

Autumn 2020
Issue #16

PolarPredictNews



MOSAic on Air
*2020 Flight Campaigns
over the Arctic*

**Arctic Sea-Ice
Minimum 2020**

**In Antarctica the
Weather Comes First**
*New Polar Prediction Matters
Contribution*

Inuit Culture on Thin Ice
The Alaska Climate Change Challenge

**Atmospheric Female Force
on The IcePod**

Polar 5 (front) and Polar 6 (back) arriving at Longyearbyen airport in Svalbard for their one-and-only 2020 flight campaign, as part of the YOPP-endorsed (AC)³ project and the annual IceBird observations maintained by the German Alfred Wegener Institute. The two Basler BT-67 research aircraft are especially designed for polar expeditions. They can operate in temperatures down to -54°C and can take off and land on gravel and snow runways. Polar 5 is equipped with a sonde to trace particles in Arctic clouds while an EM-Bird, which carries electromagnetic sensors, is towed by Polar 6 to record sea-ice properties at 15 m above the ice surface. (dbu)

Photo: Esther Horvath/Alfred Wegener Institute

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ART + SCIENCE

FEATURED IN THIS ISSUE: Taneil Uttal’s Pieceful Pictures of the Day



Dear Colleagues,

On 12 October 2020, the MOSAiC expedition finished, with RV Polarstern coming home to Bremerhaven after 389 days at sea. As mentioned several times before, the observations provided by MOSAiC will be a game changer for our ability to model critical processes in the Arctic and thus advance predictive capacity across the Northern Hemisphere. In this issue of PolarPredictNews a detailed account of the home coming event is provided. Furthermore, a warm air intrusion event is described that reached RV Polarstern in April 2020. It is likely that this intrusions will become one of the most studied events in the years to come. Finally, in this issue you will find many colourful MOSAiC impression from PPP Steering Group member Taneil Uttal who participated in leg 2 of MOSAiC.

There has also been major progress with the development of the YOPP Data Portal. A new explainer video will help people using the portal. And a new and straightforward interface allows users to enter meta data of YOPP relevant data, thereby making them visible to the wider community.

Another major milestone was reached by the YOPP Southern Hemisphere team by having an overview paper published in the Bulletin of the American Meteorological Society. Reading is highly recommended: <https://doi.org/10.1175/BAMS-D-19-0255.1> Find more details under NEW PUBLICATIONS.

Finally, I would like to thank Paolo Ruti for his outstanding support of PPP and YOPP in his role as Chief of WMO’s World Weather Research Division (2014–2020). On 1 October 2020, he started a new job as Chief Scientist at EUMETSAT. Good luck, Paolo!

Happy reading,
Thomas Jung

The Year of Polar Prediction (YOPP) is a major international activity that has been initiated by the 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.



photo: Martina Buchholz/
Alfred Wegener Institute

ART + SCIENCE

FEATURED IN THIS ISSUE:

Taneil Uttal's Pieceful Pictures of the Day from MOSAiC Leg 2



by Taneil Uttal, NOAA Earth Systems Research Laboratory

In her role to lead the atmospheric team, PPP Steering Group member Taneil Uttal joined MOSAiC Leg 2 aboard RV Polarstern. When not in the Arctic, Taneil works as a senior meteorologist with the U.S. National Oceanic and Atmospheric Administration (NOAA); her focus is on the Arctic atmosphere. As it is good practice for science teams hosted on board Polarstern to leave an entry in the guestbook, Taneil took over the artist role for Leg 2 and left a colorful impression of MOSAiC Leg 2. A poster-to-print version of Taneil's drawing can be found in the middle of PolarPredictNews.

Every time I go out on vacation or a field trip, I pack all my art supplies; but normally I can't find the time to use them. During polar night, it was sometimes hard to fall asleep, so every time I could not sleep, I would get my pencils out and some paper and start drawing. After a long day of experiments, it was also great to sit on the deck and paint in silence.

When we were getting towards the end of Leg 2, the Captain was coming to our daily meetings and insisted that there must be a guestbook entry and somebody has to put something in it. Looking at the guestbook I really understood about Polarstern's history – we were the 122nd crew! As nobody was making a move, I thought about giving it a chance.

Pictures of the Day

The inspiration came very easily to me during everybody's favorite part of our evening meetings on board. Every day, we decided which photo had made it to be crowned "Picture of the Day". Every tiny part of the picture was thus inspired by a "Picture of the Day" – lots of little pieces, like that one when a polar bear visited the observatory. I also took small thumbnails of actual data, like the



photo: Michael Gallagher/NOAA

ones the researchers get when analyzing thin slices of snow, and they looked like beautiful abstract art to me! Or the cloud measurements, the salinity profiles – I took all that and integrated it into the drawing. It was really fun to do that!

Numbers All Over

At some point, I would show the drafts to my colleagues and ask them, which number they are; it could be anything. So, when taking a close look to the image, there are white circles with numbers all over. For example, for the one person it was the number of liters of water they have filtered. If you look to the left-ish middle, you can see a bubble with our coordinates, which are supposed to be our northernmost point. Sadly, I got it wrong at that time, it's supposed to be 88°26'! I corrected that in the original picture in the guest book, but this scan was made ahead of that time. I'd like to mention here that Leg 5 did make it to the North Pole (0° 0'), and thus outnumbered us... Hard get that number wrong!

Taneil has also featured in one of the latest *The IcePod* episodes (see #13 *Female Atmospheric Force on The IcePod*) where she talks about her experience at MOSAiC Leg 2, about her passion to knit hats on board, and about making space for the younger generations to eventually take over. (kw/lh)

01

MOSAIC On Air

This Year's First Airborne Campaigns Over the Central Arctic

by Daniel Butkaitis and Kirstin Werner, WWRP International Coordination Office for Polar Prediction/Alfred Wegener Institute

After five months of compulsory break due to the COVID-19 pandemic, the polar research aircraft Polar 5 and Polar 6 were finally able to launch their airborne campaigns from Svalbard on 30 August 2020. These were the first survey flights that the aircraft, maintained by the German Alfred Wegener Institute, could carry out over the Arctic since Svalbard has closed in spring. The three-week campaign, which was part of the MOSAiC expedition, aimed to collect data on sea-ice thickness and from the atmosphere to improve our understanding of essential atmospheric processes that lead to cloud formation over the Arctic.

In total, four survey flight campaigns had been planned for this year to support the MOSAiC one-year ice drift through the central Arctic. Two of the campaigns were supposed to be launched during spring, when the Arctic sea ice would have reached its maximum extent. However, the spring campaign had to be cancelled due to the Coronavirus pandemic. Another two flight campaigns were

planned for summer when the Arctic sea-ice extent will have reached its minimum. Thanks to the support by the Norwegian government and the Governor of Svalbard the summer campaign flights were finally able to take off on 30 August from Longyearbyen airport, Svalbard.

During their three-week campaign, the research aircraft performed a total of 17 flights over the Arctic Ocean north and west of Svalbard, with each flight lasting between three and seven hours. Initially, it was planned to follow the trajectory of the MOSAiC floe and the air-mass trajectories passing RV Polarstern. Although RV Polarstern eventually changed her route and moved outside the possible flight range of the aircraft, the collected atmospheric data will supplement the MOSAiC mission.

Clouds Over the Arctic

The ACA campaign (ACA stands for Airborne observation over the Central Arctic) with Polar 5 addressed the following key question: How do clouds form over the Arctic, and which components, especially aerosol particles and turbulent eddies, play a significant role in the process? Recent studies have shown that clouds play an important role in



The research aircraft Polar 5 and Polar 6 arriving at Svalbard to conduct their survey flights over the Arctic (photo: Esther Horvath/Alfred Wegener Institute).



Satisfied with Mother Nature

Despite the difficulties, the research aircraft succeeded in collecting valuable dropsonde data and perform numerous cloud measurements. *“They will be important to quantify the cloud prediction skills of the NWP models“*, says Manfred Wendisch, professor for meteorology at the University of Leipzig, Germany. Overall happy with the outcome achieved with the flights, Wendisch says: *“We obtained a nice data set to look at the influence of sea ice versus open ocean conditions on cloud evolution and on the effects of the radiative budget during late summer. We were quite satisfied with the cases mother nature presented us for our measurements.”*

Summer Sea-Ice Export Through Fram Strait

The focus of the Polar 6 campaign was to analyse thickness and surface characteristics of the sea ice in the central Arctic as well as in the Fram Strait, a narrow passage connecting the North Atlantic with the Arctic Ocean. Information collected during flights will be used to examine the link between thickness variability, sea-ice age, and the source area of sea ice. Alongside satellite-based sea-ice information, the results will be used to quantify the summer sea-ice export through Fram Strait. For the measurements, researchers mainly relied on the so-called EM-Bird instrument. The EM-Bird is an electromagnetic measuring device, with the shape of a torpedo, which is attached beneath or behind the plane at a height of about 15 metres during the flight. Polar 6 was also equipped with a MACS/DLR camera developed by the University of Münster.

the warming of the Arctic atmosphere. In the mid-latitudes, deep clouds have mainly a cooling effect. This is different in the Arctic where the clouds heat the air above the sea ice. Current atmospheric models are most likely to underestimate the clouds’ influence on rising air temperatures in the Arctic. The measurements will be used to investigate whether clouds above sea ice warm the environment more than models predict. ACA is part of the YOPP-endorsed (AC)³ project (Arctic Amplification: Climate Relevant Atmospheric and Surface Processes, and Feedback Mechanisms) which is a collaboration between various German research institutes and universities led by the University of Leipzig.

Manfred Wendisch who jointly with Andreas Herber from AWI leads the ACA mission describes its challenges as follows: *“The local weather was determined by frequent low-pressure systems circling the island of Spitsbergen. That caused low cloud base levels and low visibility at the airport which partly prevented us from flying.”* The changing route of RV Polarstern had also been an issue. *“One of the objectives of our campaign – the link of local Polarstern measurements with air mass evolution to and from Polarstern – could therefore only partly be achieved.”*

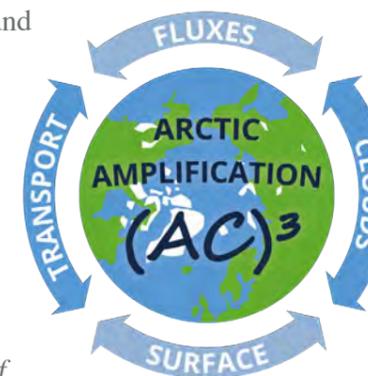


Germany. The aerial shots will be used to construct high resolution Digital Elevation Models (DEMs) of the Arctic area.

The German Alfred Wegener Institute (AWI) has carried out sea-ice thickness measurements for almost two decades as part of their long-term data program called IceBird. AWI physicists regularly survey the Arctic sea ice twice a year – at the end of the winter, when the sea ice is reaching its maximum extent, as well as in the summer when the sea-ice extent shrinks to its annual minimum.

AWI sea-ice scientist and leader of the IceBird campaign (see below) Thomas Krumpen,

was excited about the upcoming results from this year’s airborne observations. *“This summer, there’s also the exciting question of whether the conditions of the ice floes that were investigated during the MOSAiC expedition stand out in comparison to our long-term data. In other words: whether the ice was generally thinner or thicker than in the past; whether the high summer temperatures had any major effects on it; and whether the rapid drift led to an unusually high number of pressure ridges.”*



Manfred Wendisch (upper photo) and Thomas Krumpen during the research aircraft campaigns on Svalbard (all photos on this and the previous page: Esther Horvath/Alfred Wegener Institute).



02

Welcome Home, Polarstern!

by Daniel Butkaitis and Laura Hüßner, WWRP International Coordination Office for Polar Prediction/Alfred Wegener Institute

After almost a full year in the Arctic, the German research icebreaker RV Polarstern finally returned to Bremerhaven on 12 October 2020, along with the scientific crew of the fifth leg of MOSAiC – and with them a whole bunch of yet untold stories and uncharted data sets. Laura Hüßner and Daniel Butkaitis from the YOPP Coordination Office followed this historical moment right on the spot.

It was early this morning, before sunrise, when boarding for the consort ship “Ubena” started. The boat would accompany the Polarstern’s return to Bremerhaven’s Lloyd dockyard; only a few people were standing in line to get onto Ubena. Before boarding, everybody’s temperature had to be checked, face masks were also mandatory.

The city and the harbor were wrapped in darkness and silence up to this time. Even though everybody still seemed a bit tired at this early morning hour, this sleepy mood soon changed to pure excitement as we passed the watergate around 6:45 am, waiting for the moment Polarstern would appear on the horizon.

Around 07:30 am, a silhouette finally appeared on the horizon – is it...? Yes, it’s her! Polarstern was about to enter the ports of Bremerhaven, surrounded by an escort fleet of smaller boats, which we would



Returning RV Polarstern in the morning sun on the way into her home port (photo: Laura Hüßner/Alfred Wegener Institute).

join. The crew of Polarstern really received a warm welcome from every side, as all ships started to honk their horns. Even a few tears of joy were shed. It seemed as if mother nature also wanted to say hello to the homecoming crew, bringing sunshine and even rainbows along Bremerhaven, despite the weather report predicting rain for this morning.

To this date, the MOSAiC expedition has been the largest of its kind with a duration of 389 operating days and a total of more than 500 experts from twenty nations on board while another 300 colleagues worked in the background. The aim of the expedition was to gather information and data on atmosphere, ocean, sea ice, ecosystems and biogeochemistry of the Arctic.

The researchers collected more than 150 terabytes of data and around one hundred ice samples. Although it will take several years to analyze all of the data, the crew members of MOSAiC still witnessed “a dying Arctic Ocean”, as Markus Rex, leader of the MOSAiC expedition, stated to the [press](#).

After the strains of the past year, Polarstern now needs a little rest. The next station for the good old lady will be to receive preventive maintenance in order to get ready for the next expedition in December, this time heading southwards towards Antarctica.

Find more on our [@polarprediction](#) [instagram](#) and [twitter](#) accounts as well as on [www.awi.de](#).

03

Arctic Sea-Ice Minimum 2020 – How Long Until We Break the Ice?

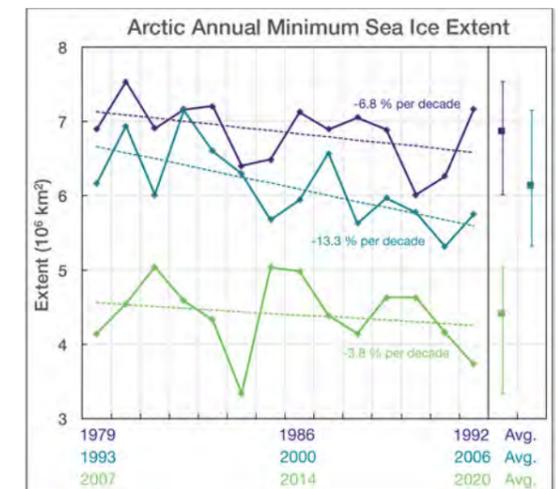
by Daniel Butkaitis, WWRP International Coordination Office for Polar Prediction/Alfred Wegener Institute

This year’s Arctic sea-ice minimum extent has been the second lowest ever since the beginning of modern observations, showing the accelerating speed of sea-ice retreat in the Arctic. The 14 lowest extents of Arctic sea ice all occurred in the past 14 years, making it undeniable that we are going to face tremendous changes in the Arctic, with all consequences linked to this development.

Regular changes in sea-ice extent over seasons, months, weeks, or even from day to day fall under what is called the natural variability. As such, around mid-March, the Arctic sea ice usually reaches its maximum. During mid-September, the situation is reversed. Prior to the start of satellite observations in the late 1970s, comprehensive records on sea-ice variability in the Arctic have been rare. Nowadays, long-term satellite data build the base for many of the sea-ice prediction models.

Retrospective on the Arctic Summer 2020

On 15 September, the annual minimum Arctic sea-ice extent of 3.74 million square kilometers was reached, only being undercut by the year 2012 when the minimum extent was 3.39 million square kilometers. The year 2020 remains well below the climatological average. The sea-ice decline has been mostly noticeable in Baffin Bay, and in the Beaufort, Chukchi, and East Siberian Seas. In these regions, the majority of the ice had already melted by July and August this year, with unusually high melting rates. In contrast to the Beaufort Sea where the melting rate was more or less on average. Indeed, the summer 2020 has been marked as the warmest one since at least 1979. This, combined with high atmospheric pressure ridges moving from Alaska eastwards to Kara and Laptev Seas, led to record-low ice extents during June and July. The rate of ice loss slowed down by August so that the sea-ice extent went from lowest to second-lowest on record. After the minimum on 15 September 2020, ice growth rapidly began in the Beaufort, Chukchi and East Siberian Seas.



Linear trend of the Arctic sea-ice minimum extent for three 14-year periods. On right side, the average (square) and range (line) of the sea ice extents for each period are shown (source: NSIDC).

From Raster Image to Daily Maps

But how is the extent of Arctic sea ice analyzed exactly? Most sea-ice data and model simulations rely on satellite observations. Satellites are flying over the polar regions around 14 times per day, scanning a 1,500 to 2,000 km-wide strip each time. They are equipped with instruments to measure the microwave radiation of the Earth; most radiation is released from land, water and ice surfaces. But also, the atmosphere is emitting radiation, influenced by clouds, aerosols and other gases. Because the radiative emission spectrum is different for every type of surface, sea ice can easily be distinguished from open water in satellite measurements after a number of data processing steps. The latter can be challenging because satellites differ in their used algorithms, frequency channels, and in their resolution. As a final product of processing, a satellite raster image is created.

Satellite raster images are used to measure multiple parameters. Most common is the Arctic sea-ice extent (SIE) defined as areas with 15% ice cover or more. Other common quantitative parameters are sea-ice concentration (SIC), going from 1 (full ice) to 0 (no ice), sea-ice volume (SIV) and sea-ice thickness (SIT). These observational data are being used in models to adjust their starting point, like Helge Goessling, sea-ice expert from the German Alfred Wegener Institute (AWI) explains: “Most of the research and development goes into forecast

systems that are based on dynamical models that simulate the evolution of the atmosphere, ice, and ocean. Such forecast systems also require sophisticated methods, known as data assimilation, to bring observations into the system in order to find a realistic initial state for each forecast.”

Sea-ice predictions remain more challenging than forecasting the weather. “While forecast systems are well-established for weather prediction, their extension to sea-ice prediction is still at a relatively early stage. Statistical methods to predict hemisphere-wide sea-ice extent are still a challenging benchmark for dynamical forecasts”, says Goessling who has been former director of the Polar Prediction International Coordination Office.

However, some improvements have been made in the past years, at least theoretically: “Major advances include the extension of numerous operational forecast systems to include dynamical sea-ice components but also the development of forecast verification and benchmark methods to measure sea-ice forecast skill in a meaningful way. Progress was also made to better understand the impact of sea-ice model resolution and the rheology meaning how the ice responds to forces. Not to forget the advances in sea-ice data assimilation methodology.”

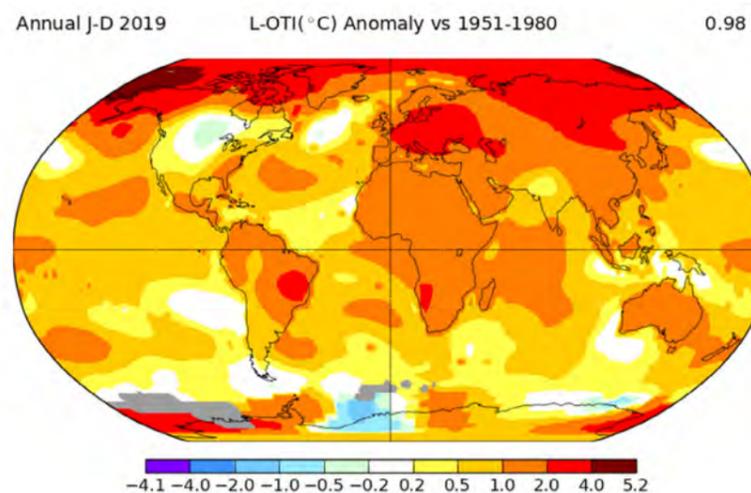
Daily updated sea-ice maps and data can be found at the AWI-maintained [Meereisportal/seaiceportal](#) or at the [National Snow and Ice Data Center \(NSIDC\) webpage](#). The latter works in close collaboration with the Sea Ice Prediction Network – Phase 2 (SIPN2), which offers monthly reports on the Arctic sea ice since 2008 during the summer melting phase. These Sea Ice Outlook Reports can be found [online](#), as well as their recently published 2020 [Post-Season Report](#).

Arctic – The Hot Pot of Climate Change

The Arctic has proven to be a hotspot, or even a ‘hot pot’, for climate change. Here, global warming is progressing [more than twice as fast](#) as in the rest of the world. When looking at long-term satellite data since 1979, a significant downwards trend is obvious. In the 41-year recording, sea-ice extent

decreased by around 14% per decade; almost half of the Arctic ice has disappeared during this year’s sea-ice minimum, as compared to 1979.

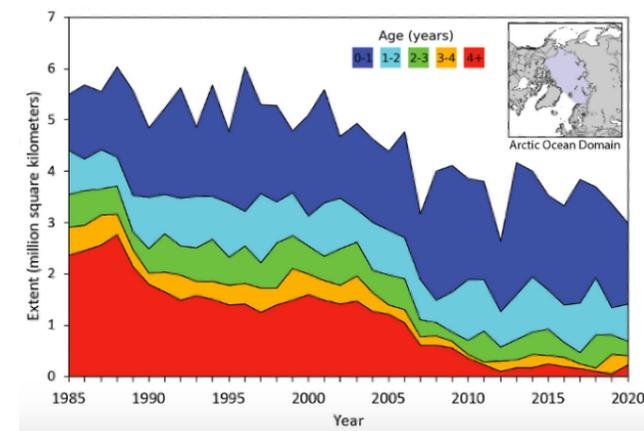
There are many reasons for the rapid sea-ice decline, often linked to positive feedback-loops. One of the most prominent positive feedbacks driving Arctic Amplification is the so-called ice-albedo [feedback loop](#) which Helge Goessling boils down to the essence of: “The darker ocean absorbs more light than sea ice does, which contributes to the Arctic warming amplification.” Light snow and ice surfaces reflect most of the sun’s radiation and lead to a high albedo. Darker surfaces absorb more of the radiation instead of reflecting it, thereby lowering the albedo. When more sea ice melts and turns into darker water, even more radiation will be



Distribution of surface temperature anomalies 2019 compared to mean values 1951-1980 (source: data.giss.nasa.gov/gistemp/maps/).

Treading on Thin Ice

It’s not just the area of ice that is disappearing but the entire Arctic environment is currently undergoing big change. Generally speaking, ice can be divided as thin single-year and usually thicker multi-year ice. A [study by Lindsay and Schweiger](#) showed that most of the thicker multi-year ice (>1m) has gone by now, even in regions like the central Arctic basin, where perennial sea ice usually dominated. While the change may open up new opportunities and routes for shipping, this new state of the Arctic being dominated by one-year ice is likely going to amplify so that sea ice melts even more rapidly as compared to the past. According to the NSIDC, sea ice older than four years is declining by 6% per year, in comparison to the average between 1984 and 2020.



Time series of different ice age categories at the annual minimum extent from 1985 to 2020 (source: NSIDC).

Danger from Deep Down – Heat Blobs Underneath the Ice

A recent [study](#) by Polyakov et al. reveals that the halocline layer in the Arctic is currently weakening and the upward heat flux from the warm Atlantic water is increasing accordingly. During the winter 2017/2018, the heat flux has more than doubled in the Eurasian Basin, which is further impeding sea ice to refreeze. The halocline is the zone of separation between the cool, fresh surface layer and the warm, salty Atlantic waters below. However, the presence of the halocline might not be taken for granted anymore as it seems to have been degrading during recent years. This could lead to rapid ocean changes within just a short time interval. Yet, there exists a large uncertainty when it comes to projections of the future Arctic Ocean conditions with consequence to Arctic weather and climate predictions.

What is the Future of the Arctic Going to Look Like?

With the given facts, the world is heading towards a mostly ice-free Arctic summer. A recent paper published by Guarino et al. in Nature Climate Change shows this could already happen by 2035. Helge Goessling expects the consequences of the Arctic sea-ice retreat to lead to societal challenges: “The most direct consequence will be the increased accessibility of the Arctic to human marine activities such as cargo transport, resource exploitation, and fishery. Sea-ice monitoring and forecasts will still be an important prerequisite for safe operations because during other seasons than late summer the Arctic will still be ice covered. Other consequences include impacts on the Arctic Ocean’s ecosystems and biogeochemistry and people living at the coasts.”

Arctic Amplification in Mid-Latitudes?

“There is an ongoing scientific debate around the question how exactly the Arctic warming amplification and sea-ice decline actually impact regions outside the Arctic”, says Helge Goessling. He expects the Arctic Amplification to also cause changes in mid-latitude weather conditions. “Simply speaking, there is evidence that the milder Arctic winters facilitate events in the mid-latitudes with stronger easterly winds typically associated with harsh winters in Europe, for example. However, the fact that those continental air masses tend to be warmer than they used to be likely overcompensates for the changes in circulation, meaning that European winters are not expected to become colder.”

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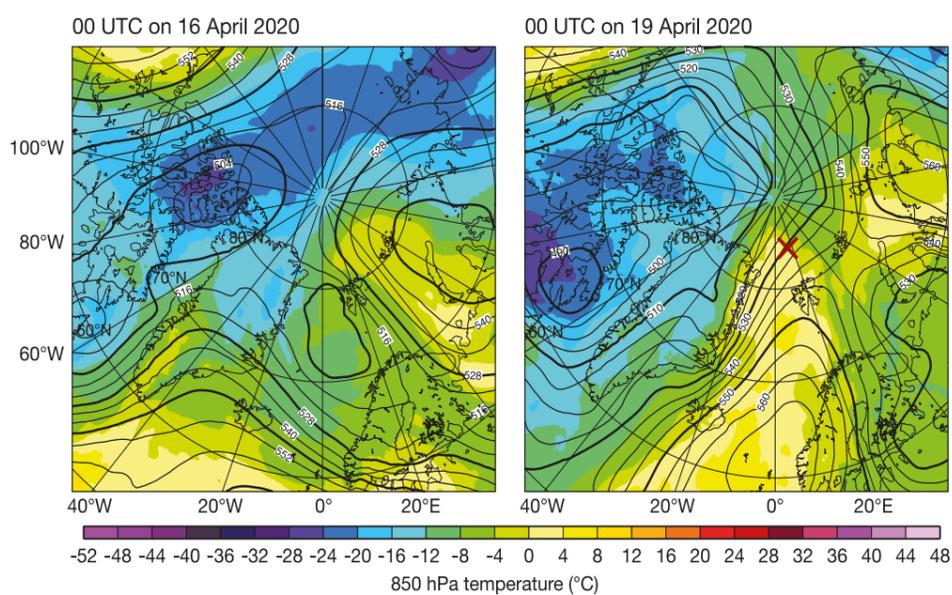
04

Warm Intrusions into the Arctic in April 2020

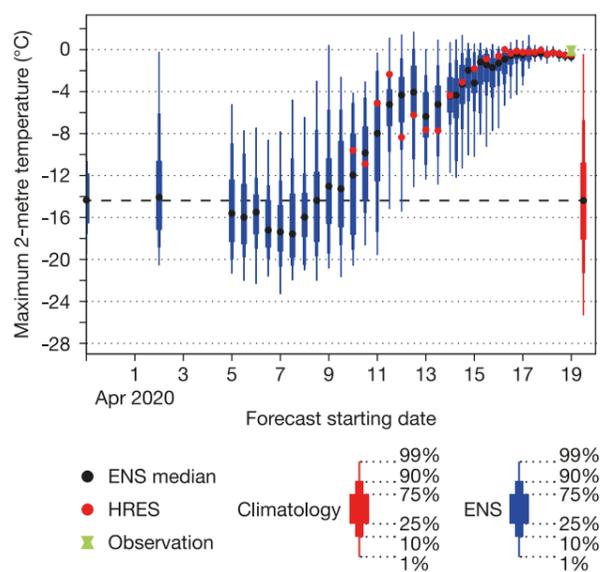
by Linus Magnusson, Jonathan Day, Irina Sandu (all ECMWF), Gunilla Svensson (Stockholm University)

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Warm spells in the central Arctic during winter and spring are typically associated with intrusions of warm and moist air from the mid-latitudes (warm air intrusions hereafter). Two such events took place in April 2020. They passed the German icebreaker Polarstern, which was drifting in sea ice as part of the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) campaign. In both cases, the surface temperature measured on Polarstern rose from the normal April temperature of around -20°C to around 0°C. ECMWF forecasts supported targeted observations made during this period, which will in turn help the Centre to improve its ability to predict warm air intrusions. MOSAiC is a one-year observational campaign linked to the World Meteorological Organization's Year of Polar Prediction (YOPP) project. YOPP aims to understand atmospheric, ocean and sea-ice processes and advance prediction capabilities in polar regions. The MOSAiC campaign started



Synoptic situation on 16 and 19 April. Analysis of geopotential height at 500 hPa (contours) and temperature at 850 hPa (shading) for 00 UTC on 16 April 2020 (left) and 00 UTC on 19 April (right). The cross shows the approximate location of Polarstern on 19 April (source: Magnusson et al., ECMWF Newsletter).



Analysis of Evolution of forecasts for the 19 April warm air intrusion. The plot shows ensemble forecasts with different starting times for maximum 2-metre temperature for the Polarstern location on 19 April (source: Magnusson et al., ECMWF Newsletter).

in October 2019. YOPP and MOSAiC are led by the Alfred Wegener Institute (AWI, Germany), and the U.S. National Oceanic and Atmospheric Administration (NOAA) coordinates forecast evaluation at MOSAiC.

Targeted Observations

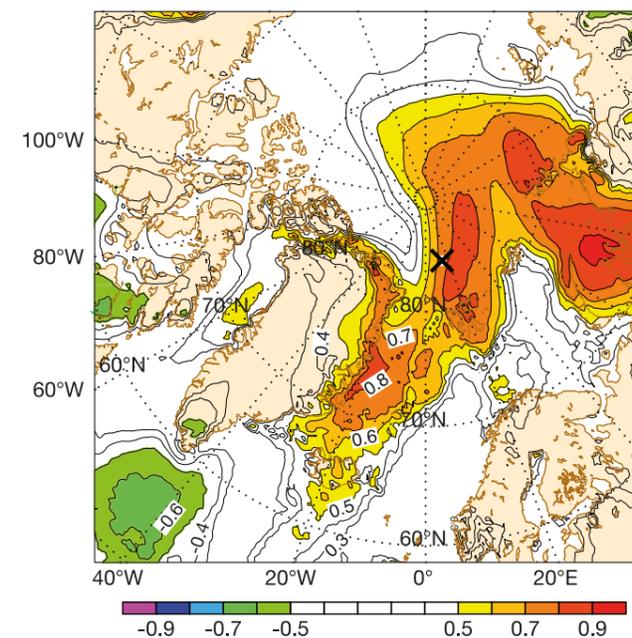
The third period of enhanced Arctic observations during YOPP took place in spring 2020 to complement the MOSAiC campaign. It took the form of a targeted observing period (TOP), which was different from the earlier special observing periods (SOPs) in 2018. In the TOPs, extra observations were only requested during selected meteorological situations of relevance for the Arctic. During this TOP, additional radiosondes were launched from different stations situated along warm air intrusions in order to shed light on the processes governing these situations. During the period of the

warm air events, when Polarstern was located north of Svalbard, four radiosondes a day were launched at several upstream locations and seven a day on board Polarstern.

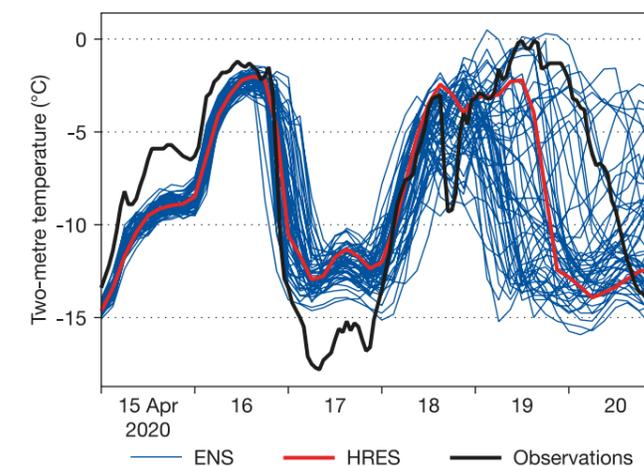
Although the two warm air intrusion events on 16 and 19 April were close in time, they were associated with different synoptic patterns. In the first event, the warm air was pushed to the northeast in front of a trough over Scandinavia, while in the second event the warm air was transported over the Atlantic on the western side of a ridge that developed over Scandinavia. The second case is a more typical flow configuration for creating warm conditions in the Atlantic sector of the Arctic.

Valuable Guidance

Various ECMWF forecast products were used in the planning for the TOP, such as the Extreme Forecast Index (EFI) for temperature and water-vapour flux, upper-level flow forecasts and meteograms for the Polarstern location. Evaluating the performance of all forecasts for 2 m maximum temperature valid on 19 April, the ensemble had a clear signal 7–8 days in advance about warmer than normal conditions at the location of Polarstern. The EFI product for 2 m maximum temperature from five days before 19 April also flagged up the risk of unusually high temperatures. By 19 April, the first warm air intrusion was being advected to the east (north of Russia) and the second one was north



Two-metre maximum temperature EFI. The chart shows the 5-day forecast from 00 UTC on 15 April 2020 of the EFI for 2-metre maximum temperature on 19 April. (source: Magnusson et al., ECMWF Newsletter)



Predictions and Polarstern observations. Point forecast from 15 April 00 UTC for the location of Polarstern on 19 April for 2-metre temperature from the high-resolution forecast (HRES), the ensemble forecast (ENS) and observations from Polarstern (source: Magnusson et al., ECMWF Newsletter).

of Svalbard, as predicted. The second event was associated with large uncertainties due to the narrow nature of the warm-air feature. For example, in the forecast from 15 April, while most of the members indicated a very high daily maximum temperature, many ensemble members ended the warm spell too early at the Polarstern location, resulting in massive temperature errors during most parts of the day. Although there were large uncertainties in the timing and details of the event, the ECMWF forecasts gave valuable guidance for observation campaign planning.

Outlook

The data collected during the MOSAiC campaign and the YOPP special observing periods will be used for model evaluation and development at ECMWF. To correctly forecast warm air intrusions and associated impacts, several aspects such as the origin and nature of the air mass, synoptic conditions, interactions with sea ice and mixed-phase cloud processes need to be correctly captured. It is therefore necessary to understand the physical mechanisms governing such events in order to improve the forecasting system. To this end, observations such as the ones from MOSAiC and YOPP are essential.

Inuit Culture on Thin Ice – The Alaska Climate Change Challenge

by Laura Hüßner, WWRP International
Coordination Office for Polar Prediction/Alfred Wegener Institute

Inuit communities have inhabited the high northern latitudes for centuries and their lifestyles are perfectly adapted to the cold, harsh Arctic weather conditions. A recently released report by the Inuit Circumpolar Council Alaska (ICC Alaska) describes how food sovereignty and self-governance are affected by changes of weather and climate.

The impacts of climate change on communities have tended to dominate the daily news, although right now the rising numbers of new COVID-19 cases take priority over stories about the damage caused by extreme weather conditions or flooding. While the consequences of climate change remain less obvious in the mid-latitudes, Arctic coastal communities already regularly face environmental changes in their everyday lives. Traditional Inuit knowledge on weather and sea ice is gradually becoming less reliable. Providing the northern communities with highly reliable Arctic weather and sea-ice forecasts is therefore crucial for them to plan their year-round hunting schedule to ensure their survival.

“In order to become healthy again, we need to be in control of our lives here.”

(ICC Alaska report, P. 13)

Food Sovereignty and Self-Governance

The Inuit Circumpolar Council Alaska (ICC Alaska) recently released a report led by Inuit, entitled “[Food Sovereignty and Self-Governance - Inuit Role in Arctic Marine Resource Management](#)”. The report illuminates Inuit management practices that have successfully safeguarded Arctic peoples for thousands of years. ICC is a permanent participant in the Arctic Council; it has grown into a major international non-governmental organization that currently represents around 180,000 Inuit people from Alaska, Canada, Greenland and Russia. In the report, the sustainable use of resources such as char, beluga, walrus and salmon are highlighted as examples of current hunting management practices in the Inuvialuit Settlement Region, Alaska.

We Need to Be in Control of Our Lives

Prior to U.S. governmental management policies, Inuits followed adaptive hunting practices in which they managed the different species they were hunting to maintain a sustainable distribution of animals that could support a healthy ecosystem. The disjointed management situation in which they find themselves today has even led to them getting arrested for exercising hunting practices they have known for years to be sustainable.

To ensure that the Inuit peoples can maintain sovereignty and continue their traditional food procurement activities, the ICC Alaska report recommends close cooperation between the government and Inuit representatives, e.g., when setting up hunting and fishing regulations for northern Alaska. In this way, Inuit food sovereignty can be connected to a holistic and adaptive management to ensure food security, health, and well-being throughout the Arctic for the Inuit generations to come. Current environmental changes lead to extreme, unpredictable weather conditions, rising air temperatures, and hence changes of animal migration. The report highlights the need for the Inuit communities to adapt by better understanding the new weather patterns. This will support them in being able to anticipate when animals and plants are likely to be available as a food source in the new state of the Arctic.

“It is not only the weather [changing] around here. You could tell where the sun would set. [...] The sunset is different now. [...] It is a big difference ever since that global warming.”

(ICC Alaska report, P. 103)

Making Use of Traditional Knowledge

A [study](#) recently published by Fox et al. describes a long-term research project based in Kangiqtugaapik (Clyde River), Nunavut, Canada. A research team comprising Inuit and visiting meteorologists combined Inuit traditional knowledge with information from a community-based weather station network. Interviews were conducted to feed into mutual discussions to co-produce knowledge

related to human–weather relationships and weather information needs and uses in one of the Nunavut communities. The paper links Inuit knowledge with environmental modelling with the aim to better understand human-weather relationships. It also provides insights into the process of building diverse research teams and knowledge production.

„[...] We have been sustaining this environment for thousands of years without degrading it. Resources keep coming back to us, year after year. And that’s one thing millions of people in the world misunderstand: we are actually part of the environment [...]”

(ICC Alaska report, P. 12)

Learn from Each Other

Inuit hunters pay close attention to the weather and make decisions on the basis of their weather observations. Meteorologists are not so different. In their paper, Fox et al. mention that travelling on land together with their Inuit research team helped the visitors to understand the specific concerns that Inuit face when travelling. The authors also learned about the sources of information Indigenous people use to infer on upcoming weather conditions – a precious ability to save lives that needs to be refined to continue to protect northern communities in the changing Arctic.

YouTube Mini-Series

Learn more about Inuit communities’ situation by watching the [YouTube mini-series “After the Ice”](#), produced by the Arctic Research Consortium of the United States (ARCUS).



Hunters at the edge of a polynya in the winter near Cape Dorset, Nunavut, Canada (photo: Gita Ljubicic).

08

Goodbye, Paolo!

Since 2014, Paolo Ruti held the position as Chief of the World Meteorological Organization's World Weather Research (WWR) Division. On 1 October 2020, he was appointed as Chief Scientist to EUMETSAT, the European Organization for the Exploitation of Meteorological Satellites.

Over the past 15 years, Paolo Ruti has supported various projects and programmes – including the Polar Prediction Project – of the World Weather Research Programme (WWRP) with his active scientific experience, focusing on climate change, climate services and applications to key sectors. He coordinated the first EU project on climate services (CLIM-RUN) and has served as a member of various executive committees and scientific steering groups such as the European Climate Research Alliance. He has also been involved in the international agenda to support initiatives such as the Sendai Framework and the Paris Agreement. Thanks to Paolo's



efforts and support, the PPP Steering Group and the YOPP Coordination Office were able to globally collaborate and to build a strong international community around YOPP and PPP. This strengthened the science underpinning the advancement of polar predictive capacity and improved the weather and sea-ice forecast services for the Arctic, the Antarctic and beyond.

In his future role as chief scientist for EUMETSAT, Paolo Ruti will remain true to his passion for weather and climate research and risk management. EUMETSAT is specialized in observing the atmosphere, ocean and land surfaces and offers products that help to enhance and safeguard the daily lives of European citizens.

The PPP Steering Group, the International Coordination Office for Polar Prediction and the polar prediction community are grateful for Paolo's support of the PPP/YOPP effort and wish him the very best and – most importantly – lots of fun with future challenges. *(dbulkw)*



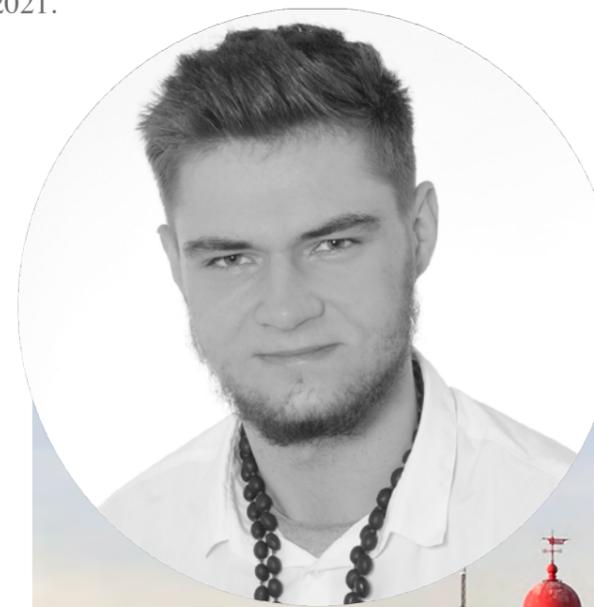
Photos: (above) Paolo Ruti private; (bottom) with PPP Steering Group in March 2018 in Reykjavik, Iceland, Snorri Zóphóniasson/Icelandic Meteorological Office.

09

ICO Support from the South

As the Polar Prediction Project is now in the middle of its Consolidation Phase, a lot of work needs to be done in terms of coordination and communication. Therefore, two new interns recently relocated from the South of Germany to support the International Coordination Office (ICO) for Polar Prediction at the Alfred Wegener Institute in Bremerhaven.

Laura Hüßner is currently studying environmental engineering at the University of Applied Science Weihenstephan-Triesdorf in Triesdorf, close to Nuremberg, Southern Germany. In 2018, she completed a Bachelor of Music. Laura assists the YOPP International Coordination Office, as well as the APPLICATE and ESM projects until February 2021.



Daniel Butkaitis is studying Water Resources Management at the Rottenburg University of Applied Forest Science, close to Stuttgart, Germany. As a member of the non-governmental organisation Technology without Borders, he recently supported a project in Gambia where he gained some practical experience of project management. Driven by his interest in science and climate change, he will assist

the YOPP International Coordination Office, as well as the APPLICATE and ESM project teams in their daily business until March 2021. *(ico)*



Photos: Laura Hüßner private; PhotoArt Manuela Hund; (bottom) Bremerhaven skyline, Kirstin Werner.

10

YOPP Research Publications and Acknowledgement

by Laura Hüßner, WWRP International
Coordination Office for Polar Prediction/Alfred Wegener Institute

Acknowledgement of YOPP is highly appreciated in order to help determining the success of PPP and YOPP. To inform the wider community, authors of YOPP-related papers are invited to send their papers to the International Coordination Office for Polar Prediction (ICO).

In order to help determining the success of PPP and YOPP towards the end of the Consolidation Phase, the ICO kindly asks authors of YOPP-related papers to **include the following statement in the acknowledgements** section of their articles:

This is a contribution to the Year of Polar Prediction (YOPP), a flagship activity of the Polar Prediction Project (PPP), initiated by the World Weather Research Programme (WWRP) of the World Meteorological Organization (WMO). We acknowledge the WMO WWRP for its role in coordinating this international research activity.

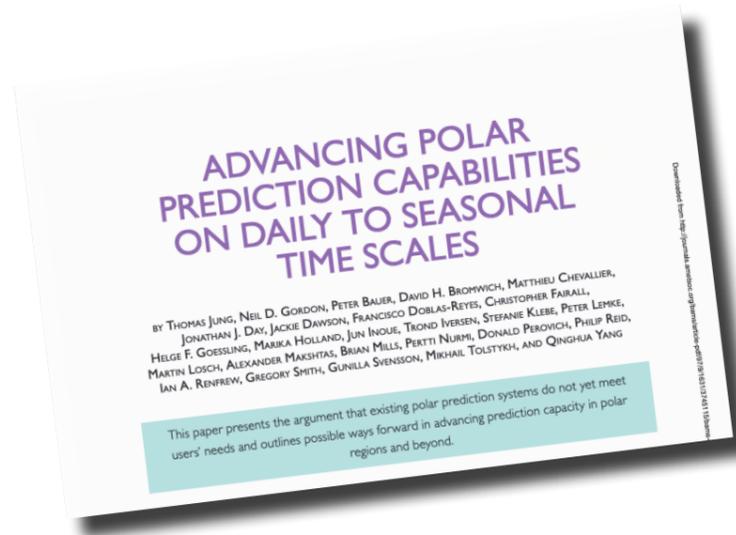
Furthermore, please **cite the following paper** whenever you consider it applicable as it provides a good overview of the scientific rationale and the main components of YOPP:

Jung, T., Gordon, N.D., Bauer, P., Bromwich, D.H., Chevallier, M., Day, J.J., Dawson, J., Doblus-Reyes, F., Fairall, C., Goessling, H.F., Holland, M., Inoue, J., Iversen, T., Klebe, S., Lemke, P., Losch, M., Makshtas, A., Mills, B., Nurmi, P., Perovich, D., Reid, P., Renfrew, I.A., Smith, G., Svensson, G., Tolstykh, M., Yang, Q., 2016: Advancing Polar Prediction Capabilities on Daily to Seasonal Time Scales. Bulletin of the American Meteorological Society. doi: [10.1175/BAMS-D-14-00246.1](https://doi.org/10.1175/BAMS-D-14-00246.1)

The ICO welcomes any information on new papers that provide contributions to YOPP, optionally including a short summary on the paper, formulated for a general audience. Selected publications may be featured on the website or in the newsletter to inform the wider community.

Please send references of newly published papers (plus a short summary) to office@polarprediction.net.

Research publications related to polar prediction topics, and in particular resulting from the various Year of Polar Prediction efforts, are listed in chronological order under <https://www.polarprediction.net/publications/research-publications/>.



11

New Video Tutorial – How to Search for Data in the YOPP Data Portal

by Laura Hüßner and Kirstin Werner, WWRP International Coordination Office for Polar Prediction/Alfred Wegener Institute

MET Norway and the YOPP International Coordination Office have published the first in a series of video tutorials on how to use the YOPP Data Portal. YOPP maintains this metadata portal as an overview archive for Arctic and Antarctic data generated during the Year of Polar Prediction. The community is invited to find YOPP data from a specific area or time to use for their various purposes.



Through discovery metadata, the YOPP Data Portal offers a web interface to find information about YOPP datasets.

The YOPP Data Portal utilizes interoperability interfaces to harvest metadata describing YOPP datasets from the data centers where they are archived. The YOPP Data Portal also serves as the interface for YOPP datasets feeding into the WMO Information System (WIS). It facilitates real-time access to data through the internet and the WMO Global Telecommunication System (GTS) as requested by the user community.

A new video tutorial is now available for users to learn more on how to search for metadata at the YOPP Data Portal. This video is the first in a series of video tutorials to be produced in order to make the use of the YOPP Data Portal as easy as possible.

Find the [first YOPP Data Portal video tutorial](#) on the YOPP [YouTube channel](#).



12

YOPP with High Visibility

The YOPP Implementation Plan, version 2, has recently been mentioned in the latest report of “Changes in the Arctic: Background and Issues for Congress” of the U.S. Congressional Research Service (CRS).

The goal of the Polar Prediction Project is to enable a significant improvement in environmental prediction capabilities for the polar regions and beyond, by coordinating a period of intensive observing, modelling, prediction, verification, user-engagement and education activities.

The YOPP Implementation Plan, version 2, has recently been mentioned in the latest report of “Changes in the Arctic: Background and Issues

for Congress” (10 September 2020) of the U.S. Congressional Research Service (CRS) –the public policy research agency of the U.S. Congress. The plan was used to guide the development of funding for U.S. Arctic research activities in the 2020/2021 period.

This demonstrates the high visibility of YOPP across a number of major international science and investment decision-making bodies and bodes well for the immediate YOPP Legacy. YOPP has featured in funding and policy decisions in the United States, the European Commission and in Arctic Science Ministerial meetings. YOPP is also high on the agenda of the Interagency Arctic Research Policy Committee (IARPC). (jw/kw/lh)

13

Female Atmospheric Force on *The IcePod*

by Kirstin Werner and Sara Pasqualetto, WWRP International Coordination Office for Polar Prediction/Alfred Wegener Institute

Two new episodes of *The IcePod* were recently published. We interviewed NOAA meteorologist and PPP Steering Group Member Taneil Uttal on the experiences she brought back to her Colorado home from Leg 2 of MOSAiC. Plus: *The IcePod* went south – but only in a literal way; the first Antarctic (and live!) episode with Antarctic weather forecaster and psychology student Vicki Heinrich is now available.

Measuring the Zeros

For the sixth episode, *The IcePod* went overseas where we connected with Taneil Uttal in Boulder, Colorado. Taneil is a meteorologist at NOAA, the U.S. National Oceanic and Atmospheric Administration. Taneil Uttal and Anja Sommerfeld from the fifth episode of *The IcePod* were the female atmospheric force during the darkest hours of the MOSAiC sea-ice drift. As the leader of the Atmospheric Team, Taneil felt it was her main job to make everybody else's job easy. Science makes just one (fulfilling) part of a scientist; there is more, and much more to Taneil. Spending the morning hours in Polarstern's red salon, Taneil volunteered for the second leg's entry on the ship's guestbook – she pieced her impressions from the central Arctic together into a colourful vibrant drawing, which you can check out right here, in this PolarPredictNews issue #16!



The *IcePod* episode 6 with Taneil Uttal (photo above: Michael Gallagher/NOAA) and the first Antarctic and live episode of the *IcePod* with Vicki Heinrich (photo: Peter Hargreaves).

Paid to Look at the Clouds and Play with Balloons

For our first live episode that we broadcasted during the APECS workshop “Antarctic Science: Global connections”, we met with the Australian weather observer and Ph.D. candidate Vicki Heinrich. For more than ten years, Vicki has been a regular in the Antarctic to look at the clouds and play with balloons, all courtesy of the Australian Bureau of Meteorology (BoM). She came across this opportunity to be trained on identifying the ten types of clouds in a newspaper, and it saved her from the mining industry. So why did Vicki then move into psychology? In 2019, she started her Ph.D. thesis “Use of Weather and Climate Information:

Risk perception and decision-making in the Antarctic” in order to learn more about how people use weather information to make their daily decisions. To get to know the other side – the user's perspective – is clearly an add-on to her career, and also to us, as her project was YOPP-endorsed. It turns out – as a preliminary result – everybody wants to know about the wind.

Find the new and all previous *IcePod* episodes e.g. on [Spotify](#), [Apple Podcast](#), [Castbox](#) (no sign-up needed) or on our website theicepodcast.home.blog.

14

In Antarctica, the Weather Comes First – Interview with Antarctic Forecaster Graham Oakley

by Kirstin Werner, Alfred Wegener Institute and International Coordination Office for Polar Prediction

In an interview for [Polar Prediction Matters](#), the dialogue platform for providers and users of polar forecasts, Antarctic forecaster Graham Oakley provides insights into his experience in weather forecasting. Antarctic weather observer and psychology Ph.D. student Vicki Heinrich talked to her colleague at the Australian Bureau of Meteorology (BoM) about a typical day as an Antarctic forecaster, how progress has been made in Antarctic meteorology, and why Graham Oakley considers himself a seasonal refugee.



Mawson station with Mt Henderson in the background (left) and Mt Vinson Base camp near Union Glacier (below) (photos: Graham Oakley).

For many years, Graham Oakley has worked for the Australian Bureau of Meteorology (BoM) and the Australian Antarctic Program. “*In Antarctica, the weather comes first*”, he says in his interview with Vicki Heinrich. The difference between weather forecasting in Australia compared to in Antarctica would be the change in priorities, explains Oakley. While in Australia, people ask for the weather only

after they have decided to do certain things, “in Antarctica it's „where and when will the weather be ok, then we will decide what we're going to do.“

Oakley has not only worked on the three Australian Antarctic bases Mawson, Davis or Casey; he has also worked with a tourism operator and joined several research voyages aboard the Australian research icebreaker RSV Aurora Australis.

After so many years in Antarctica, it is still the weather that makes his job challenging: “*It is a bit like playing golf. As soon as you start thinking you're good, you spray one into the bush. You always need to be thinking about what else could happen and make sure everyone is aware of any uncertainty and prepares for it.*“

Find the Polar Prediction Matters interview with Graham Oakley [here](#).

Polar Prediction Matters (PPM)

Polar Prediction Matters is a non-peer reviewed forum initiated as a means to foster the dialogue between those that research, develop, and provide polar environmental forecasts and those that use (or could use) polar environmental forecasts to guide socio-economic decisions. As a contribution to the Year of Polar Prediction, PPM features written contributions that provide a range of individual views on how polar environmental forecasts (and other environmental information, e.g., satellite imagery) are actually used, whether additional needs exist, and what factors might limit the effective use of forecasts.



15

New YOPP-Endorsed Project – The Arctic Rain on Snow Study

by Laura Hüßner, WWRP International
Coordination Office for Polar Prediction/Alfred
Wegener Institute

The project Arctic Rain on Snow Study (AROSS) recently received YOPP Endorsement. AROSS seeks to better understand Arctic rain on snow events and melt-refreeze, with a focus on hunting and, in particular, reindeer herding livelihoods.

The Arctic Rain on Snow Study (AROSS) is a collaboration between the University of Colorado Boulder, the Alaska Pacific University, the University of Lapland and involves extensive community engagement and co-production of knowledge.

When rain falls on an existing cover of snow, followed by cold temperatures, or it falls as freezing rain, a hard crust can be formed. There is growing evidence that such events are becoming more common in the rapidly warming Arctic, and it is increasingly recognized that they can have pronounced impacts on Arctic wildlife, domesticated reindeer, and human activities such as travelling or hunting. Rain on Snow (ROS) events have already resulted in large die-offs of reindeer because the icy crust makes it difficult for reindeer to find forage and their movements may be inhibited.

The goal of AROSS is to develop and analyze a database of the location, timing and intensity of Rain on Snow and extreme cold-season precipitation

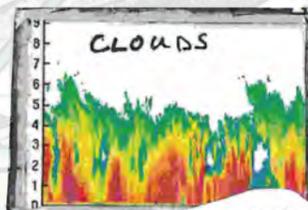
16

YOPP Down South – The YOPP-SH Sessions at the APECS Southern Hemisphere Workshop

by Clare Eayrs, New York University, Abu Dhabi

On 11 August, YOPP in the Southern Hemisphere (YOPP-SH) researchers participated in the APECS Online Workshop “Antarctic Science: Global Connections” that took place alongside the online events for the cancelled Scientific Committee on Antarctic Research biennial Open Science Conference and Delegates Meeting (SCARCOMNAP2020).

YOPP-SH researchers joined a total of 31 invited speakers from around the world to engage with over two hundred attendees who participated in the seven online workshops. These workshop sessions, ranging from science communication to logistical collaborations, were spread out over 11 to 13 August 2020 to accommodate as many different time zones as possible. The recordings from all sessions are available at the [APECS vimeo site](#).



events spanning the entire Arctic. Moreover, Mark Serreze and his international team are going to assess how these events have been forecasted and how prediction of ROS can be improved in the future.

Furthermore, AROSS aspires to quantify the impacts of events on semi-domesticated reindeer or Arctic wildlife, and develop an online Data and Knowledge Hub as a resource on the state of knowledge of Arctic ROS and extreme precipitation events and their impacts. As ROS events have a major impact on the physical, ecological and human elements on the Arctic system, the project team will work in close collaboration with the Indigenous community. More information about AROSS can be found on the [project's website](#).

AROSS and other YOPP-endorsed projects can be found at the [data base](#).

Kirstin Werner and Sara Pasqualetto from the Year of Polar Prediction International Coordination Office made the first-ever live broadcast of The IcePod, the official podcast of the YOPP initiative to improve weather and sea-ice forecast in the Arctic and Antarctic. In this episode, they interviewed Vicki Heinrich, a psychology PhD candidate at the University of Tasmania in Hobart, Australia, and a member of the YOPP-Southern Hemisphere Task Team. In an entertaining discussion, Vicki described her experiences as an Antarctic weather observer, what life is like on the ice, and how understanding the weather helps in decision-making. The edited version of the podcast was released on 07 October 2020 and is available [here](#).

The [YOPP-SH science session](#) on 11 August 2020 was supported by ten speakers from the YOPP-SH community who presented an overview of some of the key activities associated with YOPP-SH. This was a session bursting with information on a wide range of YOPP-SH activities such as the SIPN South sea-ice prediction initiative, the Antarctic Automatic Weather Stations network, and a project where Antarctica atmospheric observations were carried out by a windsled. The presentations provided early career researchers (ECRs) with a great opportunity to find out more about some of the projects

17

Shaping the Future of Geoscience – AGU Fall Meeting 2020

The AGU Fall Meeting 2020 will be one of the world's largest virtual scientific conferences. It is designed for global engagement and participation. AGU 2020 will bring together leading Earth and space scientists, current and future global thought leaders and scholars at a challenging time for Earth's citizens and environment.

From 1 to 17 December 2020, the [AGU Fall Meeting](#) will be held online. With an impressive [meeting schedule](#), there are twelve exciting days to come. To make the conference accessible for people across all time zones, most content will be made available for attendees to view and peruse outside of scheduled

associated with YOPP, how they can use weather and ice forecasts in their research, the different kinds of data that are available, and ways to contribute to YOPP and PPP. There were also examples of some of the innovative ways that projects and programs can overcome the challenges of collecting data in and around Antarctica.

Recordings of all the APECS workshop sessions can be found at the [APECS Vimeo site](#). We highly recommend this site for browsing the many other recorded webinars and conference sessions on a wide range of topics of interest to ECRs. The YOPP-SH session is available [here](#) and The IcePod interview with Vicki Heinrich is available on [Spotify](#), [Apple Podcasts](#), or [Castbox](#) (see [#13](#) Female Atmospheric Force on The IcePod).



sessions during the meeting. The American Geophysical Union promises to make it the most diverse, engaging and dynamic AGU Fall Meeting to date.

To gain access to the virtual platform, attendees need to [create an AGU account](#) to access the Fall Meeting 2020 registration site and then [register](#) for the AGU Fall Meeting 2020. Early bird registration ends by Friday, 30 October at 11:59 PM ET. Students and people with low income are free to attend. If there are any questions left, find some answers [here](#). (lh)

18

VERIFICATION WORKSHOP & CHALLENGE

Around-the-Clock International Verification Method Workshop

by Barbara Casati, Environment and Climate Change Canada

The November 2020 [Around-the-Clock International Verification Methods Workshop Online \(2020-IVMW-O\)](#) will span two weeks in November consisting of daily two-hour online sessions, with live-stream presentations and discussions.

The November 2020 Around-the-Clock International Verification Methods Workshop Online (2020-IVMW-O) is an outreach activity of the WWRP/WGNE Joint Working Group on Forecast Verification Research (JWGFVR). This virtual event intends to fill the gap between the 7th and 8th International Verifications Methods Workshop, since the latter has been postponed due to the COVID-19 pandemic. The workshop spans two weeks, from 9 to 13 and from 16 to 20 November 2020.

The sessions are staggered across different time zones in order to accommodate presenters from different countries around the Globe, while maintaining the verification discussion spinning around-the-clock. The sessions are by design limited to two hours per day, in order to enable attendance without compromising daily regular (home-based) work flow. Participation is only for registered attendees. All presentations are made available to registered attendees one week prior the event. Live-stream presentations and discussion are performed online via MS Teams.

Further information is available on the [2020-IVMW-O website](#).

Second International Verification Challenge

by Joint Working Group of Forecast Verification Research (JWGFVR)

The Joint Working Group of Forecast Verification Research (JWGFVR) calls for participation in the second International Verification Challenge – Seeking for the Best New Verification Metrics Making Use of Non-Traditional Observations.

Forecast verification is evolving beyond traditional metrics for basic weather variables to make use of many new sources of data to assess forecast quality. This additional information gives people greater confidence to use the forecasts in their decision making.

Research shows that impact-based forecasts and warnings are more effective than traditional weather forecasts and warnings in prompting people to take action, but we are only just starting to quantify the impact of the weather on human activities and use this information to evaluate forecasts. The advent of social media and the ease of sharing photos and other data from smart phones and home weather stations means that citizens can now contribute relevant information for assessing forecasts and warnings. Weather and climate sensitive industries also have a strong interest in measuring the utility of forecasts and warnings for their business, which means translating the forecasts into user-relevant variables (e.g. energy output, crop yield, aircraft departure rates, etc.) that can be verified against industry measurements.

To encourage the development of verification approaches making use of new sources and types of observations, the World Meteorological Organization's Joint Working Group on Forecast Verification Research (JWGFVR) is conducting a challenge to develop and demonstrate new forecast verification metrics using non-traditional observations. The contest is in support of the WWRP projects on High Impact Weather, Subseasonal to Seasonal Prediction (S2S), and Polar Prediction Project (PPP). ▶

The challenge will consider all applications of meteorological and hydrological forecasts, deterministic and ensemble, that are relevant to the public and user sectors including operational forecasting, agriculture, energy, emergency management, transport, etc. The metrics can be quantitative scores or diagnostics (e.g., diagrams), but they must use non-traditional observations

to be considered for the prize.

The JWGFVR warmly encourages all interested researchers and practitioners to participate. The deadline for entries is 30 April 2021. Please find more information including the submission forms [here](#).

19

Upcoming Online Events

9-30 November 2020

[13th Polar Law Symposium](#)
registration open and free

11 November 2020

[ASM3 Webinar Series: Addressing Gaps and Barriers in International Arctic Science Research](#)
registration open
(followed by webinars until 09 June 2021)

16-19 November

[WMO Data Conference](#)
registration open

20 November 2020

[National Weather Service Alaska Climate Outlook Briefing](#) (by Rick Thoman)

30 November & 02 December 2020

[Arctic Futures Symposium](#)
registration is open

1-3 December 2020

[The 11th Symposium on Polar Science](#)
meeting site opens 16 November

01-17 December

American Geophysical Union [AGU Fall Meeting](#)
registration is open, Free for Students

07-10 December 2020

[Arctic Change 2020](#)
registration is open

18 December 2020

[National Weather Service Alaska Climate Outlook Briefing by Rick Thoman](#)

1-4 February 2021

[Arctic Frontiers 2021: Building Bridges](#)

20

Polar Prediction at Virtual Arctic Frontiers 2021

by Sara Pasqualetto and Kirstin Werner, WWRP International Coordination Office for Polar Prediction/Alfred Wegener Institute

During the 2021 Arctic Frontiers Science Conference, this time taking place online, YOPP and partners will hold a session entitled “Advanced Prediction Capabilities for the Arctic and Beyond”.

Since Arctic Frontiers started out in 2006, the northernmost Nordic winter conference has steadily grown to what is now ‘the event’ when it comes to a pan-Arctic forum for dialogue and exchange between science, government and industry. Arctic Frontiers is the place where new partnerships across nations, generations and ethnic groups are being built. And so – ‘Building Bridges’ – is the title of the 2021 Arctic Frontiers Science conference scheduled from 1 to 4 February 2021. The 2021 edition of the conference will be organized in a new format. Taking into account concerns related to the spread of COVID-19, the organising committee of Arctic Frontiers decided to hold the meeting online, instead of the usual in-person gathering in Tromsø, Norway. Various contributions showcasing the most relevant issues and results from different disciplines tackling Arctic research were submitted by 6 October 2020, bringing the new Arctic Frontiers concept to life.

Session by YOPP and Partners

Amongst six science sessions, the session on „Advanced Prediction Capabilities for the Arctic Region and Beyond“ organized by YOPP, [WMO](#), [MET Norway](#), [ECCC](#), and [DMI](#) will capitalize on and consolidate recent scientific accomplishments for advanced probabilistic climate, weather and sea-ice forecast information, tailored to key social, environmental and economic needs. Presentations on activities and results from YOPP-endorsed projects will be featured, as well as contributions from other projects that focus on Arctic environmental monitoring, prediction and services for safe and sustainable Arctic operations, and on basic science, observations, model development and implementation.

In their keynote presentations, chair of the PPP Steering Group Thomas Jung (Alfred Wegener Institute) and PPP Steering Group members Irina Sandu (ECMWF), Gunilla Svensson (Stockholm University) and Ian Renfrew (University of East Anglia) will bring forward key issues resulting from their contributions to PPP and YOPP to provide a framework for discussion.

For further information on the session organized by YOPP and partners, check the [session proposal site](#). Further information and updates [here](#).

Arctic Frontiers 2021
Session 6. Advanced prediction capabilities for the Arctic and beyond
Keynote Speakers

			
Thomas Jung Alfred Wegener Institute	Irina Sandu ECMWF	Gunilla Svensson Stockholm University	Ian Renfrew University of East Anglia

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ArcticNet's Arctic Change 2020 Goes Virtual – YOPP Session on Users of Forecast Services

by Laura Hüßner and Kirstin Werner, WWRP International Coordination Office for Polar Prediction/Alfred Wegener Institute

From 7 to 10 December 2020, the Arctic Change Conference 2020 will take place. While usually held as a face-to-face meeting around Canada, this year's ArcticNet annual science meeting will be organized completely virtually. A YOPP-related session chaired by PPP-SERA members Gita Ljubicic and Jackie Dawson will be part of the program.

ARCTIC CHANGE 2020

The Arctic is experiencing an unprecedented change. Circumpolar nations face an increased demand to enhance their observational capacity and to better understand Arctic processes to ensure availability of all information needed to support evidence-based policy and decision-making. Science and knowledge mobilization play a pivotal role in this process.

A major goal of the Canadian Network of Centres of Excellence (NCE) [ArcticNet](#) is to engage Inuit organizations, northern communities, universities, research institutes, industry as well as governmental and international agencies as partners in the

scientific process and the steering of the network. What started as the first [Arctic Change conference in 2008 in Québec](#), has developed into one of the largest trans-sectoral international research conferences. The 2020 online-only conference is the fourth Arctic Change conference to bring together the world's foremost northern scientists to discuss the emerging global challenges and opportunities to face them.

Co-chaired by [PPP-SERA](#) members Gita Ljubicic and Jackie Dawson, the Year of Polar Prediction is contributing to the Arctic Change 2020 conference with the session entitled „[Tailoring Polar Weather, Water, Ice, and Climate Information and Services to Address Diverse User Needs](#)“. It is the third in a series of sessions that Ljubicic and Dawson have so far organized for ArcticNet where various initiatives that tailor, translate, or adapt current weather, water, ice and climate (WWIC) information and services are invited to present on how to suit the diverse user needs. This time, focus is on Arctic or Antarctic examples and experiences with tailoring polar WWIC information and services across a range of sectors, including amongst others: subsistence hunting and harvesting, fisheries, shipping, tourism or aviation.

Find more on the YOPP/PPP-SERA session [here](#), an overview of all Topical Sessions at the Arctic Change 2020 Conference [here](#) and a timetable of the program [here](#).

ArcticNet Network of Centres of Excellence and partners warmly invite the global Arctic community to join the conference – from wherever you are. For further information, visit <https://arcticnetmeetings.ca/ac2020/>.

Left: photo credits from left to right: Martina Buchholz/Alfred Wegener Institute; Simon Witter/ECMWF; Eva Dalin, Stockholm University; private

NEW PUBLICATIONS

Effects of Sea-Ice Concentration Uncertainty on Wave Evolution Modelling

In a new paper by Takehiko Nose et al., the impact of uncertainty in sea-ice concentration on spectral wave model simulations at the marginal ice zone is investigated.

With the ongoing sea-ice decline in the Arctic Ocean new opportunities for human activities open up, such as for ships to access the Northern Sea Route or the Northwest Passage. Improved prediction capabilities are key for vessels to safely circumnavigate risks such as perennial sea ice, high winds, or hazardous waves. The latter was objective of this study conducted during an expedition to the Chukchi Sea in November 2018 on board the Japanese research vessel RV Mirai. The Arctic Ocean wave model TodaiWW3-ArCS, based on the WAVEWATCH III® (WW3) model, was used to investigate the effects of uncertainty in satellite-retrieved sea-ice concentration (SIC) on modelled waves in the refreezing marginal ice zone (MIZ). The MIZ is defined by the World Meteorological Organization as “the region of an ice cover which is affected by waves and swell penetrating into the ice from the open ocean”.

The results indicate that the SIC uncertainty in different datasets causes uncertainty in model wave height. This effect, surprisingly, can overwhelm the uncertainty arising from the choice of model ice types, i.e. the wave-ice interaction parameterization that is adopted for a wave-ice simulation. In conclusion, the accuracy of satellite-retrieved SIC was the main source of error when modelling waves in the refreezing MIZ (when wave scattering was not dominant), which can imply that wave-ice model tuning may not be as effective when the knowledge of the true SIC field is uncertain. (dbu)

Nose, T., Waseda, T., Kodaira, T., Inoue, J.: Satellite-retrieved sea ice concentration uncertainty and its effect on modelling wave evolution in marginal ice zones. *The Cryosphere* (2020); doi: [10.5194/tc-14-2029-2020](https://doi.org/10.5194/tc-14-2029-2020).

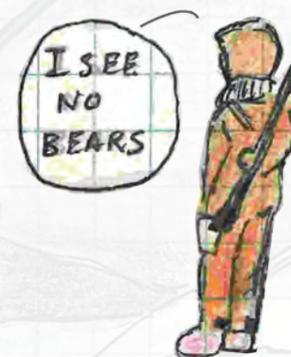
Arctic Radiosonde Observations Increase the Accuracy of Hurricane Track Forecasts

Radiosonde observation data can help to increase the predictability of extreme weather events in the mid-latitudes.

Trough or not trough – that is the question. In case of hurricanes, this question (along with many others) is actually existential – for the forecasters. Hurricanes with upper-level troughs are harder to predict, and often relatively large errors in the prediction of troughs result in large ensemble spreads, which result in failure to forecast hurricane track. In contrast, for hurricanes without upper-level troughs, mean central position errors are relatively small in all operational forecasts because of the absence of upper-level strong wind around troughs over the mid-latitudes.

The authors investigated the accuracy of operational medium-range ensemble forecasts for 29 Atlantic hurricanes over the mid-latitudes. The observing system experiment revealed that inclusion of additional Arctic radiosonde observation data obtained from the Japanese RV Mirai in 2017 improved error and ensemble spread in upper-level troughs with strong wind at initial forecast time, increasing the accuracy of the forecast of the track of Irma in 2017. Previous studies also revealed that increases in the number of radiosonde observations at Arctic existing stations enhance the skill to forecast mid-latitude events. (lh)

Sato, K., Inoue, J., Yamazaki, A.: Performance of Forecasts of Hurricanes with and without Upper-Level Troughs over the Mid-Latitudes. *Atmosphere*, 11 (7), 702 (2020); <https://doi.org/10.3390/atmos11070702>.

**Changing the Role of Non-Indigenous Research Partners in Practice to Support Inuit Self-Determination in Research**

In a new paper by Wilson et al., benefits and the potential to build on the existing research capacity of Inuit peoples are examined. The authors describe the lessons learned from a non-Indigenous researcher in supporting Inuit self-determination in research.

Arctic environmental science has yet to acknowledge, or truly practice decolonizing research by advancing Indigenous participation, capacity building, and knowledge in Arctic environmental science. There is expanding literature towards alternative research approaches, however less has been written about how to implement these approaches in practice, and which role non-Indigenous research partners might play in supporting Inuit self-determination in research. The paper describes the decolonizing methodology of a non-Indigenous research partner and presents a co-developed approach for Inuit and non-Indigenous researchers interested in supporting Inuit self-determination. In the presented model – called the Sikumiut model – the roles of Inuit and non-Indigenous research partners were redefined, with Inuit governing the research and non-Indigenous research partners training and mentoring Inuit youth to conduct the research themselves.

The Sikumiut model shows how involving Inuit in decision-making positions ensured that Inuit data ownership, accessibility, and control over how their traditional Inuit knowledge (“Qaujimagatuqangit”) is documented, communicated, and respected for its own scientific merit. (lh)

Wilson, K. J., Bell, T., Arreak, A., Koonoo, B., Angnatsiak, D., Ljubicic, G. J.: Changing the role of non-Indigenous research partners in practice to support Inuit self-determination in research. *Arctic Science*, 6(3): 127-153 (2020), <https://doi.org/10.1139/as-2019-0021>.

The Year of Polar Prediction in the Southern Hemisphere (YOPP-SH)

In a community effort, activities to enhance forecast capabilities in the Antarctic and the Southern Ocean in the frame of the Year of Polar Prediction in the Southern Hemisphere (YOPP-SH) have recently been summarized.

Led by PPP Steering Group member David Bromwich, efforts around the YOPP Special Observing Period (SOP) during the Antarctic summer season 2018/2019 have been published in *BAMS*. During the three-month period, more than 2,200 additional weather balloons were launched which roughly doubled the Antarctic routine radiosonde program. In addition, the network of drifting buoys in the Southern Ocean was enhanced. Early results from observing system experiments using the extra data from the SOP indicate greatest forecast improvement for deep cyclones near the Antarctic coast. SOP data have also been applied to provide insights on an atmospheric river event as well as to better understand spatial and temporal characteristics of Antarctic sea-ice extent. Based on the success of the Antarctic summer YOPP-SH SOP, a winter YOPP-SH SOP is currently being organized to support explorations of Antarctic atmospheric predictability in the austral cold season when sea ice is rapidly expanding over the Southern Ocean. (kw)

Bromwich, D., Werner, K., Casati, B., Powers, J.G., Gorodetskaya, I., Massonnet, F. et al.: The Year of Polar Prediction in the Southern Hemisphere (YOPP-SH). *Bull. Amer. Meteor. Soc.*, 101(10), E1653–E1676 (2020), <https://doi.org/10.1175/BAMS-D-19-0255.1>

YOPP-endorsed! – The POPEYE Project: „It was a Thrill to Contribute to YOPP“

Interview: Laura Hüßner and Kirstin Werner,
WWRP International Coordination Office for Polar
Prediction/Alfred Wegener Institute

The YOPP-endorsed project POPEYE even has YOPP in its name; it stands for „Profiling at Oliktok Point to Enhance YOPP Experiments“. POPEYE involves enhanced profiling of the atmosphere at Oliktok Point in Alaska during the Arctic summer YOPP Special Observing Period in 2018. During the field campaign, four radiosondes were launched daily, and the lowest 1,000 m of the atmosphere was studied by tethered balloons and unmanned aircraft systems to collect information on the vertical structure of thermodynamic properties, winds, and aerosol properties. We spoke with POPEYE project PI Gijs de Boer about the campaign and the resulting outcome. Gijs is an atmospheric scientist at the Cooperative Institute for Research in the Environmental Sciences (CIRES), the University of Colorado, Boulder, and the NOAA Earth System Research Laboratory (ESRL).

Dr de Boer, the POPEYE campaign took place in 2018 aligned with the YOPP Arctic summer Special Observing Period. What was the YOPP-endorsed project POPEYE about and what was the exact timeline?

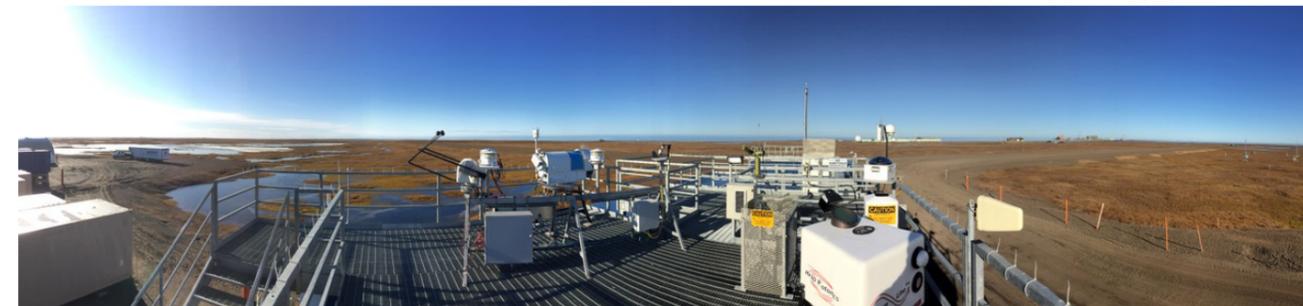
The campaign was all about getting additional, detailed measurements of the lower Arctic atmosphere during the Arctic summer YOPP Special Observing Period (SOP), using a combination of remotely-piloted aircraft systems (RPAS), tethered balloon systems (TBS), and extra radiosoundings. These activities stretched between 1 July and 30 September 2018. The original intent was to conduct alternating two-week periods of RPAS and TBS flights, with one extra radiosonde being launched daily at Oliktok Point (standard launch times of 1730 and 2330 UTC, with an extra sonde being launched at 0530 UTC). Unfortunately, weather conditions prevented the launch of some radiosondes, and about halfway through the campaign, the RPAS had some control issues that resulted in their grounding for the rest of the time. These measurements were in addition

to the routine observations collected by the third Atmospheric Radiation Measurement (ARM) Mobile Facility (AMF-3) that has been deployed to Oliktok Point by the U.S. Department of Energy ARM program since 2013.



What kind of measurements and investigations have been carried out at Oliktok Point, Alaska?

Oliktok Point has seen the presence of the AMF-3 since late 2013. This means that over the last five to six years there have been intensive and comprehensive measurements of the Arctic atmosphere, including those coming from remote sensors (radars, lidars, radiometers, etc.), surface meteorology and radiation, aerosol measurements, and regular radiosonde launches. In addition, there is an area of restricted airspace around Oliktok Point that helps to support airborne observing systems, like TBS and RPAS. Together, these platforms support studies of atmospheric physical and chemical properties and processes and model evaluation studies. Since 2015, I have led the Northern Alaska site science team under funding by the U.S. Department of Energy Atmospheric Systems Research (ASR) program. This team has conducted a variety of studies at Oliktok Point along the lines of what is discussed above. ▶



The POPEYE site at Oliktok point, Alaska (all photos on this and next page: Gijs de Boer, headshot: CIRES)

Who, besides you, was part of the POPEYE team?

The official POPEYE team included myself, Matthew Shupe, Amy Solomon and Janet Intrieri, who were supported by the site science team, as well as collaborators from the University of Colorado and a great group of additional ARM team members.

Where did the funding for POPEYE come from?

POPEYE was supported by the U.S. Department of Energy Atmospheric Radiation Measurement (ARM) and Atmospheric System Research (ASR) programs. Additional funding was provided by the NOAA Physical Sciences Laboratory.

There's been already some time after the campaign to analyse the data. What are most exciting results? Are there already publications resulting from the field work's observations?

POPEYE resulted in the collection of a highly detailed dataset that documents fine scale and aerosol structure of the lower Arctic atmosphere. The temporal frequency of the profiling and the spatial resolution of the sensors deployed together offer a unique perspective on key physical processes

YOPP-endorsed!

YOPP endorsement is available for projects, programmes and initiatives and also for institutions and operational centers that contribute to the Year of Polar Prediction's goals to improve weather and sea-ice forecasts in polar regions. More than 85 projects, programmes and initiatives already received endorsement from YOPP.

related to the structure of the lower atmosphere, aerosol transport and mixing, and the environmental conditions supporting clouds. There are a couple of publications that were recently submitted that leverage these measurements to evaluate a couple of prediction systems (one research and one operational).

Not everyone has the chance to participate field campaigns in Alaska. What do you consider the most exciting part in the project for you personally? Is there something you are particularly proud of?

Besides all of the cool measurements that we collected, it was a thrill to be able to contribute to the large YOPP effort. I'm always looking for people who may be involved with model development or evaluation efforts who could use the highly detailed observations we captured as part of this campaign. And, I got to see three or four polar bears at Oliktok Point!



How does POPEYE contribute to improving the polar prediction system?

POPEYE measurements offer unique perspectives that can be used to evaluate prediction systems and conduct sensitivity studies to assess the impacts of individual parameterizations, data assimilation schemes, and more. We have conducted some initial studies along these lines, but I would really love to find additional collaborators to do more of this. ▶

I also believe that POPEYE was one of only a few observing activities in the Alaskan Arctic during the second SOP.

What are you currently working on? Have you been involved in a follow-up project after POPEYE?

I am currently working on a w-i-d-e variety of things, from the usual Arctic work, to hurricane research, to the tropical marine boundary layer, to sensor and platform engineering efforts! Too many things right now (but I love every minute of it). Specific to the Arctic and to Oliktok Point, we are in the middle of a variety of studies, including recently submitted and nearly submitted papers, e.g. on numerical weather prediction model evaluation at high latitudes or the better understanding of the vertical structure of the lower atmosphere and the impact on aerosol distributions over that regime. And... We just wrapped up MOSAiC! As a whole, MOSAiC was quite successful, and I was also personally very happy with the performance of my RPAS team, who spent approximately five months on the Polarstern to deploy a variety of RPAS for atmospheric and surface observations. We're moving towards using those measurements to evaluate the impact of sea-ice leads, better understand the scales associated with surface features and the impacts of those features on surface albedo during the melt season, and the general performance of numerical prediction tools over the central Arctic.

Where can the YOPP community access the data and also get more information about POPEYE and your other projects in Alaska?

POPEYE data are available for download from the DOE ARM data archive:

<https://adc.arm.gov/discovery/#/>.

See also the POPEYE overview paper:

de Boer, G. et al.: Atmospheric observations made at Oliktok Point, Alaska, as part of the Profiling at Oliktok Point to Enhance YOPP Experiments (POPEYE) campaign, Earth Syst. Sci. Data, 11, 1349–1362, (2019) <https://doi.org/10.5194/essd-11-1349-2019>



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