Waves to Weather

Newsletter Oct/Dec 2022

Welcome to a new W2W newsletter! The first thing that you will likely notice is that we are meeting again in person. This is especially important for a collaborative research effort like ours, and the smiles that you see in the photos were on our faces the whole time. As always, we have selected some research highlights that we hope will be of interest, as well as some of activities for outreach and to promote equal opportunities.

From all of us in W2W, we wish you a happy and restful holiday season, and a productive new year!

George Craig

Contents

If you have any questions or comments about this newsletter or W2W in general, we would be happy to hear from you!

Upcoming events

- The **workshop on scale interactions, data-driven modeling, and uncertainty in weather and climate** will be held jointly with TRR 181 "Energy transfers in Atmosphere and Ocean" (https://www.trr-energytransfers.de) in Ingolstadt from 27-30 March 2023. Save the date!
- The Meteorological Institute in Munich will celebrate its **100th anniversary** on 30 March 2023. Save the date!

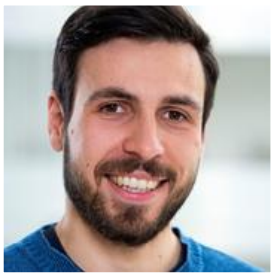
Additional information on upcoming events can be found here:
http://www.wavestoweather.de/meetings

News

Kevin Höhlein (TUM, project B5) visited KIT from 10-14 October 2022 to work on a joint publication on wind gust postprocessing with neuronal networks with Benedikt Schulz (KIT, C5). Kevin presented his ongoing research to the working groups of Peter Knippertz and Sebastian Lerch, and met Jieyu Chen (from Sebastian's group) to further discuss collaboration. Discussions continued during dinners with ECS from W2W and KIT.

From left to right: Athul Satheesh, Lea Eisenstein, Kevin Höhlein, Christoph Fischer and Benedikt Schulz.

Hella Garny, Jonas Späth, Philip Rupp, Sheena Löffel (C8 project) and Georgios Fragkoulidis (C4 project, Phase 1) attended the **7th SPARC General Assembly** at ECMWF from 24-28 October 2022 (see photo below, https://www.sparc-climate.org/meetings/7th-sparc-general-assembly/).

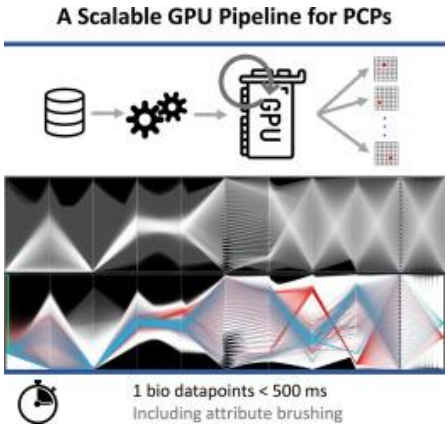


Congratulations, Benedikt Schulz for your **2022 Outstanding Student and PhD candidate Presentation Award**!
https://www.wavestoweather.de/news/price-2022

Research Highlights

Here are some examples of recently published research from W2W.

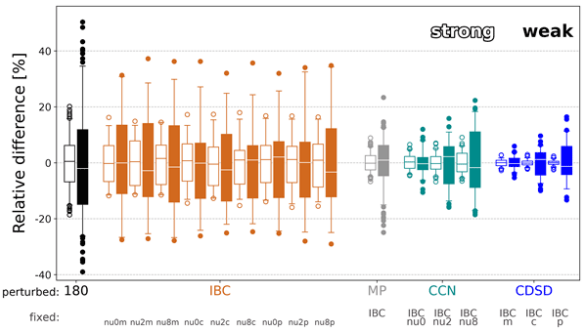
1. GPU accelerated scalable parallel coordinates plots (J. Stumpfegger, K. Höhlein, G. Craig and R. Westermann)



Parallel coordinates are a powerful technique to visually analyze multi-parameter data. We propose a scalable GPU realization of parallel coordinates building upon 2D pairwise attribute bins, to significantly reduce the number of lines to be rendered. Our approach comprises a GPU compute pipeline that combines shader-based scattering with atomic increment operations to efficiently count how often a line is drawn.

Read the full article:
https://www.sciencedirect.com/science/article/pii/S0097849322001868

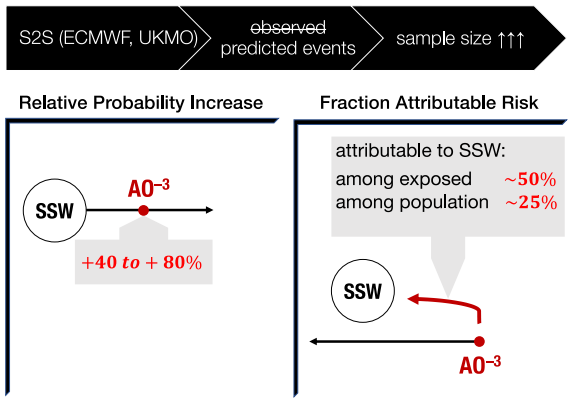
2. The impact of microphysical uncertainty conditional on initial and boundary condition uncertainty during different synoptic control (T. Matsunobu, C. Keil and C. Barthlott)



This study quantifies the impact of poorly constrained parameters used to represent aerosol–cloud–precipitation interactions on precipitation and cloud forecasts associated with uncertainties in input atmospheric states. Uncertainties in these parameters have a non-negligible impact on daily precipitation amount and largely change the amount of cloud. The comparison between different weather situations reveals that the impact becomes more important when convection is triggered by local effects.

Read the full article: https://doi.org/10.5194/wcd-3-1273-2022

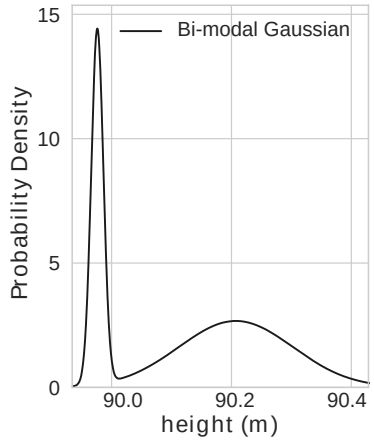
3. Stratospheric modulation of Arctic Oscillation extremes as represented by extended-range ensemble forecasts (J. Späth and T. Birner)



The stratospheric polar vortex is a strong cyclonic jet that forms every winter around the polar cap. It is known that large disruptions of the vortex, called sudden stratospheric warmings (SSWs), can also affect subsequent weather at the surface. In this study, we examine how often tropospheric extremes are attributable to preceding stratospheric extremes. First, we boost the available sample size of SSWs: Instead of focusing on events that occurred in the real atmosphere (approximately 30 events since satellite coverage), we analyze events that are predicted in subseasonal-to-seasonal ensemble forecasts (approximately ten thousand events). Second, we compute statistical measures such as the fraction of attributable risk: We find that about one quarter of large-scale weather extremes during winter may be attributable to preceding SSWs.

Read the full article: https://doi.org/10.5194/wcd-3-883-2022

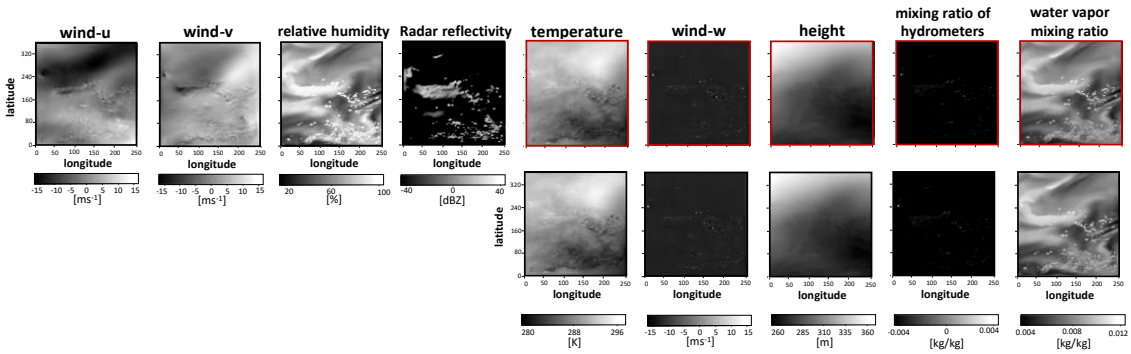
4. Convergence of forecast distributions in a 100,000-member idealised convective-scale ensemble (K. Tempest, G. C. Craig and J. R. Brehmer)



An idealised ensemble that replicates key properties of the dynamics and statistics of cumulus convection is used to identify how sampling uncertainty of statistical quantities converges with ensemble size. A universal asymptotic scaling for this convergence was found, which was dependent on the statistic and the distribution shape, with largest uncertainty for statistics that depend on rare events.

Read the full article: https://doi.org/10.1002/qj.4410

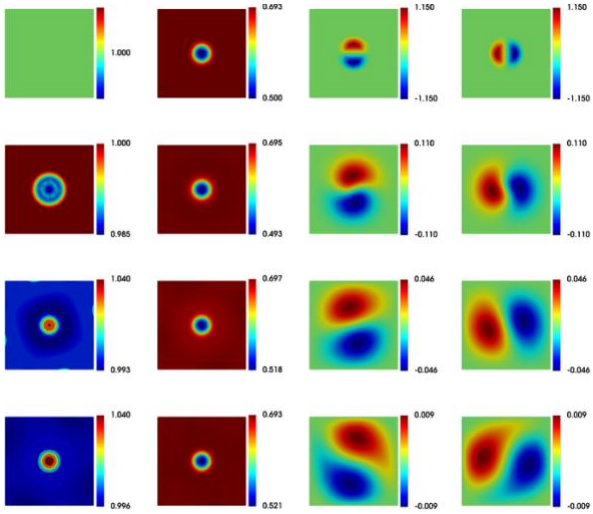
5. Deep Learning-based Parameter Transfer in Meteorological Data (F. Farokhmanesh, K. Höhlein and R. Westermann)



Numerical simulations in earth-system sciences consider a multitude of physical parameters in space and time, leading to severe I/O bandwidth requirements and challenges in subsequent data analysis tasks. Deep-learning based identification of redundant parameters and prediction of those from other parameters, i.e. Variable-to-Variable (V2V) transfer, has been proposed as an approach to lessening the bandwidth requirements and streamlining subsequent data analysis. We examined the applicability of V2V to meteorological data and found that redundancies within pairs of parameter fields are limited, which hinders application of the original V2V algorithm. Therefore, we assessed the predictive strength of meteorological parameters by analyzing the learning behavior of V2V reconstruction networks in an ablation study. We demonstrated that efficient V2V transfer becomes possible when considering groups of parameter fields for transfer, and proposed an algorithm to implement this.

Read the full article: 10.1175/AIES-D-22-0024.1

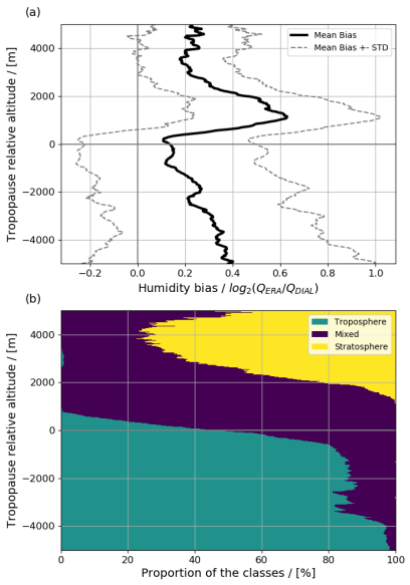
6. Compressible Navier–Stokes Equations with Potential Temperature Transport: Stability of the Strong Solution and Numerical Error Estimates (M. Lukáčová-Medvid'ová and A. Schömer)



We present a dissipative measure-valued (DMV)-strong uniqueness result for the compressible Navier–Stokes system with potential temperature transport. Strong solutions are stable in the class of DMV solutions. More precisely, a DMV solution coincides with a strong solution emanating from the same initial data as long as the strong solution exists. We derive a priori error estimates for a mixed finite element-finite volume method.

Read the full article: https://doi.org/10.1007/s00021-022-00733-z

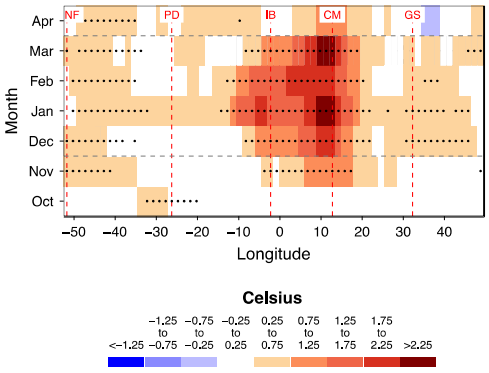
7. Vertical structure of the lower-stratospheric moist bias in the ERA5 reanalysis and its connection to mixing processes (K. Krüger, A. Schäfler, M. Wirth, M. Weissmann and G. Craig)



A moist bias in the extratropical lowermost stratosphere is one of the most prominent systematic humidity errors in current NWP models. The presence of this moist bias is known but less is known about its vertical structure and its origin. We use a comprehensive multi-campaign data set of airborne lidar water vapor profiles to characterize the vertical structure of the moisture bias in the ERA5 reanalysis. We find a moist lower-stratospheric bias of up to +55% at 1.3km altitude above the thermal tropopause and uncover a decreasing bias beyond.

Read the full article: https://doi.org/10.5194/acp-2022-505

8. Upper-level winter troughs near 40 degrees North have an amplified low-latitude linkage over Africa (N. Ward, A. H. Fink, R. J. Keane and D. J. Parker)



In boreal winter, strong upper-level midlatitude troughs across the Atlantic Africa southwestern Asia sector became recognized as important factors in some extreme weather events. We study the 20% of winter days with strongest trough signatures during 1982-2020 and show that the trough impact over northern Africa is particularly strong in magnitude, low-latitude extent and persistence, leading to the characterization of a northern Africa mode of several-days weather fluctuation. Mid-level tropical plumes of moisture are also typically present for strong troughs and can lead to weather extremes.

Read the full article: https://doi.org/10.1002/asl.1129

Additional publications relevant to W2W are listed here:
http://www.wavestoweather.de/publications

Past activities

Mathematics of the Weather workshop (MOW22)

The MOW22 took place in Bad Orb from 4 – 6 October 2022. Thirty-five participants (27 in person, 8 online) from eight different countries took part in this forum to discuss new numerical approaches for use in numerical forecasting, climate modeling and research into numerical modeling of the atmosphere. This year's special topics were data assimilation, machine learning and climate. Speakers included Dale Durran (Univ. Washington), Joe Klemp, Bill Skamarock and Chris Snyder (NCAR, USA), Yi Yuan (IAP Beijing, China), Takuya Kawabata (Japan Meteorological Agency, Tsukuba), and Rupert Klein (Freie Univ. Berlin).
The workshop was organized by Jurgen Steppeler with the support of W2W, and jointly with the HIWeather programme of the WMO.
The presentations were diverse and excellent, including these given by the Early Career Scientists. Discussions were fruitful and the atmosphere was very friendly, partly thanks to the evening program. Thank you to all the active contributors!
For more information about the program and abstracts, visit:
https://www.wavestoweather.de/meetings/mow2022

Participants of the MOW22 workshop

Guest at KIT

Alyson Douglas (Univ. of Oxford) visited Corinna Hoose's group at KIT on 5-6 October 2022. On 5 October, she gave a seminar, participated in Corinna's group meeting and discussed with Lena Frey (B1), Annika Oertel (B8), and Corinna (B1, B6, B8) about perturbed parameter ensembles, emulators and alternatives to the approaches that are currently used in projects B1 and B8. On 6 October, she visited Christian Grams' group.

From left to right: Barbara Dietel, Gabriella Wallentin, Annika Oertel, ***Alyson Douglas****, Hyunju Jung and Corinna Hoose.*

8th W2W Annual Meeting

This meeting took place from 28-30 November 2022 in Würzburg. About 80 people took part in the meeting, including the invited guests:

- Linda Schlemmer (DWD; keynote speaker)
- Peter Düben (ECMWF; keynote speaker)
- Gwendal Rivière (LMD, ENS, Paris; keynote speaker)
- Ron McTaggart-Cowan (Env. Canada)

Carolyn Reynolds (NRL, USA) took part online with a few more participants. The keynote presentations were highly relevant for W2W and many discussions took place at the coffee breaks, during lunches and dinners, and at the "Meet the Speakers" session organized for the ECS and the guests to talk about career opportunities and long-term strategies at each guest institution, three of them being weather services. The ice breaker with mulled wine was also a great opportunity to meet the guests and to reconnect with colleagues, sometimes seen for the last time one year ago in person.

The poster sessions were very successful, and most discussions ran longer than the poster sessions themselves.

Research Area C poster session

Group picture on 29 November 2022

New members were elected at the **General Assembly of the W2W members**:

- Julia Pongratz (LMU)
- Eyke Hüllermeier (LMU)
- Sebastian Krumscheid (KIT)
- Ugur Cayoglu (KIT)
- Michael Wand (JGU)

We welcome all five researchers in W2W!
The members also thanked Bernhard Mayer for coordinating Research Area B during Phase 2. Christian Keil was elected as a **new SG member** and he will lead RA-B in Phase 3, upon funding.

A **new ECS committee** was elected and consists of:

- Hyunju Jung (KIT)
- Sören Schmidt (JGU)
- Richard Maier (LMU)

Amelie Mayer (project C4, JGU) was elected as a **new member of the Equal Opportunity Committee** (EOC).
We thank the four ECS for their involvement and active participation in W2W's activities.

The current **Scientific Advisory Board** provided active and constructive feedback during the meeting. Since its term ends at the end of Phase 2, the W2W community thanked all SAB members for their constant constructive feedback during these four years, which has helped to improve the excellence of, and the collaborations in the consortium.

Childcare was provided for two children during the meeting. They enjoyed the games in the parks next to the hotel, the swimming pool, and many other activities offered by the friendly and professional care taker.

Impression of the childcare

An informal **topical lunch on Diversity** also took place on 29 November. This was the occasion to hear about what "diversity" means to the participants, and what measures and activities would be relevant to the W2W community.

The **program** and more details about the meeting are available here:
https://www.wavestoweather.de/meetings/w2w-ann-meet-2022

"Short Bias-Check-to-go" workshop

On 13 December 2022, 10 scientists (9 W2W, 1 KIT/IMK-TRO) took part in an online "Short Bias-Check-to-go" workshop. This workshop was a follow-up from the workshop on unconscious biases offered at the W2W kick-off meeting in 2019. In addition to a short presentation by the trainer, a large part of the workshop was dedicated to the discussion of case studies, which were relevant for W2W, and how the participants could react in specific situations. For more information, visit:
https://www.wavestoweather.de/equal_opportunity/activities/short-bias-workshop

Participants of the workshop on biases

Seminars and guest program

Read about the **W2W Fellows program** and find out about previous **W2W guest scientists** here:
http://www.wavestoweather.de/guest

Past and upcoming **W2W seminars** are listed here:
http://www.wavestoweather.de/seminars

The seminars and colloquium are broadcasted live using **Adobe Connect**. If you would like to receive a link to listen to the presentation, please contact us.

Communication

Dissemination

Past issues of the newsletter

Past issues of this newsletter are available here:
https://www.wavestoweather.de/communication/dissemination-activities/publications/quarterly_newsletter

Interview on the EGU blog

Federico Grazzini (Transfer Project T2, LMU) gave an interview to Davide Faranda (https://www.lsce.ipsl.fr/Pisp/davide.faranda/) on 17 November 2022 on the EGU blog of Nonlinear Processes (https://blogs.egu.eu/divisions/np/) about the relationship between global warming and Mediterranean extreme events. You can read the interview here:
https://www.wavestoweather.de/communication/outreach-activities/press-releases/interview-in-egu-blog

Presentation at the Vietnamese Weather Service

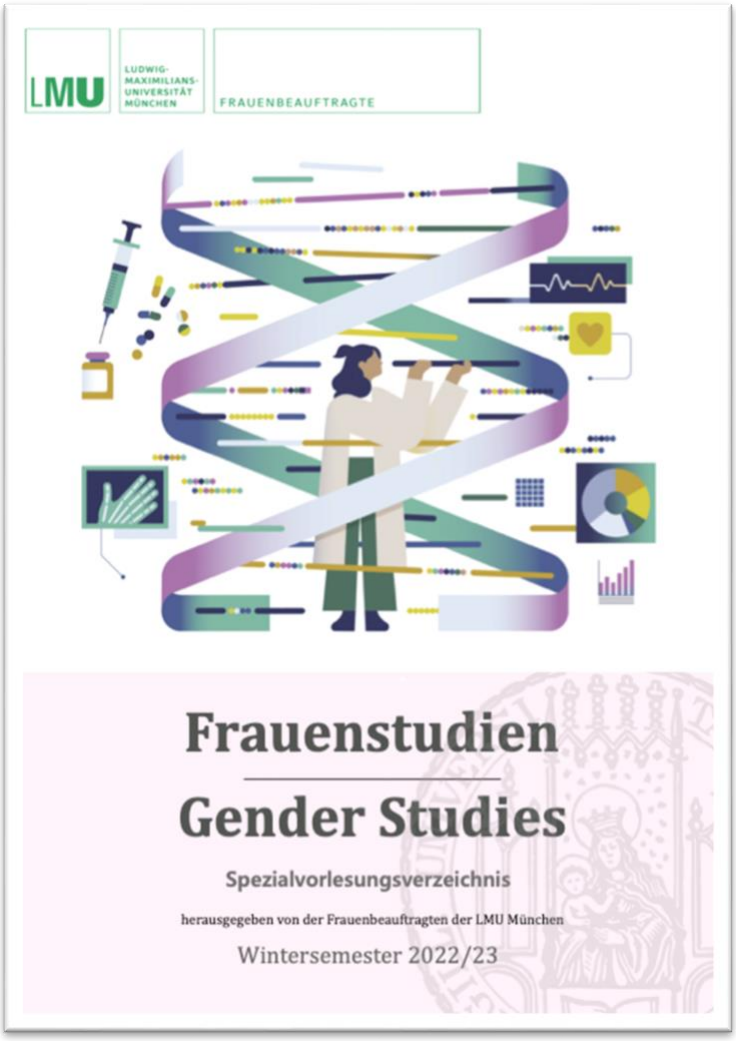
Andreas Fink presented results from projects C2 and C3 to the director of the National Centre for Hydrometeorological Forecast (NCHMF) and ca. 25 NCHMF employees in Hanoi, Vietnam, on 22 November 2022. The presentation called “Using novel forecasting techniques to improve prediction of tropical rainfall and cyclones” was followed by a lively and fruitful discussion on postprocessing and hybrid forecast methods. To find out more, visit:
https://www.wavestoweather.de/communication/dissemination-activities/meetings/presentation-at-nchmf-2022

Andreas Fink at the NCHMF in Hanoi, Vietnam, on 22 November 2022

Equal opportunity (EO) activities

Report on EO activities at the meteorological institute at the LMU

The activities offered at outreach events for school girls such as Girls' Day were summarized in the Gender Studies lecture timetable for the winter semester 2022/2023 at LMU, available here (in German, p. 9-11):
https://www.frauenbeauftragte.uni-muenchen.de/genderkompetenz/frauenstudien1/frauenstudien/wise-2022-23.pdf



Cover of the lecture timetable

Distribution of the "Of course!" comic book

The second volume "Of course!^{2}" is now printed! Audine Laurian distributed both volumes (Of course! and Of course!^{2}) at the **"MINT-EC-Schulleitungstagung 2022"** on 4 November in Koblenz. This yearly event is organized by the national excellence school network MINT-EC. The school managements of all MINT-EC schools in Germany came together to meet and exchange. This has been an excellent opportunity to connect with schools in Germany, and to advertize and distribute the comic book to school directors and teachers. More information is available here:
https://www.wavestoweather.de/equal_opportunity/activities/schulleitungstagung2022

Stand at the MINT-EC-Schulleitungstagung 2022

German Conference of Women in Physics

The German Conference of Women in Physics (Deutsche Physikerinnentagung), taking place annually since 1997, was hosted by the Karlsruhe Institute of Technology (KIT) in November 2022. The conference offers female physicists of different areas and at different career levels - from student to professor as well as physicists in industry - the possibility for networking and professional exchange. This year, the conference included a session on Meteorology and Atmospheric Physics, and an invited keynote presentation by Franziska Glassmeier (right on the photo below, with Corinna Hoose) from TU Delft. Franziska presented her work on aerosol-cloud-climate cooling as a data-driven dynamical system, and also discussed career choices and related challenges. The keynote presentation was supported by W2W.

Corinna Hoose and Franziska Glassmeier at the 26th German Conference of Women in Physics. Photo credit: Olimpia Bruno

To learn more about this event, visit:
https://www.wavestoweather.de/equal_opportunity/activities/physikerinnen-tagung-2022

Girls' Day 2023

This outreach event for school girls in Germany will take place on 27 April 2023. You can read about past Girls' Days offered by W2W scientists here:
https://www.wavestoweather.de/equal_opportunity/activities

EO measures in W2W

- Read about the EO committee:
  http://www.wavestoweather.de/equal_opportunity/contact
- Read about the EO measures offered in W2W:
  http://www.wavestoweather.de/equal_opportunity/eo_measures
- Read about the EO measures and activities already implemented:
  http://www.wavestoweather.de/equal_opportunity/activities

Fall's highlight

Cloud formation at Trollstigen, Norway. Photo: Martin Hanke-Bourgeois.
Martin Hanke-Bourgeois appreciates and is proud of the great time he had as PI of W2W and wishes best success for the application for the third funding period.

Contact

Dr. Audine Laurian
Scientific Manager of Waves to Weather (SFB TRR 165; W2W)

Meteorological Institute
Ludwig-Maximilians University
Theresienstr. 37
80333 Munich
Germany

Tel: +49 (0) 89 2180-4513
Fax: +49 (0) 89 280-5508

Email: audine.laurian@lmu.de
Internet: http://www.wavestoweather.de