



Sunset view from Maria S. Merian (Photo: Wiebke Körtke, Uni Bremen).



Sea ice conditions during MSM93 (Photo: Wiebke Körtke, Uni Bremen).

Transregional Collaborative Research Center on Arctic Amplification

(AC)³ Newsletter

EDITORIAL

Dear (AC)³ Newsletter Followers,

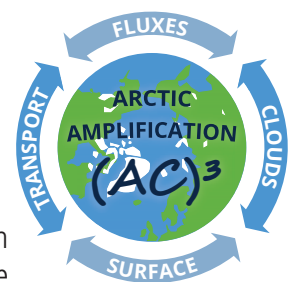
this is the 2021 summer edition of our biannual (AC)³ Newsletter. As usual, we have compiled some facts and news who hopefully might be of interest to you. We present major events from the last half year, introduce new fellows joining the project, and report on outreach activities and publications from our project.

A major challenge was to organize and perform the spring General Assembly of (AC)³. That required a lot of flexible skills and efforts in preparing the event. In the middle of the Corona pandemic we had no other choice than to organize the General Assembly in an online format. It sounds strange, but actually the online format went very well. The chosen online tool turned out to be quite useful. It was technically reliable, and allowed close communication in scientific regards and also on a personal level. We had nice discussions and interactions. However, the desperate desire to meet in person is undisputed, of course, and so we urgently long for the next major (AC)³ event, the 3rd (AC)³ Scientific Conference on Arctic Amplification in fall, which we truly hope will be held in the form of a face-to-face meeting in Potsdam. Let's keep fingers crossed, that we will be able to meet in person for this meeting, it would be so good for all of us!

Another major activity, which is reported in this issue of the Newsletter is a cruise with the research vessel Maria S. Merian, in the middle of the pandemic! This is an important achievement! We need to keep the ball rolling in our project in spite of all the challenges posed by the virus! In the same line, we would like to mention the Dry Run for the HALO-(AC)³ measurement campaign coming up in March/April 2022. We had to find an appropriate way to perform this Dry Run in an online format, and again it worked quite well. The HALO-(AC)³ campaign is, beside MOSAiC, one of the very important observational activities planned during the current second phase of our project. Let's hope the very best that we can successfully perform it next year.

We would like to also highlight one of our latest outreach activity: we have launched: "Mias Klimatagebuch"! We have already 100 followers on Twitter. Please think of how you may contribute, it is so important to catch already the youngest of potential new Arctic scientists.

Enjoy reading our Newsletter!
With kind regards from Leipzig,
Manfred, Marlen, and Simone.



July 2021
11th Issue

TOPICS IN THIS ISSUE

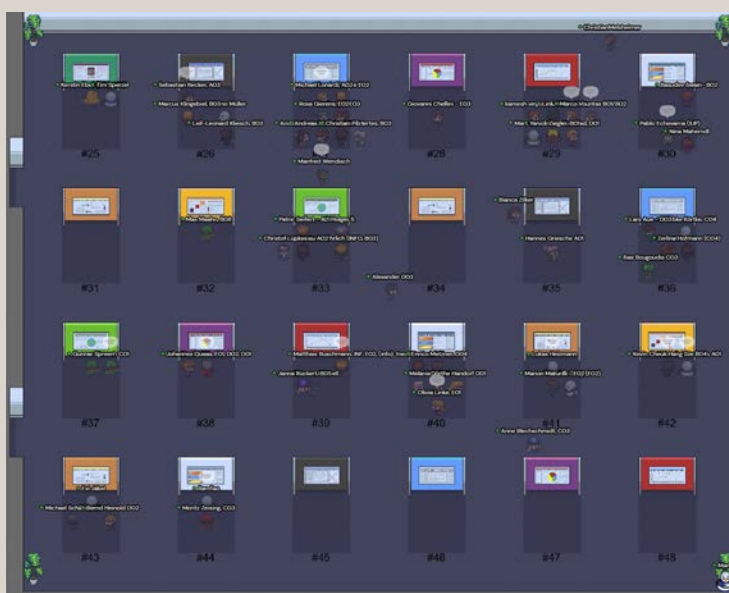
- Editorial
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MEETING REPORT

(AC)³ GENERAL ASSEMBLY AT VIRTUAL BEACH

by Marlen Brückner

Challenging times requires creative and innovative tools. The ongoing pandemic forces us and the rest of the world also in the year 2021 to communicate mostly online. Therefore, we were looking on the continuously growing online market for a suitable format or platform for our biannual General Assembly (GA) in March 2021. It's not so easy to find the "right" tool for our needs in the variety of products and solutions. After an intensive research we were glad to find the online platform Gather.town (<https://gather.town/>) This online conference tool offers numerous graphic possibilities to recreate your own conference room, poster sessions and meeting locations virtually. Namely, in the style of a 90ies video game.



If you interact online with another person, often the flexibility of a face-to-face communication is missing. In real life, people would form smaller groups, sometimes only one is talking, or they are talking at the same time. By facing towards a certain person or using spatial distance we are able to concentrate on individual persons or talks even if the surrounding noise is loud. The special feature of the web interface is the reconstructed interaction within the space: Using a small avatar you could move easily within the room and navigate towards or away from a person. Only when a certain distance is given, a small video chat window opens and you can see and talk to the other person. Accordingly, the window is closing when you move away from the other. In this way, new and flexible conversation groups could evolve.

We created an (AC)³ beach location for the second day of our GA including separate rooms for poster sessions

and breakout rooms. And in fact, it almost feels like a normal face-to-face meeting. Especially for our "new" second-phase members like Phd students or postdocs, who didn't even have the chance to meet others beside scientific talks during coffee breaks, it was extremely helpful to get to know each other. During the morning and afternoon poster session we had very good discussions and exchange between projects that matched any real life experience. With almost 50 different posters, members had the chance to present themselves, their work and plans within the project.

We actually had a lot of fun with this kind of a virtual meeting. And at the end of the meeting everybody folds up their laptops with the feeling of being a part of this project. Nevertheless, we are really looking forward to finally meeting each other in person during our planned (AC)³ Science Conference in October. We are keeping our fingers crossed!

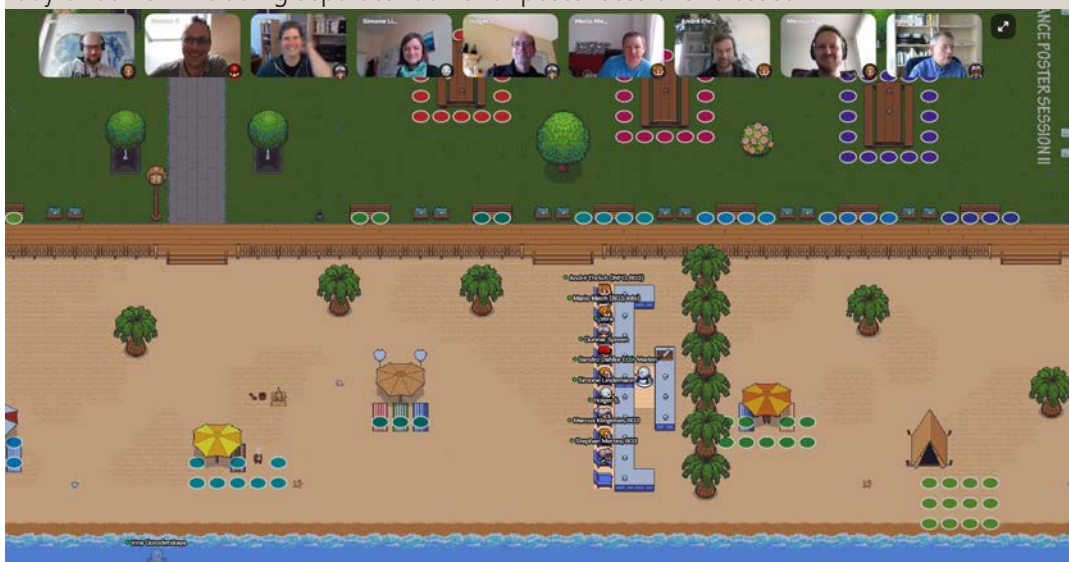


Fig. 1 (top): Poster session during (AC)³ GA (platform: <https://gather.town/>).

Fig. 2 (bottom): Impressions from the meeting venue - the (AC)³ beach, including room for private conversations, discussions and new ideas (platform: <https://gather.town/>).

MSM93 - TRAVELING NORTH TO THE ICE IN THE MIDDLE OF SUMMER

by Wiebke Körtko (PhD student in C04 at Uni Bremen) & Astrid Bracher (PI in C03 at AWI Bremerhaven)

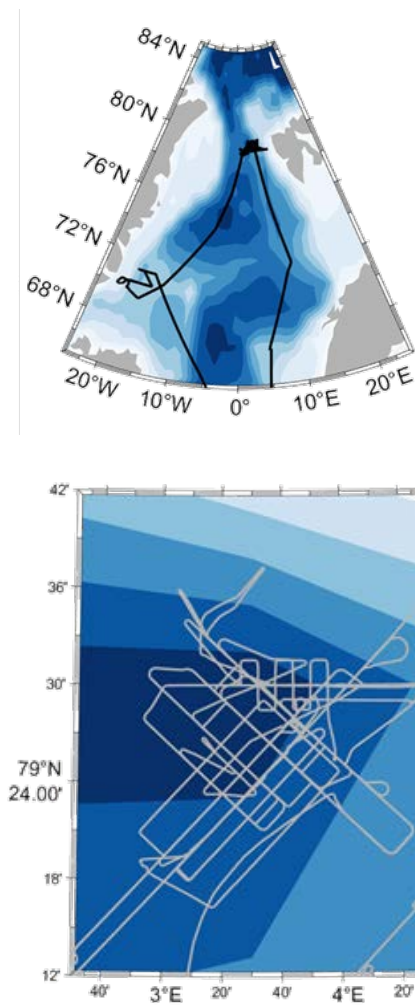


Fig. 3: Cruise track (top) and region of the front study (bottom).

Will our cruise take place? This was probably the most important (non-scientific) question of the cruise with the research vessel Maria S. Merian in early summer 2020. Planning and participating in a cruise during Covid times brought some changes in the name of the cruise, the participant list, and the departure time. But we were lucky! After a few days in a hotel quarantine and only negative Covid test results, we entered Maria S. Merian in Emden in the end of June 2020. Two (AC)³ PhD students for C04 and one scientist supporting C03 with optical sampling were on board, traveling north to Fram Strait, the area between Greenland and Svalbard. Due to Covid, just one person per cabin was allowed, reducing the number of scientists to thirteen. The aim of the cruise was to explore submesoscale processes in Fram Strait. This included a process study as well as the support of long-term observations in Fram Strait and, at least in planning, the recovery of moorings in East Greenland.

After six days of transit (with some sea sickness), we reached our working area, the Fram Strait. The first days were dedicated to equipment tests and doing a CTD (conductivity-temperature-depth measurement) transect across the West Spitsbergen Current. At the same time, the support of the long-term observations was carried out. Five moorings were recovered and four new moorings were deployed, so that the monitoring of warm Atlantic water flowing into the Arctic Ocean can be continued. The following days, we were close to the ice edge and an in-situ camera transect was occupied. This was followed by three repetitions of a 100 km long transect with the Triaxus towed system. The Triaxus is an impressive system, which is towed behind the ship and can be kept in a constant depth or undulate, e.g. between the surface and a certain depth. On this system, different sensors (physical, biogeochemical, biooptical) are placed, thus gaining highly resolved data. The weather kept changing between really sunny with a nice view on the spiky mountains of Spitzbergen and the typical Fram Strait weather with lots of fog (naturally during the time we wanted to observe the sea ice from the bridge).

MEET THE (AC)³ FELLOWS

Hi everyone,

my name is Nina Maherndl and I just started my PhD at the Leipzig Institute for Meteorology (LIM) in the B08 project. I am from Bad Ischl, a small town in upper Austria and moved to Vienna to study Physics at the University of Vienna. There, I did both my BSc and MSc with a focus on aerosol physics and discovered my interest in atmospheric physics and clouds. Last Summer, I spent two weeks as an intern at the Sonnblick Observatory, a (meteorological) measurement and research station located at an altitude of 3106 m in the Austrian alps.

Within (AC)³, I am working on characterising the spatial variability of ice water content in and below mixed-phase clouds. We will use airborne in-situ and remote sensing data collected during the ALOUD and the upcoming HALO-(AC)³ campaign, which I am looking forward to participating in. My first steps include a lot of reading (of course) as well as combining ALOUD in situ probe data sets to create best-estimate particle size distributions for liquid and frozen cloud particles.



MSM93 - TRAVELING NORTH TO THE ICE IN THE MIDDLE OF SUMMER

(continued)

Along the 100 km transect, we identified a region of extremely strong horizontal gradients – exactly what we were looking and hoping for: a front. Fronts are boundaries between different water masses, in our case the boundary between warm, salty Atlantic water and cold, fresh Polar water. We sampled this front extensively for one week to map the front's complete spatial structure and its development over time. Within this week, we towed the Triaxus as well as an underway CTD to get highly resolved hydrographic data. During the entire ship transect, optical properties of the surface water were measured from a direct seawater supply. The ocean currents were continuously measured with the vessel mounted ADCP (Acoustic Doppler Current Profiler). During day-time, station work was carried out: Profiles were done with the CTD-rosette, the in-situ camera, and a light optical package. Water was sampled from the CTD-rosette, the marine snow catcher, and the ship's sea water intake for different analysis like trace gases (CFCs, noble gases, tritium), nutrient concentrations, primary production, or phytoplankton concentrations. To be able to see the front's movement, we deployed surface drifters following the currents. Drifting sediment traps were also deployed and recovered after 24 hours. The subduction line (the point at which the Polar water goes under the Atlantic water) could also be

seen on the ship's radar and at the water surface.

After this intense observation of the front in Fram Strait, we started our way towards East Greenland to recover some moorings in and in front of Scoresby Sund (the world's longest and possibly most beautiful fjord). Unfortunately, a storm pushed thick multi-year sea ice in the entrance of the fjord. We tried to enter, but the ice was too thick for Maria S. Merian, which can operate in (medium thick) ice but is not an icebreaker. As for sight-seeing, this was a quite nice time. We even saw a polar bear with her two cubs, as well as several seals, birds and even some (blows of) whales. But since we were up in the north to do some science, we went back to the ice shelf and did two transects across the East Greenland Current. We returned to the ice edge several times to check, whether the ice conditions had improved, but we were not able to enter the fjord and thus the recovery of moorings could not take place.

We started our transit back home and ended the scientific program with one last deep station in the international waters east of Iceland. After some more sea sickness we were back in Emden in the end of July – with lots of samples, data, and nice memories.



Fig. 4: Optical instrumentation used during MSM93 to hyperspectrally measure the absorption, attenuation and radiation of underwater light with active and passive instrumentation: At the discrete stations with the optical package (upper two right panels), towed behind the ship mounted on the Triaxus (lower left panel) and permanently during the entire expedition with an instrument operated with surface water pumped via a flow-through setup in the ship's laboratory (lower right figure). Photos from Julia Oelker IUP & AWI, and Tim Kalvelage.

The continuously obtained data from the surface waters and the data obtained along the Triaxus transects on the optical properties, are used to derive the abundance and composition of phytoplankton and its degradation products. These data complement the AWI's group field data, sampled since 2015 in this region and are key for evaluating the coupled ocean biogeo-chemical model FE-SOM2-REcoM2 within the PhD project in C03. Within (AC)³ this model is further developed to simulate realistic aerosol precursors in the Arctic Ocean; the Fram Strait region serves as a hot spot area for assessment of the model. In this area, additional aerosol precursor data are available from the cooperation partners TROPOS (project B04) and GEOMAR (cooperation within PEBCAO: <https://www.awi.de/forschung/biowissenschaften/polare-biologische-ozeanographie/arbeitsgruppen/planktonoekologie-und-sedimentation-im-arktischen-ozean/pebcao.html>).

News from the field

MSM93 - TRAVELING NORTH TO THE ICE IN THE MIDDLE OF SUMMER

(continued)

This cruise will be the basis for the studies of both PhD students in C04. In one study, the hydrographic data will be analysed to understand the frontal system and its development in time and space. After a first look at the data, they seem to be very interesting and helpful to understand a frontal system. Further analysis is planned on the frontal evolution, effects on the mixed layer, and some front statistics. In the other study, the trace gas data will be used to identify different exchange processes at the two sides of the front. The Fram Strait trace gases then might be compared to data sampled during the MOSAiC campaign and help to understand the changing processes in an atlantifying Arctic Ocean.

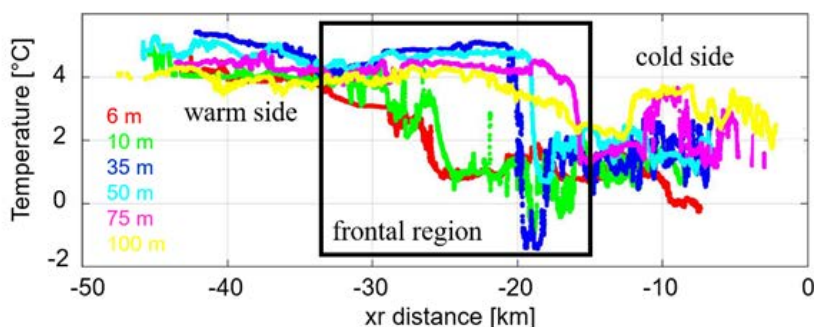


Fig. 5: Temperature measurements along a transect with the towed Triaxus system in different depths. The strong temperature decrease shows the frontal region between the warm and cold side (Zerlina Hofmann).

News from the campaign preparation

WEATHER OBSERVATIONS DURING HALO-(AC)³ DRY RUN

by Sebastian Becker (PhD student in A03 at Uni Leipzig) & Johannes Röttenbacher (PhD student in HALO project)

In spring 2021, the HALO-(AC)³ campaign was planned to be conducted with three research aircraft (HALO, based at Kiruna, Sweden, and Polar 5 and Polar 6 based at Longyearbyen, Svalbard) in the Arctic. However, due to the pandemic, the campaign had to be postponed to spring 2022. The shift opened up the opportunity for an intensive dry run performed between 22 - 26 March to practice the coordination of the flights and test the communication. In the scope of the dry run, a group of PhD students observed the weather for the originally planned six-weeks period of the campaign (8 March to 18 April) in order to get a feeling for common weather situations.

The main goal of the HALO-(AC)³ campaign is to study the evolution of cold air outbreaks (CAO) and warm air intrusions (WAI). Thus, the weather observations focused on such events. Table 1 summarizes the occurrence of CAO and WAI events during the six-weeks period together with an assessment of the flying conditions for the Polar aircraft. Strong CAO frequently occurred during the observations and were quite persistent (especially from 3 to 11 March).

MEET THE (AC)³ FELLOWS

Hi, my name is Andreas Walbröl, I have been a passionate meteorologist since I was 6 years old. At the University of Cologne I have accomplished both BSc. and MSc. meteorology programs. This was my University of choice because it gave me the opportunity to get some insights into Geophysics as well, which I also find interesting.

Since I have always loved the cold and harsh environments of Scandinavia and the high Arctic as well as working with observational data, (AC)³ was the perfect spot for me to continue my career as a scientist. I am honored to be a part of B05 where I can process data from the vast MOSAiC campaign. I derive temperature and humidity profiles, but also Integrated Water Vapour and Liquid Water Path from microwave radiometers (MWRs) that were stationed onboard the Polarstern. A part of my work focuses on the creation of a synergetic retrieval combining MWRs with complementary moisture sensitivity, aiming to improve the vertical resolution of humidity profiles and applicability in cold and dry conditions compared to more common single-MWR retrievals. The retrieved data will be compared with data products (radiosondes, reanalyses, satellites, other instruments onboard Polarstern, ...). The MOSAiC observations will be exploited as reference data for a detailed water vapor analysis regarding its variability and vertical distribution to better assess its influence on Arctic amplification.



News from the campaign preparation
WEATHER OBSERVATIONS DURING HALO-(AC)³ DRY RUN
 (continued)

The belonging dry and cold Arctic air advected southward over the open ocean forms typical cloud streets, which are obvious in the satellite image shown in Fig. 6. In contrast, the rather weak WAI were rare and did not penetrate further north than Svalbard.

The large amount of CAO during the six-week period of observations is encouraging that there could be lots of good opportunities for next year's campaign. Although WAI were rather rare this year, we hope for more WAI events during the campaign. However, since the flight hours are limited, we would have not been able to investigate all of this year's events. Nevertheless, we should be able to cover the strongest events. With these encouraging findings, we are excited and looking forward to the upcoming HALO-(AC)³ campaign in March and April next year.

	Week 1							Week 2							Week 3						
	08.03.	09.03.	10.03.	11.03.	12.03.	13.03.	14.03.	15.03.	16.03.	17.03.	18.03.	19.03.	20.03.	21.03.	22.03.	23.03.	24.03.	25.03.	26.03.	27.03.	28.03.
CAO																					
WAI																					
P 5/6																					

	Week 4							Week 5							Week 6						
	29.03.	30.03.	31.03.	01.04.	02.04.	03.04.	04.04.	05.04.	06.04.	07.04.	08.04.	09.04.	10.04.	11.04.	12.04.	13.04.	14.04.	15.04.	16.04.	17.04.	18.04.
CAO																					
WAI																					
P 5/6																					

Tab. 1: Cold air outbreak (CAO) and warm air intrusion (WAI) occurrences together with flight conditions for the Polar 5 and Polar 6 aircraft during the weather observations of the HALO-(AC)³ dry run. The strength of the orange color indicates the strength of the CAO and WAI. Green means favourable flight conditions, yellow difficult flight conditions and red denotes a no flight day.

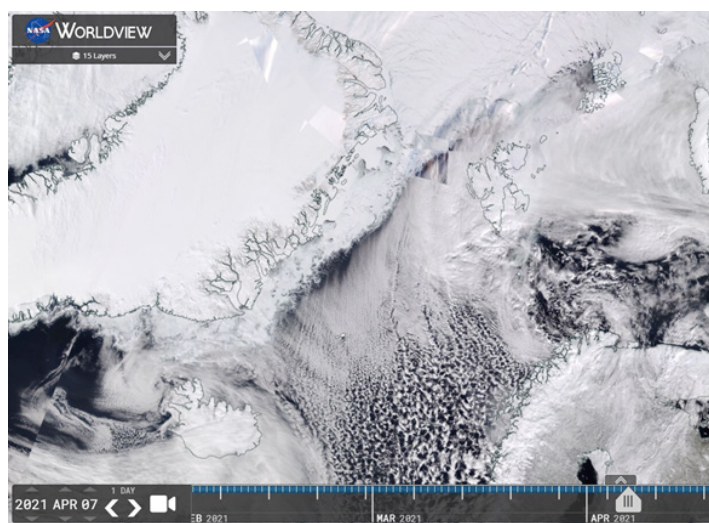


Fig. 6: NOAA-20 satellite image from 7 April 2021. Pronounced cloud streets are visible, reaching from the ice edge in the Fram Strait towards Scandinavia (<https://worldview.earthdata.nasa.gov/>).

PhD News
NEW PHD COUNCIL

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

Since the beginning of 2021, we have new PhD representatives: Janna Rückert (Bremen), Hannah Niehaus (Bremen), Elisa Akansu (Leipzig), Olivia Linke (Leipzig), Zerlina Hofmann (AWI), Birte Kulla (until May 2021) (Cologne) and Giovanni Chellini (Cologne).

So far, we have organized a few "Scientific-Kaffee-kraenzchen" or virtual lunch breaks to welcome new PhD-students to the project. Also, the first scientific speed-dating took place where we were paired up randomly and got to know each other's research. If you missed it, do not worry, there will be a next one soon!

With the support of Matthias Buschmann, we introduced a new calendar to the (AC)³-intranet. Check out if there are any workshops or conferences which may be relevant for you. Let us know if you feel that something is missing.

Of course, you can get in touch with us anytime if any problems arise during your PhD. However, for serious issues, we initiated the implementation of Ombudspersons within (AC)³. If you are unable to resolve a conflict yourself, there is the option of contacting Annika Dähne (IRTG), Susanne Crewell (Cologne), Justus Notholt (Bremen), or Manfred Wendisch (Leipzig).

Do you want to get more involved? We meet once a month via zoom to discuss ideas: What do we want to organize ourselves? What do we have to suggest to the Scientific Steering Team (SST)? All PhD students are very welcome to join our meetings or get in touch with us, whether it is with new ideas or simply out of curiosity about what we are up to - :)



Fig. 7: The new PhD representatives (from top to bottom): Zerlina Hofmann (AWI), Janna Rückert (Bremen), Elisa Akansu (Leipzig), Olivia Linke (Leipzig), Giovanni Chellini (Cologne) and Hannah Niehaus (Bremen).

Outreach activity for kids and interested adults

MIA'S KLIMATAGEBUCH GOES ONLINE

by Simone Lindemann (Administrative coordinator, project outreach activities at Uni Leipzig)

Hello (AC)³ team,

It's me - Mia! As of May our blog <https://mias-klimatagebuch.de> is online. I'm really happy and excited to see all the curious (children's) eyes that hopefully read along.

WHAT IS THE BLOG ABOUT?

I encounter the topics climate, climate change etc. everywhere. People talk about it at school, there are demonstrations in the streets... Together with my Arctic fox Mika, I'm going to search for answers and take you on an exciting journey of discovery. Together we will find out what a polar researcher does, how it really looks like in the Arctic, and what exciting things are happening in the large research project (AC)³.

THANK YOU!

...to all of you, who have already been busy twirling along and answering my "holes-in-the-belly" questions. Indeed, now I know, for example, that I can't hop on clouds (actually too bad) and that it's freezing cold and dark for a long time in the Arctic.

I would be happy if you could continue supporting me and if there would be more answerers. There are still open questions looking for an answerer.

Do you want to participate or do you have great ideas? Feel free to contact me: Frage@mias-klimatagebuch.de

Many greetings,

Yours Mia ;-)

P. S.: Feel free to follow me on Instagram: [mias_klimatagebuch](https://www.instagram.com/mias_klimatagebuch)



Fig. 8: Mia and her cuddly toy Mika are investigating questions of climate change, the Arctic and the research project (AC)³ (Illustrations: Simone Lindemann). Behind the 10 year old Mia created by Simone Lindemann there are more than 100 researchers within (AC)³ answering her questions and try to explain "their" research topics to kids and interested adults.

(AC)³ NEWS

- Call for Abstracts – 3rd (AC)³ Science Conference on Arctic Amplification in Potsdam, Germany, 25 to 27 October 2021. Further details and application at <https://www.ac3-tr.de/meetings/>
- HALO-(AC)³ Hackathon planned for December 2021 including a preparation phase, where participants explore different topics, and a collaboration phase to test and train virtual collaboration
- Stay informed: if you want to receive this newsletter regularly, you can subscribe online at <http://ac3-tr.de>

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(AC)³ NEWSLETTER

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(AC)³ Publications

GLIMPING THE INS AND OUTS OF THE ARCTIC ATMOSPHERIC CAULDRON

Abstract

Ironically, the chilly Arctic is one of the hot spots of global climate change: Temperatures there are increasing faster than anywhere else on Earth, coinciding with other rapid environmental changes across the region. Shifting conditions in the Arctic, remote as they may seem, will likely have substantial effects of interest to us humans living at lower latitudes, from altering fisheries and wildlife habitats to opening new transoceanic shipping routes and causing shorelines of thawing permafrost to crumble and encroach on coastal communities.

Projecting the future of Arctic climate remains difficult, however. This issue arises in part because of inconsistencies among results from climate modeling and analysis methods regarding potential links between Arctic warming and another element of Earth's climate that dramatically affects humanity: severe weather in the midlatitudes, including storms and extreme temperatures. To help resolve some of these uncertainties and provide better data for weather and climate models, which should translate into more realistic forecasts and projections, we are leading a novel aircraft campaign to observe transformations of air masses along their way into and out of the Arctic.

We call this effort the HALO-(AC)³ campaign. The HALO-(AC)³ mission will provide unique data to evaluate the output of numerical atmospheric models covering a wide range of scales, both spatial (from single air columns to Arctic-wide) and temporal (from instantaneous to several days).

Wendisch, M., D. Handorf, I. Tegen, R. A. J. Neggers, and G. Spreen (2021), Glimping the ins and outs of the Arctic atmospheric cauldron, *Eos*, 102, <https://doi.org/10.1029/2021EO155959>. Published on 16 March 2021.



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