

WORLD METEOROLOGICAL ORGANIZATION

WWRP POLAR PREDICTION PROJECT (WWRP-PPP)

8TH STEERING GROUP MEETING

27 FEBRUARY – 1 MARCH 2017

NATIONAL CENTERS FOR ENVIRONMENTAL PREDICTION (NCEP)

5830 UNIVERSITY RESEARCH COURT COLLEGE PARK,
MARYLAND 20740, UNITED STATES



YOPP Open Science Session (back row, from left) Winfried Hoke, Christopher Fairall, SiriJodha Khalsa, Helge Goessling, Mikhail Tolstykh, Greg Smith, Shanna Pitter, Daniela Liggett, Paolo Ruti, Thomas Jung, Eivind Støylen, Jørn Kristiansen, Don Perovich, Matthew Shupe, Richard Swinbank, NN, Peter Bauer, NN, NN
(front row, from left) David Bromwich, NN, Jun Inoue, Qinghua Yang, Kirstin Werner, Alice Bradley, Matthieu Chevallier, Jonathan Day, Melissa Zweng, Gunilla Svensson, Barbara Casati, Xingren Wu, Robert Grumbine, Michael Ek



PPP Steering Group Meeting #8: (back row, from left) SiriJodha Khalsa, Greg Smith, Winfried Hoke, David Bromwich, Matthew Shupe, Mikhail Tolstykh, Daniela Liggett, Jonathan Day, Robert Grumbine, Richard Swinbank, Christopher Fairall, Don Perovich
(front row, from left) Helge Goessling, Qinghua Yang, Xingren Wu, Kirstin Werner, Jun Inoue, Alice Bradley, Matthieu Chevallier, Barbara Casati, Gunilla Svensson, Thomas Jung, Peter Bauer, Eivind Støylen, Jørn Kristiansen

YOPP Open Session

1. Welcome and Opening

Bill Lapenta, director of NCEP (National Centers for Environmental Prediction), welcomed the Polar Prediction Project (PPP) Steering Group (SG) and participants to the meeting. He pointed out that Louis Uccellini (Director of NOAA NWS, the National Weather Service of the National Oceanic and Atmospheric Administration, USA) is committed to addressing “Grand Challenges”, including support for the Polar Prediction Project and other WWRP THORPEX legacy projects. **Paolo Ruti**, (head of the WMO WWRP, World Weather Research Programme) welcomed the participants on behalf of WMO. He noted the need to continue to strengthen the link between research and operational centres, in such areas as ensemble forecasting and subseasonal to seasonal prediction. PPP is very much part of this initiative. **Thomas Jung**, (chair of the PPP SG) also welcomed the participants. He was pleased the Steering Group had been invited to hold this meeting at NCEP, since that gives PPP an excellent opportunity to engage with colleagues from the US. The main focus of the meeting is planning for the Year of Polar Prediction (YOPP), including exploring synergies with the MOSAiC project.

2. Introductory Presentations

Paolo Ruti talked about YOPP and its relationship with WMO priorities. He started off by outlining the WMO long-term vision, leading up to the first WWRP Open Science Conference in 2014. Following that conference, WWRP has developed a new implementation plan, with an enhanced focus on users. The plan is centred on four societal challenges: urbanization, high-impact weather, water, and new technologies. The WMO research programme links polar and high mountain regions – this theme includes the Global Cryosphere Watch (GCW), the Polar Climate Predictability Initiative (PCPI) and the Polar Prediction Project.

Thomas Jung (Alfred Wegener Institute, Germany) gave a presentation on YOPP background and planning. In the late 2000s, there were discussions on the legacy of IPY, the approaching end of THORPEX and Arctic climate change. These discussions led to the first PPP SG meeting in 2011, with the objective of formulating project goals and activities. The PPP mission statement recognised the need for significant improvement in environmental prediction capabilities, at hourly to seasonal time scales. Observational coverage in polar regions is relatively poor, and YOPP aims to improve this. Additional observations will also help improve the representation of key process in models, and explore the predictability of the atmosphere-ocean-ice system. YOPP will improve the understanding of linkages with lower latitudes and verification methods including both, their benefits to society, and also provide training opportunities.

The YOPP project has three phases. We are currently in the Preparation Phase. The YOPP Core Phase (mid-2017 to mid-2019) will include enhanced modelling and prediction efforts, with two Arctic Special Observing Periods (SOPs) to close gaps in the observing systems, with extensive buoy coverage, and processed-focussed field campaigns. Similar activities will also take place in the Antarctic,

with a single SOP. The YOPP Consolidation Phase will be focused on analysing results from the Core Phase, with a third Arctic SOP in conjunction with MOSAiC. The YOPP endorsement process is intended both to help coordination and also to help proposers. So far, around 50 projects have been endorsed. There is currently a gap, with very few projects focused on Southern Hemisphere oceans. Preparations for YOPP are being progressed through several Task Teams. A range of communication channels have been developed, including a website, social media, a regular newsletter, and a mailing list. The PPP International Coordination Office (ICO) is currently developing a video. A YOPP launch event is planned for May 2017 at the WMO headquarter in Geneva, Switzerland. Several challenges remain, including involving more countries, developing a strong data component, and engaging better with the satellite community.

Greg Smith (Environment and Climate Change Canada, ECCC) then gave an overview of planned YOPP activities by ECCC. He noted that the PPP strategy is well aligned with Canada's northern strategy. ECCC's operational observation programme will be enhanced north of 60°N for YOPP, including doubling radiosondes launches to 4 per day at 8 sites. On-ice buoys will be dropped in the high Arctic, budget permitting, and/or at lower latitude by ships of opportunity. ECCC also runs supersites at Iqaluit and Whitehorse, Canada.

The ECCC modelling effort will focus on improved representation of physical processes, lower boundary conditions and representation of small ice features. ECCC will run a YOPP prediction system comprising the Global Environmental Multiscale Model (GEM) at 2.5 km plus NEMO-CICE at 3-8 km, producing daily 48-hour forecasts (NEMO: Nucleus for European Modelling of the Ocean; CICE: Los Alamos sea ice model). This system will be supplemented by several other systems, including coupled medium-range deterministic GDPS-GIOPS (Global Deterministic Prediction System, Global Ice Ocean Prediction System), monthly ice-ocean ensemble, and seasonal prediction (CanSIPS, Canadian Seasonal to Interannual Prediction System). It is not yet clear how the forecasts will be disseminated and archived. ECCC will also carry out verification activities, using both WMO standard methods and neighbourhood methods. They will also institute virtual forecasting desks for weather and ice briefing and obtaining real-time evaluation and feedback. ECCC is also becoming increasingly involved with the North American node of the proposed WMO Arctic Regional Climate Center.

Bob Grumbine (NCEP, NOAA, Maryland) outlined YOPP activities at NOAA-NCEP, which includes the Environmental Modeling, Climate Prediction and Ocean Prediction Centers. NCEP plan to run a high-latitude coupled model, combining atmosphere, land and hydrology models. At high latitudes, the land model has been extended to include boreal, tundra biomes, seasonal snow pack, land ice, permafrost, and seasonal freeze/thaw. There are currently several operational sea-ice models. NCEP is developing a NOAA Environmental Modeling System (NEMS) coupled system, which will include atmosphere, ocean, ice, and wave components. They are developing a sea-ice data assimilation system that is more elaborate than for Sea Surface Temperatures (SST).

3. Keynote Presentations

Jun Inoue (Japanese National Institute of Polar Research, NIPR) described the impact of additional observations on predictive skill. He used several case studies to investigate both local and remote phenomena. In a study using the ALEDAS2 LETKF system, he demonstrated that extra observations improve the ensemble mean forecast of central pressure of a major storm. In other cases of cold air outbreaks over East Asia and the Eastern US, he showed that additional observations improved the predicted central pressure and tracks of cyclones. Other studies confirmed that Arctic observations can help with the prediction of tropical cyclones in summer. He also noted that NIPR will conclude an agreement to cover the provision of soundings from Cape Baranova, Russia.

Matt Shupe (NOAA, Earth System Research Laboratory, Boulder) presented a report on MOSAiC which will be a year-round observation campaign in the high Arctic. The German research icebreaker RV Polarstern will constitute the central observatory from fall 2019 through fall 2020. MOSAiC will employ a multi-scale design: The central observatory ship will be linked with ice-based measurements on scales less than 5 km; a distributed network around the ship will include measurements on scales up to 50 km; large scale observations will explore linkages to 1000 km and beyond. Similarly, the modelling strategy covers a range of scales: process understanding and validation, regional scale modelling and large scale predictions. MOSAiC is distinctive in three ways: it will fill the observing gap, it will be year round, and its heterogeneity addresses upscaling for models.

David Bromwich (Byrd Polar and Climate Research Center, Ohio, USA) gave an overview of the YOPP Southern Hemisphere component. He recommended checking the website (<http://polarmet.osu.edu/YOPP-SH/>) at Polar Meteorology Group for latest details. He noted that the planned Southern Hemisphere SOP will run from mid-November 2018 through mid February 2019. Roughly half the YOPP-endorsed projects cover the Southern Hemisphere.

Barbara Casati (Environment and Climate Change Canada) talked about verification in the polar regions. She noted that the Task Team has written a report on verification for YOPP that contains more detail. She stressed the need for enhanced model diagnostic output at supersites to support better understanding of polar processes. Barbara outlined some more novel verification approaches that could be more relevant to some end users. These approaches include spatial verification methods (e.g. scale-separation and distance metrics) and the sea-ice verification method developed by Goessling et al. Challenges include: observation uncertainty, data sparseness and representativeness, comparing model and satellite data, and dealing with instrument failure.

Daniela Liggett (Gateway Antarctica, New Zealand) described the socio-economic dimension of YOPP. PPP-SERA is a trans-disciplinary group with a focus on understanding how users obtain, perceive, comprehend and use weather, water, ice and climate (WWIC) information. PPP-SERA is developing a scoping document (to be presented at YOPP launch event) framed around two key concepts: mobilities and the value chain. They consider a range of

information providers: government agencies, private sector enterprises, academic and non-profit organizations. Users include: resource extraction, government activities, tourism, construction and industrial transportation. Users often rely on their experience; there is a need for better communication and interpretation of information, while taking into account technical limitations. There is an ongoing challenge of how best to engage with people – the “Polar Prediction Matters” online feedback platform will help to address this issue, it is planned to be active during the YOPP Core Phase.

In the last presentation of the open session, **Helge Goessling** (Alfred Wegener Institute, Germany) gave a more organisational talk on how to engage in YOPP. First, he encouraged participants to get their project endorsed by YOPP – this will increase the visibility of research and help for coordination. Second, he urged people to contribute to the YOPP special observing periods by taking additional observations, and making them available on the GTS (Global Telecommunication System, WMO). Third, he invited people to contribute to the YOPP modelling component. Fourth, he encouraged participation in YOPP related events. Fifthly, he asked the ICO to be put in touch with Polar forecast users. Finally, he invited participants to join one of the YOPP Task Teams, where they have relevant expertise.

Thomas Jung closed the meeting at 1 pm and thanked everyone for their contributions. A group photograph was then taken outside the front entrance.

YOPP Steering Group

1.,2. Opening and Organization of the meeting

Thomas Jung opened the Eighth PPP Steering Group meeting at 2 pm. Thomas noted that YOPP is not just a flagship activity of PPP. Instead, PPP has essentially become YOPP. He outlined the agenda and purpose of the meeting. The main aims are to update the Steering Group with progress by the YOPP Task Teams and to discuss the tasks remaining to be done to prepare for the YOPP Core Phase.

3. Status of WWRP and WCRP-CliC

Paolo Ruti updated the Steering Group with recent WWRP developments. It is planned to finalise the implementation plan for the upcoming Executive Council meeting in May 2017. Action areas and activities, with specific objectives will be published shortly – those will form a living document describing a rolling two-year plan. There is a Commission on Atmospheric Sciences (CAS) session coming up in October 2017 in Bali. There has been a lot of discussion on reforming technical commissions (including CAS). It is proposed that each commission will become an advisory board, advising WMO how to address societal issues. There is ongoing discussion on how better to integrate Global Atmosphere Watch (GAW), World Climate Research Program (WCRP) and WWRP (e.g., a joint vision on modelling). It is important that YOPP is presented at the scientific summit before the CAS session.

Alice Bradley (University of Colorado Boulder) gave a presentation on WCRP Climate and the Cryosphere (CliC). Activities relevant to YOPP include the Arctic Sea Ice Working Group, which needs to be integrated into MOSAIC and YOPP, and also the Antarctic Sea Ice Process and Climate group. The Technical Committee on Sea Ice Observations addresses interoperability issues. The Southern Ocean Region Panel will contribute to the YOPP-SH planning workshop in Boulder, CO in June 2017. CliC strengths are in coordination and comparison – notably through model intercomparison projects (MIPs, e.g., SIMIP, CMIP). Thomas Jung mentioned that there are plans for a MIP on Arctic amplification and Arctic mid-latitude linkages.

4. Status report from YOPP Task Teams

Representatives from the Task Teams each gave a report on recent progress, and introduced the issues to be discussed by the breakout groups.

Richard Swinbank (WMO Consultant to PPP, Exeter, UK) reported on behalf of the modelling Task Team. A draft modelling plan has been written, and a set of core standard model output fields has been proposed. The two main aims of the discussion are: first to agree what needs to be done to finalise the modelling plan, and second to agree the common model output – particularly ocean, sea-ice and wave data.

On behalf of the SOP Task Team, **Thomas Jung** reported that a letter has been sent to Permanent Representatives for the WMO (PRs), and a similar letter to other potential contributors. The letters provided information about the planned SOPs and invited contributions to YOPP. Overall the feedback to the letters has been very positive.

Action 4.1: ICO to inform SG of outcomes from PR letters (summary and original files).

Action 4.2: ICO to send information about SOPs to all endorsed projects.

Action 4.3: ICO to write an email to all those who replied to the PR letters, thank them for their efforts, and provide them with an update on next steps.

Don Perovich outlined some key issues for the Buoy Task Team, including: what kind of buoys do we have, what range of instruments, what will be available during the YOPP Core Phase? He also mentioned that webcams can be very useful, even if they do not give quantitative information. The challenge is that ice is always on the move, and it is not always easy to fill gaps. The Task Team will participate in meetings of the International Arctic Buoy Programme (IABP) and International Programme for Antarctic Buoys (IPAB).

On behalf of the Satellite Task Team, **Thomas Jung** reported that the main contact was with the Polar Space Task Group (PSTG). There is a lot of satellite data potentially available – Task Team activities include providing the YOPP community with a list of operational products and agree on priorities for potential new products. He also said that PPP-SG and PSTG should combine to push for better buoy products, for both the cryosphere and atmosphere.

Daniela Liggett gave an update on PPP-SERA activities, in addition to those mentioned in her earlier talk. It is anticipated that the group's scoping document will be finished for the YOPP launch in mid-May. One of the PPP-SERA co-chairs, Machiel Lamers, has received funding for the YOPP-endorsed project SALIENSEAS on Arctic (weather & climate) information systems, which is well-positioned to make a significant contribution to YOPP-related efforts. PPP-SERA also plans to develop a repository of their expertise.

Barbara Casati outlined the work of the YOPP Verification Task Team. One challenge is the need to adapt Commission for Basic Systems (CBS) verification standards to be more appropriate to the polar regions, including use of more levels (including the stratosphere), and lowering the thresholds used for precipitation. They need more information about available observations from the relevant Task Teams. The Task Team is also requesting higher frequency model data at supersites. They are also proposing a special “post mortem” after each SOP.

David Bromwich reported on behalf of the YOPP-Southern Hemisphere Task Team (YOPP-SH). A planning meeting is scheduled for June 2017 at NCAR, Boulder, CO, and this will be crucial for getting the SH oceanography on board.

Eivind Støylen (Physical Oceanography, University of Oslo) gave the report from the Data Task Team on behalf of Øystein Godøy. There was a data planning meeting in Norway in November. It was agreed to have the YOPP Data Portal hosted by the Meteorological Institute in Norway (met.no). This will benefit from experience gained during the International Polar Year (IPY), and though hosting the Global Cryosphere Watch portal. The YOPP Data Task Team plans a metadata-driven, open-dataspace, net-centric approach, with distributed storage of data. Previous experience shows that standards are often differently interpreted, and requirements for user metadata are generally underestimated. The portal will need to support both real time data exchange and access to archived data. There is a need to specify and agree on accepted interoperability standard for metadata and data, and agree and specify the services needed. Contributing data centres should set up specific interfaces for YOPP.

Action 4.4: Øystein Godøy and Data Task Team to finalise YOPP data concept.

Jonathan Day (University of Reading, UK) presented the report of the Education Task Team. A summer school was held in Abisko, Sweden in April 2016, and another is planned for 2018 (probably in partnership with the EU Horizon2020 project APPLICATE). He noted that a webinar series is being developed with the Association of Polar Early Career Scientists (APECS). The EU Horizon2020 project Blue Action includes training with more focus on business, policy makers and project partners. Blue-Action expressed interest in joining the YOPP-APPLICATE school. A third EU Horizon2020 project, INTAROS, is planning a summer school in about 2020.

Kirstin Werner (Alfred Wegener Institute, Germany) gave an update on outreach and communications. A range of channels are being used including, website, twitter, newsletter, video and infographics. A communication plan has been developed. A SWOT (strengths, weaknesses, opportunities, and threats) analysis on YOPP communication concluded that we can build on the strength of the project, using high public awareness of polar regions and climate change. Key questions to be discussed include: what are the key messages we like to send, and who are we targeting in terms of communication and outreach?

5. JCOMM Joint Session

Vasily Smolyanitsky (Arctic & Antarctic Research Institute, Saint Petersburg, Russia) gave a remote presentation on behalf of the Expert Team on Sea Ice (ETSI) of the Joint Commission on Oceanography and Marine Meteorology (JCOMM). ETSI plans to provide sea-ice products for YOPP, especially during the SOPs, which could be used for evaluation and perhaps assimilation. They are also interested in using observation data from YOPP. ETSI maintains and updates sea-ice technical documentation and provides support for sea-ice climatology and ice information services. Data are available via a server in Boulder. Helge Goessling asked whether the 2010 document on sea-ice information services would be updated. Vasily answered that it will be updated soon. Greg Smith noted that some products (e.g., ice edge data) need to be used with caution, as they were produced for use by the

shipping industry and are not necessarily appropriate for model verification (e.g. positive bias in ice edge position applied for security reasons).

Action 5.1: ICO to advertise JCOMM products, for use in model evaluation.

Action 5.2: ICO (Helge) to follow up on sea-information document [Sea Ice information services for the world] by WMO.

6. Keynote Presentation – APPLICATE

Thomas Jung gave a keynote presentation on the APPLICATE project. The project includes 16 partners from 9 countries, with a budget of 8 Million Euro plus a Russian contribution. It is a four-year project starting November 2016. Its mission is to develop enhanced predictive capacity in the Arctic and mid latitudes, bringing together the Numerical Weather Prediction (NWP) and climate communities. Three main themes are: delivering enhanced predictions, understanding Arctic-midlatitude linkages and knowledge transfer. It contributes to YOPP in several ways: assessment of model performance; production of the ECMWF YOPP dataset, model development (including process models and coupled SCM (Single Column Model)); elucidating Arctic-midlatitude linkages; and providing guidance for observing system design. APPLICATE data will be made available through the YOPP Data Portal.

7., 8., 9. Breakout Groups

There were three parallel sessions of breakout groups, with outcome from the discussions reported in session 11. During the lunch break, Dave Bromwich presented a NOAA science seminar on “The Arctic System Reanalysis: Motivation, Development, and Performance”.

10. Keynote Presentation – INTAROS

Agnieszka Beszczyńska-Möller (Institute of Oceanology, Warsaw, Poland) gave a remote presentation on INTAROS, which is a five-year EU funded project. Work package 3 covers the enhancement of multidisciplinary in situ observing systems, improving critical gaps and building additional capacity in Arctic observing system. It covers five different tasks, split mainly geographically. Task 3.1 contributes to the PROMICE (Programme for Monitoring of the Greenland Ice Sheet) development of observations in coastal Greenland. Task 3.2 provides additional moored buoys and other instruments north of Svalbard, towards the deep Nansen basin. Task 3.3 similarly covers the Fram Strait. Task 3.4 provides a distributed system for ocean and sea-ice, including ice-tethered platforms (ITPs), and sea-ice mass balance buoys (SIMBA). Task 3.5 provides distributed systems for atmosphere and land, including monitoring atmospheric composition. Potential contributions to YOPP SOPs include: data from moorings in NE Greenland and N of Svalbard, data from ITPs, SIMBAs, and data from Ferrybox (measurement system for surface ocean). Instruments could also be deployed on icebreakers in 2018 and 2019.

Following Beszczyńska-Möller’s presentations, there was agreement that she would be an excellent INTAROS point of contact for YOPP.

11. Reports from Breakout Groups

Richard Swinbank reported on the breakout group discussion on Modelling. The group agreed to change the way in which YOPP Reference Datasets are classified, so that they are split into Core Datasets and Datasets of Opportunity (see Figure 1), and differentiating ‘Core Datasets’ into Dedicated YOPP and Operational Datasets. Experimental datasets are defined as before, but more information will be added to include short descriptions of planned experiments and their aims. There was agreement on the principle of asking modellers to provide standardized sets of core model output. It was agreed to expand the core set to include additional sea-ice and ocean data, and to include more detailed model and forecast data at supersites.

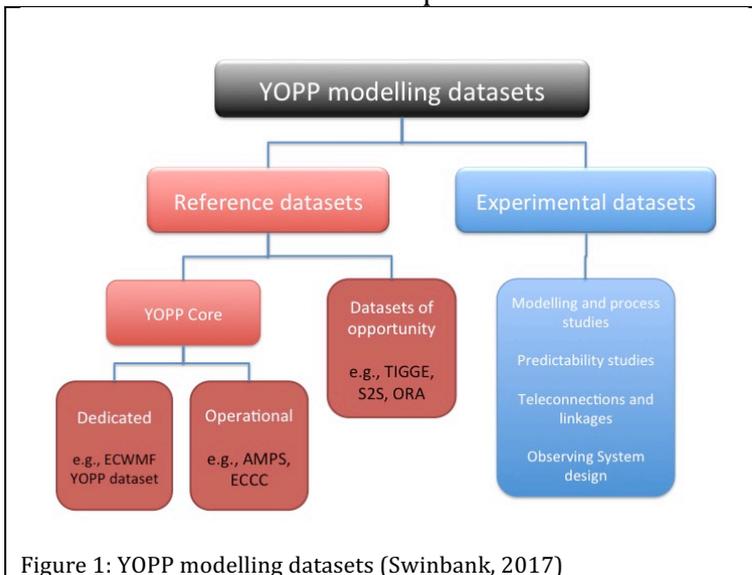


Figure 1: YOPP modelling datasets (Swinbank, 2017)

Action 11.1: Richard Swinbank to revise YOPP modelling plan, including revised classification of reference datasets.

Action 11.2: A representative of each data provider to check that the list of datasets in the modelling plan is correct.

Action 11.3: Richard Swinbank to revise document on core model output data, to include expanded list of sea-ice and ocean model data.

Action 11.4: Barbara Casati, Gunilla Svensson and Eric Bazile to develop a list of locations of supersites for additional detailed model output, and specifications of the requested model output data. Richard Swinbank to add this information to the core model output data document.

Kirstin Werner reported on Communication and Outreach. The target audience includes the general public, forecasting community and users of forecast products. The group discussed what does YOPP actually provide and what YOPP can provide to that audience. There was a need to register requirements of forecast centres, creating a “customer base”. It was agreed to develop messages about YOPP, with example text.

Action 11.5: Communication and Outreach Task Team to develop a slogan for YOPP, for use outside the YOPP community.

Action 11.6: Communication and Outreach Task Team to engage with forecast centres and users via letters, emails, direct contact and user feedback forum.

Action 11.7: Communication and Outreach Task Team to compile a short summarising video based on short video interviews of Steering Group members and others answering the question “What is YOPP?”

Action 11.8: Communication and Outreach Task Team to develop outreach materials for a range of different audiences, e.g., new YOPP brochure; media kit for journalists; general power point presentation for involved scientists to be used at meetings etc.

Action 11.9: Communication and Outreach Task Team to use YOPP activities in the field (during SOPs and field campaigns) for creating content (videos photos, etc.).

Daniela Liggett reported on the PPP-SERA discussion. We need to decide who we want to engage with, and how to engage. We should prioritise research that will affect end users, and raise awareness about YOPP.

Action 11.10: ICO with PPP-SERA to compile list of endorsed projects thematically relevant for SERA, and also with relevant answers from WMO letters, in order to avoid contacting stakeholders too often.

Action 11.11: ICO with PPP-SERA to formulate plan on how best to coordinate user engagement between endorsed projects to avoid targeting the same stakeholders multiple times.

Action 11.12: ICO, with the help of all SG members, to draft a table of contacts (stakeholders) who should be targeted with engagement.

Jonathan Day reported on Education. It was agreed to brainstorm a future YOPP-APPLICATE school. The Abisko school had been very successful and the group recommend doing it again, using APPLICATE money plus co-funding. It was also agreed to explore the use of webinars and massive open online course (MOOC), and interfacing with other education initiatives (including other summer schools).

Action 11.13: Jonathan Day, Gerlis Fugmann and Alice Bradley to hold teleconference(s) to discuss plans for a YOPP-APPLICATE school in around 2018, and other YOPP education coordination.

Action 11.14: Education Task Team to consider use of webinars with APECS, and MOOC with other education initiatives.

Thomas Jung reported on Satellites. The main action is to develop a prioritised list of parameters that should be provided in satellite products to support YOPP. Both data assimilation and model evaluation/development will be considered. A limited number of “game changers” should be identified. Provide PSTG with the draft list, finalise before May 2017 (when the YOPP Core Period starts).

Action 11.15: ICO to contact PSTG to check whether there is progress in agreeing the prioritised list of satellite products, to be finalized before May 2017.

David Bromwich reported on the Southern Hemisphere. There was a need to entrain the Southern Ocean community. Various enhanced modelling efforts are planned including Antarctic Mesoscale Prediction System (AMPS), ECMWF and many regional efforts. There are potential commitments for enhanced observation including more radiosondes and buoys. The YOPP-SH planning meeting will be held in conjunction with the 12th Workshop on Antarctic Meteorology and Climate.

Action 11.16: YOPP-SH Task Team to make vigorous efforts to entrain the Southern Ocean oceanographic community into YOPP-SH, at the Boulder meeting in June 2017.

Action 11.17: YOPP-SH to request details on Southern Hemisphere buoy deployments from IABP.

Barbara Casati reported on the Verification discussion. It was agreed that there should be post-mortems after each SOP involving forecasters at major NWP centres. The post-mortem would include synoptic review, forecaster subjective evaluation, upper air and surface verification. The group agreed on the YOPP verification goals and priorities in the draft document, with a few changes. A YOPP verification reference table will be produced, based on the table of model output. It was agreed to carry out supersite single-column process-based verification (see Action 11.4); 4-5 points should be output around each site.

Action 11.18: ICO and Verification Task Team to organize a post-mortem discussion after each SOP to discuss with forecasters: a synoptic review of the weather, subjective evaluation of model performance and objective verification scores.

Action 11.19: Verification Team to produce a reference table of verification scores, based on the table of core model output.

Helge Goessling reported on the Observation discussion, which covered YOPP buoys, field campaigns and SOPs. Airborne platforms were not well represented at the meeting. It was noted that special weather or sea/ice forecast services are possible to support field campaigns. Wave buoys, and waves in general, need more consideration in YOPP. Buoy coverage is promising in Arctic; available buoys/floats need to be matched to deployment opportunities. Floats need to be promoted as well. Antarctic buoys need more discussion in the near future.

Action 11.20: Buoy Task Team and Aircraft Task Team to compile table of non-satellite observation data for the Arctic and Antarctic.

Action 11.21: SOP Task Team to compile mailing list of points of contacts from replies to PR letters.

Action 11.22: SOP Task Team to provide feedback to those who replied to the letters, and contact those who have expressed an interest but not yet replied.

12. ICO Matters

The SG agreed that the endorsement process was valued. It was agreed that ICO should extend the endorsement procedure to include institutional endorsement.

Action 12.1: ICO to extend the endorsement process to include institutional endorsement and clarify on the website that institutional activities (including institutions and workshops) are welcomed for endorsement.

The YOPP Launch event is planned for the WMO Executive Council meeting in May [*Sec. note* – date is now confirmed as 15th May]. This will be an occasion to publicise YOPP and engage with WMO members and the media.

There was general discussion on how to strengthen the work of the ICO. It was agreed that there should be better communication back to leaders of endorsed projects. The endorsement procedure was working well, aiming for a turn around within 7 working days, compared to the published 14 working days.

Action 12.2: ICO to set up mailing list for all PIs of YOPP-endorsed projects.

It was requested that WMO travel procedures be carried out further in advance of meetings.

Additional contributions for the newsletter were invited. News items on the polarprediction.net website are also valuable for inclusion in progress reports for WWRP and Alfred Wegener Institute (AWI). It is planned to showcase YOPP at a range of meetings – SG members were encouraged to help publicise YOPP. Material is being developed, and is available via [dropbox](https://goo.gl/EFX1jK) (shortened URL: goo.gl/EFX1jK).

13. Steering Group Matters – Closed Session

SG members discussed budget and membership matters.

Action 13.1: Thomas Jung to contact Sarah Jones on proposed new PPP SG members.

Action 13.2: Thomas Jung to thank those PPP-SG members that will be stepping down.

14. Miscellaneous

At the upcoming EC-PHORS meeting in Ushuaia, Argentina, Thomas Jung will explore the possibility of topping up the PPP trust fund. This will also be an opportunity to publicise the SOPs and to obtain advice.

A future planning workshop is not affordable at the moment, and interaction via teleconference is encouraged. It is recognised that it would be good to get observational experts and modellers together if resources permit.

Possible venues for the next SG meeting are under consideration, possibly in Iceland or mainland Europe. Ideally the dates would align with the launch of the first SOP (Wed 31st January – Friday 2nd February, 2018).

Action 14.1: PPP SG members and ICO to save the dates for the next PPP SG meeting (Wed 31st January – Friday 2nd February, 2018).

15. Data Discussion

Since there had been no data breakout group, the remaining time was used for discussion of the YOPP Data Component. Met Norway will develop and host the Data Portal, taking into account the lessons learnt from IPY and GCW. The YOPP Data Portal will rely on discovery metadata provided by data centres, and different levels of Data Portal functionality can be offered. Data taken during SOPs and communicated through GTS can be made available, although there are some differences in data received via GTS at different centres – which is under investigation. High-resolution radiosonde data should be accessible from national data centres, via the WMO Information System (WIS). Those data should be in BUFR format, following WMO standards, which could be handled by the Data Portal.

The customers of the YOPP Data Portal will mostly be from the research community (natural scientists and social scientists), but could also include the satellite and operational prediction communities.

There was some discussion of the functionality of the portal, options include: point users to the data; download the data; simple post processing and visualization. Some datasets would simply be pointed to by the portal (e.g., ECMWF YOPP data). Other data might be downloaded through the portal (e.g. field campaign data), requiring passing credentials and setting up a basket service. Simple post-processing (of some model data) could include subsetting and transformation - what is needed to get this functionality?

Potential YOPP data hubs could include the Arctic data archive centre, PANGEA, and the INTAROS data centre, IASOA. National and international archiving solutions need to be explored for 'homeless' data. The Task Teams needs to enable data to be stored, visible and accessible. A list of data centres to work with YOPP Data Portal needs to be compiled.

The range of data covered will include: modelling and prediction data; observations (SOPs, field campaigns); satellite data. The satellite data are primarily for model evaluation, with the portal supplying links to the data, from the Satellite Task Team.

Action 15.1: ICO to revisit the composition of the Data Task Team.

Action 15.2: Data Task Team to develop a data management plan.

Action 15.3: Data Task Team to discuss how best to progress the YOPP Data Component, including producing sample data and developing use cases.

Action 15.4: Data Task Team to contact endorsed projects, and compile a list of data centres that will work with the YOPP Data Portal.

16. Wrap-up, Next Steps and Closing

In his closing remarks, Thomas Jung noted that YOPP is on course. By investing over the coming months, further improvement is still possible. Regular SG teleconferences will be arranged over the coming months. Some Task Teams will possibly be meeting in the autumn in Montreal.

Action 16.1: ICO to send out to PPP SG a doodle poll with dates for monthly teleconferences until next Steering Group meeting

Finally, Thomas thanked the local organisers on behalf of the SG, noting that everyone felt very welcome and that their support was very much more than normal.

List of Abbreviations

AFES	AGCM for the Earth Simulator
AGCM	Complex Atmospheric Climate Model
ALEDAS2	AFES-LEKTF Ensemble Data Assimilation System, updated version
AMPS	Antarctic Mesoscale Prediction System
APECS	Association of Polar Early Career Scientists
APPLICATE	Advanced Prediction in Polar regions and beyond: Modelling, observing system design and Linkages associated with a Changing Arctic climaTE
AWI	Alfred Wegener Institute
BPCRC	Byrd Polar and Climate Research Center
BUFR	Binary Universal Form
CanSIPS	Canadian Seasonal to Interannual Prediction System
CAS	WMOs Commission for Atmospheric Sciences
CBS	Commission for Basic Systems (WMO)
CICE	Los Alamos sea ice model
CLiC	Climate and Cryosphere, WMO
CMIP	Coupled Model Intercomparison Project
ECCC	Environment and Climate Change Canada
ECMWF	European Centre for Medium-range Weather Forecasts
ETSI	Expert Team on Sea Ice
GAW	Global Atmosphere Watch
GCW	Global Cryosphere Watch
GDPS	Global Deterministic Prediction System
GEM	The Global Environmental Multiscale Model
GIOPS	Global Ice Ocean Prediction System
GTS	Global Telecommunication System of WMO
IABP	International Arctic Buoy Programme
ICO	International Coordination Office for YOPP
INTAROS	Integrated Arctic Observing System (Nansen Environmental and Remote Sensing Center, Norway)
IPAB	International Programme for Antarctic Buoys
IPY	International Polar Year (2007-2008)
ITP	Ice-Tethered Platforms
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology
LEKTF	Local Ensemble Transform Kalman Filter
MIP	Model Intercomparison Project
MOOC	massive open online course
MOSAiC	The Multidisciplinary drifting Observatory for the Study of Arctic Climate
NCAR	National Center for Atmospheric Research in Boulder, Colorado
NCEP	USA National Centres for Environmental Prediction
NEMO	Nucleus for European Modelling of the Ocean
NEMS	NOAA Environmental Modeling System
NIPR	National Institute of Polar Research, Japan
NOAA	USA National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction

NWS	National Weather Service
PCPI	Polar Climate Predictability Initiative
PPP	WMO's Polar Prediction Project
PPP-SERA	Societal and Economic Research and Applications workgroup
PROMICE	Programme for Monitoring of the Greenland Ice Sheet
PSTG	Polar Space Task Group
SCM	Single Column Model
SG	Steering Group
SIMBA	sea-ice mass balance buoys
SIMIP	Sea Ice Model Intercomparison Project
SOP	Special Observing Period
SST	Sea Surface Temperature
SWOT	strengths, weaknesses, opportunities, and threats
TC	Tracks of Cyclone
THORPEX	The Observing System Research and Predictability Experiment
WCRP	World Climate Research Program
WIS	WMO Information System
WMO	World Meteorological Organisation
WWIC	weather, water, ice and climate
WWRP	World Weather Research Programme (WMO)
YOPP-SH	YOPP Southern Hemisphere Task Team