



The Tropopause Region in a Changing Atmosphere

Newsletter

— ISSUE #01 WINTER 2026 —

Hello and Welcome!

We're thrilled to launch this platform to connect researchers, students, and partners across disciplines as we explore the dynamic systems shaping our atmosphere. From boundary layer processes to climate feedbacks, our work bridges observation, modeling, and theory to address pressing environmental challenges.

This first issue introduces our core teams, highlights recent field campaigns, and previews upcoming workshops and colloquia. Whether you're a seasoned atmospheric scientist or just beginning your journey, your insights and collaboration are vital to our mission.

We invite you to contribute ideas, share updates, and engage with our community. Let's foster curiosity, innovation, and impact — together.

Stay tuned for our next edition, and thank you for being part of this exciting endeavor.

Warm regards,
The Editorial Team

Content

- Overview past year
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 - Lecture Series
 - Summer School



The plenary



The Review Desk

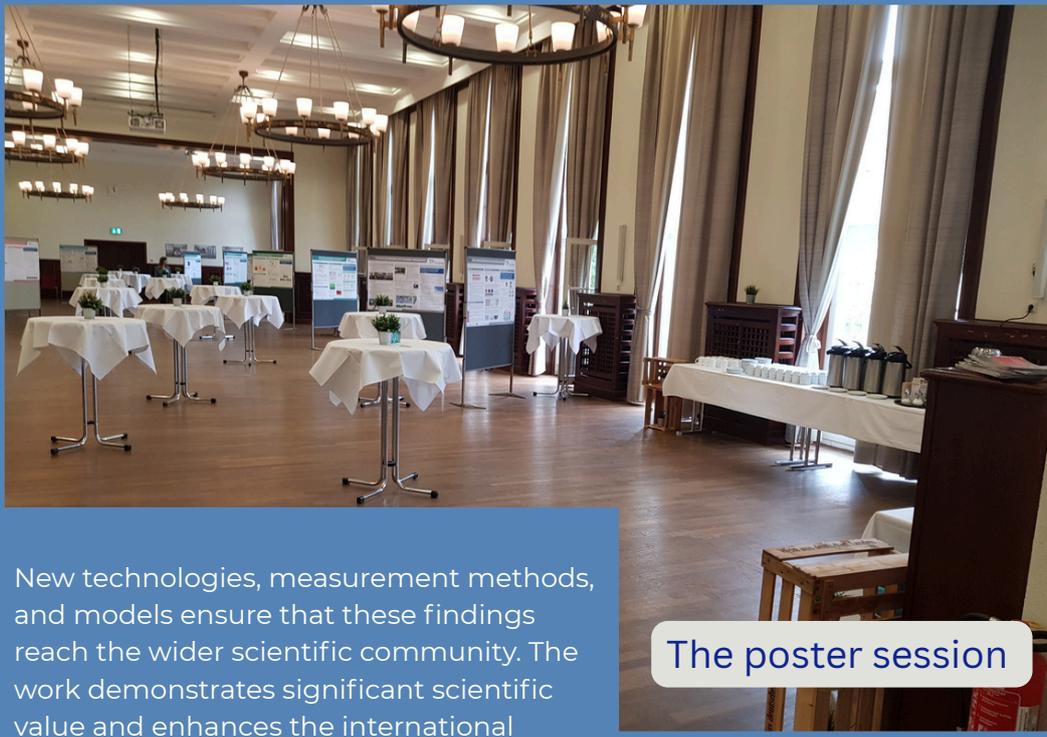
Success for TPChange

September 16th and 17th: Show down at the Alte Mensa at JGU Mainz. But with combined effort of all members the review was successful and TPChange is funded for the second phase! Our reviewers were quite impressed by our early career researchers and the work they presented.

The evaluation highlighted that our research on the tropopause region (UTLS), has been pursued consistently and with high scientific impact since the beginning of funding. The reviewers and the DFG recognized that the consortium follows a holistic approach, considering processes such as aerosols, trace gases, cloud formation, turbulence, gravity waves, and vertical and horizontal transport mechanisms. The combination of a broad UTLS relevant expertise represented in our TPChange consortium was recognized as worldwide unique and a key strength.

Notably the research was explicitly termed as outstanding and world-wide leading in the fields of gravity wave actions at the tropopause, UTLS aerosol processing and with regard to the research on the water vapor bias in the lowermost stratosphere. A key strength of TPChange is the close integration of observations, laboratory experiments, and modeling. This combination has provided new insights into particle formation, aerosols, and water vapor transport, showing that the tropopause should be seen as a dynamic exchange region rather than a barrier. Extensive aircraft and balloon campaigns, along with laboratory experiments, offer a unique spatial coverage that increasingly includes global perspectives.

Review



The poster session

New technologies, measurement methods, and models ensure that these findings reach the wider scientific community. The work demonstrates significant scientific value and enhances the international visibility and relevance of the project. The integration of observation, experimentation, and modeling lays the foundation for incorporating these processes into future global climate models.

The consortium's publication record is particularly impressive: researchers consistently publish in leading journals, enhancing both international visibility and scientific impact. Early-career scientists benefit from the interdisciplinary collaboration and breadth of expertise. Overall, the consortium forms a strong, well-integrated network that advances research on this complex atmospheric region in a sustainable way.

A big 'THANK YOU' to all who have contributed such a great work, that our review got successful: The IPA secretaries, the student and PhD helpers, the ZDV multimedia team, and all the colleagues who did their best to make this review successful.

Hoping for the best during the reviewers discussed ...



During the review panel...



What else happened in the second half of 2025?

THANK YOU: ECR

First, we want to say a big “Thank You” to the ECR for all the work you’ve done in Phase I, congratulations to the papers you submitted and to your graduation! Special Thanks go to the ECR committee for all the organisations you did and for your time in attending the SSG meetings and general discussions.

Congratulations

to all TPChange ECRs who successfully defended their PhD theses last year!

- 📄 **Christine Borchers** (A05) in March 2025
- 📄 **Matthias Kohl** (associated to A03) in July 2025
- 📄 **Jackson Seymore** (A07) in July 2025
- 📄 **Frederik Harzer** (C05) in September 2025
- 📄 **Philipp Joppe** (A04) in November 2025
- 📄 **Amelie Mayer** (associated to B04) in December 2025
- 📄 **Cornelis Schwenk** (B08) in December 2025
- 📄 **Lasse Moormann** (B02) in December 2025
- 📄 **Chun Hang Chau** (B01) in January 2026

 [link to thesis](#)

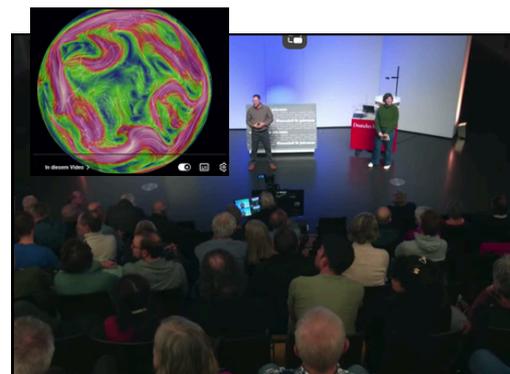
ECR TRAINING

As many of the Phase-I-ECR would have to orientate towards a new field of activity, TPChange offered a training on “Job application and interview strategies”. Either online or in presence, the ECR had the opportunity to learn about how to manage the next important steps in their life. Once again Karin and Philipp from “Natural Science Careers” did a great job in coaching our ECR.



OUTREACH

After 2024 Peter Hoor had held a talk at “Deutsches Museum in Munich”, [introducing TPChange to a broad audience](#) within the series ‘Wissenschaft für jedermann’, Thomas Birner showed 2025 [details on “Jetstreams”](#). You can access the Youtube of the presentations by the link. A great film about TPChange has been produced by Mainz students, which will soon be available by our website.



PUBLICATIONS:

We can be proud on a large number of publications within TPChange, congratulations to the authors!

On pages 7-13 you see the latest publications since Summer 2025. There is also a reasonably large number of preprints which probably will be listed in our next newsletter issue as published.

Furthermore, the [TPChange Special Issue](#) has been established as an inter-journal SI in the Copernicus journals ACP, AMT, GMD and WCD.

Towards Phase II!

We are looking forward to three and a half more exciting years with great science!

Upcoming events:

ANNUAL MEETING

On March 9-12 our next Annual Meeting will take place, again at the Kur(Spa)hotel Bad Dürkheim.

It will serve as a kick-off meeting for all new members, where the most important results from Phase I will be shown as well as strategies for the future will be discussed.

We are glad to welcome Christina Williamson, Peer Nowack and Peter Hitchcock as our external guests who, besides showing their TPChange relevant research, will be available for a discussion with the ECR on career aspects.

And, again we were able to hire NSC for a career training for our ECR:

From Wednesday afternoon to Thursday, Karin Bodewits will give a course on time management.



Group photo from the Annual Meeting 2025

LECTURE SERIES

In order to establish a common ground of knowledge about the tropopause region and the processes affecting it, TPChange will offer to the (new) ECR an online lecture series:

20 March: *Introduction to the UTLS* (Peter Hoor) / **24 March:** *Stratospheric Circulation* (Thomas Birner) / **1 April:** *Ice Clouds* (Martina Krämer) / **10 April:** *Atmospheric Aerosol* (Johannes Schneider)

SUMMER SCHOOL



On September 20-25 our Summer School will take place in Schmerlenbach nearby Würzburg at the [Tagungszentrum Schmerlenbach](#).

ECR will hear introductory lectures to the UTLS and TPChange topics, and they will be introduced to their projects by 'hands on project work'.

NEW TPCHANGE MEMBERS INTRODUCE THEMSELVES

We are glad that TPChange has been able to hire already 23 new colleagues. Those who begin by February introduce themselves in the 'HELLO' boxes on the following pages.



Hi!

I'm **Lisa**,
and I will start my
PhD in February as
part of the TPChange
project in research area B08.

I studied Meteorology at
Johannes Gutenberg University Mainz, where
I completed both my Bachelor's and Master's
degrees.

During my Bachelor's thesis, I worked on the
characterization of an ozone sensor for
TPChange, focusing on its response to
temperature and pressure. In my Master's
thesis, my research shifted more strongly
towards atmospheric processes, where I
investigated observed humidity in the upper
troposphere and lower stratosphere in
association with warm conveyor belt outflow.
In my PhD project, I will focus on the
numerical modelling of transport processes of
relevant atmospheric species in warm
conveyor belts. I am very much looking
forward to actively contributing to a relevant
research programme and to further
developing my scientific skills within an
internationally connected and supportive
research environment.

Outside of research, I share my life with my
partner and four cats. I enjoy reading,
traveling, and dancing, which has been a big
part of my life since childhood. In 2024, my
dance group became German champions in
urban dance.



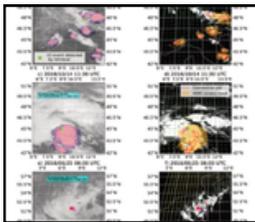
Hey there,
my name is
Marius

and I recently
joined the project B06 of the second phase of
TPChange as a PostDoc at the Institute for
Atmospheric and Environmental Sciences at
Goethe University Frankfurt. I've been
fascinated by atmospheric phenomena since
childhood, and I still enjoy chasing them today,
often through a camera lens. In my research so
far, I've worked across boundary-layer and
mountain meteorology: from studying
simulated deep-convection tracks around
Frankfurt, to quantifying shallow cumulus
cloud organization for parameterization, and to
investigating the highly turbulent formation
mechanisms of the iconic banner cloud at the
Matterhorn during a field campaign and high-
resolution simulations. Now I'm taking my
turbulence passion a few kilometers upward,
excited to help improve the representation of
mixing in the UTLS through refined turbulence
parameterization.

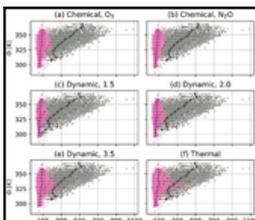
TPChange Publications in 2025

(First authors: TPChange or associated members)

Aricò, M., D. Piontek, L. Bugliaro, J. Mayer, R. Müller, F. Kalinka, and M. Butter (2025): A novel machine learning retrieval for the detection of ice crystal icing conditions based on geostationary satellite imagery. *Atmospheric Measurement Techniques* 18 (23), 7129–7152. doi: [10.5194/amt-18-7129-2025](https://doi.org/10.5194/amt-18-7129-2025)



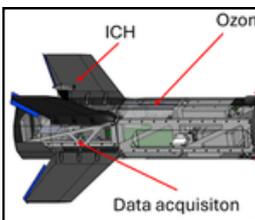
Bauchinger, S., A. Engel, M. Jesswein, T. Keber, H. Bönisch, F. Obersteiner, A. Zahn, N. Emig, P. Hoor, H.-C. Lachnitt, F. Weyland, L. Ort, and T. J. Schuck (2025): The extratropical tropopause – trace gas perspective on tropopause definition choice. *Atmospheric Chemistry and Physics* 25 (21), 14167–14186. doi: [10.5194/acp-25-14167-2025](https://doi.org/10.5194/acp-25-14167-2025)



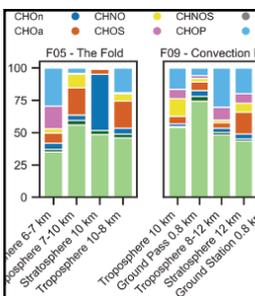
Borchers, C., L. Moormann, B. Geil, N. Karbach, D. Wasserzier, and T. Hoffmann (2025): Development and use of a lightweight sampling system for height-selective UAV-based measurements of organic aerosol particles. *Atmospheric Measurement Techniques* 18 (23), 7231–7242. doi: [10.5194/amt-18-7231-2025](https://doi.org/10.5194/amt-18-7231-2025).



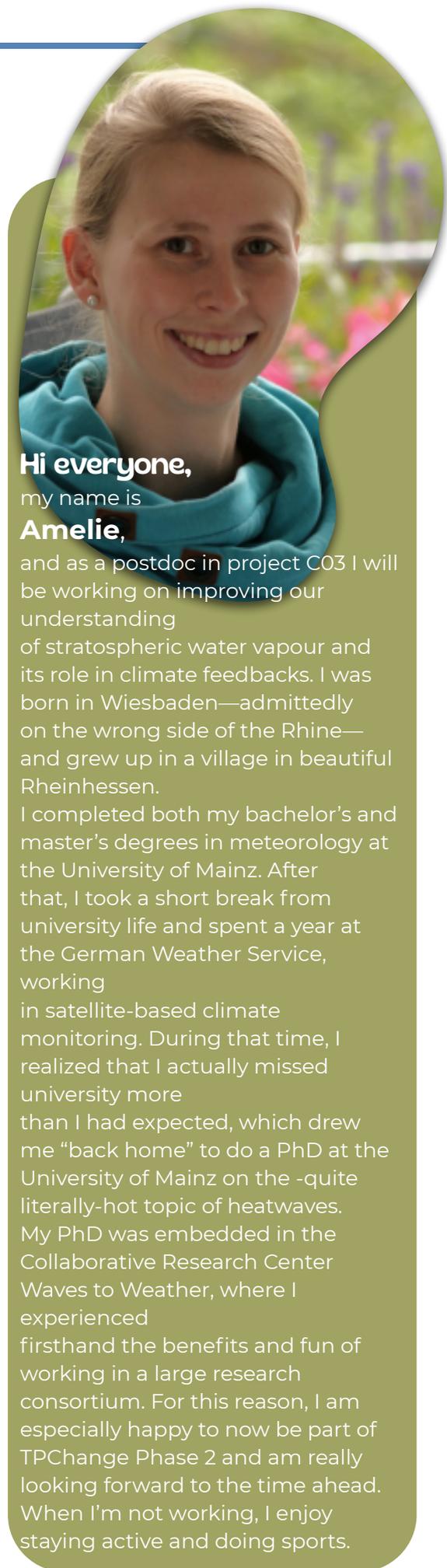
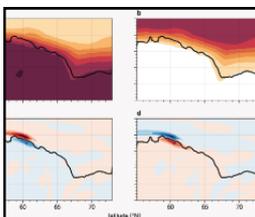
Bozem, H., P. Joppe, Y. Li, N. Emig, ..., A. Breuninger, J. Curtius, ..., S. Ismayil, K. Kandler, D. Kunkel, ..., H.-C. Lachnitt, A. Petzold, S. Richter, ..., C. Rolf, L. Schneider, J. Schneider, A. Vogel, and P. Hoor (2025): The Tropopause Composition TOWed Sensor Shuttle (TPC-TOSS): a new airborne dual platform approach for atmospheric composition measurements at the tropopause. *Atmospheric Measurement Techniques* 18 (22), 6545–6568. doi: [10.5194/amt-18-6545-2025](https://doi.org/10.5194/amt-18-6545-2025).



Breuninger, A., P. Joppe, J. Wilsch, C. Schwenk, H. Bozem, N. Emig, L. Merkel, R. Rossberg, T. Keber, A. Kutschka, P. Waleska, S. Hofmann, S. Richter, F. Ungeheuer, K. Dörholt, T. Hoffmann, A. Miltenberger, J. Schneider, P. Hoor, and A. L. Vogel (2025): Organic aerosols mixing across the tropopause and its implication for anthropogenic pollution of the UTLS. *Atmospheric Chemistry and Physics* 25 (22), 16533–16551. doi: [10.5194/acp-25-16533-2025](https://doi.org/10.5194/acp-25-16533-2025).



Chau, C. H., P. Hoor, and H. Tost (2025b): Simulated mixing in the UTLS by small-scale turbulence using multi-scale chemistry-climate model MECO(n). *Atmospheric Chemistry and Physics* 25 (20), 13123–13140. doi: [10.5194/acp-25-13123-2025](https://doi.org/10.5194/acp-25-13123-2025)

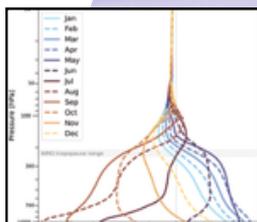


Hi everyone,
my name is
Amelie,

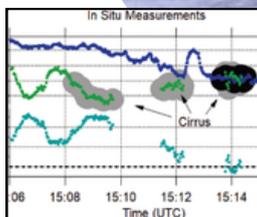
and as a postdoc in project CO3 I will be working on improving our understanding of stratospheric water vapour and its role in climate feedbacks. I was born in Wiesbaden—admittedly on the wrong side of the Rhine—and grew up in a village in beautiful Rheinhessen. I completed both my bachelor's and master's degrees in meteorology at the University of Mainz. After that, I took a short break from university life and spent a year at the German Weather Service, working in satellite-based climate monitoring. During that time, I realized that I actually missed university more than I had expected, which drew me “back home” to do a PhD at the University of Mainz on the -quite literally-hot topic of heatwaves. My PhD was embedded in the Collaborative Research Center Waves to Weather, where I experienced firsthand the benefits and fun of working in a large research consortium. For this reason, I am especially happy to now be part of TPChange Phase 2 and am really looking forward to the time ahead. When I'm not working, I enjoy staying active and doing sports.

continued: **Publications within 2025**

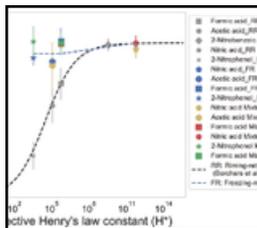
Degen, J., B. C. Baier, **P. Jöckel, J. M. Menken, T. J. Schuck, C. Sweeney, and A. Engel** (2025): CO₂ variability and seasonal cycle in the UTLS: insights from EMAC model and AirCore observational data. *Atmospheric Chemistry and Physics* 25 (22), 15741–15763. doi: [10.5194/acp-25-15741-2025](https://doi.org/10.5194/acp-25-15741-2025)



Emig, N., A. K. Miltenberger, P. M. Hoor, and A. Petzold (2025): Impact of cirrus on extratropical tropopause structure. *Atmospheric Chemistry and Physics* 25 (20), 13077–13101. doi: [10.5194/acp-25-13077-2025](https://doi.org/10.5194/acp-25-13077-2025).



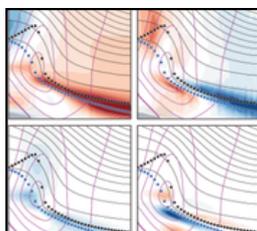
Gautam, M., A. Theis, J. Seymore, M. Hey, S. Borrmann, K. Diehl, S. K. Mitra, and M. Szakáll (2025): Retention during freezing of raindrops – Part 1: Investigation of single and binary mixtures of nitric, formic, and acetic acids and 2-nitrophenol. *Atmospheric Chemistry and Physics* 25 (19), 11813–11828. doi: [10.5194/acp-25-11813-2025](https://doi.org/10.5194/acp-25-11813-2025).



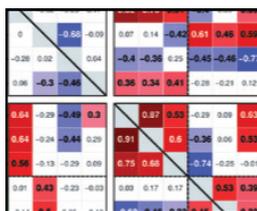
Guo, Z. and A. Miltenberger (2025): Climatology of warm conveyor belt contributions to UTLS moisture in ERA5 between 2010 and 2019. *Journal of Climate*, doi: [10.1175/JCLI-D-25-0020.1](https://doi.org/10.1175/JCLI-D-25-0020.1)



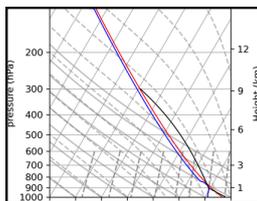
Harzer, F., H. Garny, F. Ploeger, J. M. Menken, and T. Birner (2025b): Adiabatic versus diabatic transport contributions to the ozone budget in the northern hemispheric upper troposphere and lower stratosphere. *Atmospheric Chemistry and Physics* 25 (21), 14909–14921. doi: [10.5194/acp-25-14909-2025](https://doi.org/10.5194/acp-25-14909-2025)



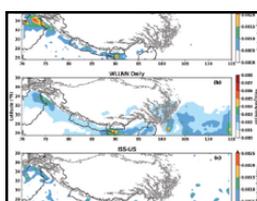
Harzer, F., H. Garny, S. M. Davis, and T. Birner (2025a): Probing the suitability of meridional stratospheric ozone gradients for inferring interannual variability and trends of the subtropical jet stream. *J. Climate* 38, 2571–2588. doi: [10.1175/JCLI-D-24-0530.1](https://doi.org/10.1175/JCLI-D-24-0530.1).



Hernández Pardo, L., H. Morrison, and A. Possner (2025): Dynamics of Downdrafts Around a Growing Convective Cloud: A Numerical Study. *Journal of Geophysical Research: Atmospheres* 130 (22), e2025JD044236. doi: [10.1029/2025JD044236](https://doi.org/10.1029/2025JD044236).



Jadhav, H., P. Singh, B. Ahrens, and J. Schmidli (2025): Machine Learning-Based Identification of Key Predictors for Lightning Events in the Third Pole Region. *ISPRS International Journal of Geo-Information* 14 (8), doi: [10.3390/ijgi14080319](https://doi.org/10.3390/ijgi14080319).



Hi everyone,
my name is **Alina**,
and I'm from Mainz, ,
where I also grew up.
In February 2026,
I will start my PhD at
Johannes Gutenberg
University Mainz,
joining Project B08 in
TPChange (Phase 2).

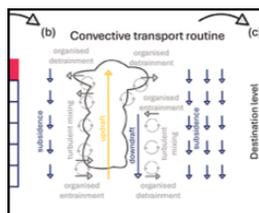
I studied Meteorology at JGU Mainz for both my Bachelor's and Master's degrees, so staying at a familiar academic environment for my PhD felt like a natural and exciting next step.

In my Master's thesis, I focused on hail and deep convection in the Munich area, combining observational data and reanalysis products to investigate convective processes and their large-scale atmospheric drivers. I particularly enjoyed working in depth on a specific topic, which motivated me to pursue a PhD position within TPChange.

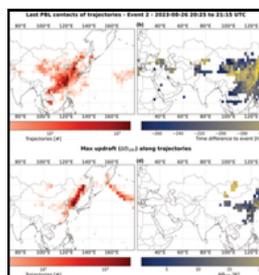
Within Project B08, my PhD will focus on a climatological perspective on moisture variability and transport processes in the extratropical UTLS. Using reanalysis and observational data, I will investigate how large-scale circulation and transport pathways shape the structure and variability of the UTLS in a changing climate. Outside of research, I love travelling and discovering new places and people. I'm very much looking forward to being part of TPChange and contributing to this new research phase.

continued: **Publications within 2025**

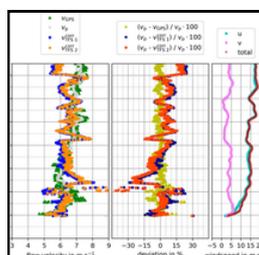
Jeske, A. and H. Tost (2025): The historical climate trend resulted in changed vertical transport patterns in climate model simulations. *Atmospheric Chemistry and Physics* 25 (21), 14435–14448. doi: [10.5194/acp-25-14435-2025](https://doi.org/10.5194/acp-25-14435-2025).



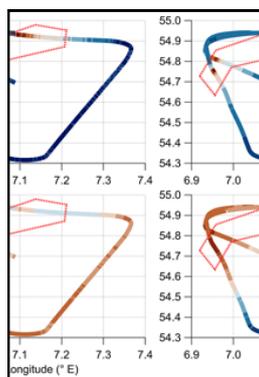
Jesswein, M., V. Lauther, **N. Emig**, **P. Hoor**, **T. Keber**, **H.-C. Lachnitt**, L. Ort, **T. Schuck**, J. Strobel, R. Van Luijt, C. M. Volk, F. Weyland, and **A. Engel** (2025): Tracing elevated abundance of CH₂Cl₂ in the subarctic upper troposphere to the Asian Summer Monsoon. *Atmospheric Chemistry and Physics* 25 (14), 8107–8126. doi: [10.5194/acp-25-8107-2025](https://doi.org/10.5194/acp-25-8107-2025).



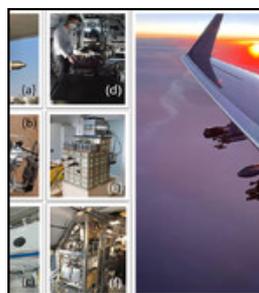
Jost, S., **R. Weigel**, **K. Kandler**, **L. Valero**, J. Girdwood, C. Stopford, W. Stanley, L. K. Eichhorn, C. von Glahn, and **H. Tost** (2025): Improving the accuracy in particle concentration measurements of a balloon-borne optical particle counter, UCASS. *Atmospheric Measurement Techniques* 18 (17), 4397–4412. doi: [10.5194/amt-18-4397-2025](https://doi.org/10.5194/amt-18-4397-2025).



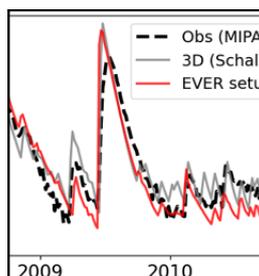
Joppe, P., **J. Schneider**, J. Wilsch, H. Bozem, **A. Breuninger**, **J. Curtius**, **M. Ebert**, **N. Emig**, **P. Hoor**, **S. Ismayil**, **K. Kandler**, **D. Kunkel**, I. Kurth, **H.-C. Lachnitt**, Y. Li, **A. Miltenberger**, **S. Richter**, **C. Rolf**, **L. Schneider**, **C. Schwenk**, N. Spelten, **A. L. Vogel**, Y. Cheng, and **S. Borrmann** (2025): Transport of Biomass Burning Aerosol into the Extratropical Tropopause Region over Europe via Warm Conveyor Belt Uplift. *Atmospheric Chemistry and Physics* 25 (21), 15077–15103. doi: [10.5194/acp-25-15077-2025](https://doi.org/10.5194/acp-25-15077-2025).



Jurkat-Witschas, T., **C. Voigt**, ..., **M. Krämer**, ... **L. Bugliaro**, ... **J. Mayer**, S. Mertes, **M. Moser**, ... **J. Schneider**, ... **L. Tomsche**, ... (2025): CIRRHUS-HL: Picturing high- and mid-latitude summer cirrus and contrail cirrus above Europe with airborne measurements aboard the research aircraft HALO. *Bulletin of the American Meteorological Society*, BAMS-D-23-0270.1. doi: [10.1175/BAMS-D-23-0270.1](https://doi.org/10.1175/BAMS-D-23-0270.1)



Kohl, M., C. Brühl, J. Schallock, **H. Tost**, **P. Jöckel**, A. Jost, S. Beirle, M. Höpfner, and A. Pozzer (2025): New submodel for emissions from Explosive Volcanic ERuptions (EVER v1.1) within the Modular Earth Submodel System (MESSy, version 2.55.1). *Geoscientific Model Development* 18 (13), 3985–4007. doi: [10.5194/gmd-18-3985-2025](https://doi.org/10.5194/gmd-18-3985-2025).



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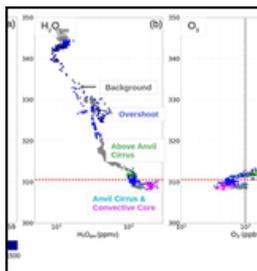
my name is **Martin** and I'm now a PhD student in the second phase of TPChange, where

I will study the convection-induced vertical transport of water vapor and tracer gases from an Eulerian and a Lagrangian perspective. I have been fascinated by all aspects of convection since childhood. Back then, I started observing thunderstorms, reading in the Wetterzentrale forum, or checking the GFS output at Wetter3. Since then I knew that I wanted to study meteorology, which I later did at University of Leipzig. There, I focused on how well NWP models simulate the development of deep convection by evaluating their forecasts using satellite remote-sensing data. After my time in Leipzig, I worked for the German Weather Service (DWD) where I was involved in the project SINFONY. My key topic there was the improvement of forecasts with regard to summerly deep convection by combining observation-based nowcasting and NWP forecasts. Up to now, I have investigated deep convection on small spatiotemporal scales. With my research in TPChange on how a warming climate will affect vertical transport in convection and the structure of the upper troposphere, I will now consider the impact of convection on larger scales.

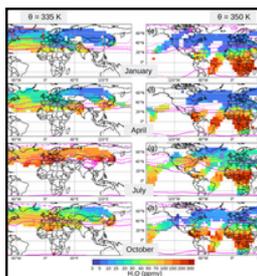


continued: **Publications within 2025**

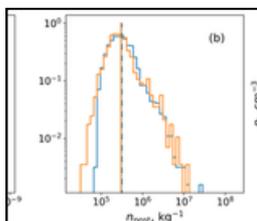
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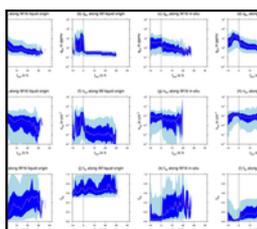
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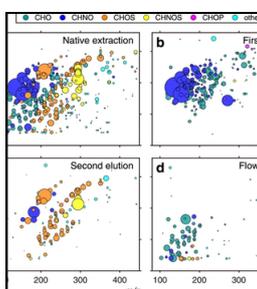
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Available Campaigns	
abbreviation	location
ACCLIP	Asia

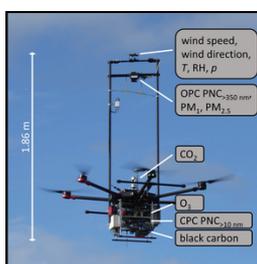
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Hi everyone,

my name is

Sabrina,

and I recently started my PhD as part of Phase II of the TPChange project in the Atmospheric Trace Gases group at the Institute for Physics of the Atmosphere, University of Mainz.

My journey in research also began in Mainz: I completed my BSc in Physics and MSc in Computational Sciences. My master's thesis, carried out in collaboration with the German Aerospace Center (DLR), combined my interests in aviation and atmospheric physics. Using satellite remote sensing, I explored the effectiveness of flight rerouting to reduce contrail formation, a major contributor to aviation's climate impact.

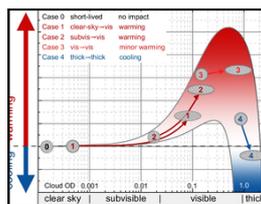
For my PhD, I am focusing on quantifying the radiative forcing of contrails using satellite observations and airborne measurements, aiming to provide insights for more sustainable aviation.

Outside of research, I enjoy spending time outdoors—hiking, skiing, playing beach volleyball and currently training for an upcoming half marathon.

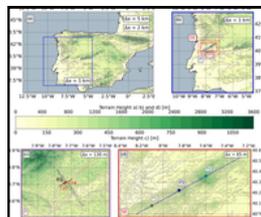
I'm excited to continue exploring the intersection of atmospheric science and sustainable aviation as part of TPChange.

continued: **Publications within 2025**

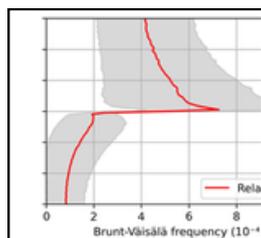
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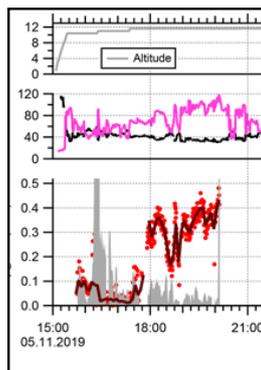
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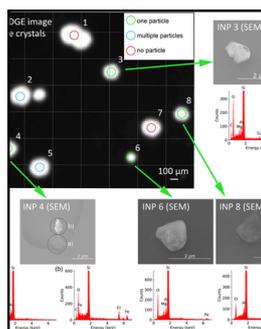
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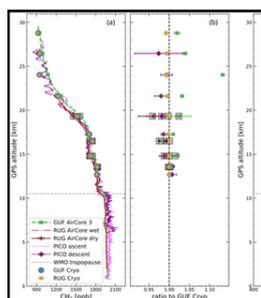
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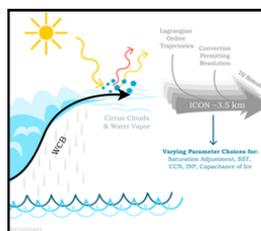
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Hi all,

I'm

Matthias

and I am a PostDoc in Project C07, part of the Numerical Modelling group in the Atmospheric Chemistry department at the Max Planck Institute for Chemistry, Mainz. I completed my PhD last year, focusing on global model simulations of atmospheric aerosols from the surface to the stratosphere, in close collaboration with TPChange Phase I.

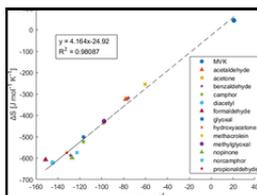
I studied Physics and Economics at Johannes Gutenberg University, Mainz, and wrote my master's thesis on experimental particle physics with CERN. In parallel I was working in an IT start-up, helping build a novel online journalism platform. My growing interest in sustainability, atmospheric processes and climate naturally led me to the Max Planck Institute, where I aim to better understand the complex impacts of natural and anthropogenic aerosols on climate and public health.

I've been lucky to become a father twice during my PhD, and family keeps me busy most of my time. When I do find free time, you'll find me playing volleyball or tennis, hiking, or cycling.

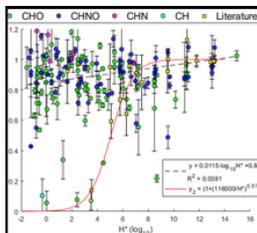
I'm excited to be part of TPChange's second phase as an active member, and to further explore the fascinating processes in the tropopause region.

continued: **Publications within 2025**

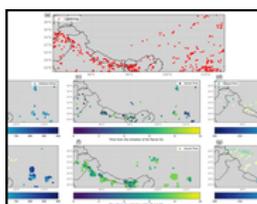
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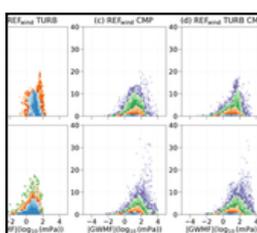
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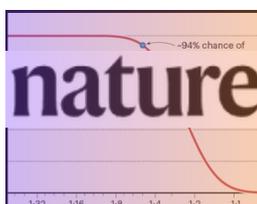
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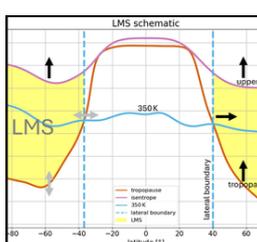
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"Hi everyone,
 I'm Laura,
 nice to meet you!
 I am a PhD student in the Stratosphere-Troposphere Dynamics & Climate group of Prof. Dr. Thomas Birner at the Ludwig Maximilian University of Munich, and I look forward to working with you all as part of the TP Change Project C05 on large-scale structure and variability of lowermost stratospheric water vapour. Currently, my research mainly focuses on transport mechanisms of water vapour in the UTLS and the related dynamic and thermodynamic drivers. Previously, I studied physics at Ruprecht Karl University of Heidelberg where I joined the Palaeoclimate dynamics and variability group at the Institute of Environmental Physics for my master thesis, investigating how different forcings influence effective precipitation changes between various past, present, and future climate states. I also had the opportunity to work on the NFDI4Earth project "Propagating complex uncertainties in data cubes" as a member of the Climatology and the Biosphere group at the Geo- and Environmental Center of the Eberhard Karl University of Tübingen. At its core, my motivation for engaging in science is simple: I want to learn about the connections—grand or subtle—that surround us. In a world that is increasingly fragmented, let's try to understand what connects us!"

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Speaker

Prof. Dr. Peter Hoor
Institute for Atmospheric Physics
Johannes Gutenberg-Universität Mainz

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