

PolarPredictNews

Newsletter #10

March 2019



Dr. Penny Rowe of the University of Santiago launches a radiosonde from the Chilean Research Station, Escudero. Radiosondes were launched twice daily as part of Chile's project for YOPP, *Characterization of the Antarctic Atmosphere and Low Clouds (CAALC)*, in collaboration with the nearby Korean station, King Sejong (photo: Nicolas Dettling)

Dear Colleagues,

on 15 February 2019 the first YOPP Special Observing Period in the Southern Hemisphere (SOP1-SH) came to a close. From what I can see, this SOP is on course of making important contributions to the mission of YOPP. Some of the progress, including training and new publicly available datasets, is reported in this issue of PolarPredictNews. Perhaps not surprising, there is interest by the community to hold another SOP, this time with a focus on the ocean. Upcoming meetings, mentioned in this issue, will contribute to the planning of a potential SOP2-SH. The last few weeks have also seen a number of important meetings briefly summarized in this issue. The YOPP-IASC Arctic Science Workshop in Helsinki was certainly a highlight, featuring first outcomes from the two Arctic SOPs. This workshop was directly followed by the 10th PPP Steering Group (PPP-SG) meeting. The format of

future YOPP planning following detailed scientific discussion turns out to be a success story; and we are planning to employ this format in 2020 again. 01 / 20

I am also very pleased to report that the Alfred Wegener Institute (AWI) and WMO have extended their Memorandum of Understanding. This means that AWI will continue to host the International Coordination Office for Polar Prediction until the Polar Prediction Project will come to a close in 2022.

Finally, I would like to congratulate Peter Bauer once again for having been awarded the Helmholtz International Fellowship. Peter was one of the founding members of PPP-SG; his influence on making YOPP what it is today has been tremendous. You can find a very interesting interview in this 10th issue of PolarPredictNews.

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.

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certificate to Peter Bauer who is a pioneer in the field of high-resolution modelling, prediction and computing. During a one-week visit, he had the chance to meet with researchers and early career scientists at the German Helmholtz Centre for Polar and Marine Research in Bremerhaven. In his lecture entitled “Why future weather and climate prediction needs to pay serious attention to computing?”, Peter Bauer shared insights on the current challenges of predictive capabilities limited by computing skills, in view of developing more realistic Earth System Models.

Receiving the Helmholtz Fellow Award is a great honour for Peter Bauer: “I am very grateful for that as it emphasises the need and opportunity for international collaboration. An international fellow is, by definition, based on collaboration between Helmholtz as a whole, with its different institutes and disciplines, and an international organisation like ECMWF.”

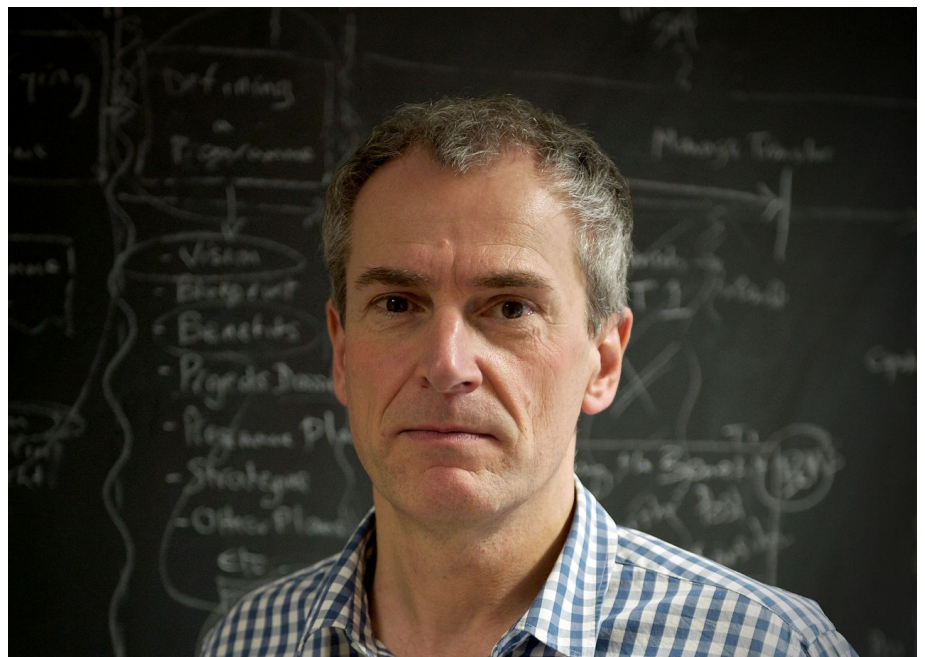
Peter's work brought significant advancements in many fields of Earth System Research, such as satellite remote sensing in weather and climate prediction, the assimilation of observations

01 In the Mind of the Modeller |
A conversation with ECMWF Deputy Director of Research Peter Bauer on supercomputing, his work to advance weather prediction and the future prospects of technology and science.

Interview: Sara Pasqualetto

Text: Sara Pasqualetto and Kirstin Werner

Peter Bauer is Deputy Director of Research and Manager of the Scalability Programme at the European Centre for Medium-Range Weather Forecasts (ECMWF). He is one of the pioneers shaping the Polar Prediction Project and the Year of Polar Prediction as a Steering Group member from Day 1. In 2018, he has received the Helmholtz International Fellow Award. On 5 February 2019, Antje Boetius, Director of the Alfred Wegener Institute (AWI), handed over the Helmholtz Fellow



Peter Bauer, Deputy Director of Research at ECMWF (photo: ECMWF).

in numerical models, climate monitoring, weather and climate model development and, more recently, the preparation of models and forecasting systems for extreme-scale computing. In the different roles he had since he first joined ECMWF in 2000, Peter Bauer has significantly supported the Year of Polar Prediction (YOPP), as well as large-scale projects such as the EU Horizon-2020 APPLICATE and Helmholtz Earth System Modelling (ESM) projects.

“With the apparent challenges that we are facing for global Earth system modelling, for enhancing predictive skill and technological challenges, tight science-technology collaboration is even more important”, he says.

We have met Peter for an interview during his stay at AWI to ask him more about his work and research, the challenges that come with it, and the potential for future advancements in the field. The entire interview can also be watched [on video](#) on the [YOPP YouTube channel](#). More information on Peter Bauer and his work can be found on the [ESM website](#).

What does it mean for you to be an International Helmholtz Fellow?

It will allow me to visit the different Helmholtz Centres, to engage in dialogues with people in polar sciences here at AWI but also in computing science at the Jülich Supercomputing Centre, about Earth System Science with colleagues in Potsdam, or on environmental science at the Centre for Environmental Research in Leipzig. I will have the opportunity to initiate dialogues and come up with a common strategy that will not only help internationally, but also within Helmholtz. With the challenges that we are facing for global Earth System Modelling, it is fundamental that scientists get together and work shoulder-to-shoulder.



Peter Bauer gave a lecture in February at the Alfred Wegener Institute in Bremerhaven, Germany (photo: Luisa Cristini/AWI).

In your awarding lecture at AWI, you talked about the problems that numerical weather prediction has in terms of computing capacity. What do you think is the biggest challenge in representing physical processes in numerical models?

Ultimately, we want to create better and more realistic Earth System Models. This means that we account for all the physical processes that are relevant for predictive skill and this will need

better computing in order to be more precise and realistic. We also need to understand better some of the processes, for example the exchange of heat and energy between atmosphere, sea ice and ocean. Even land surfaces, vegetation, or urban effects have an impact on the atmosphere. With this level of complexity, enhanced computing performance is a must.

Even if the computing challenges you explained in your lecture were to be

overcome, what would be the biggest issue related to data management?

More complex models will inevitably produce more data. Even if we could run a 1-km global simulation today, what would we do with the data? We cannot even plot it on our current system! Yet, our users would like to extract the full spectrum of the information contained in these data, at the same speed as today.

How do you think the work of ECMWF could help in solving these issues?

It is all part of research. ECMWF is not alone – the weather and climate prediction community is large and very well organised. ECMWF has been very effective in bringing things together and turning research into operations. This is because we centralise European excellence and resources in one place but also have a very focused mission on medium-range forecasting, that allows us to concentrate all our efforts on that goal.

What do you think about the involvement of the public in weather prediction? Do you see issues in the communication of this subject?

People are affected by weather every day, and the impact of weather and climate extremes is becoming more and more clear. Events like the violent storms or heatwaves over Europe last summer affect people's lives, and I think this is communicated quite well. Perhaps not quite as well communicated is the enormous investments that are still required to make the next step towards even more enhanced predictive skills. We are trying to do this through big international projects but there is still a lot of work to do.

Peter, you had a remarkable career since you completed your PhD in Meteorology at the University of Hamburg and spent about ten years as a researcher at the German Aerospace Center DLR. You have received many awards and fellowships overseas at the National Oceanic and Atmospheric Administration (NOAA) and NASA and joined ECMWF in the year 2000. What do you like most about your job?

It is very satisfying to work at an operational centre because you can see the immediate impact of your work every single day. This is what motivates most people at ECMWF, namely to work very hard and contribute to that success. In my current position, the satisfaction comes also from being able to define the future of where our research goes, how we interact with our member states, how we can cooperate with specific organisations like Helmholtz and then see how that turns into success.

What would you say is your "strongest suit"?

I am good at bringing people together, setting up a motivated team and doing something that nobody

else has tried yet, like working on the interaction between science and technology, in this case atmospheric physics and computing.

...and what about your weakness?

Sometimes things advance too slowly for me and I become impatient, and that does not really help. If you are really ambitious, you want to have success fast and see the outcome of what you have been planning for years. Certain things take longer and

others go faster, but you have to give things time and let researchers do their work.

From your experience, what is the best strategy for a successful teamwork?

Communication, for sure. You have to accept that people are different and understand that this difference is

what makes working in a team successful. You do not want ten or twenty times the same personality with the same technical skills, but rather the different types, the strengths and the weaknesses that people have to offer and that combination advances us further. For this to work, I think you need good transparency and communication.

What would you like to see realised in the coming five years?

I would like to see the ambitious science-technology programme that we are implementing now as being realised successfully. For example at ECMWF, we see now for the first time a real change of mind in the way we deal with the computing and data handling issues. We can see that we will be able to implement the scientific ambitions that we have for more realistic Earth System Models, and I would like to see this brought to life.



Alfred Wegener Institute's Nordsee Museum Hall was fully booked to attend the lecture by Peter Bauer (photo: Luisa Cristini/AWI).

**02 Italian Educational Project
CAPIRE-YOPP: Four Daily
Radiosoundings from Antarctic
Concordia Station** | About four hundred students are involved in the educational project CAPIRE-YOPP which has added two more radiosondes daily for two weeks to the Italian Meteo observatory programme of the Italian-French Antarctic research station Concordia (Dome C). As a contribution to the Year of Polar Prediction's Special Observing Period in the Southern Hemisphere, for the first time, four daily soundings at synoptic hours were performed from this station on the Antarctic Plateau which is considered one of the coldest places on Earth. In addition to the two radiosoundings launched by the Italian meteorological observatory programme in the framework of the Italian National Research Antarctic Programme (PNRA) as a contribution to YOPP, over a duration of two weeks two additional weather balloons were deployed

For the CAPIRE-YOPP educational project, scientists from Antarctic Italian-French Concordia station connected with Italian students and teachers via video conference (photo: Giuseppe Camporeale).



every day from the Italian-French station Concordia (also known as Dome C station), as part of the Italian education project CAPIRE-YOPP. CAPIRE is the acronym of the Italian title of the project "Comprendere la Previsione meteoRologica in antartide sostenendo YOPP" and means "Understand Antarctic weather forecast sustaining YOPP". At the same time CAPIRE translates to UNDERSTAND. From 1 to 14 January 2019, Concordia station for the first time performed four daily radiosoundings at synoptic hours 00, 06, 12 and 18 UTC. The unique data set that has been produced during these two weeks in early January adds to the meteorological activities performed at Terra Nova Bay on the Antarctic coast. It will allow modellers and operational forecasting centres to evaluate the effect of enhanced weather observations to their weather forecasts for the Ross Sea and Victoria land areas throughout to the East Antarctic Plateau.

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For two weeks in January, the team at the Concordia station launched four weather balloons per day as a contribution to the education project CAPIRE-YOPP during the YOPP Special Observing Period in the Southern Hemisphere (photo: Giuseppe Camporeale).

Outstanding Educational Activity

The field activities within CAPIRE-YOPP are part of an outstanding educational activity involving 17 intermediate and high-schools of

the Milan metropolitan area and are promoted by the University of Milano-Bicocca and the Italian National Research Council CNR. Thanks to the fundamental contribution by the PNRA, the Italian National Agency of New Technologies, the Energy and Sustainable Economic Development ENEA and by the Meteo Service of the Italian Air Force, about four hundred students could be involved in the various activities connected to polar meteorology and climate such as in-depth events, seminars, lessons including a visit to one of the operational meteorological centres in Italy. High-school students will be also involved in performing data analysis and presenting their scientific results.

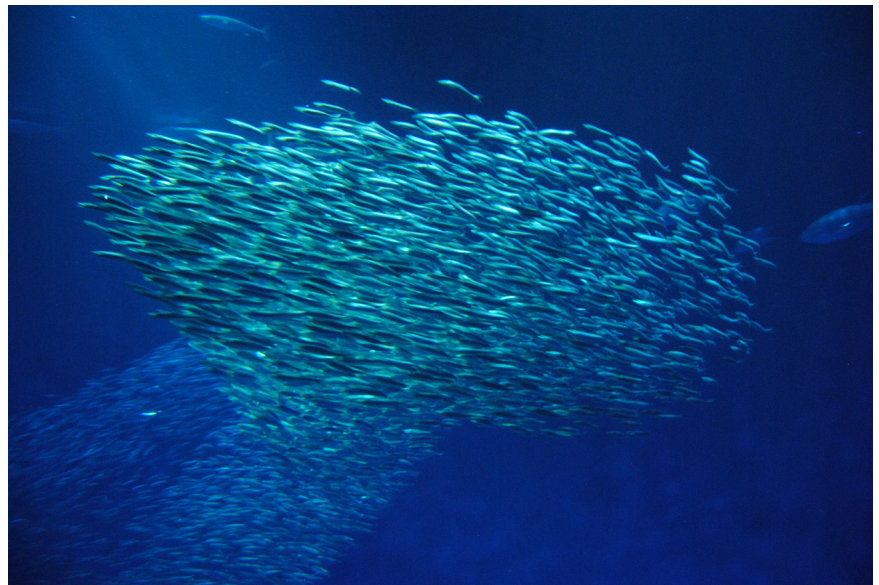
On 27 November 2018, the field campaign of CAPIRE-YOPP was launched with a live connection to Concordia station, when students and teachers were able to directly talk to scientists who are staying at the station to carry out meteorological observations during this ongoing austral summer. Once the fieldwork was concluded on 14 January, another live connection to the station allowed a delegation of students and professors to meet the researchers engaged with the extra-soundings activities during YOPP's Special Observing Period in Antarctica. Students will be awarded with a certificate and a little gadget at a final event in summer which also marks the end of the YOPP Core Phase. With this educational activity, students who might become the next generation of polar researchers are given a unique opportunity to learn and apply scientific methodologies and techniques, but also become familiar early in their career with the language of scientific research, as well as with topics related to polar meteorology.

Live connection events, together with movies and pictures showing balloon launches and field activities, can be followed here: <https://volarebeyondyopp.blogspot.com/>

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03 Why Don't We Have Forecasts of Fish? | Many challenges remain before fish forecasts become a less fanciful reality, says Mark R. Payne, senior scientist at the Technical University of Denmark (DTU-Aqua), in the new contribution to Polar Prediction Matters.

The sea not only is a source of food but sustains a source for employment, revenue, tradition and culture. Foreseeing fluctuations of e.g., fish swarms would enable many societies and communities in the Arctic and beyond to much better prepare for the variable conditions of marine life.



Passing school of Northern Anchovy at the Monterey Bay Aquarium, California (photo: Kirstin Werner).

In his article for Polar Prediction Matters, Mark Payne, who leads the Climate Services work package within the EU Horizon-2020 project Blue Action, describes the efforts to develop forecasts of living marine resources where the dynamics of a fish species and interactions between species are still complex and difficult to measure. While first fish forecast products have emerged already a decade ago, a predictive understanding of the relationship between the physical and biological environment remains challenging.

Read the full article on the Polar Prediction Matters Helmholtz website [here](#).



Aircraft flyby with the site in the foreground. The aircraft campaign RadSnowExp took place in November 2018 over Iqaluit, Canada (photo: Ivan Heckman/ECCC).

04 Aircraft Campaign over Canada's Iqaluit YOPP Supersite | (by Mengistu Wolde, National Research Council, Canada, Zen Mariani and Alexei Korolev, both ECCC) **An aircraft campaign to measure cloud microphysics and snow precipitation in the Canadian Arctic has been conducted over Iqaluit, Nunavut, Canada (~64N, 68W) in November.** The field project RadSnowExp is a multi-platform and multi-sensor study to address the pressing need for provision of precipitation measurements globally. For the project, the National Research Council's (NRC) Convair-580 aircraft was instrumented by NRC and Environment and Climate Change Canada (ECCC) with state-of-the-art in-situ sensors, triple frequency (Ka, X, and W-band) polarimetric and Doppler radars, lidars, and a G-band radiometer. The aircraft was deployed to Iqaluit, Nunavut, between 19 and 30 November 2018 and conducted four flights (totalling twenty flight hours).

Iqaluit is one of ECCC's Canadian Arctic Weather Science (CAWS) supersites which has also been identified as a YOPP Supersite. It is equipped with an extensive array of in-situ and remote sensing sensors; including a scanning Ka-band polarimetric radar and multiple lidars and radiation flux sensors, all of which operate 24 hours during seven days of the week for research purposes. Although satellite calibration and validation (cal/val) activities are not a core component of the RadSnowExp campaign, attempts have been made to fly along the satellite tracks of the Global Precipitation Measurement (GPM) satellite mission, CloudSat, and ADM-

Aeolus satellites, taking coincident measurements at the same time the satellite was overhead. Results from the campaign will provide information on the sensitivity and variability of the multi-frequency polarimetric radar and passive microwave signatures to different precipitation types in the Arctic, including intensive snow events over different surface types.

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05 Antarctic LIDAR Data now Available | **Daily LIDAR plots are now available from the Antarctic Concordia Station.** As a contribution to YOPP, daily LIDAR plots are now available to the public from the Antarctic Italian-French Concordia Station. The tropospheric LIDAR instrument provides year-round tropospheric profiles of aerosol and clouds every five minutes, 24 hours per day. The LIDAR instrument was funded through the Italian Antarctic Research Programme PNRA and has been used during the YOPP Special Observing Period in the Southern Hemisphere as part of the YOPP-endorsed project "Water Budget Over the Dome C Station" (in short: H2O-DC) to distinguish solid from liquid cloud layers, with a vertical resolution of 7.5 m and a minimum overlap altitude of 10 m. The LIDAR covers the local troposphere from the surface up to approximately 7,000 m altitude, operating fully automatic at 532 nm.

Using the same wavelength as the CALIPSO satellite science mission (see more [here](#)), the new

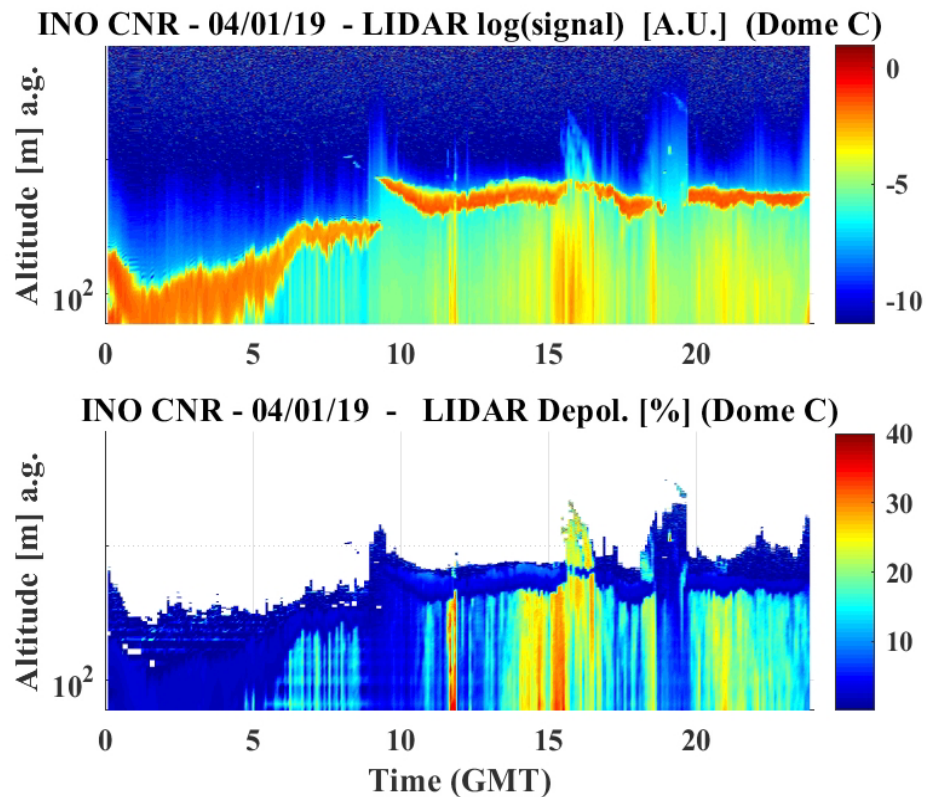
LIDAR data starting from 1 January 2018 provide a ground-truth point for satellite-borne LIDAR data. The capability to discriminate between water and ice phases provides a unique test ground for microphysical aerosol and cloud modelling in Antarctica. The altitude of origin of the precipitation can easily be estimated from the LIDAR plots, thus providing a reliable tool for tracking the origin of locally collected precipitation for isotopic and contamination studies. Studies on the inversion of radiometric and photometric data sensitive to the type and altitude of clouds will also benefit from the LIDAR-derived knowledge of cloud properties such as bottom and thickness.

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The pre-processed data are updated on a daily basis but no quality-check is applied. Users of the data should note that the continuity of the data series might be broken by laser/datalink failures. Time-lapse videos of cloud coverage are also automatically collected. Further information and data samples are available at http://lidarmax.altervista.org/englidar/_Antarctic%20LIDAR.php

The data (quick-look, daily false colour LIDAR plots), starting from 1 January 2018, are available at the following ftp server:
IP: 149.139.18.31 (port 21)
user: Concordia
pw: station

For numerical data, the use of the data in publications, copyright credits or any other information, please contact the P.I. Massimo Delguasta massimo.delguasta@ino.it.



A sample of LIDAR data plot, as available on the public server. (Upper plot: signal. Lower plot: depolarization, log. Z units). A “snake-like” red cloud in the signal plot appears to be a liquid water fog/cloud in the depolarization plot (deep blue). Ice precipitates from the cloud are visible after 5 AM (light blue to red on the lower depolarization plot) (source: Massimo Delguasta).

06 Antarctic Special Issue in Advances in Atmospheric Sciences | The journal *Advances in Atmospheric Sciences* now invites contributions to the Special Issue on Antarctic Meteorology and Climate. The ongoing efforts of the Year of Polar Prediction in the Southern Hemisphere (YOPP-SH) provide a stimulus for a focused research on Antarctic meteorology and climate. Routine observations in the Antarctic were enhanced during the YOPP-SH Special Observing Period from mid-November 2018 to mid-February 2019. These additional data will enable intensified research activities to improve predictive capabilities in the Antarctic. The *Advances in Atmospheric Science* Special Issue entitled “Antarctic Meteorology and Climate: Past, Present and Future” will showcase recent and ongoing research progress in 1) Antarctic meteorology and numerical weather prediction and 2) climate variability and change in the Antarctic to contribute to a more thorough

understanding of issues in Antarctic meteorology and climate in past, present and future.

Submission is now open until 31 August 2019.

More information can be found [here](#).

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07 SAVE the DATE: YOPP in the Southern Hemisphere meeting #04 | The 4th YOPP in the Southern Hemisphere meeting will take place on 27-28 June 2019 in Charleston, South Carolina. As in previous years, a YOPP in the Southern Hemisphere (YOPP-SH) meeting will be held in conjunction with the Workshop on Antarctic Meteorology and Climate (WAMC). Hosted this year by the Space and Naval Warfare Systems Center (SSC) Atlantic, the 14th WAMC is scheduled for 25 to 27 June 2019 to take place at the Citadel College, Bond Hall in Charleston, SC. Following WAMC, the YOPP-SH meeting #04 will start at 1 pm on 27 June and will be continued in the morning of 28 June.

Project investigators and representatives of national agencies active in Antarctica are invited to provide updates on their activities during the YOPP Special Observing Period (SOP) in the Southern Hemisphere, 16 November 2018 to 15 February 2019. To make most effective use in data denial experiments of all the additional radiosonde observations collected during the SOP, we want to assemble complete radiosonde data sets from all operators. We will likely want to assemble all surface observations as well. A key question to be decided by the meeting is whether to hold a winter SOP in the April-June time period in either 2020 or 2021.

For further information about the 14th WAMC, please see [here](#). Details on registering for 14th WAMC and YOPP-SH#04 meetings will follow.

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08 YOPP-IASC Arctic Science Workshop | (by Kirstin Werner and Helge Goessling) **More than one hundred participants discussed recent progress and ways towards improved polar prediction at the Arctic Science Workshop that took place from 14 to 16 January 2019 in Helsinki, Finland.** The meeting was jointly organized by the International Arctic Science Committee (IASC), the Year of Polar Prediction (YOPP) International Coordination Office, and the Finnish Meteorological Institute (FMI) as host. The first day of the meeting was dedicated to keynote lectures to set the stage on current efforts to bring together observations and modelling during the Year of Polar Prediction.

Extreme weather events during SOPs

One of the foci during the following science sessions was the analysis of additional observations that have been obtained during the first two YOPP Special Observing Periods (SOPs) in the Arctic. Extra polar observations during the

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The YOPP Arctic Science Workshop took place at the Finnish Meteorological Institute in Helsinki (photo: Kati Johansson/FMI).

SOPs captured several extreme weather events that provide useful benchmarks to assess current forecast capabilities and to understand how such events unfold. A Sudden Stratospheric Warming during the Arctic winter SOP (February-March 2018) occurred ahead of the rare event of a polynya opening north of Greenland. While warm anomalies prevailed over the Labrador region as well as the Beaufort and Bering seas in March, northern Russia and large parts of Europe experienced a “Beast from the East”, or what the Finns whimsically call a “Finnish Wednesday”, with extremely low temperatures and heavy snowfall. Interestingly, the polynya north of Greenland re-opened during the Arctic summer SOP (July-September 2018), resulting from another period of anomalously warm southerly winds.

Results presented from first data denial experiments capitalising on the SOP data indicate that the polar observing systems clearly have impacts on forecast skills not only in polar regions but also in the mid latitudes, and that in particular conventional (i.e., surface, wind profiler, and upper-air) observations are most influential during winter.

A too simplistic, or partly completely missing, surface snow component in state-of-the-art

numerical prediction systems has been highlighted as a prevailing cause of surface warm biases, both over land and on sea ice. The use of multi-layer snow schemes is a promising way to improve near-surface temperatures and the energy budget in models in cold atmospheric conditions.

During parallel breakout sessions on predictability, processes, verification, and user engagement, the workshop participants discussed current questions and topics that are particularly relevant to help shaping the YOPP Consolidation Phase (July 2019 to 2022). During this final phase, YOPP data and research will be synthesized to ensure sustained improvements in environmental prediction capabilities for the polar regions and beyond. Recommendations from the breakout groups included: to further promote and maintain YOPP observational and model data; to put focus on case studies with regard to extreme events captured by the SOP observations, and Arctic process understanding; to work toward specific and practical recommendations for the polar observing system; and to ensure the transfer of YOPP outcomes into operation and services, including the securing of funds for service development.

The abstract book and agenda with links to presentations can be downloaded from the [workshop website](#).



The tenth meeting of the PPP Steering Group took place from 16 to 18 January 2019 at the Finnish Meteorological Institute in Helsinki (photo: Kati Johansson/FMI).

09 Polar Prediction Project Steering Group Meeting #10 in Helsinki | (by Jeff Wilson/WMO Consultant) **The tenth session of the Polar Prediction Project Steering Group (PPP-SG) took place in Helsinki, Finland, at the headquarters of the Finnish Meteorological Institute (FMI) from 16 to 18 January 2019.** The meeting specifically focused upon refining the plan for the YOPP Consolidation Phase, developing plans for the third Special Observing Period for the Northern Hemisphere (SOP-3) as well as general coordination and

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administrative matters.

An updated plan for the YOPP Consolidation Phase (1 July 2019 to 31 December 2022) will be subsequently incorporated into a third version of the “WWRP Polar Prediction Project Implementation Plan for the Year of Polar Prediction (YOPP)” which is expected to be completed prior to the launch of the Consolidation Phase at the 18th World Meteorological Congress in Geneva in June 2019. The new draft plan for the Consolidation Phase builds upon the original plan, identifying the key research, operations and services activities that will need to be carried out over the four years of YOPP Consolidation. As well, a range of evaluation metrics will be identified in the new version of the YOPP Implementation Plan to determine the success of YOPP prior to and following the conclusion of PPP in 2022. The PPP-SG also agreed on a new working structure to better fit the activities foreseen for the next four years. The full meeting report is currently under preparation.

10 APPLICATE General Assembly 2019 and Early Career Event | *(This article is based on an article published on the [ECMWF website](#))* **Some 70 scientists reviewed “exciting first results” at the second General Assembly and an early career event of the EU-funded APPLICATE**

project on polar prediction at ECMWF from 28 January to 1 February 2019. The overarching goal of APPLICATE is to develop enhanced predictive capacity for weather and climate in the Arctic and beyond, and to determine the influence of Arctic climate change on northern hemisphere mid-latitudes, for the benefit of policy makers, businesses and society.

“Just over half-way into the project, APPLICATE is well on track: exciting first results were discussed and we expect to make further substantial progress over the next year,” says Irina Sandu, the coordinator of polar prediction activities at ECMWF and member of the PPP Steering Group. One of the findings to date, reported by ECMWF scientist Heather Lawrence, is that existing observing systems in the Arctic improve forecast skill in the region in the short and medium range and in the mid-latitudes in the medium range.

“Interestingly, it appears that a better use of existing satellite observations, in particular over snow and sea ice, is probably just as important as new observations,” Heather Lawrence notes.

In terms of modelling, ECMWF scientist Gabriele Arduini presented progress on a new multi-layer snow scheme being developed at ECMWF.



About 70 people came together from across Europe end of January for the APPLICATE General Assembly at ECMWF (photo: ECMWF, CC BY-NC-ND 4.0).



Thomas Jung, coordinator of APPLICATE and chair of PPP Steering Group opened the General Assembly at ECMWF (photo: ECMWF, CC BY-NC-ND 4.0).

“Our results suggest that a better description of snow physical processes improves the representation of the snowpack in our numerical weather prediction (NWP) models and reduces systematic errors in short-range wintertime forecasts of minimum temperature over the Arctic,” Gabriele Arduini says.

Other topics included atmospheric interactions between the Arctic and the mid-latitudes (Kunhui Ye, Alfred Wegener Institute); improving the representation of sea-ice variability (Eduardo Moreno-Chamarro, Barcelona Supercomputing Center); and the Northern Hemisphere atmospheric response to Arctic summer sea ice loss (Svenya Chripko, CERFACS).

Training Sessions for Early Career Scientists

The last two days of the meeting were dedicated to supporting the work of early career scientists, which is also part of APPLICATE’s objectives. The event was jointly organized by APPLICATE, APECS and ECMWF and involved stimulating lectures on scientific writing by François Massonnet, project management by Luisa Cristini, or the development of case studies by Dragana Bojovic and Marta Terrado. “Training of early career scientists is critical for transferring comprehensive skills to the next generation

of climate scientists. We were delighted to have such high-profile talks from ECMWF including Peter Bauer, Irina Sandu, the Copernicus team led by Jean-Noël Thépaut, and from other APPLICATE partners”, says APPLICATE project manager Luisa Cristini.

11 Second Arctic Science Ministerial Meeting | In playing a critical role for improving polar weather and sea-ice process understanding by enhancing observations and skillful prediction, the Year of Polar Prediction has been highlighted during the second Arctic Science Ministerial meeting.

The Second Arctic Science Ministerial (ASM2) held

on 25 – 26 October 2018, in Berlin, Germany was jointly organized by the European Commission, Finland as the current chair of the Arctic Council, and Germany. During the first day, researchers presented new developments in Arctic research while on day 2, science ministers from 26 nations came together to discuss how to strengthen future international cooperation in the Arctic.

The meeting in particular addressed progress in Arctic research made since the first Arctic Science Ministerial that took place in 2016 in Washington D.C. To enhance and develop collaborative activities, it was emphasized to strengthen, integrate and sustain Arctic observations, to facilitate access to Arctic data, and to share Arctic research infrastructures. Enabling an understanding of the regional and global dynamics of Arctic change is hereby key to assess the vulnerability and to build resilience of the Arctic environments and societies.

The Year of Polar Prediction was highlighted as one of the key projects to improve confidence in better prediction based on a better understanding of the Arctic environment. ASM2 endorsed ongoing and future cooperations to increase the predictive capabilities of Arctic

weather and climate change. As important contributions to YOPP, also the EU APPLICATE project, the Canadian Arctic Prediction System (CAPS) and the International Arctic Systems for Observing the Arctic (IASOA) Observatories were highlighted during ASM2.

The third Arctic Science Ministerial meeting will be held in Japan in 2020, co-hosted by Iceland taking over the Arctic Council chairmanship this year.

12 (Near-) Future of Arctic Shipping

| (by Halldór Jóhannsson, Arctic Portal and the EU Arctic Project Cluster)

Discussions, observations and stakeholder consultations at the Arctic Shipping Summit, Hamburg, in December 2018. The 13th Arctic Shipping Summit was held on 5–6 December in Hamburg, Germany. The summit was attended by about sixty international professionals, from N-America, Europe and Russia representing national coastguards, senior Arctic government officials, shipping companies, harbor officials, Liquefied Natural Gas (LNG) projects, lawyers, Protection and Indemnity Insurance (P&I) Clubs, as well as Arctic researchers and lecturers.

The discussion topics included: the Polar Code; the geo-political landscape; information technology; infrastructure developments; insurance concerns and risks; practicalities of operations; and the training and future of Arctic Shipping. Key issues addressed and questioned by the conference attendees were: safer operations and prevention of negative environmental impacts in the Arctic; the development of new services, products and technologies for safe operations; the need for improved monitoring in the Arctic Ocean; and how to improve cooperation.

As a conference chair, I used my privilege to ask all attendees what their most immediate concerns regarding the above were, and how they predicted the future to be for Arctic Shipping in twenty years from now. The majority stated



Sailing routes across the Arctic (source: Arctic Portal).

that they currently did not see developments supporting increased small to medium business operations in the Arctic, even not in twenty years. A very strong consensus was that there would be caution and likely much less activity in shipping through the Arctic than previously predicted, at least by small to medium commercial shipping operators. The cost, complications and potential risk were simply too high, and the return and advantage too small for them to become interested. The concerns of the stakeholders were a clear lack of infrastructure and information services but more that the business case was not there, or at best, unclear. As domestic shipping, fishing and tourism were however expected to increase, there were raising concerns of limited search and rescue infrastructure and training. The question “Who is responsible for organizing and paying for needed further developments?” was also widely discussed but neither the shipping nor the insurance companies currently saw a clear role here for them to play.

In conclusion, there is a clear and highly important need for ongoing research and improved integrated observations, new information services and infrastructure development in the Arctic region, not least search and rescue services. It is, however, not clear at the moment who should organize and fund the needs expressed during the summit. As shipping in the

Arctic will develop in a global context, it will need to become an international undertaking. Future activities will likely be driven by the largest international companies that can approach the business of Arctic Shipping from a political and global agenda. The Russian Yamal LNG is seen as a case study and an immediate test of the viability of future Arctic Shipping.

13 Renewal of Memorandum of Understanding between WMO and AWI | An extension of the Memorandum of Understanding (MoU) has been signed by the World Meteorological Organization (WMO) and the German Alfred Wegener Institute (AWI). This MoU will ensure continued support of the Year of Polar Prediction (YOPP) by the International Coordination Office until YOPP comes to an end in 2022.

With the MoU, AWI has offered to continue hosting the International Coordination Office (ICO) of the Polar Prediction Project in form of an in-kind contribution. Currently led by Kirstin Werner, the International Coordination Office supports the PPP Steering Group in the planning and implementation of PPP and YOPP priorities and coordinates activities with other WMO programmes and international partner organizations. The renewal of the MoU ensures administrative and organizational support by the ICO until the end of the Year of Polar Prediction in 2022.

14 YOPP-endorsed! – Wisconsin AWS | 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 80 projects, programmes and initiatives already received project endorsement from YOPP.

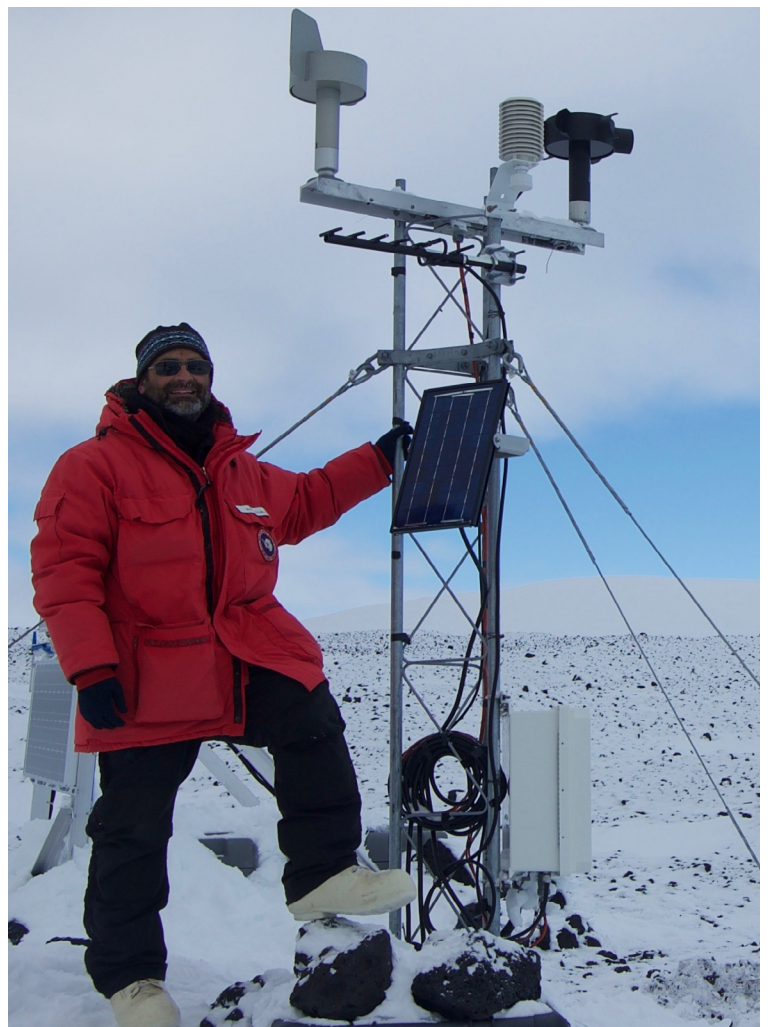
The “Collaborative Research: Antarctic Automatic Weather Station Program 2016-2019”, in short *Wisconsin AWS*, is one of the largest Antarctic meteorological observing networks with more than forty years of observations. The Antarctic Automatic

Weather Station Program is currently coordinated by Matthew A. Lazzara and his team from the Antarctic Meteorological Research Center of the University of Wisconsin-Madison, United States.

Dr. Lazzara, what is the YOPP-endorsed project Wisconsin AWS?

The Wisconsin AWS project is about being able to observe and capture the weather and climate of the Antarctic surface. With so few staffed (manned) stations in Antarctica, and even fewer in the interior, Automatic Weather Stations (AWS) are the way to characterize the meteorology that takes place. For science research problems, weather forecasting, logistics efforts and even educational inquiries, the AWS network provides unique and extremely

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Matthew Lazzara from the Antarctic Meteorological Research Center (AMRC) at the University of Wisconsin–Madison is the Principal Investigator of the YOPP-endorsed Antarctic Automatic Weather Station Program Wisconsin-AWS (photo: Minna Bluff).

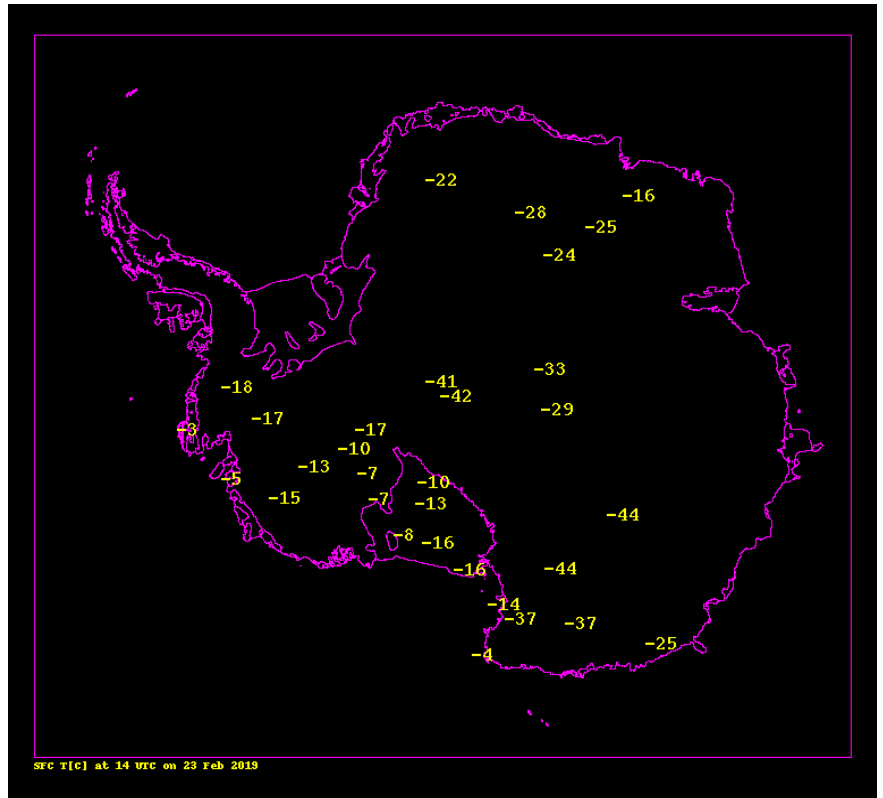
valuable observations to address these questions.

How does Wisconsin AWS contribute to improving weather predictions in the Antarctic?

Observations from the Automatic Weather Stations (AWS) are used in multiple ways to contribute to weather forecasting. First and foremost, weather forecasters are using the observations in their forecasting routine directly. They are looking at the trends, using other empirical methods, etc. with the observations themselves. Second, observations from the AWS are fed into the global modelling systems and other numerical weather prediction systems. They provide one of a series of observations aid in initializing these forecasts. Third, the AWS observations are used to validate forecasts made by forecasters and made by the global and NWP modelling systems. Finally, the observations are used in reanalysis systems (to a very high degree in some cases), and reanalysis (such as ERA-I) have been the backbone of some science investigations in the Antarctic in recent years. The AWS network provides critical “ground truth” for the validation of weather forecasts, satellite observations and confirmation/corroborating information used in a host of sciences beyond weather prediction (e.g., glacial, geological, cryospheric (e.g. sea ice, etc.) research).

What was going on during your recent summer field campaign? Did you yourself go down there?

This past season, I was unable to deploy myself but I did deploy last year at this time. This summer, our team installed some test equipment for a new project that is underway to develop a new electronic core for an AWS. This work is still in progress.



Surface temperatures at locations of the Automatic Weather Stations maintained by the Wisconsin AWS team from 23 February 2019 (source: <https://amrc.ssec.wisc.edu/>).

How do you choose a new location for an Automatic Weather Station?

We determine new AWS locations primarily based on the science research questions we pose (and are funded), and secondarily based on what is logistically possible.

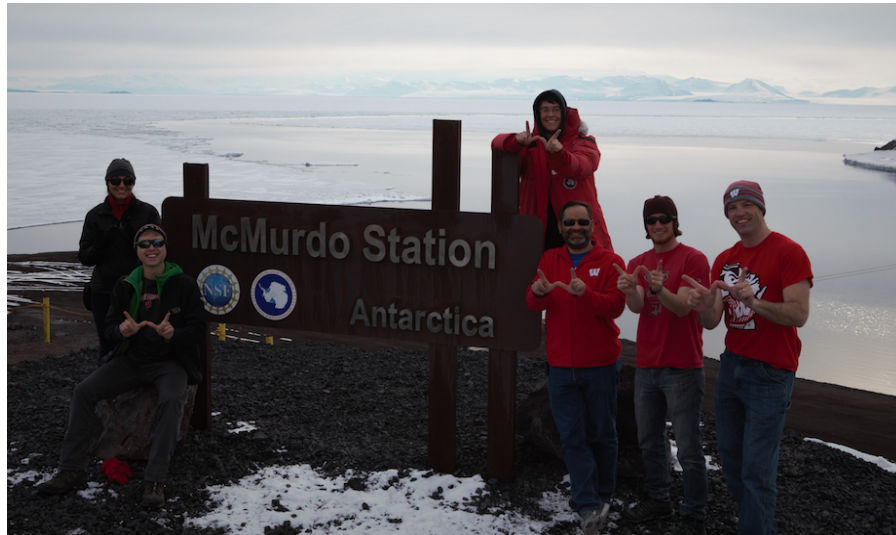
How many AWS are currently in the network? What are the issues when installing a new AWS site?

Currently, we have 57 AWS sites in the Wisconsin AWS network, which is over one-third to one-half of all AWS installed on the Antarctic continent. It’s a huge responsibility, and one that my team and I feel is an honor to work on. When installing a new site, there are lots of different things to consider: its use, how we’ll maintain it, is it going to be installed on snow or ice or rock? Are we going to install it or one of our collaborating groups? Several different questions that we aim to address before going out to do an installation.

Who is in your team, and where do the funds come from?

The Wisconsin AWS team involves two staff

members, two emeritus staff members, and two undergraduate students – and we have collaborators at the University of Colorado at Boulder (my colleague John Cassano and one of his graduate students) – along with myself. It's a small team, and we do a lot. At Madison College, my co-investigators there and I have several undergraduates working with us on our new electronics project, along with the Wisconsin AWS team.



The Wisconsin AWS team currently maintains 57 Automatic Weather Stations in Antarctica (photo: Oliver Chen).

Where to follow the project? What should the polar prediction community keep in mind about Wisconsin AWS?

You can follow our project via our website (<https://amrc.ssec.wisc.edu/>),

especially the “[On the Ice](#)” blog during the field season work. We also have social media that we keep some updates (<https://twitter.com/antmet> and <https://www.facebook.com/AMRCAWS>).

- 16 The funding for the Wisconsin AWS Program and / Madison AWS projects is from the U.S. National
- 20 Science Foundation (NSF) which oversees the U.S. Antarctic Program.

Good project management is key here for planning. Who takes care of the overall planning, and what are important elements and main challenges for the planning of an installation?

In our research group, overall planning is a group effort – everyone contributes different elements. While the funded science is the overarching drive, there are a host of individual elements that go into planning an AWS installation. Everything from considerations about the location (e.g., is it on rock or snow?), to what sensors do we need to get at the science goals, to data processing and quality control, etc. Surface installation conditions are becoming a growing concern (e.g., crevasses). In a budget-restricted environment, there are limits on the availability of logistics to visit, service, repair and maintain our AWS sites. Yet, despite these challenges, we are fortunate to have AWS systems in place, which for the most part, run several years without servicing.

Otherwise, we provide a yearly set of reports including a field season report found on our website as well as a report to the community each year, given at the Workshop on Antarctic Meteorology and Climate (see also #07) and that is also posted on our website.

As for what to keep in mind about the Wisconsin AWS project - it is one of the longest running observing networks on the most data sparse continent in the world.

New Publications

15 Assessing the Impact of Surface and Upper-Air Observations on the Forecast Skill of the ACCESS Numerical Weather Prediction Model over Australia | Synoptic observations account for about sixty per cent of the forecast error reduction, reveals a new evaluation of the impact of observations by the Australian Bureau of Meteorology on the short-term forecast skill provided by the Australian Community Climate and Earth-System Simulator (ACCESS) global numerical weather prediction (NWP) system. With the adjoint perturbation forecast model utilized within the 4D-Var assimilation system, the individual impact of each assimilated observation in a cycling NWP system can be calculated. Results show that synoptic observations account for about sixty percent of the 24-h forecast error reduction, with the remainder accounted for by aircraft, radiosondes, wind profilers, pilot balloons, buoys and ships. In contrast, the largest impact per observation is from buoys and aircraft. Overall, all observation types have a positive impact on the 24-h forecast skill. Such results help to support the decision-making process regarding the evolution of the observing network, particularly at the national level.

Soldatenko, S., Tingwell, C., Steinle, P., Kelly-Gerreyn, B.A. 2018. Assessing the Impact of Surface and Upper-Air Observations on the Forecast Skill of the ACCESS Numerical Weather Prediction Model over Australia. *Atmosphere*, 9, 23. <https://doi.org/10.3390/atmos9010023>

16 Arctic Mission Benefit Analysis: impact of sea ice thickness, freeboard, and snow depth products on sea ice forecast performance | A modelling system for systematic assessment of observations. Assimilation of remote-sensing products of sea-ice thickness into sea ice-ocean models has been shown to improve the quality of sea-ice forecasts. The Arctic Mission Benefit Analysis system was developed to systematically assess the added value of the assimilation of sea ice, snow, and ocean observations on the quality of sea-ice forecasts, applying a novel technique called Quantitative Network Design. In this paper,

authors assess the observation impact of different satellite products in terms of the uncertainty reduction in a four-week forecast of sea-ice volume and snow volume for three regions along the Northern Sea Route in May 2015. The study compares the impact of sea-ice thickness and (lower-level) freeboard products and quantifies the synergies that can be achieved through joint assimilation of snow and sea-ice products. It turns out that even with an uncertainty of 15 cm, the snow product achieves a considerable extra performance gain. The system is designed in a modular form and, thus, suited for extension to additional observational products and forecast quantities.

Kaminski, T., Kauker, F., Toudal Pedersen, L., Voßbeck, M., Haak, H., Niederdrenk, L., Hendricks, S., Ricker, R., Karcher, M., Eicken, H., and Gråbak, O., 2018: Arctic Mission Benefit Analysis: impact of sea ice thickness, freeboard, and snow depth products on sea ice forecast performance. *The Cryosphere*, 12, 2569-2594. <https://doi.org/10.5194/tc-12-2569-2018>

17 Leads and ridges in Arctic sea ice from RGPS data and a new tracking algorithm | A new algorithm can be used to track deformation in sea ice in satellite observations. Arctic sea ice is an aggregate of ice floes with various sizes. The different sizes result from constant deformation of the ice pack. If a floe breaks, open ocean is exposed in a lead. Collision of ice floes forms pressure ridges. In this paper, the authors present algorithms that detect and track these deformation features in satellite observations and model output. The tracked features are used to provide a comprehensive description of localized deformation of sea ice and help to understand its material properties.

Hutter, N., Zampieri, L., Losch, M. 2019. Leads and ridges in Arctic sea ice from RGPS data and a new tracking algorithm. *The Cryosphere* 13, 627-645. <https://doi.org/10.5194/tc-13-627-2019>

18 Upcoming Events

2-5 April 2019

Workshop on Predictability, Dynamics and Applications Research using the TIGGE and S2S ensembles ([more](#))
ECMWF, Reading, UK

8-12 April 2019

PPP Societal and Economic Research and Applications (PPP-SERA) Meeting #05 ([more](#))
Universidad de Magallanes, Punta Arenas, Chile

8-12 April 2019

European Geosciences Union
Session: Climate Variability and Prediction in High Latitudes (CL4.12/AS4.12/CRI.14/OS1.29) ([more](#))
Vienna, Austria

24-26 April 2019

Polar Prediction Workshop ([more](#))
Norman, Oklahoma, USA

18 13-17 May 2019

/ ESA Living Planet Symposium

20 **Session:** A2.09: Retrievals of sea ice properties and processes ([more](#)) Milano, Italy

22-30 May 2019

Arctic Science Summit Week 2019 ([more](#))
Arkhangelsk, Russia

17-19 June 2019

Ninth IICWG workshop on sea-ice modelling, data assimilation and verification ([more](#))
Bremen, Germany

27/28 June 2019

YOPP Southern Hemisphere meeting, in conjunction with Workshop on Antarctic Meteorology and Climate ([more](#))
Charleston, South Carolina, USA

8-18 July 2019

International Union of Geodesy and Geophysics (IUGG) General Assembly ([more](#))
Session: First Results from the Year of Polar Prediction (M02)
Montréal, Canada

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 May/June 2019.

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Advances in Atmospheric Sciences

Special issue:
Antarctic Meteorology and Climate: Past, Present and Future

Call for papers

Lead Editor:

Jiping Liu, *Department of Atmospheric and Environmental Sciences, University at Albany, State University of New York, Albany, NY, USA.*

Guest Editors:

David Bromwich, *Polar Meteorology Group, Byrd Polar and Climate Research Center, The Ohio State University, Columbus, OH, USA.*

Dake Chen, *State Key Laboratory of Satellite Ocean Environment Dynamics, Second Institute of Oceanography, Hangzhou, China.*

Raul R. Cordero, *Departamento de Física, University of Santiago, Santiago, Chile.*

Thomas Jung, *Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany.*

Marilyn Raphael, *Department of Geography, University of California - Los Angeles, Los Angeles, CA, USA.*

John Turner, *British Antarctic Survey, Natural Environment Research Council, Cambridge, UK.*

Qinghua Yang, *School of Atmospheric Sciences, Sun Yat-sen University, Zhuhai, China.*

Scope:

The Antarctic, including the continent of Antarctica and the Southern Ocean, is a critically important part of the Earth system. Scientific research in the Antarctic has always been, and remains, a challenging endeavor. The ongoing effort of the Year of Polar Prediction (YOPP) in the Antarctic provides a stimulus for a focused research effort on Antarctic meteorology and climate, i.e., a special observing period will take place from mid-November 2018 to mid-February 2019, which will have intensified research activities, including enhanced synoptic observations. More comprehensive and precise observations, increased computing power and improving understanding of Antarctic meteorology and climate, suggest that we expect that coupling of the atmosphere, ocean and sea ice in numerical weather prediction will be achieved with sufficient skill as to become operational in coming years. Climate change research in the Antarctic is comparatively neglected compared to that of the Arctic. However, it is clear that climate change is already impacting the Antarctic, such as warming of the Antarctic Peninsula and Antarctic Circumpolar Current, increasing of the overall Antarctic sea ice, and accelerating ice loss from the Antarctic ice shelf/sheet. Studying climate change in the Antarctic is important, which enables us to predict future climate change more accurately and provide information to policy makers.

This special issue will showcase recent and ongoing research progress in 1) Antarctic meteorology and numerical weather prediction and 2) climate variability and change in the Antarctic. The compilation of research papers in this special issue is expected to contribute to a more thorough understanding of issues in Antarctic meteorology and climate in the past, present and future. Submissions in, but not limited to, the following research areas, are invited:

- Antarctic meteorology and numerical weather prediction
- Observations in the Antarctic from various field campaigns and remote sensing
- Explore the ways in which the Antarctic atmosphere (including stratosphere) interacts with the ocean, sea ice, and the global climate system
- Observational evidence of variability and change in Antarctic climate
- Determine possible causes of climate variability and change identified in the Antarctic using observational analysis and climate model simulation
- Past Antarctic climate variability and change at regional and continental scales

Important dates:

Manuscript submission open: March 1, 2019

Manuscript submission deadline: August 31, 2019.

Estimated publication time: January 2020.

Submission URL: <https://mc03.manuscriptcentral.com/aasiap>

Please select: "Special issue: Antarctic"

Please refer to the Author Guide for an MS Word template, Endnote reference style, and more detailed style instructions (<http://159.226.119.58/aas/EN/column/column315.shtml>).

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Do feel free to contact us on aas@mail.iap.ac.cn if you have any queries regarding the special issue.

