
Polar lights over the blue house, the AWIPEV station, in Ny-Ålesund (Photo: Michael Lonardi, Uni Leipzig).


Coloured sky over Ny-Ålesund - the beginning of polar night (Photo: Michael Lonardi, Uni Leipzig).

Transregional Collaborative Research Center on Arctic Amplification

(AC)^3 Newsletter

December 2021
12th Issue

EDITORIAL

Dear (AC)^3 Newsletter Followers,

We are approaching the middle of phase II of (AC)^3, time is flying so fast. So, this is a good moment to look back and evaluate what we have achieved so far since the establishment of the (AC)^3 project in 2016. We did so during the successful 3rd (AC)^3 Science Conference on Arctic Amplification that luckily took place as a face-to-face meeting in Potsdam in October this year. This issue of the (AC)^3 Newsletter contains a brief summary of the Conference. In addition we are just before submitting a comprehensive (AC)^3 overview paper.

As usual, in this issue there are also some reports on exciting observational and modelling activities within (AC)^{3}during the last six months, introductions of new (AC)^3 fellows, and a summary of a recent highlight paper from (AC)^3.

On the other hand, now is also time to look forward and to plan what we still hope to achieve until the end of phase II. As an example, we are in the hot phase preparing the HALO-(AC)^3 campaign in March/April 2022, let's keep fingers crossed that we succeed with it! And we already begin with the preparations for the proposal for phase III during the next six months.

Have fun reading this issue of the (AC)^3 Newsletter! And enjoy some relaxing days during the Christmas holidays. All the best to all of us during 2022!

With kind regards from Leipzig,
Manfred, Marlen, and Simone.

TOPICS IN THIS ISSUE

3RD (AC)³ SCIENCE CONFERENCE ON ARCTIC AMPLIFICATION

by Marlen Brückner

We were so happy and relieved that we were finally able to perform our 3rd (AC)³ Science Conference on Arctic Amplification in Potsdam on 25 – 27 October 2021. With the Seminaris SeeHotel in Potsdam we found a really nice location at the Templiner Lake surrounded by autumn colored forests.

After more than half a year of planning and hoping that the conference could actually take place as a meeting in person, everyone was excited to see other people from the (AC)³ crowd and to talk to them. For many of us it was actually the first big meeting in presence for almost two years. It sounds a little strange, but we all gathered our PhD students and postdocs in phase II for the first time in real life. Often it is the little things that you notice, like "Oh, you are taller in real life than I could have imagined in online meetings!". But exactly these interpersonal encounters are exactly what we have so sorely missed.

Fig. 1: Impressions from the plenary room and the poster sessions in the hotel lobby (Photos: Marlen Brückner).

We have put together an interesting conference program and, in addition to our 7 international Scientific Advisory Board members, we also invited other high-level international experts in the field of Arctic research. In three scientific sessions on Aerosols & Clouds, Sea Ice, and Large Scale Dynamics we heard not only the keynote talks from the experts but also talks from our PhD students. In our four crosscutting activity breakout groups we discussed joint projects and in the evening we saw an exciting slideshow from Esther Horvath about the MOSAiC expedition. The two poster sessions on the second day gave everyone plenty of time to present their work and, above all, to discuss it directly in front of the poster. This kind of feedback and collaboration just cannot be done virtually with the same intensity. So it wasn't particularly surprising that after the conference many were very exhausted and hoarse from speaking out loud. In Corona times you tend to forget how stressful a conference can be. Nonetheless, each of us drove back home with a with new impetus of motivation and input.

Thanks to all for this great conference!

Fig. 2: Conference group photo of all participants in front of Templiner See (Photo: Marcus Klingebiel).

News from the field

A FLYING BELUGA? WHAT'S HAPPENING IN NY-ÅLESUND?

by Elisa Akansu (PhD student in A02 at TROPOS)

In mid-September, $(AC)^3$ scientists packed their warm clothes, left their sunny home and travelled to the Arctic. The destination was Ny-Ålesund at Svalbard and the objective was to start the first two-month measurement period with the tethered balloon system BELUGA. Yes, it's not a whale, it's a 90 m^3 helium-filled balloon - and it flies. BELUGA is capable of lifting about 20 kg of meteorological instruments, and the targets are clouds, aerosols, radiation, and turbulence.

The first group of "balloonies" (this is what the AWIPEV team called the BELUGA group) set up the container, that served as a base, the winch and pulley and prepared everything to get started with profiling the Arctic atmospheric boundary layer. The first weeks were already successful and low wind speeds allowed many balloon measurement days. To be prepared for the upcoming polar night, measurements were also carried out at night.

After three weeks, the first change of the team took place. Motivated and full of excitement, I left for Svalbard at the beginning of October for the handover and to continue working together with my colleagues from LIM and TROPOS.

And not only balloon-borne measurements were performed, but instruments were also set up at the old pier and on Mount Zeppelin to collect fog, cloud water, aerosol particles, rain, and snow. Additionally, samples of the sea surface microlayer (SML), the uppermost layer of the oceanic water column, were collected, for which we went out on the fjord in a small motorboat. Besides our measurement activities, we met another $(AC)^3$ team that was in Ny-Ålesund at the same time to set up a radar and to install a snow camera.

Fig. 3: Top: Balloon measurement site in Ny-Ålesund. Bottom: Preparation for balloon operations in the morning (Photos: Elisa Akansu, TROPOS).

MEET THE $(AC)^3$ FELLOWS

Hello everyone,

my name is Hannah Niehaus. I recieved a bachelor and a master degree in physics at RWTH Aachen University. During my master studies I got some insight into industry oriented work in the subject area of laser physics. Afterwards I decided for a turnaround and shifted to environmental physics and climate research.

I have always been fascinated by weather phenomena and harsh, remote regions. When I got the opportunity to put my brain work into the investigation of the Arctic, I did not hesitate for long. In autumn 2020 I joined the $(AC)^3$ community as a PhD candidate at the University of Bremen in the working group "Satellite Remote Sensing" of Gunnar Spreen. Since then I am working on an improved retrieval of melt ponds and surface albedo from satellite measurements on an Arctic-wide scale. This will contribute to the analysis of the surface processes and the energy budget in the Arctic summer.

News from the field

A FLYING BELUGA? WHAT'S HAPPENING IN NY-ÅLESUND?

(continued)

While I still arrived in daylight, the days became noticeably shorter and soon, the direct sun was only shining on the other side of the fjord. Fortunately, I was once able to join a boat trip to the other shore and enjoy the last rays of sun on my face, just in time before the dark season set in.

On the 25th of October, the polar night officially began and with it a time of breathtaking beauty and colour in the sky. Twilight lasted all day, and the moon wandered along the horizon. After long days of measuring, we could often enjoy polar lights – that makes you forget the cold very quickly. And the wildlife of Svalbard was very impressive. We saw reindeer, polar foxes, ptarmigans, and seals – but fortunately (or unfortunately?) no polar bears.

Fig. 4: BELUGA with scientific payload ready to measure (Photo: Elisa Akansu, TROPOS).

Towards the end of this campaign, there was only a maximum of one hour of twilight per day. During snowstorms, it was dark all day long. This meant that we all adapted our habits: wearing reflective vests and headlamps became the new normal. Even snow shovelling was occasionally on the agenda before BELUGA could be taken out of the hangar. And when the temperatures dropped down to -20°C, the tea in the cups froze pretty quickly at the container site. But we were creative to keep ourselves as warm as possible.

That's polar night in the Arctic.

More to come soon – stay tuned for the second measurement period in March-May 2022!

News from the modelers

MODELLING MARINE PRIMARY ORGANIC AEROSOL

by Anisbel Leon (PhD student in D02 at TROPOS)

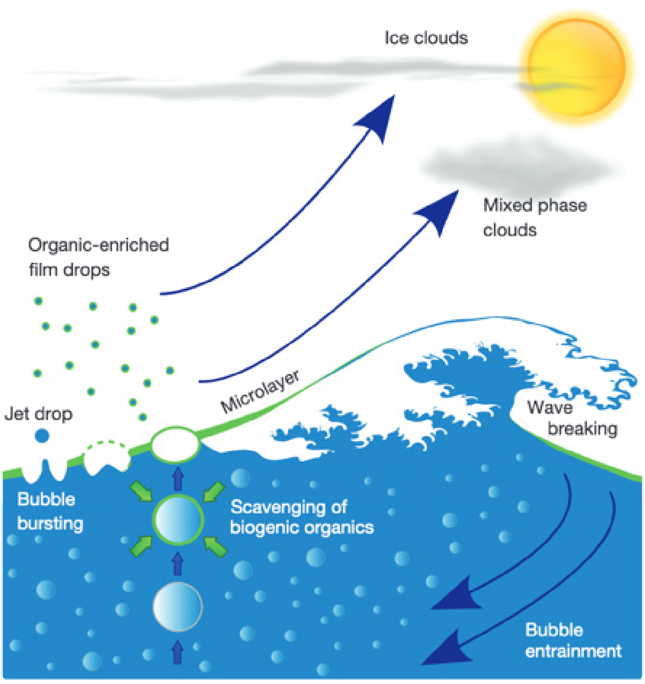


Fig. 5: Marine organic aerosol emission.

Marine organic aerosol (MOA) is a major contributor to cloud condensation nuclei (CCN) and ice nucleating particles (INP) over pristine open-ocean and coastal regions that facilitate the formation of cloud droplets and ice in clouds. In the Arctic, the summer-time loss of sea ice together with the rapid ice retreat are key factors for potentially increased marine aerosol emissions, having a major impact on mixed-cloud formation, radiation, precipitation and atmospheric dynamics.

In our planned studies with the aerosol-climate numerical model ICON-A-HAM, we want to investigate the influence of primary marine organic aerosol on the Arctic climate and its rapid warming. Marine primary organic aerosols are emitted when bubbles bursting scavenges surface-active organic matter and other materials (Fig. 5). These aerosols could act as CCN and INP having a major impact on mixed phase clouds. Results from the ship-based campaign PASCAL in the European Arctic found indications that at warmer air temperatures (> –15 °C) biogenic INP of marine origin locally emitted are dominating.

News from the modelers

MODELLING MARINE PRIMARY ORGANIC AEROSOL

(continued)

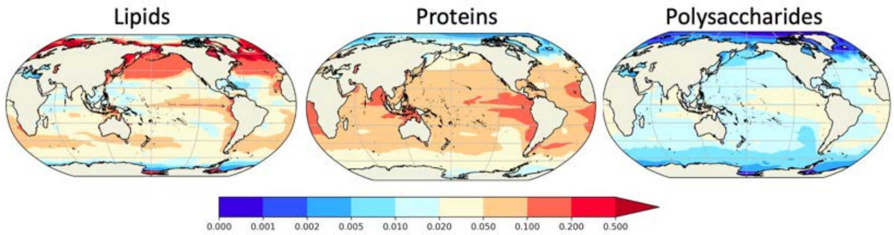


Fig. 6: Submicron sea spray aerosols organic mass fraction (OMF).

The model development focuses on the implementation of a detailed, species-resolved ocean emission scheme (OCEANFILMS), where marine organic matter is partitioned into five classes with differing physical and chemical parameters (polysaccharides, proteins, lipids, humics, processed compounds).

The fraction of organic matter found in aerosols is shown in Fig. 6.

While lipids compounds contribute the majority in regions of high productivity corresponding to blooms periods, in less-productive waters and late blooms periods, organic mass is primarily contributed by proteins and polysaccharides (Fig. 6).

The new emission scheme has been applied in ICON-A-HAM (Fig. 7). We are currently working towards including the marine organic aerosol's life cycle and interactions with mixed-phase Arctic clouds. Detailed model evaluation with observations will be made to explore the ability of the atmospheric model to represent these natural processes.

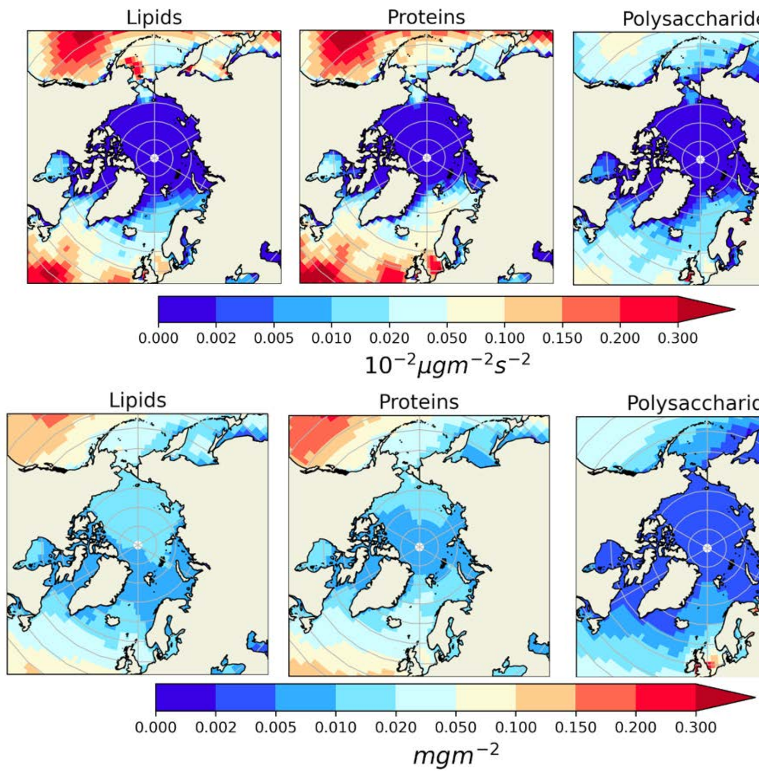


Fig. 7: Accumulated emission mass flux and atmospheric burden (November). First model simulation results for the Arctic region.

MEET THE $(AC)^3$ FELLOWS

Hi everyone,

my name is Imke and in September I started my PhD as part of the B03 project of $(AC)^3$ at the University of Cologne.

During my Bachelor and Master studies in Meteorology at the University of Hamburg, I investigated clouds and surface heat fluxes in the Subtropics. For my Master thesis, I participated in the EUREC4A field campaign and was onboard of the research vessel Meteor. I really enjoyed this experience. Nevertheless, I decided to change my field of research for my PhD, because the Arctic region has fascinated me since childhood.

I am happy to be part of the $(AC)^3$ community and to have the opportunity to analyze airborne remote sensing observations from Arctic mixed phase clouds. The aim of my study is to characterize these clouds and understand their variability. In doing so, I mainly use airborne radar and lidar observations taken during ACLOUD, AFLUX, MOSAiC-ACA and during the upcoming HALO-$(AC)^3$ campaign.

I really look forward to analyzing the already conducted data sets and to attending the HALO-$(AC)^3$ campaign in Svalbard next year!

News from the field

EXCITEMENT IN NY-ÅLESUND

by Tracy Kiszler (PhD student in E03 at Uni Cologne)

End of September a crew of $(AC)^3$ (B08, E02, E03) members set off on a three weeks trip to Ny-Ålesund (Svalbard). We were four people from the University of Cologne and one person from the University Leipzig, on a quest to build up two instruments. These instruments were a K-band cloud radar and the so-called VISSS (Video In-Situ Snowfall Sensor).

Except for a demolished aeroplane that couldn't take off, which led to some delays, our journey there went smoothly. After the safety course on the first day, where we learned how to defend ourselves against polar bears, the waiting for the ship with the instruments began. Larger objects are generally transported by ship to Ny-Ålesund and from the beginning on the question was if the instruments would arrive in time and intact. Luckily they did arrive two days later and the building up could start. To set up the radar a large crane was necessary and with lots of skill, the crane operator managed to neatly position the new radar on the roof of the observatory. It must be added that the roof had already been quite packed so there was not much space left to set up such a bulky instrument that should even be able to rotate.

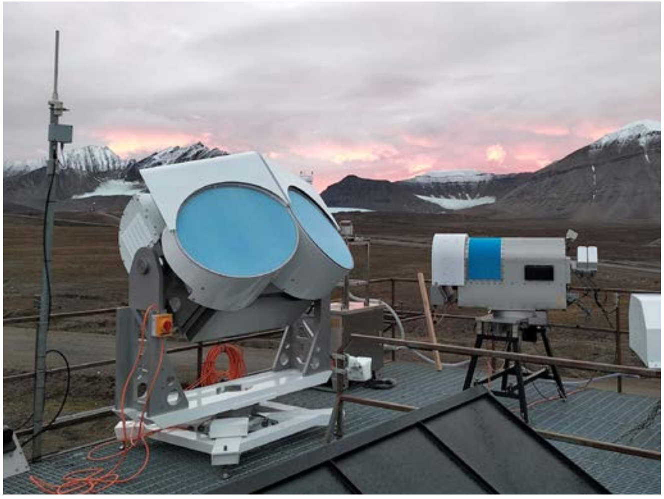


Fig. 6: The new K-band radar (front) and the Microwave radiometer (back) on the roof of the observatory.

Tab. 1: From left to right: Rosa Gierens, Giovanni Chellini, Theresa Kiszler, Nina Maherndl & Stefan Kneifel

The VISSS project took place on the ground and with support from the always helpful and witty Willi, a technical assistant at the AWIPEV station, began to take shape. Of course, some things did not work out as planned and it took more time and nerves than expected. But finally, the frame of the VISSS was set up, cables layed out, the cameras mounted and the instrument was ready for the first snowflakes that followed the call of gravity.

When we were not busy with the instruments and other tasks, we were also able to spend some time enjoying the social life of Ny-Ålesund, the gym and nature. Sadly we were confronted with the impact of human activities even in this remote location as we saw a reindeer with a large net entangled in its antlers and around its head during a hike. Generally, though, we had an interesting stay with fun and horizon broadening activities, where we met lots of people who make our science up there possible. At this point we want to thank the staff of the AWIPEV station as well as the kitchen and logistics staff who made our trip work out.

Fig. 7: The VISSS standing on the measurement field with Mt. Zeppelin in the back.

(AC)³ NEWS

Mercator Matthew Shupe just finished his first 3 month stay at the LIM institute in Leipzig. Next year he will join us again and will also be part of the HALO-(AC)³ campaign. Looking forward to that!

Stay informed: if you want to receive this newsletter regularly, you can subscribe online at http://ac3-tr.de

Fragen zum Klimawandel - (AC)3-Wissenschaftler/innen antworten.

WARUM ERWÄRMT SICH DIE ARKTIS STÄRKER ALS DER REST DER ERDE?

In den letzten Jahrzehnten hat sich die globale Durchschnittstemperatur der erdnahen Atmosphäre um etwa 1°C erhöht*. Einen Großteil der Erderwärmung verursacht der Mensch durch seinen stark angestiegenen CO2-Ausstoß.

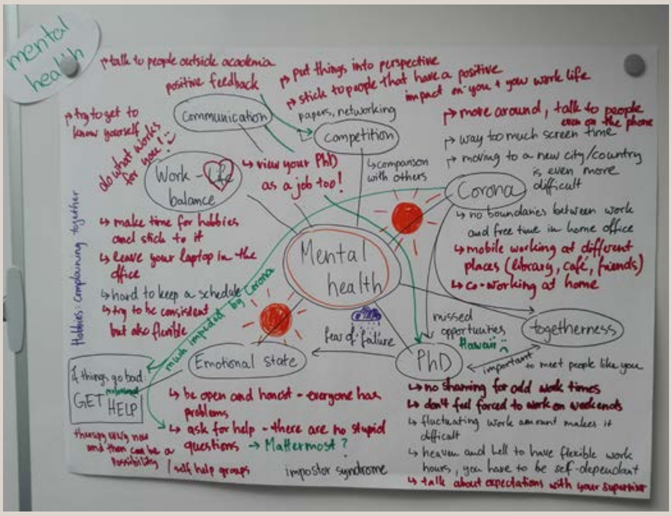
Check out our first Fact Sheet on interesting aspects on Arctic Amplification on http://www.ac3-tr.de/outreach/fact-sheets/ . (AC)³ scientists explain key facts in an easy and comprehensive language to intersted adults illustrated by drawings from Kerstin Heymach.

PhD News

PHD RETREAT IN POTSDAM

by Janna Rückert, PhD representative & student in B05 at Uni Bremen

After three exciting conference days full of talks and poster sessions, the time in Potsdam was not over yet for us PhDs! We stayed for one more day to seize the chance for a face-to-face exchange, including a pub quiz (congratulations to the team "tropical polar bears"!) and an open space in the "Bildungsforum Potsdam". We discussed different topics around our PhD life such as networking and collaborations as well as atmospheric modelling, but also possible workshops, sustainable research and mental health. The output of the discussions was documented on posters and we will follow-up on some of the ideas in the following months!



MEET THE (AC)³ FELLOWS

Hi everyone,

My name is Lars and I'm working in project D03 at the AWI Potsdam. I made the first steps of my academic career in Kiel, where I studied physics of the earthsystem and enjoyed lying on the beach after and between lectures. During this time, I also got in contact with polar research for the first time, since I was investigating sea ice variability in my bachelor thesis. Even though I was really fascinated by this topic, I decided to move back to Hamburg – the place I grew up – for my master studies and to focus on meteorology. However, I never really forgot about sea ice and the Arctic.

Therefore, I was happy that the second phase of (AC)³ started just around the time when I was looking for a PhD position, which made it possible for me to return to this interesting topic. In my PhD project I'm investigating interaction processes between sea ice and the atmosphere with a special focus on cyclone events in the Arctic. I finished the first year of my PhD by now and I am still fascinated by this topic. Based on this, I look forward to the next two years with all of you!

ACKNOWLEDGEMENTS

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DFG Deutsche Forschungsgemeinschaft

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(AC)³ Publications

A SYSTEMATIC ASSESSMENT OF WATER VAPOR PRODUCTS IN THE ARCTIC: FROM INSTANTANEOUS MEASUREMENTS TO MONTHLY MEANS

Abstract

Water vapor is an important component in the water and energy cycle of the Arctic. Especially in light of Arctic amplification, changes in water vapor are of high interest but are difficult to observe due to the data sparsity of the region. The ACLOUD/PASCAL campaigns performed in May/June 2017 in the Arctic North Atlantic sector offers the opportunity to investigate the quality of various satellite and reanalysis products. Compared to reference measurements at R/V Polarstern frozen into the ice (around 82°N, 10°E) and at Ny-Ålesund, the integrated water vapor (IWV) from Infrared Atmospheric Sounding Interferometer (IASI) L2PPFv6 shows the best performance among all satellite products. Using all radiosonde stations within the region indicates some differences that might relate to different radiosonde types used. Atmospheric river events can cause rapid IWV changes by more than a factor of 2 in the Arctic. Despite the relatively dense sampling by polar-orbiting satellites, daily means can deviate by up to 50 % due to strong spatio-temporal IWV variability. For monthly mean values, this weather-induced variability cancels out, but systematic differences dominate, which particularly appear over different surface types, e.g., ocean and sea ice. In the data-sparse central Arctic north of 84°N, strong differences of 30 % in IWV monthly means between satellite products occur in the month of June, which likely result from the difficulties in considering the complex and changing surface characteristics of the melting ice within the retrieval algorithms. There is hope that the detailed surface characterization performed as part of the recently finished Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) will foster the improvement of future retrieval algorithms.

Crewell, S., **Ebell, K.**, Konjari, P., **Mech, M.**, **Nomokonova, T.**, **Radovan, A.**, Strack, D., **Triana-Gómez, A. M.**, Noël, S., Scarlat, R., **Spreen, G.**, **Maturilli, M.**, **Rinke, A.**, **Gorodetskaya, I.**, Viceto, C., August, T., and Schröder, M.: A systematic assessment of water vapor products in the Arctic: from instantaneous measurements to monthly means, *Atmos. Meas. Tech.*, **14**, 4829–4856, https://doi.org/10.5194/amt-14-4829-2021, 2021.

(AC)³ PROJECT PARTNERS

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