

A breathtaking view of the snow-capped peaks of Spitsbergen (Photo: Pavel Krobot, University of Cologne).



The snow-covered Polar 5 waits at Longyearbyen Airport for its next mission (Photo: Johanna Drude, University of Cologne).



Transregional Collaborative Research Center on Arctic Amplification

$(AC)^3$ Newsletter

EDITORIAL

Dear readers of the $(AC)^3$ newsletter,

The latest issue of the $(AC)^3$ newsletter highlights several exciting project activities. A major event was our successful scientific conference on Arctic Amplification, the fourth of its kind within the project. Once again, our early-career researchers (ECRs) played a central role by designing three highlight sessions, proposing the keynote speakers, and co-chairing each session together with senior scientists from the $(AC)^3$ principal investigators (PIs) or Scientific Advisory Board (SAB). Strategic project issues were also discussed, but we leave the details to the conference report elsewhere in this newsletter.

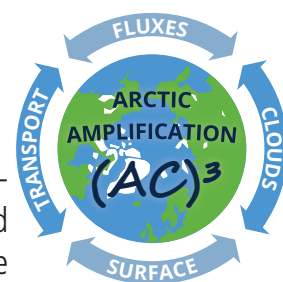
Another highlight of the first half of 2026 was the COMPEX flight campaign, possibly the last under the $(AC)^3$ umbrella. It was the eleventh campaign organized by $(AC)^3$ since 2016, contributing valuable observations to improve our understanding of Arctic amplification. Together with long-term measurements from ground stations, balloons, ships, and satellites, these campaigns form a cornerstone and a vital part of the $(AC)^3$ project's legacy. Organizing them is always a major collaborative effort.

However, we readily admit that these campaigns are always incredibly exciting and great fun. We invite you to read more in the dedicated COMPEX report.

Another wonderful initiative—also fully initiated, organized, and carried out by our early-career researchers (ECRs)—was a five-day retreat. We read the report in the newsletter and got the impression that it was a fantastic gathering; however, we leave it to the readers of the report to judge for themselves. It is also very gratifying to see the commitment shown by a number of doctoral candidates to “Mia’s Climate Diary” (Mias Klimatagebuch), a project that engaged directly with children and young people during the Leipzig Ökofete. The preparation involved a great deal of time and effort, and this ongoing dedication to such important public outreach is greatly appreciated!

Finally, we invite you to meet three new $(AC)^3$ doctoral researchers in the “Meet the $(AC)^3$ Fellows” section and to read the summary of one of our latest $(AC)^3$ publications at the end of this newsletter.

Yours,
Manfred and Marlen.



July 2026
21st Issue

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SCIENCE CONFERENCE IN COLOGNE – ADVANCING ARCTIC RESEARCH TOGETHER

by Marlen Brückner (Scientific coordinator)

For the fourth time, the $(AC)^3$ community came together for the Science Conference on Arctic Amplification, hosted by the Institute of Geophysics and Meteorology at the University of Cologne from 23–26 February 2026. Over three inspiring days, project members and invited guests exchanged ideas, discussed ongoing research, and explored future directions in Arctic science.

A special feature of every $(AC)^3$ Science Conference is the meeting with our Scientific Advisory Board (SAB). This group of internationally renowned experts has supported the project for many years, providing valuable guidance, constructive feedback, and an external perspective on our scientific strategy. As we enter the final phase of the final funding period, these discussions are especially important for refining our research priorities.

The scientific programme focused on three key research areas: mixed-phase clouds, aerosols, and sea ice. Furthermore, discussions focussed on the three Strategic Questions (SQs) that guide our research in $(AC)^3$. By combining ob-

servations, numerical models, and data analysis, all project teams contribute to improving our understanding of Arctic amplification and its impacts on the Arctic and beyond.

One of the highlights of the conference was the strong contribution of our Early Career Researchers. Through engaging presentations, they showcased innovative approaches and exciting new scientific results, complemented by inspiring keynote lectures from invited guests. The poster sessions sparked lively discussions that often continued well beyond the scheduled programme, leading to new ideas and collaborations.

Our Cross-cutting Activities (CCAs) also played a central role in our conference. In breakout sessions, our project collaborators from different disciplines further developed collaborative projects, connecting observations with simulations and advancing joint publications. These activities continue to strengthen interdisciplinary collaboration across $(AC)^3$.



Fig. 1: Interested audience listened to Franz Krauses Evening Talk (Photo: Marlen Brückner).

A particular highlight was the evening lecture by Franz Krause, Professor of Environmental Anthropology at the University of Cologne. In his thought-provoking talk, "Living in a State of Liquidity", he explored how Arctic communities adapt to environmental change, combining ethnographic research with perspectives that complemented our scientific view of the Arctic.

Of course, there was also time to recharge outside the lecture hall. Our conference social event took us to the German Sport & Olympic Museum, where participants could either join guided tours or compete in a series of fun team challenges. Whether testing sports knowledge, trying the long jump, or mastering the art of "team ski-



Fig. 2: Team work during "skiing" (Photo: Marlen Brückner).

ing," enthusiasm and team spirit quickly took over. The certificates awarded that evening now decorate more than a few office walls, serving as cheerful reminders of a wonderful evening that concluded with a shared dinner at Dom im Stapelhaus.

We would like to thank our wonderful hosts in Cologne and everyone who helped make this conference such a success. Once again, the $(AC)^3$ Science Conference demonstrated how valuable it is to come together—not only to advance our science, but also to strengthen the collaborations and friendships that make our community so special and successful.



Fig. 3: Group picture of participants of the 4th (AC)³ Sci-enc Conference on Arctic Amplification in Cologne (Photo: Marlen Brückner).

News from the field

COMPEX - CLOUDS OVER COMPLEX ENVIRONMENT

by Mario Mech (Campaign leader COMPEX from Uni Cologne)

The investigation of clouds, precipitation, and the thermodynamic structure of the Arctic boundary layer has been the focus of several airborne campaigns within (AC)³, resulting in a rich dataset spanning a range of atmospheric conditions. Nevertheless, scientific gaps remain that need to be addressed. This is when the idea for the COMPEX (Clouds over cOMPLEX environment) campaign was born.

COMPEX means, in a nutshell, we as researchers from the University of Cologne and Leipzig University (Fig.4) conducted 15 research flights (Fig.5) out of Longyearbyen on Svalbard between 13 March and 15 April 2026 with our well-established instrument suite, upgraded by a newly designed G-band Radar for Water vapor and Arctic Clouds (GRaWAC), installed in the Alfred Wegener Institute's Polar 5 research aircraft.



Fig. 4: COMPEX Logo & group picture in front of Polar 5 at Longyearbyen airport (Photo: Melanie del Guidice).

continued

COMPEX - CLOUDS OVER COMPLEX ENVIRONMENT

by Mario Mech (Campaign leader from Uni Cologne)

Flights during COMPEX provide data for research on major $(AC)^3$ targets such as cloud and precipitation fields in Kongsfjorden around the AWIPEV research base in Ny-Ålesund. This allowed linking local column observations to the broader region. The campaign also investigated clouds over sea ice and the marginal ice zone, the region where clouds start to form during cold air outbreaks. Furthermore, we studied the more mature stage, where the streets break up into a more open cell structure. Dedicated collocation flights have been performed to validate EarthCARE satellite observations in the Arctic, a spaceborne platform recently launched with a similar instrument set to that flown on Polar 5. Two research flights have been devoted to investigating the thermodynamic structure around leads in the closed sea ice. All observations from airborne instruments will be used for validation studies of atmospheric models, reanalyses, and satellite observations and products in the Arctic.

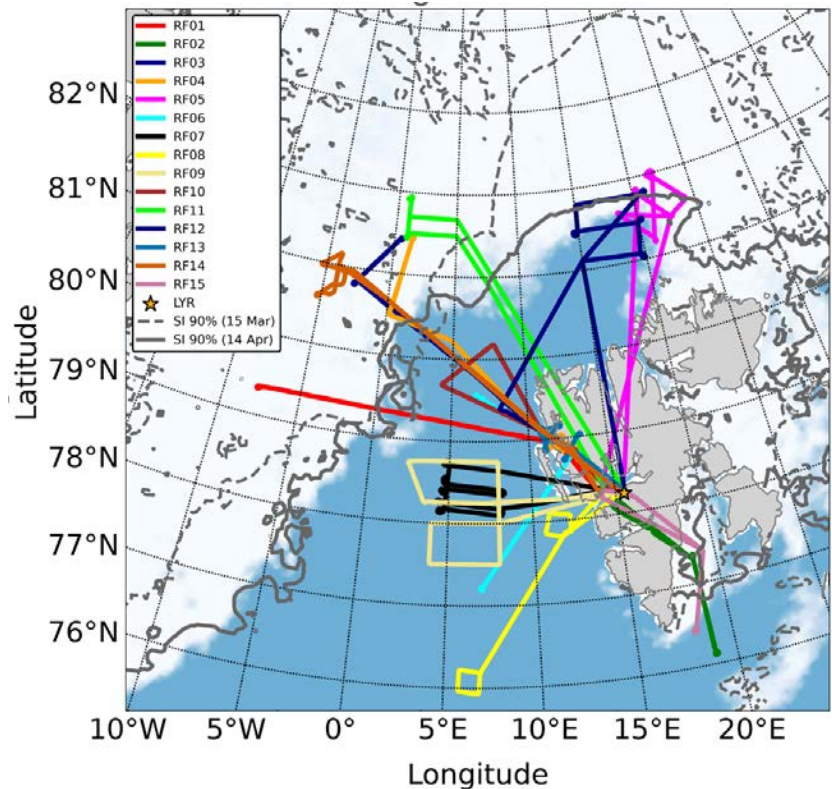


Fig. 5: Flight tracks of all 15 research flights during COMPEX campaign (Lars van Gelder).

MEET THE $(AC)^3$ FELLOWS

Hello!

My name is Richard, and I come from Nigeria, where I completed my Bachelor's degree in Physics with Electronics at the Federal University of Technology, Minna. My curiosity about the atmosphere and its role in shaping our world eventually brought me to Germany, where I pursued an M.Sc. in Environmental Physics at the University of Bremen. Along the way, I had the opportunity to work as a Research Assistant at the German Aerospace Centre in Göttingen. An experience that deepened my appreciation for how data analysis and observation data can be combined to address real-world problems like aircraft noise.

I am now a PhD researcher at the Leipzig Institute for Meteorology, University of Leipzig, working at the intersection of atmospheric science, climate modelling, and causal data science. My research focuses on dynamical climate storylines. Exploring how large-scale remote drivers such as Arctic Amplification and the stratospheric polar vortex shape regional climate and extreme weather events. To do this, I develop storypy, a Python-based package that makes it possible to quantify and communicate these forced responses across CMIP model ensembles.

What excites me most is building tools that bridge scientific insight with practical utility, helping the community better understand the pathways through which a changing climate makes itself felt in our everyday weather.

I'm thrilled to be part of the $(AC)^3$ community and look forward to the science ahead!



continued

COMPEX - CLOUDS OVER COMPLEX ENVIRONMENT

by Mario Mech (Campaign leader from Uni Cologne)

The envisioned plan for COMPEX was to spend more time over the closed sea ice and to include low-level measurements of sea ice emissivity in addition to cloud observations. This turned out to be challenging. COMPEX took place in early spring, typically during one of the coldest periods of the year, when the largest sea ice extent is expected in this region. March/April 2026 around Svalbard deviated from the climatological mean: a monthly-averaged 2 m temperature up to 6 K above the climatological mean (1961-1990), and sea ice coverage at almost a record low (<https://climatereanalyzer.org/>). This made it hard to reach the closed sea ice with Polar 5 while still having enough remaining flight time to conduct intensive observations.

In summary, 60 flight hours have been flown during the COMPEX campaign, 75 dropsondes have been launched, and a large amount of data has been collected, which will help answer some of the questions the Arctic science community asks. The atmosphere among all participants was vibrant and inspiring, even during the morning mermaid class rehearsals (Fig.6).

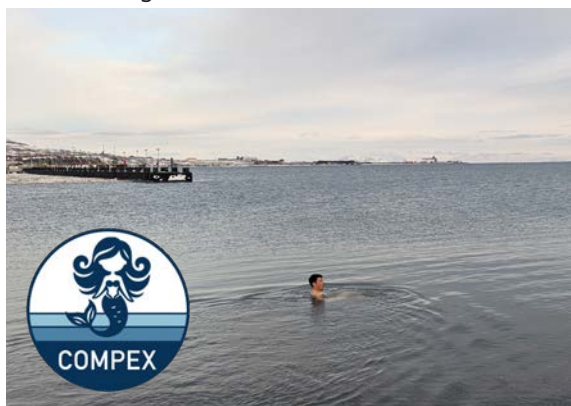


Fig. 6: Brave mermaids get their own badge (Photo: Mario Mech).

(AC)³ NEWS

SAVE THE DATES:

- (AC)³ General Assembly in Bremen, 15 - 17 September 2026
- Joint (AC)³ - MOSAiC Conference (JAMC27) "Drivers and Impacts of a Changing Arctic" in Leipzig, 8 - 12 March 2027, Further information: <https://www.jamc27.com/>

MEET THE (AC)³ FELLOWS

Hey everyone,

I'm Lars, and I joined project B03 of (AC)³ at the Institute for Geophysics and Meteorology in Cologne in October 2024. My fascination with weather and climate started long before university. As a child, I was captivated by thunderstorms, snowfall, and other weather phenomena, and I even collected temperature observations from my own small weather station during winter. This enthusiasm eventually led me to study Meteorology in Cologne, where I completed both my BSc and MSc and developed a particular interest in clouds, precipitation, and remote sensing observations.

Within (AC)³ my research focuses on using airborne observations to better understand Arctic clouds and precipitation and their role in air mass transformation processes. By combining different remote sensing measurements, I aim to improve our understanding of cloud and precipitation properties in the rapidly changing Arctic atmosphere.

One of the most exciting aspects of my PhD so far has been the opportunity to participate in two Arctic flight campaigns. Last year, I joined the two-week COMPEX-EC campaign based in Kiruna, northern Sweden, where we performed collocated underflights of the EarthCARE satellite. Earlier this year, I spent a month in Longyearbyen, Svalbard, taking part in another airborne campaign. These experiences provided invaluable scientific insights and allowed me to experience the beauty of the Arctic firsthand.

For my study, I am currently evaluating EarthCARE radar and lidar observations using airborne measurements to assess the satellite's performance in the Arctic and improve understanding of cloud and precipitation processes during cold-air outbreaks.

Outside of research, I enjoy sports and am a passionate football fan. One of the things I have always appreciated about football is its strong sense of teamwork. I have found the same spirit in the open, collaborative atmosphere and in the regular interactions with fellow PhD students and colleagues, which have made the start of my PhD especially enjoyable.



PHD RETREAT

Five Days of Science, Skills and Collaboration

by Hannah Sundermann (PhD in B03 at TROPOS)

From June 8 to 12, the (AC)³ PhDs got together in Buchholz i.d.N. for our PhD retreat. It was a week dedicated to learning, collaborating and getting to know each other better. We stayed at Heideruh, a cosy place in the middle of the forest and on the edge of the Lüneburg heath.

Throughout the week, we discussed a range of topics relevant to our work as researchers. These included sessions on holding a good scientific presentation, overcoming our inner saboteurs when trying to write our papers, dealing with Linux and Latex, statistics and the dos and don'ts of working with generative AI. During the week, we also got to test our new skills during PowerPoint Karaoke and dedicated writing and co-working sessions. In addition to technical sessions, we also had the opportunity to learn more about each others' work and many people had prepared short presentations about key aspects of their work and Arctic Amplification. Collaboration also didn't come too short, both within and outside the CCAs.



Fig. 7: PhDs enjoyed their time off in Heideruh (Photos: Hannah Sundermann).

Even though the weather kept messing with us a lot and we barely had one day without several sudden rain showers, we managed to sneak in a rainfree hike through the beautiful landscape of the Lüneburg heath.

During breaks, we practiced our tabletennis and football skills and enjoyed the amazing food that was prepared for us.

We also learned about Heideruh's long and important history (they celebrate their 100th anniversary this year) of supporting and hosting victims of fascism and political prosecution, and shared parts of our work with those who worked there.

Overall, the retreat was a great success. Everyone contributed to shaping the programme, leading sessions, and enriching discussions, making it a very engaging and collaborative experience.

(AC)³ NEWS

PEATLANDS, BIKES, COWS: EDUCATIONAL TIME ABOUT THE CLIMATE RELEVANCE OF THE "TEUFELSMOOR"

by Johannes Röttenbacher (Data stuard in INF at Uni Bremen)

Did you know that you are entitled to 5 days of educational time per year in addition to your regular holidays (unless you work in Saxony or Bavaria, sorry @Leipzig!)? (AC)³ Postdocs Janna, Moritz, and Johannes spent their educational time biking around and learning about the "Teufelsmoor", a peatland surrounding the artists' colony Worpswede near Bremen. Peatlands are large natural terrestrial carbon sinks, in which the high water level stops dead plant matter from decomposing. However, the Teufelsmoor has been transformed to a massive carbon source by labourious draining and clearing for agriculture and domestic turf-cutting since the 18th century. Nowadays, the degrading turf is one of the major greenhouse gas emitters in the region. Restoration initiatives still lack municipal priorities, and commercial use of re-wetted land progresses only slowly. We felt oddly reminded about the Arctic permafrost, which faces a similar fate due to global warming.

Together with 14 other participants from all age groups older than us, we enjoyed a week of active education. We had some time to reflect on the real world issues that people are dealing with due to land use change, climate protection efforts and the changing global economy.

Are you up for Bildungsurlaub, an extra 5 vacation days of educational vacation? Check out <https://de.wikipedia.org/wiki/Bildungsurlaub> or ask your local administration! It's your right to do so ;-)

OUTREACH REPORT

ENGAGING YOUNG MINDS: MIA BRINGS CLIMATE FUN TO THE ÖKOFETE

by Sophie Vliegen (PhD student in E01 at Uni Leipzig on behalf of the Mia Team)

This year in June, Mia's Climate Diary went to the Leipziger Ökofete again. Besides the rather windy conditions, which Mia hardly survived, it was a very successful day. The stand looked lovely, with many different decorations such as clouds, rainbows, Mia on a bike, and Mika sitting on the moon.

Many children stopped by to make a tiny Mika bookmark, color pictures from the blog, or even participate in a quiz featuring four questions about blog posts displayed at our stand. For interested 'older' visitors, we handed out fact sheets and shared information about the $(AC)^3$ project in general.

In addition, we had some interesting conversations with teachers and other people involved in outreach projects for children on climate-related topics. Overall, it was a very exciting day, and we were happy to see how much fun the children were having at our stand!



Fig. 8: The Mia Climate Diary stand was a great success and constantly visited by curious children and adults. A big thank you to the whole team (Photos: Sophie Vliegen).

MEET THE $(AC)^3$ FELLOWS

Hello everyone, my name is Lena, and I'm currently working on my PhD in the E03 project on low-level cloud representation at the University of Cologne. I also completed my Bachelor's and Master's degrees in Cologne, initially motivated by my fascination with thunderstorms, which was strongly influenced by the severe Pentecost storm of 2014 that hit my hometown of Erkrath.

I would never have imagined that, ten years later, I would be a polar researcher studying microphysical processes in Arctic clouds and collecting measurement data from these clouds aboard Polar 5 during two campaigns – even though becoming a scientist had been my dream since elementary school. Back then, I still pictured a wild-haired person in a white lab coat dramatically mixing colorful liquids – little did I know it would look quite different, but much cooler!

I'm all the happier to now be part of answering open questions about the effects of climate change on the Arctic. In my work, I conduct sensitivity studies with the ICON model, investigating how clouds are influenced by cloud condensation nuclei and ice nucleating particles—the tiny particles on which cloud droplets or ice crystals form and grow—and how important their contribution is to the modelled clouds. Later in my PhD, I will also explore other factors that could influence Arctic clouds. All of this is to help make the ICON model fit for the Arctic. Especially in areas with few observations, simulations can provide comprehensive information and, in particular, support our understanding of the processes involved.

When I'm not analyzing my simulated clouds, I've been a passionate volleyball player since childhood and love spending time in the kitchen baking and cooking vegan food. It's a great way for me to relax.

I'm very happy and grateful to be part of the $(AC)^3$ community, and I'm looking forward to everything that's still to come.



ACKNOWLEDGEMENTS

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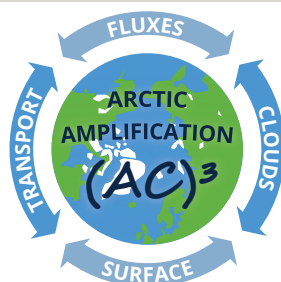
(AC)³ Publications

MOISTURE INVERSIONS IN THE CENTRAL ARCTIC: PRODUCT ASSESSMENT AND LONG-WAVE RADIATIVE EFFECT

Abstract

Water vapour is an important greenhouse gas that plays a key role in the thermal-infrared (long-wave) radiation balance at the surface. In the Arctic, previous studies have identified uncertainties regarding water vapour trends and integrated water vapour (IWV) estimates in certain seasons and regions, mostly due to missing high-quality observations from ground stations and uncertainties in satellite remote sensing. Therefore, accurate field measurements of water vapour are crucial for providing reference observations in the data-sparse central Arctic to evaluate satellite products, reanalyses, and weather forecast models. In this study, we use observations from ground-based microwave radiometers and radiosondes from the year-long Multidisciplinary Drifting Observatory for the Study of Arctic Climate expedition to analyse the quality of two global reanalyses, two weather forecast models, and two satellite products. Specifically, we evaluate the IWV and specific-humidity profiles. Our analyses revealed dry biases regarding specific-humidity profiles and IWV in dry (moist) conditions for the reanalyses and one of the weather forecast models (satellite products). We found a strong correlation between specific-humidity profile deviations to the reference (radiosondes) and the representation of specific humidity inversions. We therefore also statistically analysed the representation of humidity inversions in each dataset and determined which inversions can be detected. The presence of surface-based inversions (found in >85% of the radiosonde profiles) is generally well captured by all datasets except the satellite products, whereas elevated and weak inversions are often missed. To assess the importance of humidity inversions, we quantified their impact on downward long-wave radiation (DLR) using radiative transfer simulations of original and modified humidity profiles in clear-sky conditions. The presence of humidity inversions increases the DLR in clear-sky conditions by up to 16 Wm^{-2} , whereas misrepresentations thereof can cause DLR differences of $\pm 5 \text{ Wm}^{-2}$.

Walbröl, A., Crewell, S., Barrientos-Velasco, C., Chellini, G., Griesche, H. J., Rückert, J. E., and Ebell, K., 2026: Moisture inversions in the central Arctic: Product assessment and long-wave radiative effect. *Q J R Meteorol. Soc.* 152(776):e70110, doi:[10.1002/qj.70110](https://doi.org/10.1002/qj.70110).



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