some value in reviewing the make-up of the Task Teams and YOPP projects and cases, in particular the Data TT, the Verification TT, and the Processes TT as they are all using MMDFs and MODFs and their target processes have a strong overlap:
- the vertical representation of cloud and hydrometeors microphysics, low level (mix-phase) clouds;
- the representation radiation, turbulence, energy and momentum fluxes;
- stable boundary layer;
- atmosphere-snow interaction and ocean-sea ice-atmosphere coupling;
- ocean mixing.

Prof Jung thanked Prof Svensson and Ms Uttal for the presentation and opened the floor for discussion.

Regarding the proposal for a retroactive SOP, the PPP-SG was in favour of this approach for the reasons outlined by Prof Svensson and Ms Uttal also noting that this would provide a focussed period for the YOPP Supersites to get their data into MODF format and would help the MOSAiC researchers prioritise their data quality control and assurance. The PPP-SG commented that it would be highly desirable to have all the data from MOSAiC in MODF/MMDF format and the proposed SOP could be the first step in this longer-term goal. The dataset created from this SOP would add to the YOPP legacy, particularly the MODFs would be extremely useful as a testbed for future model development and could help develop a fuller understanding of regional variations in the Arctic winter/night. Several acronyms were suggested for this SOP, ROMP (Retrospective Observing-Modelling Period) and TROMP (Targeted Retrospective Observing-Modelling Period) but no decision was taken on the name.

Decision – agree to retrospectively define the period of 15 December 2019 to 24 February 2020 as a Special Observing Period (SOP-NH3).

Regarding the proposal for a further TOP in March 2022 (TOP-NH2), the PPP-SG agreed to endorse the concept and identified that WMO Members would need to be contacted to see if they would be interested in undertaking further flights during this time. Prof Jung noted that the letters should include details of what has already been achieved with the additional flights.

Regarding a potential re-organisation of the PPP Task Teams and the PPP website, the PPP-SG noted that the Processes TT seemed to be the leading TT and was already

interacting with the Data and Verification TTs. This situation could be formalised or left to continue informally if things were working smoothly. Regarding the website, Prof Jung noted that when PPP finishes at the end of 2022 there will not be any AWI funding available to further update and maintain the website. The ICO recognise the value of the site for the PPP and wider community and would like to see another group offer to take over some or all of the updating and maintenance.

Prof Jung thanked everyone for the discussion and closed the session.

Action

TT leads for YOPP Data, YOPPsiteMIP, Sea-ice, Verification and Processes to discuss the need for rationalisation of the TT for the remainder of PPP.	TT leads	Jun-21
ICO to include TT rationalisation as an agenda item in the May PPP-SG teleconference	ICO	Apr-21
Process/YOPPsiteMIP leads to finalise period for retroactive SOP and the name that will be used	Gunilla and Taneil	Apr-21
ICO to advise YOPP projects and YOPP Endorsed projects of the decision to retro-actively define late Dec 2019 to late February 2020 as an "SOP" and encourage appropriate NH stations to move their data into MODF format accessible via the Portal	ICO, Gunilla and Taneil	May-21
Gunilla to provide ICO with material that could be used as part of a letter from her and Thomas to countries / institutions in NH-TOP1 providing feedback and asking for interest in participating in NH-TOP2 around the HALO-AC3 campaign.	Gunilla and ICO	Aug-21
ICO to consider how to revamp website once the TT leads have come to a decision on rationalisation of the TTs. This review of the website to also identify those areas that should be maintained/kept for the longer term and what can be let go after the end of 2022.	ICO	Jun-21
Support the designation of a retro-active SOP from mid-December 2019 to mid-April 2020	????	Apr-21
Agree to define a second NH TOP in conjunction with the HALO-AC3 campaign from 7 March 2022 to 17 April 2022		

10. Evaluation and Legacy

10.1 YOPP Evaluation and Success Stories

Prof Jung introduced the topic of PPP/YOPP evaluation recalling that the PPP-SG had considered the topics of Evaluation and Legacy in some detail in the previous two sessions of the PPP-SG, and these topics had been included in the implementation plans for both PPP and YOPP. Prof Jung further recalled that the purpose of the evaluation was too critically examine what worked well and also to identify activities and actions that could have been improved.

Prof Jung reminded the PPP-SG that at the previous session, it had been decided that the output from the evaluation study should be in the form of a short (perhaps 40 pages) high-quality publication or brochure with figures and boxes of text and numbers that would be provided to participants at the YOPP Final Summit. The purpose of the brochure would be to summarise the key outputs and achievements of PPP/YOPP in an informative and engaging way.

Following the last PPP-SG session (PPP-SG#11), the ICO had developed a first draft of such a brochure to enable further feedback and ideas. Prof Jung presented this first draft noting that the final version would be put together with a graphic designer and commercial company to improve the accessibility and readability of the publication and that the diagrams, figures, layout etc could then be re-used during the Final Summit presentations as well as for publications, web publicity etc.

Regarding the timeline for preparing the brochure Prof Jung recommended the following:

- ICO to create a google doc structure to enable individuals and task teams to start contributing content (text, figures, numbers) towards the brochure
- Aim for a first draft by September 2021 with the view of presenting this to the WWRP-SSC which is due to meet in late September
- Aim for a version to be presented to the Final Summit by February 2022
- Consider updating the Final Summit version by December 2022 to incorporate outcomes from the Summit and the results of work published after February 2022.

The PPP-SG discussed the proposed timeline noting that the WWRP-SSC was a stakeholder and could provide feedback on the content and layout in September 2021 and that some of the other WWRP core projects may be interested in following what PPP is proposing. The PPP-SG noted that there was a risk that the brochure may not be sufficiently developed by late September but as the WWRP-SSC meet quarterly, there would still be time to present to the following meeting in January 2022. However, it may make it difficult to make major changes at that time based upon their feedback. The PPP-SG suggested that we dedicate at least part of each PPP-SG teleconference to discuss the open questions such as the key legacy or follow-on elements for PPP and collectively work on the text and ideas for the brochure.

The proposed chapter structure is depicted in figure 7.

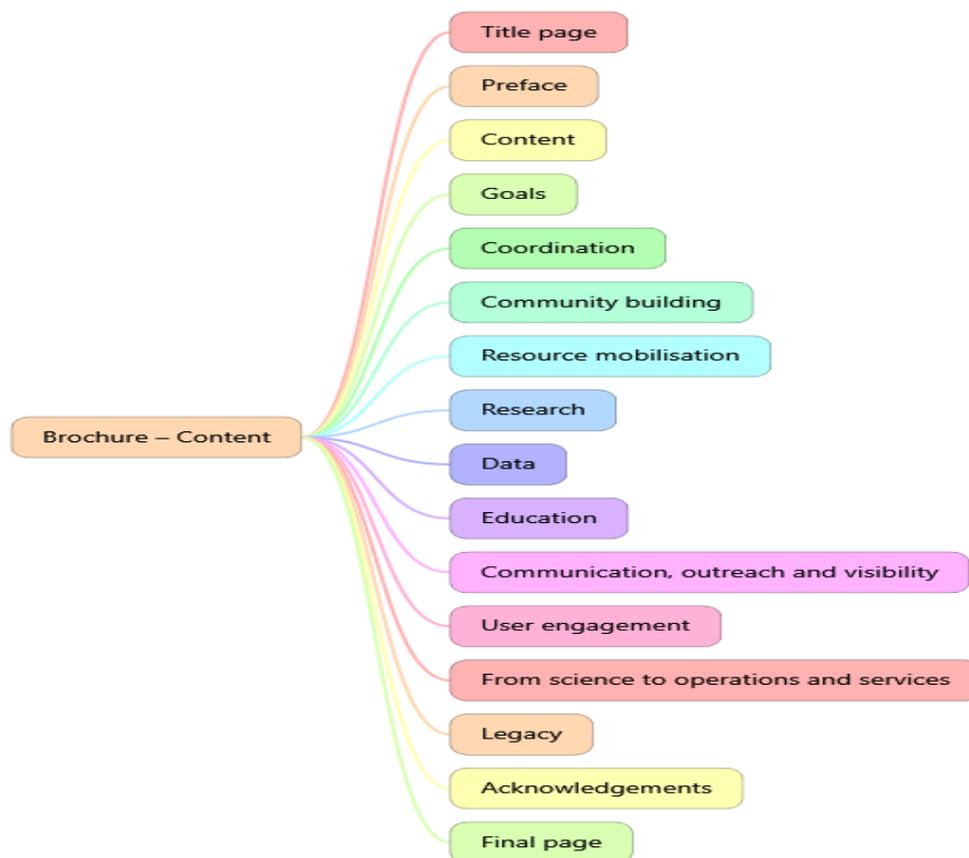


Figure 7. Proposed chapters for the PPP/YOPP evaluation brochure. Further details included in Annex-IV to this report.

The PPP-SG members provided extensive input and feedback on the content of the brochure (see Annex-IV of this report) as well as more general comments as follows:

- Inevitably there would probably be some overlap between some of the chapters but limited overlap may be positive as not everyone will read the brochure from end to end. For example, the YOPP Endorsement process could come under both coordination and community building; similarly, the science workshops could appear under community building, research as well as communication. YOPPsiteMIP could feature in multiple areas.
- Evaluation data and success stories needed to be collected from the YOPP-endorsed projects and some of them included in appropriate sections of the brochure.
- YOPP-endorsed projects and other groups be requested to contribute to the PPP Google Scholar page to assist in the compilation of PPP/YOPP publications.
- The brochure should also identify some of the future challenges and formulate recommendations that have emerged as a result of PPP/YOPP activities.
- A reminder that PPP/YOPP aim was to enable others to undertake the research rather than PPP-SG carrying out the research.
- Snapshots of the PolarPredictNews newsletter front pages could be one of the communication graphics.
- There may still be some third-party projects contributing to PPP/YOPP goals who have not yet sought endorsement.

In closing this section, Prof Jung reminded the PPP-SG that further discussions on the evaluation brochure and input to the content would occur via the monthly PPP-SG teleconferences.

Action

Schedule extended agenda item in May PPP-SG teleconference on evaluation brochure including best way to deal with endorsed projects. Also dealing with open/ future challenge questions.	ICO	Apr-21
Expand mind map and convert to Google Docs and circulate to PPP-SG	ICO	Apr-21
Update the PPP/YOPP Google Scholar collection and then circulate to YOPP and YOPP-endorsed projects asking them to check if their publications are there, if not advise ICO of the details of the missing publications	ICO	May-21
PPP-SG to notify ICO of any major YOPP-related projects that have not been endorsed	PPP-SG	May-21
Review the possible indicators for publications to see what is feasible	Eval TT	May-21
Review the major national and EU funding calls featuring YOPP to see if there are any successful projects that have not sought YOPP endorsement. If so contact them regarding the option. Keep track of numbers of successful non-endorsed projects as one possible metric	ICO	Jun-21
Seek information from PPP and YOPP mail lists regarding PPP/YOPP related publications	ICO	Mar-21
Include 'lessons learnt' breakout boxes in appropriate chapters	ICO	

10.2 Legacy

Prof Jung recalled that the PPP-SG had also discussed questions around the PPP/YOPP legacy in the previous two PPP-SG sessions and had identified the key legacy areas as per Figure 8. Prof Jung highlighted the key legacy areas and opened the floor for discussion (see details in Annex-V). The discussion focused around the following two areas:

- Identifying whether there were any mechanisms to continue supporting the PPP/YOPP community at some level after PPP and the ICO close at the end of 2022. The PPP-SG noted that there may be a possibility of either APECS or YESS showing some interest in taking over parts of the coordination relevant to early career polar researchers but no definitive actions were identified. The PPP-SG also noted that depending upon funding, there may be an option to update/relaunch the current polarprediction website towards the end of 2022 so it could serve to support the community for some time with minimal maintenance.
- The PPP-SG noted that with MOSAiC running one year behind schedule, it would be expected that associated PPP/YOPP activities would continue into at least 2023 and thus PPP was potentially ending a year earlier than was optimal. Prof Jung confirmed that AWI would not be able to extend its support for PPP/the ICO past the end of 2022. It was also noted that the

Canadian funds would run out in March 2022 and thus there was little ongoing funding to provide support for PPP activities at the present time.

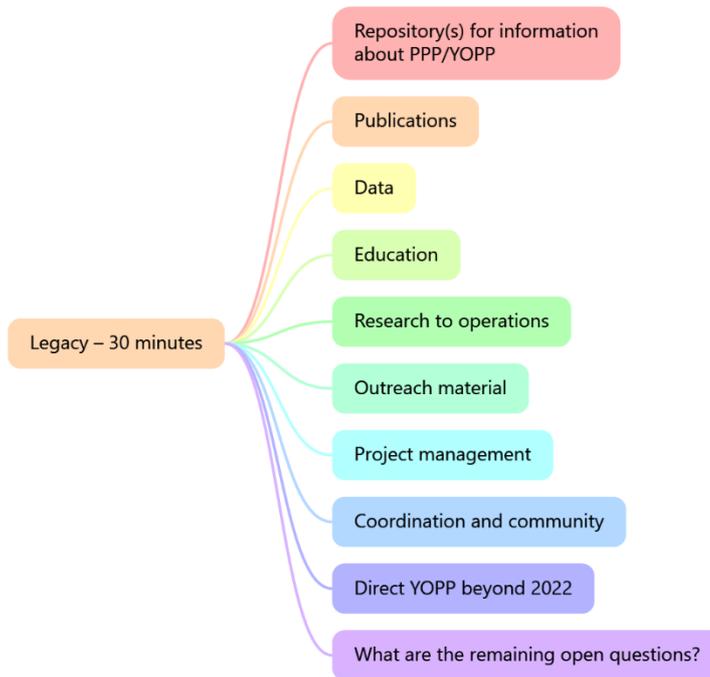


Figure 8. PPP/YOPP Legacy areas.

The PPP-SG noted that there were three distinct types of PPP activities that were incomplete:

- activities such as YOPP-SH, YOPPsiteMIP etc associated with work that had either been delayed, initiated later or extended;
- areas identified in the PPP Implementation Plan, such as exploitation of satellite data, where relatively little progress had been made until ECMWF and others had recently carried out the OSE activity which highlighted impact of not using satellite data in the winter months in the Arctic; and,
- moving the research outcomes that should come from areas such as the YOPP Processes TT work into operations.

Whilst recognising that all projects need to complete at some time, PPP-SG members indicated that there would be some interest in continuing with a number of current activities under either the guise of PPP; or potentially these activities being included in a new WWRP initiative. Dr de Coning noted that the current WWRP Implementation Plan runs to the end of 2023 and there was the opportunity for the community to provide input into the new planning but it would need to be under the umbrella of either science for services or science for policy makers.

In closing this section, Prof Jung suggested that part of the PPP legacy may actually be identifying the coming challenges and in doing this, PPP could contribute to the development of the next WWRP Implementation Plan and help ensure that PPP activities aligned with the new plan would continue.

Action

Identify key elements from PPP website, newsletters etc that should be visible post 2022 and develop costed recommendations for dealing with them	ICO	Apr-21
Include an agenda item on PPP-SG teleconference regarding what to do about PPP initiated activities post PPP	ICO	Dec-21

11. YOPPsiteMIP

Ms Taneil Uttal provided the PPP-SG with an extensive briefing about the YOPP Supersite Model Intercomparison Project (YOPPsiteMIP) status and plans for the remainder of the PPP Consolidation Phase.

Ms Uttal reminded the PPP-SG that the YOPPsiteMIP concept predated MOSAiC and is built up from the following components:

- YOPP Supersites. Nominated stations with suites of instruments measuring variables that will lead to *process understanding*;
- Models. Typically, numerical weather prediction models where *high frequency* (7.5- or 15-minutes time step) data is *output on model levels* at one grid point or an array of grid points around each Supersite. Contributing models include those from DWD, ECCO, ECMWF, FMI, MetNorway, MetOffice, NOAA/NCEP, MétéoFrance, Roshydromet, CORDEX and CESM;
- Model Intercomparison Project MIP. Agreed file *format and semantics* used for the model output and observational data promoting *multimodel* and *multisite* verification and process evaluation;
- Data. The data to be accessible through the *YOPP Data Portal* (yopp.met.no) though not necessarily held at MetNorway;
- Targeted processes. Low level clouds (including phase), stable boundary layers, atmosphere-snow/ice interactions over land and sea-ice, coupling mechanisms (variables and frequencies), ocean-ice and ocean-atmosphere exchanges.

The YOPPsiteMIP approach will allow the examination of processes by comparing the high frequency model output data with observed variables with cadences of 1 minute, 10 minute, 15 minute and 1 hour to separate the effects of local and larger transport processes on the Arctic environment and to allow investigation of how (and which) fast processes are contributing to accumulating biases in the NWP forecasts.

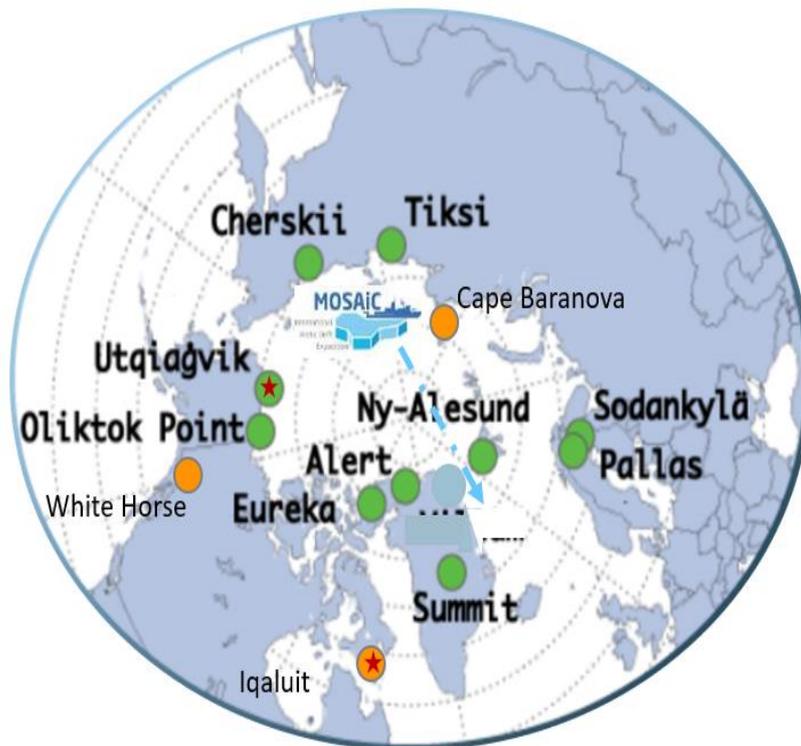


Figure 9. Overview of YOPP Arctic Supersites (please note: There are also Supersites in the Antarctic). ● IASOA (International Arctic Systems for Observing the Atmosphere) sites. ● ECCC Supersites – soon to be members of IASOA ● Cape Baranova – soon to be member of IASOA

Ms Uttal advised the PPP=SG that a MODF-formatted file contained Merged Observatory Data in standardized NetCDF formatting using the CF convention for variable naming, and a detailed specification for variable and global attributes. Ms Uttal noted that the development of the MODF format has been, and continues to be, a major task and achievement for YOPP. Ms Uttal further noted that the schema is referred to as the Hartten-Khalsa table which acknowledges the enormous effort by Leslie Hartten and Siri Jodha Khalsa in creating the schema. The MODF concept is to get all data from all sensors from one location for a finite period into one NetCDF file that looks like the corresponding NWP output. Ms Uttal observed that a MODF Makers group was established in July 2020 to speed up the creation of MODFs. The MODF Makers group is communicating using SLACK, GitLab and a monthly virtual meeting facilitated by NOAA. There are MODF-Makers representing the Supersites at Barrow, Alert, Eureka, Tiksi, Cape Baranova, Iqaluit, Pallas/Sodankylä, Odin Cruise (2018), MOSAiC, T-MOSAiC and YOPP. The task of creating the MODFs has been broken into four development phases as per Figure 10.

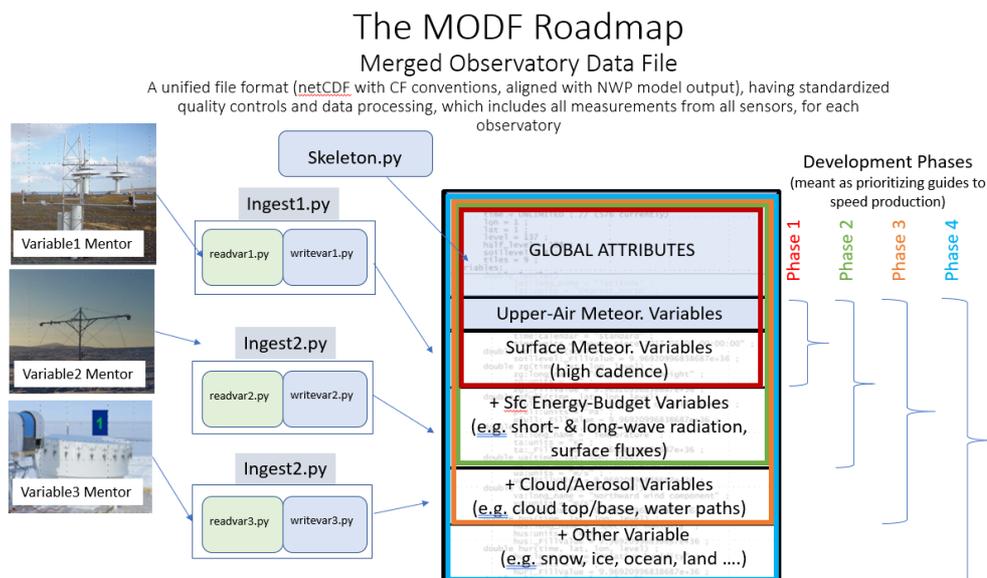


Figure 10. Roadmap for creating full MODFs for MOSAiC and YOPP

- Phase 1. Covering standard meteorological (hi cadence) surface and upper air variables
- Phase 2. Covering short and long wave radiation, surface fluxes etc
- Phase 3. Cloud and aerosol variables (cloud top/base. Water paths)
- Phase 4. Other variables such as snow, ice and ocean.

The python-based toolkit was conceived by Michael Gallagher (NOAA) as a tool that individual observatories will be able to adapt for their own purposes as well as YOPPsiteMIP purposes. The toolkit is modularised so that MODFs and MMDFs are employing common language & standards. The MODFs and MMDFs use comparable metadata from a Global Attributes Table or schema (the Hartten-Khalsa table) describing variable names, units and attributes that will evolve to accommodate the available observations, the quality control and data curation for each individual site/ship. The toolkit is in its early stage of development but work is progressing.

Ms Uttal informed the PPP-SG that MOSAiC and the project 'Terrestrial Multidisciplinary distributed Observatories for the Study of Arctic Connections' (T-MOSAiC) were adopting the MODF/MMDF concept. There are still no specific Antarctic sites selected for MODF development, however, once the toolkit is developed, it should be easier to recruit Southern Hemisphere stations to develop MODF files. Ms Uttal noted that the South Pole Station is a likely candidate because there are NOAA operators at that site in a sister laboratory to the NOAA lab developing the Northern Hemisphere MODFs, and they should be able to re-use much of the processing and code from the Northern Hemisphere sites. The goal over the next 18 months was to continue the development of the MODFs, the MMDFs and the python toolkit. The phased development referred to earlier should allow the intercomparison work involving the standard meteorological variables to commence in late 2021 or early 2022. One example of what could be done as this data comes online is illustrated by a paper Dr Jonathan Day and colleagues had recently published in the ECMWF newsletter examining the warm model bias in cold/stable conditions which is a common feature of many of the models.

Ms Uttal suggested to the PPP-SG that the MODF/MMDF toolkit would be a significant component of the PPP/YOPP legacy. This would be in addition to the anticipated analysis results which will not only separate the effects of the local and larger transport processes on the Arctic environment and the investigation of how (and which) fast processes are contributing to accumulating biases in the NWP model forecasts. In terms of risks to success, Ms Uttal identified the following risk factors that would need to be managed carefully to ensure that YOPPsiteMIP is a success:

- Underestimation of effort to quality control and curate observation data;
- Working with MOSAiC observers so they are comfortable that the first publications of their data may be in a modeling paper. This is not where most observationalists would expect to see their data first published and there could be some resistance;
- Underestimating the effort required from the YOPP Supersites to make their data available in this common format for a project they have not been intimately involved in and have little input into;
- The lack of data managers and code developers involved in creating and curating the data is an issue through the observation community which typically does not have the resources to create mandated data publications and archives;
- Loss of the PPP website as a host for YOPPsiteMIP once PPP finishes;
- Obtaining participation from the Russian observatories to provide their data covering the MOSAiC year;
- Lengthy delays in incorporating improved process understanding in the operational models due to delays in the MODF/MMDF creation and comparison activities.

Prof Jung thanked Ms Uttal for her comprehensive briefing on YOPPsiteMIP and he opened the floor for discussion. In the ensuing discussion the following key points emerged:

- The need for at least two face-to-face workshops in late 2021 or early 2022 to bring the observational community and modelling community together to address issues around creating and use of MODF/MMDF, how to attribute the observational data so that the data collectors are correctly acknowledged and have results to show to their funding agencies;
- The need to find ways to work with the Supersites to help them produce MODFs and encourage them that their data can be extremely useful even when the data has not been perfectly quality controlled and the modelling community can handle versioning to allow for increased levels of quality control;
- Identify strategies to increase the uptake of the MODF and MMDF data as it becomes available noting that whilst there are few MODF files currently available this is very difficult;
- The need to inform the main modelling centres that this data will become available in a common format so that the modelling centres can start to consider how best to utilise the data which will then feedback to increased demand for MODFs;
- Ensure that any MODFs that are created have their metadata registered in the YOPP Data Portal so that they can be found and accessed (according to the data holders requirements);
- Find out more about the work of WWRP's Coupled Model Intercomparison

Project 'Observations for Model Intercomparisons Project' (OBS4MIPS, <https://esgf-node.llnl.gov/projects/obs4mips/>) being undertaken in the climate community and how this could complement or be fed from the YOPPsiteMIP work;

- The ICO to discuss within AWI the option of getting some of the data of the Antarctic station Neumayer III into MODF format;
- Work with the Supersites to investigate how MODFs could be used for intercomparison of observational data between sites.

Actions

Develop a short document describing the sorts of tasks and skill sets the YOPPsiteMIP team require for assistance in creating MODF/MMDFso this can be used with potential supporters	Taneil and Gunilla	Mar-21
Investigate options for further support for YOPPsiteMIP programming and data management with the MOSAiC Science Board	Thomas Jung	Apr-21
Investigate what the status and capability of the climate communities OBS4MIP format and engage in discussion with them regarding YOPPsiteMIP, report back to PPP-SG teleconference	Gunilla	Apr-21
Try to find someone in AWI data management team who could participate and perhaps help to support some half day YOPPsiteMIP workshops	Thomas Jung	Apr-21
Explore options in AWI for professional data manager support and getting some of the German Arctic and Antarctic Data into MODF/MMDF format	Thomas Jung	Apr-21
Document where the MODF and MMDF data is located (perhaps keyword in the YOPP Data Portal meta data for searching purposes), and then promote	Taneil Uttal, Gunilla Svensson, Siri Jodha Khalsa, Øystein Godøy	Apr-21
Update and maintain YOPPsiteMIP timeline, perhaps host on YOPP website or similar	Taneil Uttal and Gunilla Svensson	Apr-21
Consult with MOSAiC (Matt Shupe and Marcus Rex) to see how MOSAiC is going to handle attribution for the observational data when it is used by the modelling community	Thomas Jung and Taneil Uttal	Apr-21
Discussion within MetNo about the option for assistance in getting some supersite data into MODF format. Jørn Kristiansen will need to task description etc from Taneil and Gunilla	Jørn Kristiansen	Apr-21

Develop an inventory showing which MMDF and MODF files are available for which stations and time periods. This list will need to be updated regularly (automatically?) but can then be used in discussion with the observationalists and the modelling centres to show what is already there and what can be used, perhaps some priorities identified in the document for what to do next	Taneil, Gunilla and Siri Jodha	Apr-21
Decide where the MODF/MMDF global definitions (Hartten-Khalsa table) should be kept and place it there	Taneil Uttal, Siri Jodha Khalsa	May-21
Further explore options for getting SH observation and model data into MODF/MMDF format	PPP-SG	May-21
ICO to update the YOPPSiteMIP webpage based on advice from Taneil and Gunilla	Taneil Uttal, Gunilla Svensson, ICO	Jun-21
Promote the YOPPSiteMIP concept and providing easy to follow examples of how to do it	YOPPSiteMIP and ICO	Aug-21
Identify longer term options for where to host YOPPSiteMIP description and documentation assuming polarprediction website will become static in 2023	Taneil Uttal and Gunilla Svensson	Dec-21

12. SIDFex

Dr Helge Goessling, co-lead of the PPP Sea-ice Task Team, provided the PPP-SG with an update of activities of the Task Team in the last 12 months and their plans for the remainder of the PPP Consolidation Phase.

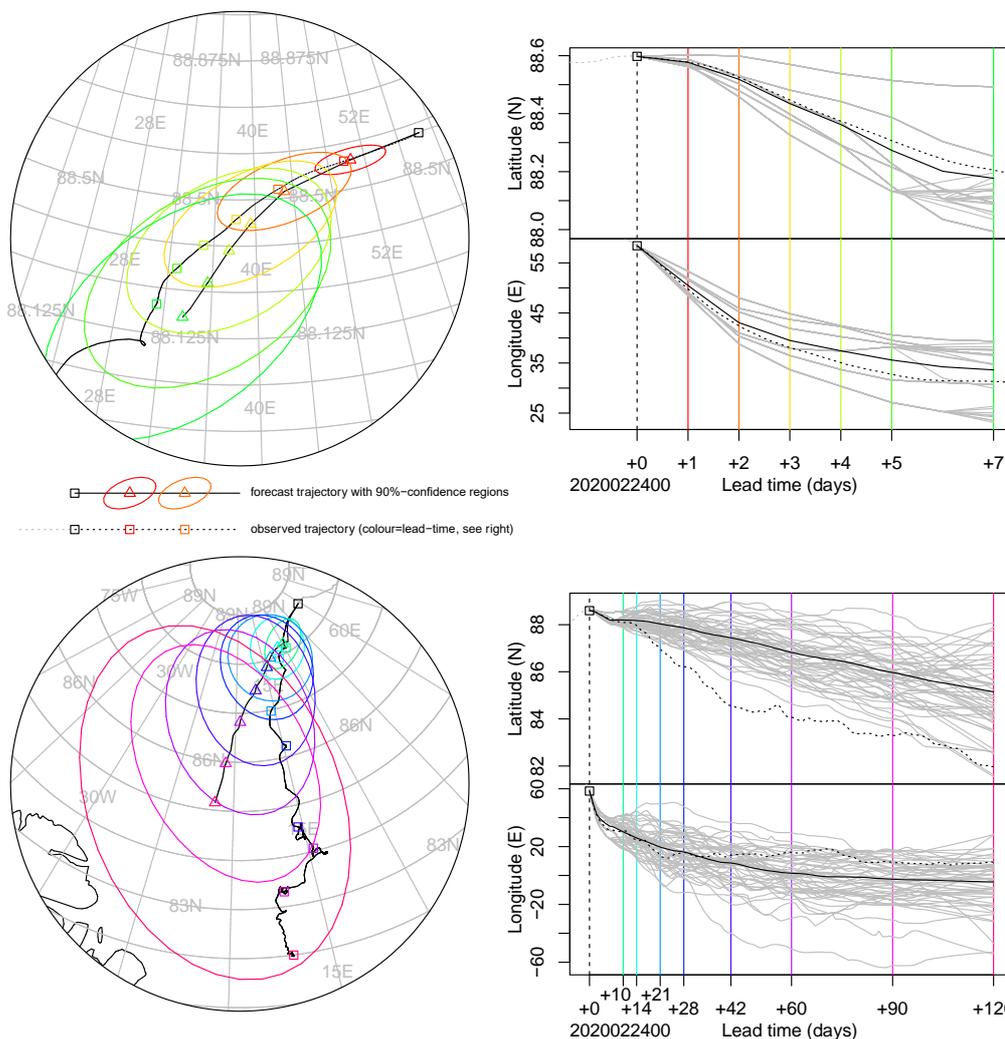
Dr Goessling recalled that SIDFex (<https://sidfex.polarprediction.net/>) is a community effort to collect and analyse Arctic sea-ice drift forecasts at lead times from days to a year. Forecasts were made with various methods for drifting sea-ice buoys and the trans-Arctic MOSAiC drift campaign. There are four phases to SIDFex and we are now in the final stage:

- Phase 1 ran from 1 June 2017 to late 2018 and was part of the YOPP Core Phase. Forecasts were made for a selected number of IABP buoys;
- Phase 2 ran from late 2018 to October 2019. In addition to tracking and forecasting the position of the IABP buoys, target points relevant to the RV Polarstern drift start position were forecast and tracked;
- Phase 3 ran from October 2019 to September 2020 during the RV Polarstern drift/MOSAiC and the SIDFex forecasts were used for operational planning support;
- Phase 4 from October 2020 to the end of 2022 includes the analysis, publication, refinement and continuation of SIDFex activities.

Dr Goessling provided the PPP-SG with an overview SIDFex. He noted that SIDFex products were based upon the sum of track forecasts from hours to a year from about 150,000 individual forecast trajectories, from 21 different forecast systems/methods (not all are numerical model-based) from 13 different groups and 12 different institutes. The types of products (consensus track, probability envelopes for each member and scatter plots) that were made available for the Polarstern location are in graphical and tabular format. Dr Goessling illustrated the usefulness of the SIDFex forecasts with a quote from a colleague at the German Space Agency DLR who was responsible for ordering high-resolution imagery around RV Polarstern’s location as part of MOSAiC. The imagery needs to be ordered (i.e. provide the latitude and longitude of the target area) approximately two days in advance of the image capture. Dr Goessling quoted his colleague as saying, “Because of SIDFEx, our hit rate (of having the Polarstern in the forecast target areas) was about 80 to 85 per cent. Without SIDFEx my expectation was that the hit rate would be below 50 per cent.”

Dr Goessling presented a number of figures illustrating the performance of the system over the twelve-month period of MOSAiC, e.g. see figure 8.

Figure 11. Long- and short-term forecasts for RV Polarstern drift based upon the consensus output from the various sea-ice drift models. Top figures show the actual track vs. the spread of forecast tracks for a seven-day period whilst the bottom figures provide a seasonal view. The seasonal forecast indicated that RV Polarstern would not drift over the North Pole.



Dr Goessling noted that the RV Polarstern drift was faster than anticipated and forecast but within the margin of error. Dr Goessling further noted that the ECMWF ERA5 reanalysis showed a consistent low pressure with a strong anomaly gradient that was quickly pushing the ship to the South and this most likely contributed to the faster than anticipated drift.

In addition to forecasting the drift position of RV Polarstern, forecasts were also made for the observatories as part of the surrounding MOSAiC Distributed Network. Estimates of the deformation in the MOSAiC network could thus be forecast and observed which is expected to provide further valuable information for shipping etc. in future years.

Dr Goessling concluded his presentation describing some of the analysis and dissemination work that is in progress:

- Systematic skill assessment of the various SIDFex members;
- Deformation forecasts of the MOSAiC Distributed Network;
- Investigating how to optimize consensus forecasts, including machine learning methods;
- Investigation the best way to exploit the SIDFex dataset to learn about model deficits and identifying ways to improve forecast systems;
- Consideration of whether to continue the SIDFex work for other field campaigns;
- Working with search and rescue groups to enable knowledge transfer for future rescue missions;
- Preparation of SIDFex overview, MOSAiC focused and sea-ice deformation papers.

Prof Jung thanked Dr Goessling for his presentation.

The ensuing discussion covered:

- Whilst all buoys that were provided were eventually deployed there is little data from the eastern (Russian) Arctic.
- The analysis to date has primarily been focused on the drift of RV Polarstern and not all of the targets across the Arctic.
- At this stage, it is not possible to untangle the drift error from near-surface wind error or other error sources in the models;
- For the full Distributed Network, we can look at how the whole network moved as a proxy for the whole field.

Prof Jung closed the session thanking Dr Goessling and the Sea-Ice task team for the excellent work.

Actions

Contact the Russian colleagues to get the status of the EUMETNET-funded buoys for science and feedback to EUMETNET	Helge	Sep-21
Investigate whether all available buoy data was used by SIDFex	Helge	Sep-21
Identify potential applications for the MOSAiC sea-ice drift observation and	Helge	Sep-21

forecast data for RV Polarstern and larger network array		
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13. YOPP Final Summit

Dr Barbara Casati briefed the PPP-SG on the local arrangements and preparations for the YOPP Final Summit which is scheduled for Sunday, 1 to Wednesday, 4 May 2022 in Montreal, Canada in recognition of the support PPP has received from Environment and Climate Change Canada (ECCC). The Meteorological Research Division of ECCC has committed funding towards the hire of the conference facility.

Dr Casati noted based upon the planning figures of 200 to 300 participants, a suitable venue (Centre Mont Royal) has been located that will allow a plenary session in the mornings and parallel sessions in the afternoons as well as one or more poster sessions. Two panel sessions are planned as well as an icebreaker, a conference dinner and no-host dinners on the other nights. There will be room for some sponsor booths and there is the possibility of hiring an adjacent room to allow up to four parallel sessions in the afternoons.

Dr Casati advised the PPP-SG that WMO had signed a Letter of Agreement (LoA) with the Canadian Meteorological and Oceanographic Society (CMOS) that will allow CMOS to contract an event management company to deal with many of the logistics of setting up and running the Final Summit. The LoA also includes funding to cover most of the audio-visual costs of the Final Summit. An initial estimate for the cost of the event management company is around CAD \$50,000. A preliminary budget for the Final Summit indicates costs of around CAD \$214,000 (excluding travel for the PPP-SG, invited guests and YOPP Fellows), with income of around CAD \$200,000 and a further contingency of around CAD \$27,000 built into the PPP budget. This budget is based upon 250 participants and full registration of CAD \$350 with discounts for students, online attendees and early bird registration.

Dr Casati updated the timeline of key actions for the YOPP Final Summit as shown below.

Table 6. Updated timeline for YOPP Final Summit

April 2021	Contract Event Management agency and venue
April 2021	Save-the-date announcement, start promotions, networking and contacting potential sponsors
June 2021	Second announcement, website opens with registration and abstract submission functionality
October 2021	Abstract submission deadline
December 2021	Letter of acceptance, registration opens
March 2022	All WMO supported travel completed
May 2022	YOPP Final Summit

Dr Casati closed her presentation by showing some suggestions for a conference logo that was developed by the ICO and options for the conference program.

Prof Jung thanked Dr Casati for her presentation and the work that she has put into the planning of the Final Summit to date. Prof Jung also thanked Dr Jim Abraham and Dr Gordon Griffiths from CMOS for agreeing to assist PPP with the Final Summit and join in this discussion.

Under Prof Jung's chairing, the PPP-SG discussed the planning for the YOPP Final Summit at some length resulting in the following.

Hotel accommodation	Dr Casati to check with Centre Mont Royal to see if they have participating hotels otherwise include identification of hotel accommodation in the RFQ for the event manager
Potential sponsors	Tinker Foundation, Pew Trust, IAATO, FedNav, IASC, SCAR, ECCC, Met Norway, ...
Conference Committee	Dr Sandu stepping down and Dr Kristiansen to take her place. The Conference Committee to meet regularly over the coming months
Additional Conference rooms	PPP-SG indicated that booking the additional rooms would be desirable to allow for more speakers in parallel sessions.
Contracting of the event management company	CMOS to work with Dr Casati, Dr Smith, and Dr Werner and Mr Wilson from the ICO to review the quotes and select the preferred provider.
Conference logo	Out of the three options presented the PPP-SG indicated a strong preference for option 3 (figure 12) but agreed with Prof Jung for further consideration following discussion with the graphic designer for the YOPP Evaluation brochure to enable consistent themes across the Final Summit and the brochure
Conference video	This topic was hotly debated with no overall consensus on content or purpose. Generally, it was felt that any video should contain a mix of field work, ECR as well as senior figures in the field and highlight what PPP had achieved. The PPP-SG recognised the value and " <i>feel good</i> " effect of a video. The PPP-SG needed further time to discuss as well as consider cost implications and who would do it and how.



Figure 12. First draft logo for the YOPP Final Summit. To be further considered as the Evaluation brochure develops

Regarding the program for the Final Summit, the PPP-SG discussed this at length as well as potential speakers ensuring gender balance and providing good representation of the various fields. It was decided to create a google sheet for PPP-SG members to suggest possible sessions and speakers for the Final Summit. Following the discussion, a tentative program for the Final Summit was agreed as per table 8, subject to further discussion by the Final Summit Committee. The PPP-SG requested the Final Summit Committee to consider the options for appropriate cultural performances and where in the program they would fit and for how the workshops on the Sunday could run. Further planning and consideration will also need to be given to how to run the future scanning panel sessions on the Tuesday afternoon. Prof Jung reminded the PPP-SG that there would be a PPP-SG meeting on Saturday 30 April and perhaps first thing on the Sunday morning if required. A short PPP-SG post summit meeting on the morning of Thursday 5 May may also be appropriate.

Table 7. Tentative overall program for the YOPP Final Summit. Note the main opening ceremony will take place on Monday 2 May

	Sunday 1 May	Monday 2 May	Tuesday 3 May	Wednesday 4 May
8:30-10:00		Opening (Fellowships Awards) Group Photo	PLENARY	PLENARY
10:30-12:00	Meeting ECR scientists	PLENARY	PLENARY	PLENARY
13:30-15:00	PARALLEL Workshops	PARALLEL	PARALLEL	PLENARY
16:00-17:30	PARALLEL Panel session or workshops	PARALLEL	PARALLEL (Future scanning panels)	CLOSING
	ICEBREAKER reception		BUFFET + PANEL	Science Slam

In closing this section of the agenda, Prof Jung further thanked Dr Casati, Dr Abrahams and Dr Griffiths for their efforts to date and he looked forward to working further with CMOS. For the Final Summit flyer, Prof Jung suggested we try to include the names of some of the well-known key note speakers to act as a further drawcard for the Final Summit.

Decision

Advise CMR that we want the additional two conference rooms.	Barbara	Mar-21
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Actions

Add block booking for accommodation to Event Manager tasks if CMR are not offering a deal	CMOS	Apr-21
Investigate options to set up a google drive sheet and associated folders to support PPP-SG discussion around the programme for the Final Summit noting concerns regarding privacy and security	ICO	May-21
Identify options to cover short falls in costs (sponsors, donors, better estimates of registration)	Final Summit Committee	May-21
ICO to identify a graphic design person for YOPP Brochure and YOPP Final Summit logo building on support for logo 3	ICO	May-21
Provide ICO suggestions for keynote speakers for Final Summit noting need for gender, geographic and domain balance	PPP-SG	May-21
Final Summit Committee to discuss cultural performances and programme and potential costs	Final Summit Committee	May-21
Further develop the idea for the Final Summit video with potential costs, providers for PPP-SG consideration, could be a glossy one along the lines of the Open Science Conference but with imagery from the Arctic and Antarctic and people interviewed outside as well as "latest thinking" type video	ICO	Jun-21
Consider options for logos for different languages (E/F/Inuit??) and implications for website and other Summit publicity	Final Summit Committee	Jul-21

14. WRAP UP, NEXT STEPS AND CLOSING**14.1 Membership**

The PPP-SG Chair, Prof Thomas Jung, opened this session advising the PPP-SG that Dr Irina Sandu would be standing down from the PPP-SG and the YOPP Final Summit Organising Committee as she had recently replaced Dr Peter Bauer on the WWRP-SSC. Prof Jung thanked Dr Sandu for her contributions to PPP over many years and leadership of the Numerical Experimentation Task Team. Dr Sandu advised the Chair that she still had an ongoing and active interest in PPP and would continue to contribute to the work of the PPP over the remainder of the Consolidation Phase. Following a short discussion, the PPP-SG nominated Dr Jørn Kristiansen to replace Dr Sandu on the YOPP Final Summit Organising Committee. Noting that there was only 18 months of PPP left, the PPP-SG agreed not to replace Dr Sandu on the PPP-SG.

14.2 Budget

Mr Jeff Wilson, ICO consultant, provided the PPP-SG with an update on the current budget status and anticipated income and expenditure for the remainder of the Consolidation Phase based upon the decisions and discussion by the PPP-SG during

this session plus information supplied by Dr Estelle de Coning regarding the status of the WMO Trust Funds.

The PPP-SG noted that there were many unknowns about travel due to COVID-19 with WMO not planning on any face-to-face meetings in 2021. Travel restrictions could impact upon the Polar Prediction School, the YOPP Final Summit, and the ability to hold critical meetings to further develop YOPPsiteMIP. The PPP-SG discussed the proposed budget, particularly the draft expenditures, at some length agreeing on the main anticipated expenditures as:

- YOPP Final Summit, ~ CHF 170,000 covering PPP-SG and invitees travel, a final summit video and a contingency amount of CHF 30,000. The PPP-SG noted that this area had the greatest unknowns in it due to the possibility of official travel restrictions, potentially people being unwilling to travel, the need for arrangements to be made by early March 2022 to ensure maximum use of the ECCC trust funds etc. A number of PPP-SG members noted that it may be possible for their institutes to cover some or all of the cost of their travel to the Final Summit as a means of reducing expenditure. The PPP-SG further noted that setting the registration cost would be a critical decision as it needed to cover costs, attract early payment and deal with the online component.
- Polar Prediction School, ~CHF 55,000, noting that a registration fee was charged at earlier schools so it may be possible to reduce these costs further.
- YOPPsiteMIP, ~ CHF 40,000 for two meetings and some funding to enable the YOPP Data Portal to display MODF and MMDF files. Prof Svensson noted that the University of Stockholm and IASC would also be supporting these two meetings.
- PPP-SERA and YOPP-SH support, ~ CHF 30,000
- LoA with AWI, ~ CHF 50,000 to cover the development of the YOPP Evaluation Brochure and content as well as costs for supporting the PPP-SG. The ICO were in process of getting definitive costs for the evaluation data and brochure layout, design and printing so this cost could vary from the notional amount.
- PPP wrap up costs, ~CHF 15,000

In Swiss Francs (CHF), it would appear that there would be a shortfall between expected income (CHF ~276,000) and expenditure (CHF ~ 362,000) of around CHF 85,000, see Annex VI. The PPP-SG agreed to inquire with their own and other institutes regarding the option for further support to the WMO PPP Trust Fund as well as requesting that the WMO write to key members requesting further support to enable PPP to complete its activities. Prof Jung requested the ICO to include budget as one of the regular items on the monthly teleconference discussions as we would need to keep track of income and expenditures and dynamically adjust priorities as things evolve.

Action

Develop motivation text for gaining further financial support for PPP from donors	ICO, WMO	Mar-21
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14.3 Any Other Business

Dr Sandu, in her role as a WWRP-SSC member, requested that the PPP-SG further consider the question of the open science questions in polar prediction beyond PPP for input into the April WWRP SSC meeting.

The PPP-SG noted that EC-PHORS as well as WWRP-SSC were meeting in the near future and requested that the Chair and Dr Kristiansen advise these groups of the outcomes and recommendations from this session.

Dr Werner advised the PPP-SG that the ICO would be happy to make changes to the website to update or reflect changes in PPP Task Team membership, goals, activities or reconfiguring of the Task Teams.

Action

Schedule a teleconference for horizon scanning prior to the SSC in mid-April	ICO	Mar-21
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14.4 Next Steering Group Meeting

Noting the budget situation and difficulties with travel due to COVID, Prof Jung stated that whilst it would be highly desirable to have a face-to-face PPP-SG session prior to the YOPP Final Summit this was unlikely. The PPP-SG decided to hold another online session in October or early November 2021 with themes: education; Final Summit, evaluation/legacy; YOPPsiteMIP/Data; and, horizon scanning related to future challenges in polar prediction. The PPP-SG will continue with the monthly meetings and there is the opportunity to extend some of these sessions for particular topics.

At this stage, the next face-to-face PPP-SG meeting would be on Saturday 30 April 2022 in Montreal with the YOPP Final Summit. The PPP-SG may also need to meet briefly on Thursday 5 May 2022 following the Final Summit. Depending upon decisions required, funding and travel restrictions a further/final online or face-to-face (potentially Geneva) PPP-SG meeting may be needed in late 2022 as part of the PPP wrap up and hand over of activities to other groups.

14.5 Review of action items from PPP-SG#12

The PPP-SG reviewed the draft actions and proposed due dates from this session clarifying and refining some actions (Annex III). The PPP-SG Chair requested that the action items and a short summary of the meeting be prepared for circulation to all PPP-SG members within two weeks of the meeting and that the final minutes be made available by late March or early April 2021.

14.6 Closure

In his closing remarks for the session, the Chair of the PPP-SG Prof Thomas Jung noted that although it was an online meeting and it was not possible to select session times that suited everyone all of the time, the overall meeting went very well with more than 20 participants in most sessions and good interaction orally and via the chat facility.

Prof Jung stated that PPP/YOPP was on course to achieve most objectives but more effort was needed over the next 18 months to really capitalize on the great work that

had already been completed. The discussions during this week identified that further work is required to complete YOPPSiteMIP, the link with MOSAiC, the YOPP Data Portal, the Spring School and the Final Summit. For the longer term, Prof Jung noted the desirability of PPP contributing to a WMO or international discussion on what are the future challenges for polar prediction, who could coordinate the activities and how they could be taken forward.

Prof Jung thanked AWI for their support to the session, particularly Dr Kirstin Werner, Ms Katharina Kirchhoff, Ms Sara Pasqualetto and the ICO intern Ms Mayleen Schlund. Prof Jung thanked the PPP-SG members for their contributions during the meeting and noted that excellent progress had been made. He further noted it was an enjoyable meeting although tiring, as he like other PPP-SG members, had other activities running at the same time. Prof Jung closed the meeting at 1050 on Friday 12 March 2021.

ANNEX I – MEETING AGENDA

Day 1. Monday 8 March UTC

Welcome (Monday 8 March 1000 to 1040 UTC)

Thomas Jung (PPP-SG Chair)
Jürg Luterbacher
Estelle De Coning (Chief, WWRP)
Kirstin Werner

Education (Monday 8 March 1030 to 1200 UTC)

Clare Eayrs

Outreach (Monday 8 March 1200 to 1330 UTC)

Kirstin Werner

Virtual Icebreaker via gather.town app (Monday 8 March 1800 to 1900 UTC)

Day 2. Tuesday 9 March

OSE (UTC Tuesday 9 March 1200 to 1230)

Irina Sandu

Data Portal (UTC Tuesday 9 March 1230 to 1400)

Thomas Jung/ Øystein Godoy/ Siri Jodha Khalsa

YOPP-SH (Tuesday 9 March 1700 to 1730 UTC)

David Bromwich

PPP-SERA (Tuesday 9 March 1730 to 1900)

Daniela Liggett and Machiel Lamers

Day 3 (Wednesday 10 March)

MOSAiC, NRT Sea Ice verification & NH-TOP results (Wednesday 10 March 1500 – 1700)

MOSAiC
Matt Shupe

Near Real Time Sea Ice Verification
Amy Solomon

Northern Hemisphere Targetted Observing Period results
Gunilla Svenson and Taneil Uttal

Evaluation and Legacy (Wednesday 10 March 2000 to 2130 UTC)

Thomas Jung and Jeff Wilson

Day 4 Thursday 11 March

YOPPsiteMIP (Thursday 12 March 1500 to 1630 UTC)

Gunilla Svensson / Taneil Uttal

SIDFex (Thursday 11 March 1630 to 1700 UTC)

Helge Goessling

Final Summit (Thursday 11 March 1900 to 2030 UTC)

Thomas Jung/ Barbara Casati/ Gordon Griffith (CMOS)/ Estelle De Coning

Day 5 Friday 12 March

PPP-SG Membership and Budget (Friday 12 March 0900 to 1000 UTC)

PPP-SG membership

Thomas Jung

PPP expenditure and income

Josephine Wilson/Estelle De Coning and Jeff Wilson

Closing Session (Friday 12 March 1000 to 1030 UTC)

Thomas Jung

ANNEX II – PPP-SG#12 PARTICIPANTS

Given Name	Family Name	Affiliation
PPP-SG Members		
Thomas	Jung	AWI
David	Bromwich	Ohio State University
Barbara	Casati	ECCC
Jonathan	Day	ECMWF
		National Center for Weather and Climate Prediction
Robert	Grumbine	Prediction
Jun	Inoue	National Institute of Polar Research
Thomas	Jung	AWI
Siri Jodha	Khalsa	University of Colorado, Boulder
Jorn	Kristiansen	Met Norway
Machiel	Lamers	Wageningen University
Daniela	Liggett	University of Canterbury
Donald	Perovich	Engineer Research and Development Center
Ian	Renfrew	University of East Anglia
Irina	Sandu	ECMWF
Gregory	Smith	ECCC
Vasily	Smolyanitsky	AARI
		National Marine Environmental Forecasting Center
Yuchen	Sun	Center
Gunilla	Svensson	Stockholm University
Eric	Bazile	Météo France
Clare	Eays	New York University Abu Dhabi
WMO		
Jürg	Luterbacher	WMO
Estelle	de Coning	WMO
Wenchao	Cao	WMO
ICO		
Kirstin	Werner	AWI
Aaron	Frehlich	AWI
Helge	Goessling	AWI
Katharina	Kirchhoff	AWI
Sara	Pasqualetto	AWI
Jeff	Wilson	ICO contractor
Mayleen	Schlund	AWI
Sara	Pasqualetto	AWI
Invited Guests		
Matt	Shupe	NOAA
Oystein	Godoy	Met Norway

Francois	Montagner	EumetSat
Amy	Solomon	NOAA

ANNEX III – DECISIONS AND ACTIONS FROM PPP-SG#12

Priority	Type	Session	What	Who	When
3-D	A	02-Education	PPP-SG to advertise the availability of YOPP Data sets for upcoming Hackathons	PPP-SG & ICO	Apr-21
1-C	A	02-Education	Approach IASC and SCAR to see if they wish to sponsor an ECR to the Final Summit and for Spring School	ICO, Dr Eayrs	May-21
1-C	A	02-Education	Ask IASC and SCAR if they wish to be part of the selection process for the Fellows	ICO, Dr Eayrs	May-21
2-E	A	02-Education	Include a question in the Final Summit Fellowship application about what YOPP has done for the applicants and which projects they have been involved in	Dr Eayrs	May-21
1-C	A	02-Education	Clare and Gunilla to coordinate with Abisko re setting of final school dates also taking into account availability of preferred lecturers	Clare / Gunilla	Jun-21
2-E	A	02-Education	Clare and Kirstin with assistance to vet the fellowship nominations and then present rated list to the PPP-SG for approval	Education TT	Jun-21
3-D	A	02-Education	Review the evaluations from the previous schools re suitability of lecturers and topics	Clare / Gunilla / Jonny	Jun-21
3-D	A	02-Education	Discuss with the organisers of the HALO-AC3 aircraft field campaigns options for potential lecturers	Jonny / Gunilla	Jul-21
2-E	A	02-Education	YOPP Education TT to propose criteria for Final Summit fellowship selection to PPP-SG for approval	Education TT	Aug-21
3-D	A	02-Education	Ensure video and still photographs taken at Spring School for publicity and records	Clare	Apr-22
4-NA	D	02-Education	Decide not to hold a hackathon		
4-NA	D	02-Education	Need to have selection of fellows completed and notified by early December 2021		
4-NA	D	02-Education	ECR is 5 years post PhD allowing for time off		
4-NA	D	02-Education	Hold Spring School in early April mindful of Easter in mid April		
1-C	A	03-Outreach	Identify who could be suitable video producers for Final Summit	Barbara / Estelle / ICO	Mar-21
2-E	A	03-Outreach	Investigate whether springy.js (http://getspringy.com/) can provide some information regarding the network analysis	ICO	Jun-21

3-D	A	03-Outreach	Find out what award the NERC newsletter won and whether <i>PolarPredictNews</i> would be eligible	Ian Renfrew	Jun-21
3-D	A	03-Outreach	Further examine options for taking material from Polar Prediction Matters and the website for either a hard copy or digital book	ICO	Feb-22
3-D	A	04-OSE	Write up the ARPEGE work for publication	Eric Bazile	May-21
2-E	A	04-OSE	Write to all institutions who provided additional RS flights and data for the SOP's to thank them for their efforts and provide some early feedback	ICO with Irina and Eric	Aug-21
1-C	A	05-DataPortal	Review portal capability to identify if any specific YOPP code needs to be developed and include in budget estimate	Oystein, Siri Jodha, Jeff	Apr-21
1-C	A	05-DataPortal	Investigate why MOSAiC data is not visible to the YOPP Data Portal via PANGAE	ICO / Oystein	May-21
3-D	A	05-DataPortal	Investigate whether the master MODF/MMDF table and toolkit source code should be included in the YOPP Data portal. Similar action under YOPPsiteMIP	Siri Jodha, Oystein and Taneil	May-21
3-D	A	05-DataPortal	Investigate whether MetNo has access to google analytics and on balance whether it is worthwhile installing	Oystein	Jun-21
3-D	A	05-DataPortal	Investigate what statistics can be derived from the YOPP Data Portal (click throughs to data centres, which are the key data centres people are accessing, what is commonly searched for ...)	Oystein, Siri Jodha, ICO	Jun-21
2-E	A	05-DataPortal	Encourage YOPPsiteMIP team to develop and share sample code for accessing and displaying YOPP Data from SOPs and share with Education TT	Taneil, Gunilla, Clare	Aug-21
3-D	A	05-DataPortal	Investigate whether new YOPP Data portal can display the google map layer which indicates the additional SOP data	ICO, Oystein	Aug-21
3-D	A	05-DataPortal	Recommend how people can link GitHub code to the Portal	Oystein, Siri Jodha, Taneil, Gunilla	Sep-21
3-D	A	05-DataPortal	Develop an estimate of how much and what sort of operational and research data is not going into the GTS	Jonny, Irina, ICO	Mar-22

4-NA	A	06-YOPP-SH	Prof Bromwich and Dr Bazile to submit papers for the QJRMS special collection	David Bromwich, Eric Bazile	Nov-21
3-D	A	06-YOPP-SH	PPP-SG and ICO to investigate options funding options to support YOPP-SH coordination post December 2022	David Bromwich, ICO	May-22
2-E	D	07-MOSAiC	Continue strong collaboration and partnership with MOSAiC particularly related to coupled modelling and YOPPsiteMIP		Apr-21
2-E	A	08-NRT Sea Ice	Promote the availability and use of the sea-ice drift forecast and observation files	ICO	Jun-21
2-E	A	09-NH-TOP	TT leads for YOPPData, YOPPsiteMIP, Sea-ICE, Verification and Processes to discuss the need for rationalisation of the TT for the remainder of PPP.	TT leads	Apr-21
2-E	A	09-NH-TOP	ICO to include TT rationalisation as an agenda item in the May PPP-SG teleconference	ICO	Apr-21
2-E	A	09-NH-TOP	Process / YOPPsiteMIP leads to finalise period for retroactive SOP and the name that will be used	Gunilla and Taneil	Apr-21
2-E	A	09-NH-TOP	ICO to advise YOPP projects and YOPP Endorsed projects of the decision to retro-actively define late Dec 2019 to late February 2020 as an "SOP" and encourage appropriate NH stations to move their data into MODF format accessible via the Portal	ICO, Gunilla and Taneil	May-21
4-NA	A	09-NH-TOP	Gunilla to provide ICO with material that could be used as part of a letter from her and Thomas to countries / institutions in NH-TOP1 providing feedback and asking for interest in participating in NH-TOP2 around the HALO-AC3 campaign.	Gunilla and ICO	May-21
4-NA	A	09-NH-TOP	ICO to consider how to revamp website once the TT leads have come to a decision on rationalisation of the TTs. This review of the website to also identify those areas that should be maintained/kept for the longer term and what can be let go after the end of 2022.	ICO	Jun-21
1-C	D	09-NH-TOP	Support the designation of a retroactive SOP from mid December 2019 to mid April 2020	????	Apr-21

2-E	D	09-NH-TOP	Agree to define a second NH TOP in conjunction with the HALO-AC3 campaign from 7 March 2022 to 17 April 2022		
2-E	A	10-Evaluation	Schedule extended agenda item in May PPP-SG teleconference on evaluation brochure including best way to deal with endorsed projects	ICO	Apr-21
2-E	A	10-Evaluation	expand mind map and convert to Google Docs and circulate to PPP-SG	ICO	Apr-21
2-E	A	10-Evaluation	Present Brochure concept to WWRP SSC for comment and feedback	Thomas Jung	Apr-21
2-E	A	10-Evaluation	Update the PPP/YOPP Google Scholar collection and then circulate to YOPP and YOPP endorsed projects asking them to check if their publications are there, if not advise ICO of the details of the missing publications	ICO	May-21
2-E	A	10-Evaluation	PPP-SG to notify ICO of any major YOPP related projects that have not been endorsed	PPP-SG	May-21
4-NA	A	10-Evaluation	Review the possible indicators for publications to see what is feasible	Eval TT	May-21
4-NA	A	10-Evaluation	Review the major national and EU funding calls featuring YOPP to see if there are any successful projects that have not sought YOPP endorsement. If so contact them regarding the option. Keep track of numbers of successful non endorsed projects as one possible metric	ICO	Jun-21
3-D	D	10-Evaluation	Seek information from PPP and YOPP mail lists regarding PPP/YOPP related publications		Mar-21
1-C	D	10-Evaluation	Will include Lessons Learnt breakout boxes in appropriate chapters	ICO	
2-E	A	11=Legacy	Seek comment from WWRP-SSC on how ongoing actions from projects such as PPP should be handled within the WMO framework (reporting and coordination wise) as the formal phase of the projects finish. Also, suggestions on what to do about the communities that have been established during the life of the project, how to hand them on.	Thomas Jung	Mar-21
2-E	A	11=Legacy	Identify key elements from PPP website, newsletters etc that should be visible post 2022 and	ICO	Apr-21

			develop costed recommendations for dealing with them		
1-C	A	11=Legacy	Decide whether we need to author a paper outlining the international coordination of major science projects	PPP-SG	Dec-21
1-C	A	11=Legacy	Include an agenda item on PPP-SG teleconference regarding what to do about PPP initiated activities post PPP	ICO	Dec-21
1-C	A	12-YOPPsitMIP	Develop a short document describing the sorts of tasks and skill sets the YOPPsitMIP team require for assistance in creating MODF/MMDF so this can be used with potential supporters	Taneil and Gunilla	Mar-21
1-C	A	12-YOPPsitMIP	Investigate options for further support for YOPPsitMIP programming and data management with the MOSAiC Science Board	Thomas Jung	Apr-21
2-E	A	12-YOPPsitMIP	Investigate what the status and capability of the climate communities OBS4MIP format and engage in discussion with them regarding YOPPsitMIP, Report back to PPP-SG teleconference	Gunilla	Apr-21
2-E	A	12-YOPPsitMIP	Try to find someone in AWI data management team who could participate and perhaps help to support some half day YOPPsitMIP workshops	Thomas Jung	Apr-21
2-E	A	12-YOPPsitMIP	Explore options in AWI for professional data manager support and getting some of the German Arctic and Antarctic Data into MODF/MMDF formatter	Thomas Jung	Apr-21
2-E	A	12-YOPPsitMIP	Document where the MODF and MMDF data is located (perhaps keyword in the YOPP Data Portal meta data for searching purposes), and then promote	Taneil, Gunilla, Siri Jodha, Oystein	Apr-21
2-E	A	12-YOPPsitMIP	Update and maintain YOPPsitMIP timeline, perhaps host on YOPP website or similar	Taneil and Gunilla	Apr-21
2-E	A	12-YOPPsitMIP	Consult with MOSAiC (Matt Shupe and Marcus Rex) to see how MOSAiC is going to handle attribution for the observational data when it is used by the modelling community	Thomas Jung and Taneil	Apr-21
2-E	A	12-YOPPsitMIP	Discussion within MetNo the option for assistance in getting some supersite data into MODF format.	Jorn	Apr-21

			He will need to task description etc from Taneil and Gunilla		
2-E	A	12-YOPPsitMIP	Develop an inventory showing which MMDF and MODF files are available for which stations and time periods. This list will need to be updated regularly (automatically??) but can then be used in discussion with the Observationalists and the modelling centres to show what is already there and what can be used, perhaps some priorities identified in the document for what to do next	Taneil, Gunilla and Siri Jodha	Apr-21
3-D	A	12-YOPPsitMIP	Decide where the MODF/MMDF global definitions (Hartten-Khalsa page) should be kept and place it there	Taneil, Siri Jodha	May-21
2-E	A	12-YOPPsitMIP	Further explore options for getting SH observation and model data into MODF/MMDF format	PPP-SG	May-21
2-D	A	12-YOPPsitMIP	ICO to update the YOPPsitMIP webpage based on advice from Taneil and Gunilla	Taneil, Gunilla, ICO	Jun-21
2-E	A	12-YOPPsitMIP	Promote the YOPPsitMIP concept and providing easy to follow examples of how to do it	YOPPsitMIP and ICO	Aug-21
2-E	A	12-YOPPsitMIP	Identify longer term options for where to host YOPPsitMIP description and documentation assuming polarprediction website will become static in 2023	Taneil and Gunilla	Dec-21
3-D	A	13-SIDFex	Contact the Russians to get the status of the EUMETNET funded buoys for science and feedback to EUMETNET	Helge	Sep-21
1-C	A	13-SIDFex	Investigate whether all available buoy data was used by SIDFex	Helge	Sep-21
1-C	A	13-SIDFex	Identify potential uses for the MOSAiC sea-ice drift observation and forecast data for the Polarstern and larger network array	Helge	Sep-21
1-C	A	14-FinalSummit	Consider replacement member for Irina on the YOPP Final Summit Committee	PPP-SG and Chair	Apr-21
1-C	A	14-FinalSummit	Add block booking for accommodation to Event Manager tasks if CMR are not offering a deal	CMOS	Apr-21
1-C	A	14-FinalSummit	Investigate options to set up a google drive and associated folders to support PPP-SG discussion around the programme for the Final Summit noting concerns re privacy and security	ICO	May-21

2-E	A	14-FinalSummit	Identify options to cover short falls in costs (sponsors, donors, better estimates of registration)	Final Summit Committee	May-21
2-E	A	14-FinalSummit	ICO to identify a graphic design person for YOPP Brochure and YOPP Final Summit Logo building on support for logo 3	ICO	May-21
1-C	A	14-FinalSummit	Provide ICO suggestions for keynote speakers for Final Summit noting need for gender, geographic and domain balance	PPP-SG	May-21
2-E	A	14-FinalSummit	Final Summit Committee to discuss cultural performances and programme and potential costs	Final Summit Committee	May-21
4-NA	A	14-FinalSummit	Further develop the idea for the Final Summit video with potential costs, providers for PPP-SG consideration, could be a glossy one along the lines of the Open Science Conference but with imagery from the Arctic and Antarctic and people interviewed outside as well as "latest thinking" type video	ICO	Jun-21
1-C	A	14-FinalSummit	Consider options for logos for different languages (E/F/Inuit??) and implications for website and other Summit publicity	Final Summit Committee	Jul-21
1-C	D	14-FinalSummit	Advise CMR that we want the additional two conference rooms.	Barbara	
2-E	A	16-Budget	Develop motivation text for gaining further financial support for PPP from donors	ICO, WMO	Mar-21
1-E	A	16-Closing	Schedule a teleconference for horizon scanning prior to the SSC in mid April	ICO	Mar-21

ANNEX IV – Input and feedback to the YOPP Evaluation Brochure

Summary of discussion around the content of the YOPP Evaluation Brochure. Chapter headings in the green shaded (left hand) column. Potential content details and comments in other columns

Title page				
Preface	Potential contributors	Thomas Jung		
		Gilbert Brunet		
		Neil Gordon		
		David Grimes		
		Petteri Taalas		
Content Page				
Goals	Mission – clarify PPP vs YOPP			
	Objectives			
	Timeline			
	Illustrations covering	Coordination	Group photo YOPP Summit in 2015	
		Prediction	Improving predictive capacity Evolution of skill atmosphere sea ice	
		Something related to prediction in polar regions		
Coordination	Explain our approach to project coordination			
	Provide an estimate of the cost of coordination (AWI and PPP TF)			
	Success stories	YOPP Endorsement		
		...		
	Indicators			
	Illustrations	Organigram		
		Steering group photo		
	YOPP Endorsement			
Boxes	International coordination office (ICO)			
	Lessons learnt			
Community building	Indicators	Workshops		
		Sessions		
		Online events		
		People reached		
		Network analyses		
	Success stories	Weather and climate		
		YOPP and MOSAiC		
		Natural and social scientists		
		Early career scientists		
		Operational and research		
	Endorsement			

		...		
	Illustrations	World map of YOPP major meetings		
		People talking engaged		
		Network analysis		
	Testimonies			
Boxes	Lessons learnt			
Resource mobilisation	PPP budget (see coordination)			
	Estimate of Third-party funding	Indicators	Third-party funded projects	
			Amount of funding	
		In kind support		
	Success stories	mentioning of YOPP in calls from funding agencies		
Endorsement				
Research	Number of Publications and citations			
	Scientific success stories	To consider further	"People who would be giving high-level presentations of research highlights at the Final Summit"	
			We need some balance Natural vs social science Arctic vs Antarctic ...	
		Processes	MOSAIC-YOPP link	
			YOPPSiteMIP	
			TOPs	
		Model development	Coupled?	
		Observing system design	OSE	
			SOPs Number of additional observations	
		Outcome and organisation of Data assimilation experiments		
		Ensemble prediction		
	Forecast verification	Helge Goessling		
		Award		
		New hardline score could be shown under goals		
	Social sciences			
Major projects	EU			
	National			
	...			
Testimonies and photos?	People (with photo) saying what their research highlight is			

		YOPP Final Summit Fellows	
Data	Our approach to data management		
	Indicators	YOPP Data Portal	Number of datasets
			Number of redirections
			Number of visits
		Special data sets	
	Data publications		
	Success stories	YOPP Data Portal	
		YOPPSiteMIP	
		Special datasets	ECMWF YOPP Dataset ...
	Illustrations	Infographic for ECMWF YOPP dataset	
...			
Boxes	Lessons learnt		
Education	Indicators	Number of events and people reached	Schools
			Sessions
			...
	Success stories	Abisko Schools	
		PPP-APECS collaboration	
	Personal stories	Jonny and Clare (as leads)	
		YOPP Final Summit Fellows	
Someone who had a steep career rise associated with YOPP			
Publications			
Boxes	Lessons learnt		
Communication, outreach and visibility	Communication and outreach	Indicators	Media coverage
			See earlier discussion at PPP-SG#12
			# invitations for Thomas Jung to speak at major meetings re PPP/YOPP ...
	Visibility	Success stories	Arctic Science Ministerial
			EU call texts
QJRMS special edition			
User engagement	Indicators		
	Success stories	Polar Prediction Matters	
	Boxes	PPP-SERA explained	
From science to operations and services	Success stories		
	Testimonies	Statements of head of weather centres (major donors, major contributors)	ECMWF
			MetNorway
			ECCC
			SOP
Legacy			
Acknowledgements			
Final page			

ANNEX V- LEGACY discussion

Discussion on the legacy items from the PPP-SG#12. The left-hand column (green shaded) are the key legacy areas identified by the PPP-SG. The remaining columns contain input and comments from the discussion.

Repository for complete information about PPP/YOPP	We need a place where all important information will be available (one stop shop), nicely presented and also maintained for some time		5 years?	
	Website 2.0	Relaunch of the website (with legacy aspect in mind)		
	Digital Book			
Publications	Documentation of scientific progress			
	Special issues			
	Books			
	Google Scholar			
Data	Special data sets			
	Data portal			
	YOPP-SiteMIP			
Education	Literacy among ECSs			
	YESS, APECS, ...	Cross cutting Young Polar Prediction Group?		
	APECS takes on some of the legacy	Also material		
Research to operations				
Outreach material	Newsletter			
	IcePod			
	Videos			
	...			
Project management	How to run such a project	Recommendations Lessons learnt	Endorsement process	
	Dedicate paper?	Probably not exactly the focus of our BAMS overview publication		
Coordination and community	Do we need continued coordination for polar prediction related activities?			
	And if so, who should coordinate this?			
	What are the groups at WMO that could take on (some) of the legacy?	Identify them		
	Do we need another fourth phase?	1-2+ years		
		Legacy, wind down, glide ... phase		
Also, in terms of MOSAiC				
WMO's strategy will run until 2023 PPP2 not an attractive option				
Direct YOPP beyond 2022	YOPP-SH, ...			
What are the remaining open questions?				

ANNEX VI – Draft budget for 2021 and 2022

Draft expenditures for PPP for the remainder of the Consolidation Phase. These figures were adjusted during the budget discussion to reduce the gap between expenditure and income.

Polar Prediction Project - DRAFT February 2021 to December 2022 Expenditure estimates

Anticipated available funds (CHF)	CHF
Balance at 1/3/2021	93,000
ECCC 21/22 funds from 1 April	133,000
Additional Donations	
Met No (annual 20k EUR in Nov 2021)	22,200
Met No additional contribution 25K EUR	27,750
Total available funds in CHF	275,950

Expenditure

Year	MM/YY	Description	Type	Amount (CHF)
2021	Jan-21	Online Stakeholder workshop	Online	0
2021	Apr-21	LoA with AWI to cover self-evaluation and PPP-SG support PPP-SG support 25,000 CHF Evaluation 25000 CHF	Evaluation	50,000
2021	Apr-21	2022 Spring School preparation Consultancy for hackathon and preparation of Jupiter notebooks	Education material	0
2021	Apr-21	IICWG	Travel	0
2021	Jun-21	PPP-SERA meeting	Travel	0
2021	Jun-21	Evaluation discussion	Travel	0
2021	Jun-21	YOPP-SH	Travel	0
2021	Jun-21	PPP-SERA workshop with WAMC	Travel	0
2021	Jun-21	Funding for YOPP Data Portal to display MODF and MMDF data	YOPP Data	15,000
2021	Jul-21	NORP summer school (Amy Solomon)	Travel	0

2021	Sep-21	Networking / Clustering / travel support for representing YOPP at meetings	Travel	2,000
2021	Oct-21	Extra PPP-SG session	Travel	0
2021	Oct-21	YOPPSiteMIP	Travel	0
2021	Oct-21	YOPPSiteMIP Science	Travel	10,000
2021	Nov-21	YOPPSiteMIP Science	Travel	15,000
2021	Dec-21	Scoping Workshop	Travel	0
2022	Mar-22	Spring School	Education	54,042
2022	Mar-22	Spring school video	Education	0
2022	Mar-22	Video Final Summit	Final Summit	30,000
2022	Apr-22	YOPP Final Summit costs	Final Summit	30,000
2022	Apr-22	YOPP Final Summit PPP-SG travel	Final Summit	69,541
2022	Apr-22	YOPP Final Summit invitees	Final Summit	31,039
2022	Apr-22	YOPP Final Summit fellowships	Final Summit	9,588
2022	Apr-22	YOPP Final Summit PPP-SERA	Final Summit	20,000
2022	May-22	YOPP-SH	Final Summit	10,000
2022	Jun-22	Wrap up costs	End of Project costs	15,000
				361,210

ANNEX VII- GLOSSARY

- 3D-EnVar: A form of data assimilation used in NWP models.
- 4d-EnVar: A form of data assimilation used in NWP models.
- 4D-Var: A form of data assimilation used in NWP models.
- ACDD: ACDD stands for NetCDF Attribute Convention for Dataset Discovery (ACDD). The discovery metadata identifies: **who** measured, simulated or analysed **what**, **where**, and **when** as well as **conditions for reuse** and **access mechanisms** for the data. <https://www.unidata.ucar.edu/software/netcdf/conventions.html>
- AMAP: Arctic Council's Arctic Monitoring and Assessment Programme. <https://www.amap.no/>
- AMPS: The US Antarctic Mesoscale Prediction System. <http://www2.mmm.ucar.edu/rt/amps/>
- AMS: American Meteorological Society. <https://www.ametsoc.org/index.cfm/ams/>
- APECS: Association of Polar Early Career Scientists. <https://www.apecs.is/>
- APPLICATE: Advanced Prediction in Polar regions and beyond: Modelling, observing system design, and Linkages associated with a Changing Arctic climate (EU Horizon2020 project). <https://applicate.eu/>
- AROME: AROME is a small scale numerical prediction model, operational at Meteo-France since December 2008. <https://www.umr-cnrm.fr/spip.php?article120&lang=en>
- ASM: Arctic Science Ministerial. <https://www.arcticscienceministerial.org/en/conference-1706.html>
- AWI: Alfred Wegner Institute Helmholtz Centre for Polar and Marine Research. <https://www.awi.de/en.html>
- BAMS: The Bulletin of the American Meteorological Society. <https://www.ametsoc.org/index.cfm/ams/publications/bulletin-of-the-american-meteorological-society-bams/>
- CAS: The WMO Commission for Atmospheric Science. http://www.wmo.int/pages/prog/arep/cas/index_en.html
- CBS: The WMO Commission for Basic Systems. <http://www.wmo.int/pages/prog/www/BAS/CBS-info.html>
- CF: Used with netCDF formatted files. CF stands for Climate and Forecast. The purpose of the CF conventions is to require conforming datasets to contain sufficient metadata that they are self-describing in the sense that each variable in the file has an associated description of what it represents, including physical units if appropriate, and that each value can be located in space (relative to earth-based coordinates) and time. <http://cfconventions.org/Data/cf-conventions/cf-conventions-1.7/cf-conventions.html>
- CLiC: A WMO initiative on Climate and the Cryosphere. <http://www.climate-cryosphere.org/>
- CLIVAR: CLIVAR (Climate and Ocean: Variability, Predictability and Change) is one of the four core projects of the World Climate Research Programme (WCRP), see www.clivar.org.
- CMIP: Coupled Model Intercomparison Project. <https://www.wcrp-climate.org/wgcm-cmip>
- COMNAP: The Council of Managers of National Antarctic Programs. <https://www.comnap.aq/>
- DA: Data Assimilation.
- DAOS: WWRP Working Group on Data Assimilation and Observing Systems. https://www.wmo.int/pages/prog/arep/wwrp/new/daos_wg_2015_main_web_page.html
- DOI: Digital Object Identifier. <https://www.doi.org/>
- DWD: Deutscher Wetterdienst (The German Weather Service). https://www.dwd.de/EN/Home/home_node.html

- ECCC: Environment and Climate Change Canada. <https://www.ec.gc.ca/?lang=en>
- ECMWF: European Centre for Medium-Range Weather Forecasts. <https://www.ecmwf.int/>
- EC-PHORS: The World Meteorological Executive Council Panel of Experts on Polar and High Mountain Observations, Research and Services.
<https://www.wmo.int/pages/polar/>
- EGU: European Geosciences Union. <https://www.egu.eu/>
- EMS: European Meteorological Society. <https://www.emetsoc.org/>
- EU Arctic Cluster: Nine currently funded Horizon 2020 Arctic projects and a FP7 funded project together build the EU Arctic Cluster – a network, which merges the most up-to-date findings on Arctic change and its global implications. <https://www.eu-polarnet.eu/eu-arctic-cluster/>
- F.A.I.R: Findable, Accessible, Interoperable, and Reusable Principles. The FAIR principles are designed to support knowledge discovery and innovation both by humans and machines, support data and knowledge integration, promote sharing and reuse of data, be applied across multiple disciplines and help data and metadata to be 'machine readable', support new discoveries through the harvest and analysis of multiple datasets and outputs. <https://ardc.edu.au/resources/working-with-data/fair-data/>
- FMI: Finnish Meteorological Institute. <https://en.ilmatietaenlaitos.fi/>
- github: GitHub Inc. is a web-based hosting service for version control of data and computer code. <https://github.com/>
- GODAE: The Global Ocean Data Assimilation Experiment. <https://www.godae-oceanview.org/>
- GOS: WMO Global Observing System.
<http://www.wmo.int/pages/prog/www/OSY/GOS.html>
- GTS: The WMO Global Telecommunication System.
http://www.wmo.int/pages/prog/www/TEM/GTS/index_en.html
- H2020: European Union Research and Innovation Programme.
<https://ec.europa.eu/programmes/horizon2020/>
- HIW: High Impact Weather, a WWRP core project
- IABP: International Arctic Buoy Programme. <http://iabp.apl.washington.edu/>
- IASC: International Arctic Science Committee. <https://iasc.info/>
- IASOA: International Arctic Systems for Observing the Atmosphere.
<https://arctic.noaa.gov/Arctic-News/ArtMID/5556/ArticleID/384/International-Arctic-Systems-for-Observing-the-Atmosphere>
- ICO: International Coordination Office for Polar Prediction.
<https://www.polarprediction.net/background/ico/>
- IICWG: International Ice Charting Working Group.
<https://nsidc.org/noaa/iicwg>
- IOC: Intergovernmental Oceanographic Commission.
<http://www.unesco.org/new/en/natural-sciences/ioc-oceans/>
- IUGG: International Union of Geodesy and Geophysics. <http://www.iugg.org/>
- JCSDA: Joint Center for Satellite Data Assimilation in the United States of America.
<https://www.jcsda.noaa.gov/index.php>
- JWGFVR: WWRP Joint Working Group on Forecast Verification Research.
https://www.wmo.int/pages/prog/arep/wwrp/new/Forecast_Verification.html
- Met Norway: The Norwegian Meteorological Institute. <https://www.met.no/en>
- Météo-France: The French Weather Service. <http://www.meteofrance.fr/>
- MOSAiC: Multidisciplinary drifting Observatory for the Study of Arctic Climate.
<https://www.mosaic-expedition.org/>
- NAWDEX: The North Atlantic Waveguide and Downstream Impact Experiment.
<http://www.pa.op.dlr.de/nawdex/>
- NCAR: National Center for Atmospheric Research in the United States of America.
<https://ncar.ucar.edu/>
- NCEP: National Centers for Environmental Prediction in the United States of America.

- <https://www.ncep.noaa.gov/>
- netCDF: The Network Common Data Form, or netCDF, is an interface to a library of data access functions for storing and retrieving data in the form of arrays.
https://www.unidata.ucar.edu/software/netcdf/docs/netcdf_introduction.html
- NMHS: National Meteorological and Hydrological Services. Generic WMO term for weather and hydrology services.
- NOAA: National Oceanographic and Atmosphere Administration, United States of America. <https://www.noaa.gov/>
- NWP: Numerical Weather Prediction.
- OPeNDAP: Open-source Project for a Network Data Access Protocol (OPeNDAP) is the developer of client/server software, of the same name, that enables scientists to share data more easily over the internet. The OPeNDAP group is also the original developer of the Data Access Protocol (DAP) that the software uses.
<https://earthdata.nasa.gov/collaborate/open-data-services-and-software/api/pendap>
- OSes: Observing System Experiments. <https://www.wmo.int/pages/prog/www/WIGOS-WIS/reports/6NWP...3/3.10.pdf>
- OSSEs: Observing Simulation System Experiments.
<http://www.met.reading.ac.uk/~stefano/research/osse/index.html>
- PAMIP: Polar Amplification Model Intercomparison Project. <https://www.wcrp-climate.org/modelling-wgcm-mip-catalogue/cmip6-endorsed-mips-article/1303-modelling-cmip6-pamip>
- PARCOF: Pan-Arctic Regional Climate Outlook Forum. <https://www.arctic-rcc.org/taxonomy/term/4>
- PDEF: WWRP Working Group on Predictability, Dynamics and Ensemble Forecasting.
https://www.wmo.int/pages/prog/arep/wwrp/new/pdef_wg_2015_main_web_page.html
- PPM: Polar Prediction Matters, a YOPP initiated dialogue platform to engage with users of polar weather and sea-ice forecasts. <https://www.polarprediction.net/yopp-activities/polar-prediction-matters/>
- PPP: Polar Prediction Project. <https://www.polarprediction.net/>
- PPP-SERA: Polar Prediction Project Task Team on Societal and Economic Research and Applications. <https://www.polarprediction.net/yopp-activities/yopp-task-teams/ppp-sera/>
- PPP-SG: Polar Prediction Project Steering Group.
<https://www.polarprediction.net/steering-group/>
- RMSEs: Root Mean Square Error is the standard deviation of the residuals (prediction errors).
- Roshydromet: The national weather service of Russia.
<http://government.ru/en/department/49/>
- RV Polarstern: German Icebreaking Research Vessel Polarstern.
<https://www.awi.de/en/expedition/ships/polarstern.html>
- S2S: Sub-seasonal to seasonal. S2S is a joint initiative of the World Weather Research Programme (WWRP) and the World Climate Research Programme (WCRP).
<http://s2sprediction.net/>
- SCAR: Scientific Committee on Antarctic Research. <https://www.scar.org/>
- SH: Southern Hemisphere.
- SIDFex: Sea Ice Drift Forecast Experiment. <https://www.polarprediction.net/yopp-activities/sidfex/>
- SIPN: The Sea Ice Prediction Network. <https://nsidc.org/data/sipn>
- SOP: YOPP Special Observing Period.
- SOP1-NH: First Special Observing Period in the Arctic, 1 February to 31 March 2018.
- SOP1-SH: First SOP for the Southern Hemisphere, 16 November 2018 to 15 February 2019.
- SOP2-NH: Second Special Observing Period in the Arctic. 1 July to 30 September 2018.
- SOP3-NH: Third Special Observing Period for the Arctic. 1 February to 31 March 2020.

- SPICE: WMO Solid Precipitation Intercomparison Project.
<https://public.wmo.int/en/resources/meteoworld/spice-%E2%80%93improving-snowfall-measurements>
- Supersites: Locations where additional observations or model data has been produced for YOPP, particularly during the Special Observing Periods.
- THINICE 2021: A conference to be organized by AMAP in 2021
- Third Pole: The region that encompasses the Himalaya-Hindu Kush mountain range and the Tibetan Plateau. <http://www.icimod.org/?q=3487>
- THORPEX: The Observing system Research and Predictability Experiment) is an international research programme established in 2003 by the World Meteorological Organization to accelerate improvements in the utility and accuracy of weather forecasts up to two weeks ahead. It is part of the World Weather Research Programme.
https://www.wmo.int/pages/prog/arep/wwrp/new/thorpex_new.html
- TIGGE: THORPEX Interactive Grand Global Ensemble.
https://www.wmo.int/pages/prog/arep/wwrp/new/documents/TIGGE_brochure.pdf
- TOP: YOPP of Polar Prediction Targetted Observing Period. Similar to SOP but increased observations are not taken during the entire period. Only at certain times related to particular locations to enable events to be tracked.
- UK MetOffice: The Weather Service of the United Kingdom of Great Britain and Northern Ireland. <https://www.metoffice.gov.uk/>
- UK: United Kingdom of Great Britain and Northern Ireland.
- US: The United States of America.
- WCRP: The World Climate Research Programme. <https://www.wcrp-climate.org/>
- WGNE: The Working Group on Numerical Experimentation (WGNE), jointly established by the WCRP Joint Scientific Committee (WCRP-JSC) and the WMO Commission for Atmospheric Sciences (CAS), which is responsible for WWRP.
<http://wgne.meteoinfo.ru/>
- WMO: World Meteorological Organisation. <https://public.wmo.int/en>
- WMS: Web Mapping Service. The OpenGIS® Web Map Service Interface Standard (WMS) provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases
<https://www.ogc.org/standards/wms>
- WWIC: Weather, Water, Ice and Climate. <https://www.polarprediction.net/yopp-activities/yopp-task-teams/ppp-sera/>
- WWRP: World Weather Research Project.
https://www.wmo.int/pages/prog/arep/wwrp/new/wwrp_new_en.html
- WWRP-SSC: WWRP Scientific Steering Committee.
https://www.wmo.int/pages/prog/arep/wwrp/new/main_page_wwrp_ssc.html
- x-validation: is a statistical method for assessing how the results of a statistical analysis will generalize to an independent data set.
- YOPP Core Phase: From mid 2017 to mid 2019.
- YOPP Data Portal: Website providing information and access to data collected during YOPP (<https://yopp.met.no/>).
- YOPP: Year Of Polar Prediction. <https://www.polarprediction.net/>
- YOPP-SH: The Year of Polar Prediction in the Southern Hemisphere.
- YOPPsiteMIP: Year of Polar Prediction Numerical Model Intercomparison Project.
https://www.polarprediction.net/.../YOPP_Supersite_common_model_output.pdf