YOPP YEAR OF POLAR PREDICTION

AWI PPP WORLD METEOROLOGICAL ORGANIZATION

International Coordination Office (ICO)
of the Polar Prediction Project

Find more information at
www.polarprediction.net

PolarPredictNews

Newsletter #09

Dec. 2018

YOPP Southern Hemisphere Special Observing Period started on 16 November 2018: First YOPP-SH SOP balloon launch from Météo France station Dumont D'Urville, Antarctica (photo: Météo France).

Dear Colleagues,

As most of us are already enjoying the Holiday season, many of our colleagues in the Antarctic and the Southern Ocean are making valuable contributions to the first Special Observing Period in the Southern Hemisphere. With the start of this SOP on 16 November 2018, the number of radiosonde launches in the Southern Hemisphere more than doubled. At the same time YOPP-endorsed projects contribute important process studies. It will be exciting to evaluate this wealth of data in the upcoming YOPP Consolidation Phase, the start of which is just a few months away.

Currently, we are planning the YOPP Consolidation Phase, with the PPP Steering Group meeting in January in Helsinki being a major milestone. Details will be published in early summer 2019 in form of an updated YOPP Implementation Plan, following some community consultation. Please stay tuned.

To the early career scientists, I would like to bring to the attention the MOSAiC School 2019, which I would consider a "once in a lifetime" opportunity. Interested? More details can be found in this issue of PolarPredictNews.

Last but not least, I would like to announce an important change in the management of the International Coordination Office for Polar Prediction (ICO). After five years as the Directror of the ICO, Helge Goessling handed over this job to Kirstin Werner. Thank you very much, Helge, for your leadership; and congratulations, Kirstin, to your new job. I am sure that the ICO will be thrieving until 2022, when PPP and YOPP will come to a close.

Enjoy this special "Holiday Edition" of PolarPredictNews,
Thomas Jung

The Year of Polar Prediction (YOPP) is a major international activity that has been initiated by World Meteorological Organization as a key component of the Polar Prediction Project (PPP). The overarching goal of YOPP is to significantly advance our environmental prediction capabilities for the polar regions and beyond. As an internationally coordinated period of intensive observing, modelling, prediction, verification, user-engagement, and education activities which involves various stakeholders, YOPP contributes to the knowledge base needed to manage the opportunities and risks that come with polar climate change.

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Content

01 Start of the YOPP Antarctic Summer Special Observing Period

On 16 November 2018, the Special Observing Period in the Antarctic started. For three months, weather services and international scientists will increase the number of atmospheric and sea-ice observations from different Antarctic land stations, during terrestrial field expeditions and aboard research vessels in the Southern Ocean. Goal of the international Year of Polar Prediction is to improve weather and sea-ice forecasts in the polar regions. When days are getting longer and research stations become busy, the summer is about to start on the Antarctic continent. November is the month when the austral field season begins. This summer, extra atmospheric and sea-ice measurements in addition to the routine observations will be carried out as a contribution to the Year of Polar Prediction (YOPP). YOPP has been initiated by the World Meteorological Organization's (WMO) World Weather Research Programme (WWRP). In response to the rapid climate changes in polar regions and related transformation of human activities, the project aims to improve environmental safety by improving forecasts in the Arctic and Antarctic. Earlier this year, two YOPP Special Observing Periods already took place in the Arctic.

More than 2,000 extra radiosondes

Expected are more than 2,000 extra radiosondes released from numerous meteorological stations from 16 November 2018 to 15 February 2019. In addition to atmospheric observations, YOPP-endorsed field campaigns and expeditions as well as autonomous instruments will feed their real-time or near-real time data into the Global Telecommunications System of WMO. The additional data generated during the Special Observing Period in the Southern Hemisphere (YOPP-SH SOP) will be used for numerical experimentation and internationally coordinated verification activities as well as for forecast evaluation and observational impact studies. Extra measurements help to identify ways to improve the prediction systems. Based on more accurate and reliable forecasts of weather and sea-ice conditions, recommendations for the

Radiosonde launch infront of Korean Antarctic King Sejong Station on King George Island (photo: instagram Sang-Jong Park/KOPRI).

The team of the YOPP-endorsed IAMCO project launches their first weather balloon from the Italian Mario Zucchelli Station on 16 November 2018 (photo: Francesco Sudati/property of PNRA).

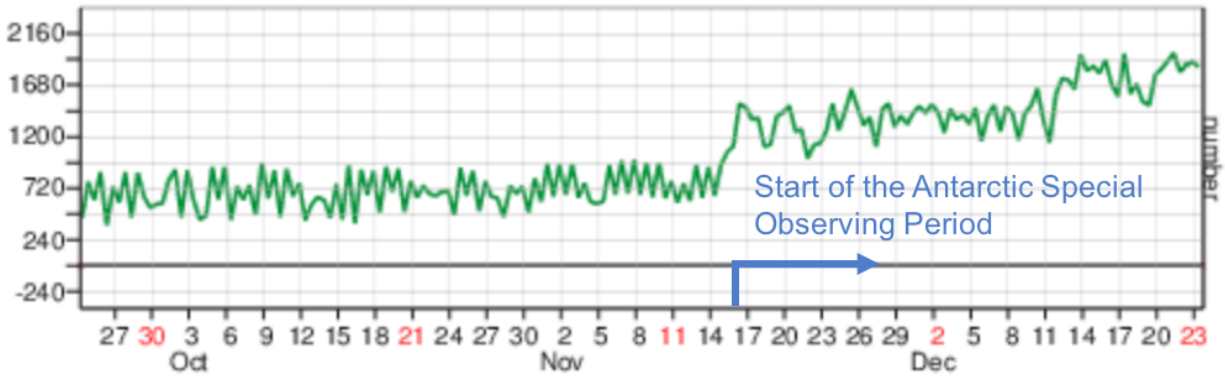
future Southern Hemisphere Polar Observing Systems can be provided.

The Antarctic Special Observing Period marks another milestone for the Year of Polar Prediction. Preparations for the YOPP-SH SOP have been ongoing since the YOPP Summit in Geneva in 2015 when the YOPP-SH committee formed. Since then, the committee led by David Bromwich from the Byrd Polar and Climate Research Center at The Ohio State University, Columbus, Ohio, United States, has been meeting every year to report on national commitments and plans for the ongoing Antarctic Special Observing Period.

Antarctic YOPP Supersites

In particular, Antarctic YOPP Supersites such as the French site Dumont D'Urville, the German Neumayer III station, the Korean station King Sejong or the British Halley and Rothera stations will launch extra weather balloons (for exact locations of YOPP Supersites see the *YOPP Observations Layer*). The increased radiosonde activity from meteorological stations and cruise expeditions can be followed on the ECMWF observation monitoring webpages (see *here*; chose different observing systems and regions). Enhanced radiosonde releases from most Antarctic upper air stations that are on the Global Telecommunications System (GTS) are also monitored by the AMPS Team at NCAR (see *here*). Data obtained by surface buoys in the Southern Ocean is also sent to the GTS; additional buoy deployments will increase the network once the research icebreakers start heading into the Antarctic waters for the summer.

As during the first two SOPs in the Arctic earlier this year (see *here* for an overview), many field campaigns and expeditions endorsed by YOPP provide additional specific observations which enable a better understanding and hence representation of environmental processes in the Antarctic weather, climate, and sea-ice models. Details on the YOPP-endorsed projects contributing to the Antarctic SOP can be found through the *YOPP Explorer*, and by following @polarprediction on *twitter* and *instagram* and hashtags #polarprediction and #YOPPextraobs.



The number of weather balloons launched in the polar regions of the Southern Hemisphere has doubled since the beginning of the Special Observing Period on 16 November 2018 (Figure: ECMWF).

02 New Director of YOPP International Coordination Office

| From 1 December 2018, Kirstin Werner will serve as Director of the Year of Polar Prediction International Coordination Office. Together with the chairman of the Polar Prediction Project Thomas Jung and the Steering Group, Kirstin Werner will continue fostering collaboration between international projects, initiatives, and programmes related to polar prediction research. Kirstin is an Arctic paleoclimatologist and has a master in science marketing with a focus on science communication. As project officer, she has already been engaged with the YOPP office since 2016 and is thus up-to-date and well-involved in a broad range of YOPP-related activities. The former Director Helge Goessling, who has taken over new responsibilities as research group leader at the Alfred Wegener Institute, will continue to support the International Coordination Office (ICO) and to contribute research aimed towards enhanced polar prediction. Paolo Ruti, chief of the World Weather Research Programme, the PPP Steering Group and the ICO thank Helge Goessling for his diligent efforts and committed support to plan, implement and internationally promote the Year of Polar Prediction.

Kirstin Werner serves as new Director of the International Coordination Office for Polar Prediction from 1 December 2018.

WMO's World Weather Research Programme, the PPP Steering Group and International Coordination Office are grateful for Helge Goessling's dedicated work as ICO Director from 2014 to 2018 to promote YOPP activities (pictures: Alfred Wegener Institute/Martina Buchholz).

03 Italy Supports Year of Polar Prediction with 500,000 EUR

| With a total budget of 500,000 EUR, the Italian National Antarctic Research Programme (Programma Nazionale di Ricerche in Antartide PNRA) increased its support to the YOPP by providing funds to five Italian projects to carry out research in the fields of atmospheric science, sea-ice and polar ocean dynamics. PNRA is a Programme supported by the Italian Ministry of Education, Universities and Research. In spring this year, PNRA published a call for projects which specifically encouraged the Italian science community to contribute to the international WMO effort to improve environmental forecasts in polar regions during YOPP. In this call, PNRA emphasized the high relevance of YOPP as a joint effort of academia, operational centers and various stakeholder groups operating in the Arctic and Antarctic to improve the capability of weather and sea ice forecasts in polar regions.

The Italian-French Concordia station/ Dome C (photo: Francesco Montomoli, PNRA/IPEV)

Projects that aimed for PRNA funding were required to receive formal YOPP endorsement prior to their proposal submission. YOPP endorsement is available since the end of 2015 for projects, programmes or initiatives that aim to contribute to improving forecasting skills in polar regions (see more on YOPP endorsement *here*). To date, about eighty projects have been endorsed by YOPP, more than a third of them carrying out research in Antarctica and the surrounding Southern Ocean. In total, seven projects have been submitted to the PNRA call. Of these, five were reviewed successfully by a panel of external peer

reviewers who have been nominated by the PPP Steering Group.

The successful Italian projects cover a wide range of disciplines and topics including new atmosphere measurements, and observational and modelling studies on sea-ice and polar ocean dynamics. Their activity add to the planned contribution of previously funded PNRA projects to YOPP observations with about two hundred extra-soundings carried out at the coastal Italian Mario Zucchelli and the Italian-French station Concordia, and station measurements related to radiation, precipitation and several other atmospheric parameters.

The budget for these extra funded projects amounts to 500,000 Euro, in addition to costs for personnel and logistics. Start of the new Antarctic projects is envisaged for the austral 2018-2019 summer season. A first meeting of the five YOPP-endorsed projects took place on 25 October 2018 in Bologna, Italy, where scientists involved in the now PNRA-funded projects discussed their strategies, activities and plans in view of YOPP.

This year's PNRA call has been for the first time specifically devoted to YOPP. Funded projects add to five earlier PNRA projects and three observatories that in 2016 were already reviewed eligible for PNRA funding, and indicate the interest to contribute to YOPP. Together with the latter, the five new Antarctic projects will strongly enrich the Italian contribution to the YOPP initiative with highly relevant new data sets and modeling activities to further help making YOPP a success.

RMetS Royal Meteorological Society

04 Year of Polar Prediction Featured by British Royal Meteorological Society

On 21 November 2018, the Royal Meteorological Society discussed advances and challenges to predict key Arctic processes during the Year of Polar Prediction. 'Arctic Prediction in a Changing Climate: Understanding Key Processes and Challenges' was the title of the Royal Meteorological Society meeting that took place on 21 November in London, United Kingdom. Speakers represented operational forecasting centers and academia involved in the international Year of Polar Prediction effort. New insights provided by several YOPP-related modelling experiments and field campaigns during two Arctic Special Observing Periods, as well as advances and challenges associated with the understanding and prediction of key Arctic processes were discussed at the meeting.

The program and abstracts of the meeting can be found *here*. Videos of the meeting are available from the *Royal Met Society's Facebook page*.

05 Sea-Ice Measurements at the German Overwintering Base Neumayer III

(by Stefanie Arndt/Alfred Wegener Institute) **The German sea-ice scientist Stefanie Arndt just returned from Antarctica where she has spent a month maintaining the running sea-ice program at the German overwintering base Neumayer III.** Sea ice fastened to coasts, to icebergs and to ice shelves is of crucial importance for the climate and for ecosystems as it modifies the local exchange processes between the atmosphere and ocean. The so-called 'fast ice' is ideal to monitor sea ice and its seasonal evolution, because it may be accessed from nearby research stations on land or shelf ice. In order to better understand sea-ice processes and mass balance, a continuous

Kayak with the electromagnetic measuring device EM31 pulled across Atka Bay to determine snow and ice thickness (Photo: Stefanie Arndt/Alfred Wegener Institute).

measurement program on the fast ice of Atka Bay close to the German overwintering base Neumayer Station III, Antarctica, is performed since 2010. This work contributes to the international Antarctic Fast Ice Network (AFIN), which has been initiated as legacy project under the International Polar Year (IPY) to establish an international network of fast-ice monitoring stations around the Antarctic coastline.

Stefanie Arndt (with YOPP flag) and Hanno Müller, meteorologist of the current overwintering team at Neumayer III station, measuring sea-ice thickness in the Atka Bay (Photo: Matthias Maasch/ Alfred Wegener Institute).

24 km transect across Atka Bay
At Neumayer Station, the wintering team measures various sea-ice and snow properties mainly between June and January when safe access to the ice is secured. Once a month, manual measurements of sea-ice thickness, thickness of platelet-ice (small ice crystals accumulating under sea ice), freeboard (the elevation of the sea-ice surface above the water), and snow thickness are repeated along a 24 km transect across Atka Bay. In addition, autonomous stations are operated on the sea ice. From those, the team retrieves continuous measurements of snow and sea-ice thickness and temperatures as well as atmospheric conditions. These routine measurements are occasionally complemented by more extensive sea-ice thickness and snow depth transects, using an electromagnetic thickness probe pulled in a kayak by a snow mobile (photo page 5).

Additional measurements over summer
Sea-ice scientist Stefanie Arndt coordinates the AFIN contribution from Neumayer Station for the German Alfred Wegener Institute. During the currently ongoing YOPP Special Observing Period in the Antarctic, Stefanie spent a month at the station to maintain the running sea-ice program. Together with the overwintering team, she also carried out additional measurements in both parallel and perpendicular transect lines across the bay in order to improve the understanding of the spatial distribution of sea-ice, platelet ice and snow thickness.

Data available through AFIN and ASPeCt
Data collected under AFIN include ice and snow thicknesses, freeboard, dates of fast-ice formation, and sea-ice breakout when Atka Bay gets ice-free during summer. Auxiliary data collected include meteorological, such as air temperature and pressure, and oceanic parameters, such as water temperature and salinity. AFIN data is available to members within the AFIN network after quality control, and will also be accessible for the wider scientific community through the YOPP-endorsed Antarctic Sea Ice Processes & Climate (ASPeCt) data library which is part of the SCAR Physical Sciences program. For Stefanie, it was a great experience to see how well the sea-ice program is working at Neumayer Station: '*I am looking forward to future measurements and studies in Atka Bay to gain knowledge on the interactions between shelf ice, ocean and sea ice in the area.*'
Contact: Stefanie Arndt stefanie.arndt@awi.de

06 **Japanese Arctic Winter Field Campaign – User Feedback to Operational Services** | *(by Jun Inoue, Japan National Institute of Polar Research)* **An early winter expedition on board the research vessel RV Mirai started in November 2018 in the Chukchi Sea.** It is the first trial for RV Mirai to enter the Arctic Ocean in the winter season. Frequent radiosondes, wave buoys, and daily conductivity-temperature-depth (CTD)

Crew aboard the RV Mirai during their Arctic winter expedition (photo: Takehito Hattori).

casts near the marginal ice zone are deployed during the cruise to investigate the predictability of weather, wave, and sea ice in the Arctic during the period of freezing.

Support by Operational Weather Centres

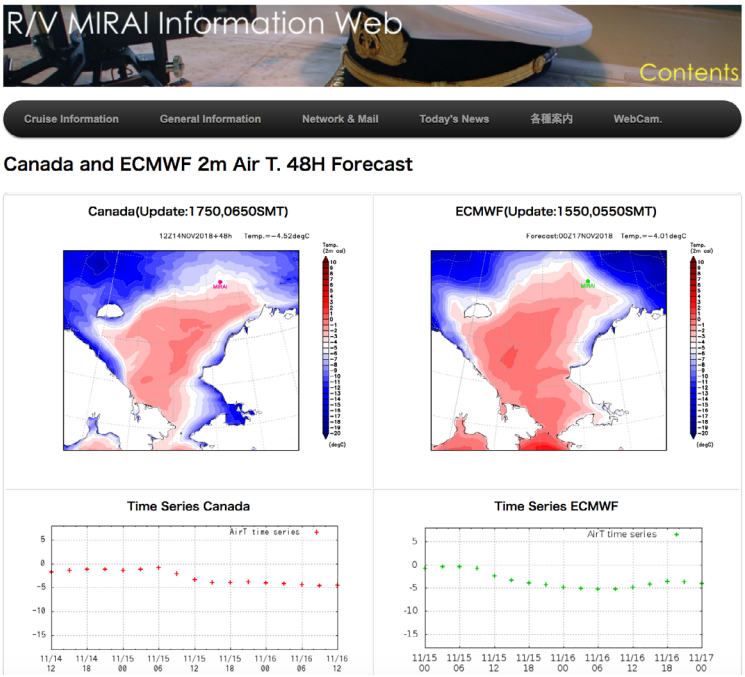
To succeed with this challenging mission to carry out valuable research activities, precise weather and sea-ice forecasts are necessary for safe navigation. Jun Inoue from the Japanese National Institute of Polar Research (NIPR) is chief scientist of this Arctic winter cruise aboard RV Mirai. For his undertaking, the scientist, who is also a member of the PPP Steering Group, receives substantial support by the European Centre for Medium-Range Weather Forecast (ECMWF) and Environmental and Climate Change Canada (ECCC) who provide the team aboard with daily operational forecasts. In addition, NIPR has developed a Vessel Navigation Unit support System (VENUS) to receive and automatically process forecast data on the ship.

When to Escape from Freezing Arctic Ocean?

Real-time forecasts are used during the expedition to manage the cruise schedule on time scales from a day to a week. Because a closing of Bering Strait by sea ice is critical for RV Mirai as an ice-strengthened ship, several parameters such as air temperature, winds, or sea ice cover, as provided by ECMWF and ECCC, need be compared in order to decide when to escape from the Arctic Ocean through the freezing Bering Strait. During daily meetings, Jun Inoue trains the captain and the ice-pilot of RV Mirai how valuable multiple center high-resolution forecasts can be for their daily decisions.

Interaction with Users of Weather Services Welcome

Feedback by users of weather services is welcome by the different operational weather centers contributing to the Year of Polar Prediction. The radiosonde data obtained aboard RV Mirai is transferred in real time so it can be used for the operational weather forecasts as a contribution to YOPP. Daily repeated CTD casts in open waters and the marginal ice zone are valuable data to evaluate coupled atmosphere-ice-ocean models that are being further developed in the frame of YOPP. In the view of the YOPP Consolidation Phase which

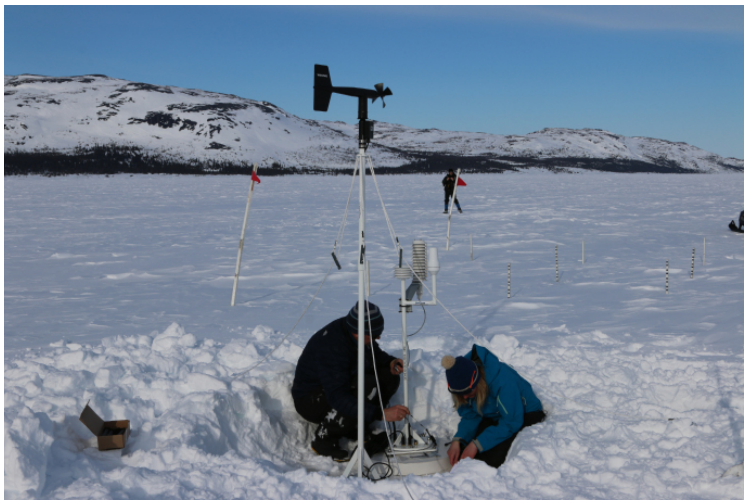


Comparison of the forecast products by different operational centers aboard RV Mirai (source: Jun Inoue/ NIPR, RV Mirai, ECCC, ECMWF)

will already start by mid-2019, this Arctic winter cruise will serve as a good example how to interact with users of weather services and to seek their requirements for safe polar navigation.
Contact: Jun Inoue inoue.jun@nipr.ac.jp

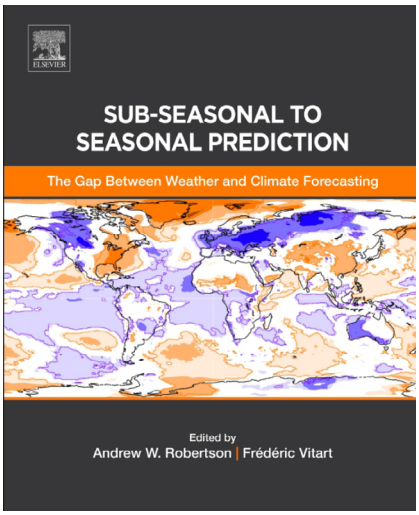
06 Newly Installed Ice Stress Sensors on Labrador Coast | *(by Adrienne Tivy, Jean-François Lemieux/both Environment and Climate Change Canada and Bruno Tremblay/McGill University)* **New sensors to measure ice stress have been installed recently by Environment and Climate Change Canada south of the community of Nain in Canada.** Goal of the multi-year field experiment project in Voisey`s Bay on the Labrador Coast is to study the internal ice stresses in a landfast ice cover under the effect of tidal and wind forcing and interaction between ice floes at the mouth of the fjord. With this, the team around Adrienne Tivy, Bruno Tremblay and Jean-François Lemieux aims to confirm the recent finding by Hata and Tremblay (2015) that (1) thermal stresses exhibit anisotropy in land-locked sea ice, (2) thermal stresses at depth have the opposite sign as those at the surface (tensile at the surface and compressive at depth when the surface cools, and vice versa), and (3) whether low (inertial to synoptic) frequency forcing from tidal currents and surface wind can be recorded by a strain gauge.

In spring 2018, three ice stress buoys (with three sensors each) were deployed short-time along with a weather station and a MetOcean UpTempO instrument to measure ocean temperature with depth (see picture above). This first deployment of the new sensors aimed at testing the equipment and identifying potential problems before the first full season measurements start in winter 2019. Next year the team will also deploy a seasonal ice-mass balance buoy at the beginning of the freeze-up season in late fall.
Contact: *Adrienne Tivy* adrienne.tivy@canada.ca



Buoy deployment in Nain, Labrador Coast comprising of a weather station for surface turbulent flux measurements (wind, surface air temperature, sea level pressure and relative humidity), three ice stress buoys with three stress sensors each deployed at different depth in the sea ice and an UpTempO instrument measuring water temperature at different depths (photo: courtesy of Carolin Mehlmann).

07 APPLICATE Scientists Involved in New Book on Sub-Seasonal to Seasonal Prediction | *(by François Massonnet)* **Scientists of the YOPP-endorsed project APPLICATE contribute a chapter on 'The Role of Sea Ice in Sub-seasonal Predictability' in the newly published S2S book edited by Andrew Robertson and Frederic Vitart.** Predicting weather and climate fluctuations at sub-seasonal to seasonal (S2S) time scales is of high relevance for the society in the current context of rapid climate changes. Rapid progress in this emerging area of research has been possible thanks to an improved understanding of physical processes underpinning predictability, the sustained development of prediction systems and observational networks, as well as the advent of high-performance computing. In that sense, the *APPLICATE* project endorsed by the Year of



Polar Prediction is a prominent example of how the scientific community addresses the S2S prediction challenge.

The scientific literature on S2S prediction has flourished in recent years, and it appears difficult to have a broad and synthetic view on the current state of knowledge. In addition, S2S prediction is a multi-faceted research area using concepts from mathematics and statistics (data assimilation, bias correction, forecast verification, ensemble forecasting), physics (atmospheric dynamics, predictability mechanisms, teleconnections), computational sciences and even social sciences, when it comes to communicating climate information in meaningful ways. To embrace and synthesize all this knowledge, the book '*Sub-seasonal to Seasonal Prediction*' has recently been published. As an accessible yet rigorous synthesis of what is known on S2S prediction, this book edited by Andrew Robertson and Frederic Vitart will quickly become a reference for students, teachers and researchers all alike.

Review by APPLICATE scientists
The five APPLICATE scientists Matthieu Chevallier, François Massonnet, Helge Goessling, Virginie Guemas, and Thomas Jung were solicited to contribute a chapter on 'The Role of Sea Ice in Sub-seasonal Predictability'. In this article, the main sources of Arctic and Antarctic sea-ice predictability, the current sea-ice forecasting capabilities and their limits are reviewed by the authors. Evidence is presented that sea ice can also be seen as a source of S2S predictability for the polar and extra-polar atmosphere. The chapter highlights the central role that sea ice is playing on S2S predictability in polar regions and beyond.

This contribution also is a recognition of the authors' individual and collective leaderships in the field of polar prediction. To a larger extent, the chapter also underlines that global S2S prediction systems will have to account for the rapidly changing conditions happening at the poles – a notion that has been at the heart of the APPLICATE project since its inception.

The book "Sub-seasonal to Seasonal Prediction" is available from *here*.

08 **Everyday Life in the Arctic – New Contribution to Polar Prediction Matters** | **Two new contributions to the Polar Prediction Matters dialogue platform report on the everyday life in Finnish Lapland and on blizzards in the Canadian Arctic.** Tanja Joona, senior researcher at the Arctic Centre of the University of Lapland in Rovaniemi, Finland, provides a personal report to the Polar Prediction Matters forum on the everyday life in Finnish Lapland. While the Arctic is often described as a vulnerable, cold and exotic place with stereotypical images of indigenous and non-indigenous communities, it is not such a homogenous area. Tanja Joona's new article provides rare insights to the daily life in Finnish Lapland which is home to approximately 183,000 people, including indigenous people: the Sámi. Read more by Tanja Joona *here*.

The Arctic is often described as vulnerable, cold and exotic place with stereotypical images of indigenous and non-indigenous communities. But the Arctic is not a homogenous place (photo: Joonas Vola).

Forecasting blizzards
In a second contribution this fall in Polar Prediction Matters, two forecasters from Environment and Climate Change Canada (ECCC) report on automated prediction products to help forecasting blizzards in the Canadian Arctic. In the Canadian Arctic, blizzards regularly occur from October to May.
Blizzard conditions are determined from a number of different weather elements so forecasting of these severe snow storms with temperatures below 0°C, wind speed stronger than 40 km per hour, and visibility less than four hundred meters are still a major challenge for meteorologists. William Burrows and Curtis Mooney introduce different automated products that may help predict blizzard and near-blizzard conditions. These prediction products developed over a period of years are meanwhile often used in operations.

Read the full article by William Burrows and Curtis Mooney *here*.

09 **Call for Applications Open for MOSAiC School 2019 | Applications are now accepted to participate in the MOSAiC School 2019. The school is jointly organized by the project 'Multidisciplinary drifting Observatory for the Study of Arctic Climate' (MOSAiC) and the Association of Polar Early Career Scientists (APECS). The Year of Polar Prediction is one of the partners for the school.**
From September 2019 to September 2020, RV Polarstern operated by the Alfred Wegener Institute will drift with the Arctic sea ice from the central Arctic Ocean towards Fram Strait. During one year, about three hundred scientists will be on board the German research icebreaker to investigate processes and the coupling of atmosphere, ocean, sea ice, bio-geochemistry, and ecosystem conditions. The MOSAiC ice drift will therefore help to better understand consequences of Arctic warming and related sea-ice loss. As MOSAiC is amongst the many projects that have been endorsed by the international Year of Polar Prediction, detailed data sets to improve weather and climate forecasts will be obtained during the one-year ice drift.

Participate in MOSAiC School 2019
For the first cruise leg of the MOSAiC expedition, APECS and MOSAiC partners such as YOPP offer the unique opportunity to participate in the MOSAiC School 2019 aboard the Russian icebreaker RV Akademik Fedorov that supports RV Polarstern on her way into the ice. The school will start and finish at the port of Tromsø in Norway, and is envisaged to take place from 15 September to 26 October 2019 (plus/minus a few days depending on logistical or weather conditions). There will be no registration fee for the school participants. However, travel to and from Tromsø has to be organized and covered by school participants. In case additional travel support becomes available, MOSAiC School organizers will contact selected participants.

Open to twenty early career researchers
The MOSAiC School 2019 is open to up to twenty early career researchers, i.e., advanced graduate students and PhD students with none to limited experience with ship-based research. International experts who are part of the MOSAIC expedition will share their knowledge with students, engage in discussions and hands-on experiences in ground-breaking research, and thus help to educate future Arctic researchers. In addition to lectures, the participants will help the MOSAiC teams on site to set up their instruments and experiments.

MOSAiC
International Arctic Drift Expedition

For more information and how to apply, please visit the *MOSAiC School 2019 website*. Application deadline is 22 January 2019 13:00 GMT. For any questions, please contact *mosaic-school@apecs.is*

10 **International Workshop on Sea Ice Modelling, Data Assimilation and Verification | A joint workshop of the International Ice Charting Working Group (IICWG), the Year of Polar Prediction, GODAE Oceanview**

(GOV) and the Coordination & Support Action KEPLER by the European Commission will be held from 17 to 19 June 2019 in Bremen, Germany. Hosted by the Alfred Wegener Institute, the workshop builds on a series of successful workshops organized by the IICWG Data Assimilation Working Group to advance international capabilities for automated sea ice analysis and prediction on timescales from hours to a season. In conjunction with the Year of Polar Prediction and GOV, a particular need has been identified regarding the development of more mature and meaningful methods for sea ice verification. The focus of the workshop is to discuss cross-cutting issues in sea ice modelling and data assimilation and how deficiencies of current systems can be more efficiently diagnosed and addressed.
Registration is due on 15 January 2019 via this website. Participants will be contacted by 15 February 2019 regarding their proposed contribution. More information can be found here.
Contact: *Frank Kauker frank.kauker@awi.de*

11 **YOPP Session at 27th IUGG General Assembly** | **YOPP will hold a session at the 27th General Assembly of the International Union of Geodesy and Geophysics that takes place from 8-18 July 2019 in Montréal, Québec, Canada.** Conveners of the session are Amelie Kirchgaessner (UK), Tom Bracegirdle (UK), Annick Terpstra (Norway) and Holger Schmithusen (Germany). The session will review efforts contributing to the Year of Polar Prediction, particularly reports and first results from recent Special Observing Periods and field campaigns in the Arctic and Antarctic. In line with the interdisciplinary nature of the Year of Polar Prediction, contributions connecting the atmosphere with the ocean, cryosphere and biosphere are invited.

International Union of Geodesy and Geophysics (IUGG)

Deadline for abstract submission is 18 February 2019. Find more about IUGG 2019 at the meeting website. The description of the session M02 - FIRST RESULTS FROM THE YEAR OF POLAR PREDICTION (YOPP) can be found via iugg2019montreal.com/m.html

12 **FAMOS 2018 Annual Meeting in Bergen, Norway** | (*by Claudia Hinrichs/Alfred Wegener Institute*) **The FAMOS (*F*orum for *A*rctic *M*odeling and *O*bservational *S*ynthesis) community held its seventh annual meeting from 23 to 26 October 2018.** The goal of the annual meetings is to coordinate all FAMOS activities and report accomplishments. The meeting also fosters exchange between observationalists and modelers, and between ocean, sea-ice and atmospheric scientists. This year, the community ventured from its usual meeting location in Woods Hole, Massachusetts, United States, across the pond to Bergen, Norway. The first day was dedicated to the FAMOS school. 39 early career scientists attended the school and

The Forum for Arctic Modeling and Observational Synthesis (FAMOS) held their annual meeting in October in Bergen, Norway (photo: Matthew Barton, Woods Hole Oceanographic Institution).

heard lectures about the state of ocean reanalysis in the Arctic, biochemical modeling, atmospheric rivers, ocean acoustics and climate services.

During the general meeting, 118 participants presented their latest scientific results and future initiatives in seven sessions of AGU-style oral presentations and in a poster session. Additionally, there was time allocated for the participants to meet in topic-oriented working groups to exchange current ideas and hypotheses, seek out collaboration and discuss plans for continuing FAMOS work beyond 2019 – in phase 3 of FAMOS. Looking towards the near future, there was also a lot of hope expressed for valuable insight into Arctic processes from the MOSAIC expedition in the upcoming year.

Videos of the presentations at the FAMOS meeting can be found *here*. The posters are available *here*. The working groups are open for collaborators to join. More information about the groups can be found at *https://famosarctic.com/teams/index.html*.
Contact: Andrey Proshutinsky *aproshutinsky@whoi.edu*

13 **YOPP Issue Tracker** | **YOPP data acquisition or transmission issues may be reported to office@polarprediction.net.** polar operations may encounter data acquisition or transmission issues. Issues noted during YOPP Special Observing Periods in particular can be reported to the International Coordination Office. Known issues will be added to the PPP website *Issue Tracker*.

Helge Goessling (left) and Thomas Krumpen (middle) aboard the German Polar-6 aircraft during the IceBird campaign in summer 2018 in the northern Greenland region (photo: Esther Horvath/Alfred Wegener Institute).

15 **YOPP-endorsed! – IceBird Project** | YOPP endorsement is available for projects, programmes and initiatives but also for institutions and operational centres that contribute to making the Year of Polar Prediction successful. More than eighty projects, programmes and initiatives already received project endorsement from YOPP.

During this Arctic summer, two scientists of the German Alfred Wegener Institute Thomas Krumpen and Helge Goessling went to Station Nord in Greenland to start their YOPP-endorsed campaign '**IceBird – Arctic Sea Ice Mass Balance Observatory**' (see also *here*) to obtain information on summer sea-ice conditions in the Arctic Ocean.

Dr. Krumpen, Dr. Goessling, what is the YOPP-endorsed project IceBird about?
The Arctic sea-ice decline is one of the most striking manifestations of climate change. Satellite observations are good at monitoring changes in ice extent but limited when it comes to ice-thickness changes. The main aim of the IceBird campaign is to determine the thickness of the sea ice in the southern Transpolar Drift and

multi-year ice regions north of Canada based on combined measurements of ice draft and total freeboard.

The IceBird 2018 survey complements earlier surveys that were made in 2001, 2005, 2010-2012, and 2016-2017, making IceBird an established monitoring campaign. Moreover, the thickness measurements have considerable potential value for satellite calibration as well as sea-ice model evaluation and development.

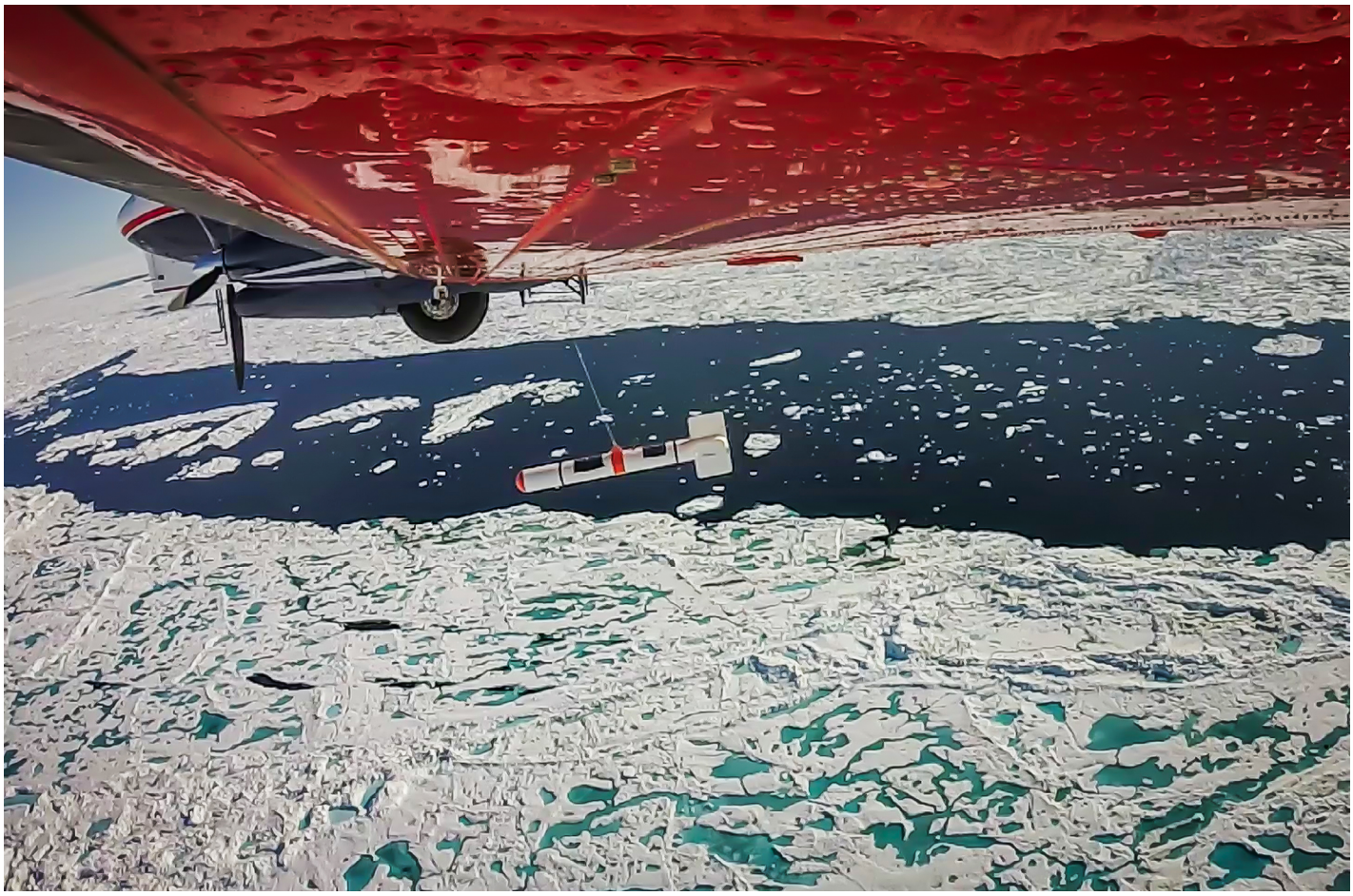
How does IceBird contribute to improving sea ice predictions in the Arctic?
There is ample evidence that sea-ice forecasts from days to seasons are very sensitive to the initial sea-ice thickness. Our measurements will help to calibrate satellite data and to tune and develop forecast models. Both satellite observations and forecast models are essential components of the data assimilation schemes that are used to generate forecast initial conditions. Better models will obviously also do a better job of predicting the further evolution of the sea-ice state. Also climate projections are expected to benefit from improved models with more realistic sea-ice thickness distributions.


Sea-ice measurements aboard Polar-6 aircraft (photo: Esther Horvath/Alfred Wegener Institute).

During the summer field campaign which took place right in the Arctic Special Observing Period you were based in Greenland. How was daily life at the station?
We started with the Polar-6 aircraft from Longyearbyen, Svalbard, on 31 July. After a few days at the Canadian station Alert, located on Ellesmere Island, we were based at Station Nord in northeastern Greenland, on the shore of the Arctic Ocean until August 17th.
The living and working atmosphere at Station Nord was tremendously friendly as well as professional and productive. The Danish soldiers from the Arctic Command running the station were very keen to support research campaigns such as ours and consider this support an important part of their mission. The station was relatively crowded with craftsmen and researchers, where crowded means around forty people in a radius of several hundred kilometres! The meals and social evenings at the station were real highlights and perfectly complemented the work aboard the aircraft and on the ground, which was particularly important when bad weather prevented survey flights, sometimes several days in a row.

What kind of measurements and investigations have been carried out?
The key measuring device that we have carried in low-level flights over the sea-ice cover is the electromagnetic (EM) bird. While it looks like a torpedo or missile (see photo page 14), the laser and low-frequency radiation it emits is much more peaceful. The laser radiation is scattered back from the ice surface, whereas the low-frequency radiation coming back allows us to determine the distance from the conductive sea water and hence the ice bottom topography. Subtracting the two measurements provides the ice thickness. The long distance we can fly with Polar-6 allowed us to obtain numerous transects of ice thickness measurements north of Greenland and Fram Strait. This August's modal ice thickness in the region — the most frequently measured value — is ~1.5 metres.

How many people are involved with IceBird, and where do the funds for the project come from?
The AWI IceBird is program funded by the German Federal Ministry of Education and Research. The campaigns take place twice a year: In summer (August) and winter (March/April), when sea ice extent and thickness are at their minimum and maximum, respectively. Crew size depends upon instrumentation and varies between five to eight people.



Low-level flight with Polar-6 aircraft over Northern Greenland sea-ice cover. Attached to the aircraft is the electromagnetic (EM) bird device to measure ice thickness (photo: Esther Horvath/Alfred Wegener Institute).

What are next steps within IceBird? Where and when will be the next field campaign?

The next AWI IceBird campaign is scheduled to take place next year in March/April. Like the summer IceBird campaigns, the scope of IceBird Winter 2019 is measuring long-term changes of sea-ice thickness, only that the focus is at the period where the ice is thickest at the end of the Arctic winter. Since the extent of the sea-ice cover is also much larger and more accessible by aircraft, we have the opportunity to measure ice thickness during winter in more regions than in summer. A typical winter aircraft campaign conducts surveys all the way between Spitsbergen and Alaska.

We will thus fly from several bases on Greenland and Canada in between. Besides the focus on sea-ice thickness, we will also investigate the thickness of the snow layer using an airborne snow radar. The combination of EM-Bird and snow radar is especially valuable to evaluate and improve sea-ice thickness information from satellites that are only able to observe sea-ice thickness in the cold period. The combination of results from IceBird and satellite observations from CryoSat-2 or ICESat-2 can then be used to predict sea-ice changes during the melting season, which then again can be evaluated with the IceBird Summer campaign series.

How to follow the project and what should the polar prediction community keep in mind about IceBird?

We have just launched a new *IceBird website* where we will keep the community updated. The YOPP community should first of all be aware that our measurements exist and that we are happy to provide the data to anyone interested. To that end, we are also planning to make the data visible in the YOPP Data Portal. We hope that our data will be valuable not only to monitor the evolution of the Arctic sea-ice cover, but also to advance polar prediction capabilities.

New Publications

Bright Prospects for Arctic Sea Ice Prediction on Subseasonal Time Scales | Subseasonal sea-ice predictions are still in an early stage while skillful predictions 1.5 months ahead are already possible. Despite the reduction of its sea-ice cover, the Arctic remains an extreme environment. Reliable forecasts of changes in sea ice within weeks or months are thus increasingly needed to manage opportunities and risks that come with ongoing socioeconomic activities in the rapidly changing Arctic. The position of the sea-ice edge is key for potential forecast users, such as Arctic mariners. But little is known about the current operational subseasonal forecast systems' ability to predict changes of the ice edge. For the first time, the state of the art of forecast system skill is assessed by using a new verification metric that quantifies the accuracy of the ice-edge position in a meaningful way.

Zampieri, L., Goessling, H. F., Jung, T., 2018. Bright prospects for Arctic sea ice prediction on subseasonal time scales. Geophysical Research Letters, 45. https://doi.org/10.1029/2018GL079394

Making the Arctic predictable: the changing information infrastructure of Arctic weather and sea ice services | In this paper, implications of the changing weather and sea ice information provided to Arctic marine areas is reviewed. National sea ice and meteorological services used to be the most important providers of operational information on sea ice and weather conditions. More recently, the community of Arctic information providers has become more heterogeneous. Collaborative platforms such as BarentsWatch, Polar View and Arctic Web are analyzed with respect to their information infrastructure's dynamics and underlying drivers of information change. In addition to the need for customized services, new initiatives formed due to the progress in information and communication technology, the need to enhance interoperability of data systems, and a desire to improve customized data conveyance from provider to user.

Knol, M., Arbo, P., Duske, P., Gerland, S., Lamers, M., Pavlova, O., Doksæter Sivle, A., Tronstad, S., 2018: Making the Arctic predictable: the changing information infrastructure of Arctic weather and sea ice services, Polar Geography, *https://www.tandfonline.com/doi/full/10.1080/1088937X.2018.1522382*

Role of Air-Mass Transformations in Exchange between the Arctic and Mid-Latitudes | Reviewing the current research status of Arctic to mid-latitude linkages, authors argue that a better understanding of how air masses are transformed on their way into and out of the Arctic is essential for improved prediction of weather and climate in the Arctic and mid-latitudes. Pulses of warm and moist air from lower latitudes can cause substantial surface warming and trigger ice melt in the Arctic. Air-mass transport in the opposite direction, away from the Arctic, leads to cold-air outbreaks. The outbreaks are often associated with cold extremes over continents. Air masses advected across the strong Arctic-to mid-latitude temperature gradient are rapidly transformed into colder and dryer or warmer and moister air masses by clouds, radiative and turbulent processes, particularly in the boundary layer. Phase changes from liquid to ice within boundary-layer clouds are critical in these air-mass transformations. The presence of liquid water determines the radiative effects of these clouds, whereas the presence of ice is crucial for subsequent cloud decay or dissipation, processes that are poorly represented in weather and climate models. Observational and modelling exercises should take an air-mass-following Lagrangian approach to attain these goals.

Pithan, F., Svensson, G., Caballero, R., Chechin, D., Cronin, T.W., Ekman, A.M.L., Neggers, R., Shupe, M.D., Solomon, A., Tjernström, M., Wendisch, M., 2018: *Role of Air-Mass Transformations in Exchange between the Arctic and Mid-Latitudes.* Nature Geoscience 11, p. 805–812.

17 Upcoming Events

14-16 January 2019
Arctic YOPP Science Workshop – Jointly organized with IASC/Finnish Meteological Institute (FMI)
Helsinki, Finland

16-18 January 2019
PPP Steering Group Meeting #10
FMI, Helsinki, Finland

2-5 April 2019
Workshop on Predictability, Dynamics and Applications Research (more)
ECMWF, Reading, UK

7-12 April 2019
EGU General Assembly
Session 'Climate Variability and Prediction in High Latitudes' (more)
Vienna, Austria

8-12 April 2019
PPP-SERA Meeting #05
Universidad de Magallanes, Punta Arenas, Chile

13-17 May 2019
ESA Living Planet Symposium
Milano, Italy

22-30 May 2019
Arctic Science Summit Week 2019 (more)
Arkhangelsk, Russia

10-14 June 2019
Observational campaigns for better weather forecasts (more)
ECMWF, Reading, UK

17-19 June 2019
Ninth International Workshop on Sea Ice Modelling, Data Assimilation and Verification (more)
Bremen, Germany

17-21 June 2019
Cryospheric Sciences with ICESat-2 hackweek 2019 (more)
University of Washington
Seattle, WA, United States

8-18 July 2019
International Union of Geodesy and Geophysics (IUGG) General Assembly (more)
Session 'First Results from the Year of Polar Prediction'
Montréal, Canada

International Coordination Office
for Polar Prediction

E-mail: office@polarprediction.net
Phone: +49 471 4831 1588

Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research
Bussestraße 24, 27570 Bremerhaven, Germany

www.polarprediction.net
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Any news or upcoming events to be announced to the community? Send an email to office@polarprediction.net.

The next issue of PolarPredictNews is expected to be out in February/March 2019.