Waves to Weather

Newsletter Oct/Dec 2021

Welcome to the final W2W Newsletter of 2021. This was another "hybrid" year. Our annual meeting in November was, for many of us, the only event where we were able to meet the community in person and share our discoveries and experiences. In contrast, the online Atmospheric Blocking Workshop in September attracted huge interest, with over 170 participants from all over the world. We are especially proud of this meeting since it was organized on the initiative of some of our early career scientists, who did a fantastic job in creating a concept and bringing it to reality. And as always, this newsletter features highlights from our scientific work and outreach activities that we hope you will find interesting.

From all of us in Waves to Weather, I wish you safe and happy holidays and a wonderful 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

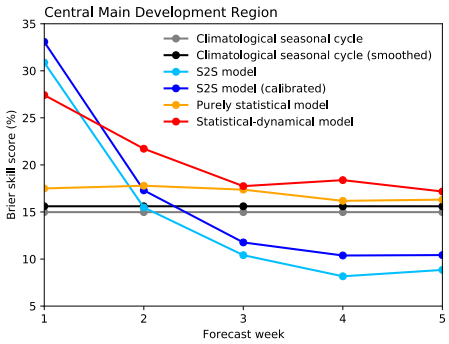
- A **W2W women workshop** will take place early 2022 and will cover topics such as general strategies (how to deal with the imposter syndrome, what to do if a colleague appears to be biased, etc.), voice training and a panel discussion with the women PIs and the ECSs in W2W.
  Visit: https://www.wavestoweather.de/meetings/women-workshop-2022
- A **W2W hands-on workshop** will take place on 4 September 2022, on the Sunday before the EMS Annual Meeting in Bonn, Germany, to showcase the tools developed in W2W to the scientific and operational communities. Save the date and stay tuned!
  Visit: https://www.wavestoweather.de/meetings/hands-on-workshop-sep2022
- The **Mathematics of the Weather conference** will take place from 4-6 October 2022 in Bad Orb with the support of W2W and in collaboration with the HIWeather programme of WMO. Registration opens on 1 March 2022 and deadline for abstract submission is 30 June 2022. Stay tuned and visit:
  https://www.wavestoweather.de/meetings/mow2022

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

Research Highlights

Here are some examples of recently published research from W2W.

1. Statistical-Dynamical Forecasting of Sub-Seasonal North Atlantic Tropical Cyclone Occurrence (M. Maier-Gerber, A. H. Fink, M. Riemer, E. Schömer, C. Fischer and B. Schulz)



We systematically assess a hierarchy of distinct model approaches for probabilistic forecasts of weekly tropical cyclone occurrence in the North Atlantic. These include various climatological models, (un)calibrated S2S forecasts, and a purely statistical modelling approach. As a contribution to bridging the sub-seasonal predictability gap, a statistical-dynamical forecast model is developed, combining statistical models and NWP-based predictors. For each forecast week, this hybrid model is trained on optimal predictor subsets, selected from a variety of climatological, oceanic, tropical, and extratropical predictors. A systematic validation in the Central Main Development Region and Gulf of Mexico shows that the statistical-dynamical approach outperforms all other modelling approaches for lead times of 2-3 weeks and beyond.

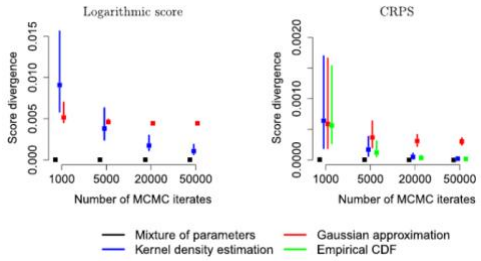
Read the full article: https://doi.org/10.1175/WAF-D-21-0020.1

2. Machine learning for total cloud cover prediction (Á. Baran, S. Lerch, M. El Ayari and S. Baran)

Accurate and reliable forecasting of total cloud cover is vital for many areas such as astronomy, energy demand and production, or agriculture. While most meteorological centers issue ensemble forecasts of TCC, these forecasts are often uncalibrated and exhibit worse forecast skill than ensemble forecasts of other weather variables. We compare several machine learning approaches for post-processing total cloud cover forecasts and demonstrate that incorporating forecasts of precipitation as additional predictor substantially improves the forecast quality.

Read the full article: https://doi.org/10.1007/s00521-020-05139-4

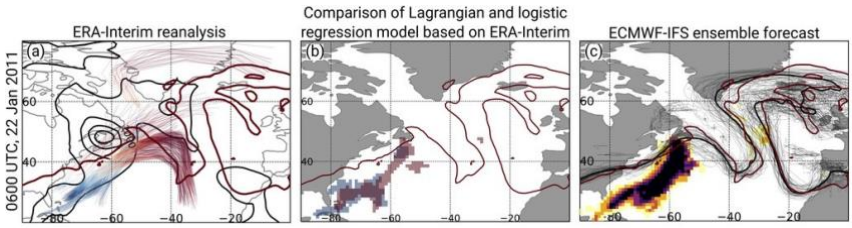
3. Predictive Inference Based on Markov Chain Monte Carlo Output (F. Krüger, S. Lerch, T. Thorarinsdottir and T. Gneiting)



In Bayesian inference, predictive distributions are typically in the form of samples generated via Markov chain Monte Carlo or related algorithms. In this paper, we conduct a systematic analysis of how to make and evaluate probabilistic forecasts from such simulation output. We develop a notion of consistency that allows to assess the adequacy of methods for estimating the stationary distribution underlying the simulation output and provide asymptotic results that account for the salient features of Bayesian posterior simulators.

Read the full article: https://doi.org/10.1111/insr.12405

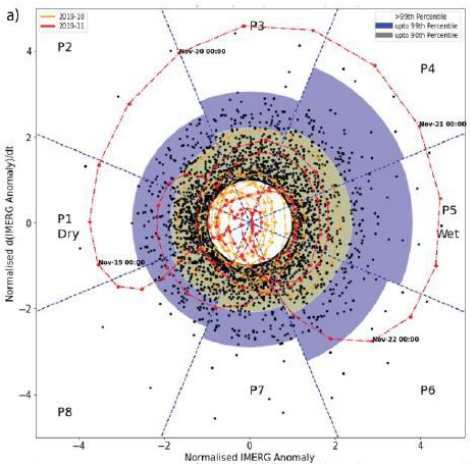
4. Toward a Systematic Evaluation of Warm Conveyor Belts in Numerical Weather Prediction and Climate Models. Part I: Predictor Selection and Logistic Regression Model (J. Quinting and C. Grams)



Warm conveyor belts (WCBs) are ascending air streams in the warm sector of extratropical cyclones. WCBs importantly affect midlatitude dynamics and are sources of forecast uncertainty. However, extensive trajectory computations, which are needed to identify WCBs, have hindered systematic verifications of WCBs in numerical models until now. To circumvent this problem, we introduce a statistical approach that identifies footprints of WCBs in large numerical datasets at low computational cost. Applying these statistical models to a large dataset of subseasonal reforecasts enables the first systematic verification of the representation of WCBs in state-of-the-art numerical weather prediction models (*Wandel et al.* 2021). The study reveals a systematic underestimation of WCB activity in particular over the eastern North Pacific and North Atlantic. Overall, the new statistical approach is an important step towards shedding light on the role of WCBs in systematic biases and error growth in numerical models.

Read the full article: https://doi.org/10.1175/JAS-D-20-0139.1

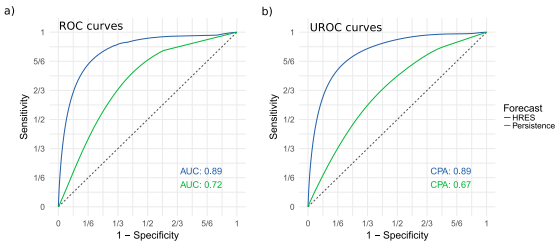
5. Meteorological causes of the catastrophic rains of October/November 2019 in equatorial Africa (S. E. Nicholson, A. H. Fink, C. Funk, D. Klotter and A. Rasheeda Satheesh)



Rains in October and November 2019 brought disaster to much of equatorial Africa. In East Africa tremendous rains triggered flooding and landslides in Kenya, causing over 100 deaths and the displacement of some 18,000 people. The situation was exacerbated by an unprecedented locust plague made possible by the intense rains. The level of the Mono River jumped a meter in four days, producing floods that affected some 50,000 residents of Benin and Togo. This article places the October and November 2019 rainfall extremes in historic context and analyses the juxtaposition of meteorological forcings required to explain these unprecedented hydroclimatic extremes in equatorial Africa. The meteorological factors considered include the Dipole Mode Index, zonal winds over the central Indian Ocean, the Walker circulation, moisture flux and divergence, ENSO and tropical sea-surface temperatures in the Atlantic and Indian Oceans, and zonal circulation. The possible contribution of Tropical Waves has also been assessed. A record-breaking strong equatorial Kelvin Waves were observed to cross Africa in November 2019 and was associated with a further enhancement of the rainfalls.

Read the full article: https://doi.org/10.1016/j.gloplacha.2021.103687

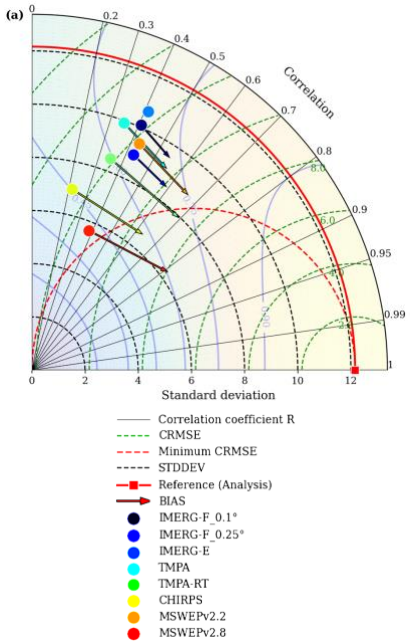
6. Receiver operating characteristic (ROC) movies, universal ROC (UROC) curves, and coefficient of predictive ability (CPA) (T. Gneiting and E.-M. Walz)



Receiver operating characteristic (ROC) curves and associated area under the curve (AUC) measures constitute powerful tools for assessing the predictive abilities of features, markers and tests in binary classification problems. ROC analysis is restricted to binary outcomes only, such as rain versus no rain. In our paper, we introduce ROC movies and universal ROC (UROC) curves that apply to any real-valued, linearly ordered outcome, along with an associated coefficient of predictive ability (CPA) measure. This new set of tools frees researchers from the need to artificially binarize the outcome.

Read the full article: https://doi.org/10.1007/s10994-021-06114-3

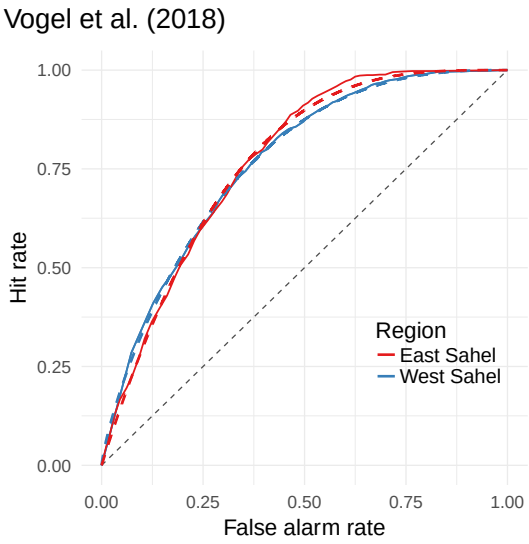
7. Validation of Satellite Rainfall Estimates over Equatorial East Africa (S. Ageet, A. H. Fink, M. Maranan, J. Diem, J. Hartter, A. L. Ssali and P. Ayabagabo



To robustly assess the performance of ensemble forecasts of rainfall, suitable validation data sets are required. The sparsity of rain gauge observations and the absence of surface radar data necessitates the use of satellite rainfall estimates in tropical Africa. To identify suitable products for the complex topography of East Africa, the performance of four (IMERG, TMPA, CHIRPS, and MSWEP) satellite rainfall estimates was assessed against daily rain gauge data at multiple spatio-temporal aggregations for the period 2001–2018. The IMERG final product turned out to be superior to all others at daily, pentanal, and decadal accumulations. Interestingly, the IMERG Early product that is not calibrated by surface observations performed best for extreme rainfall events.

Read the full article: https://doi.org/10.1175/JHM-D-21-0145.1

8. Receiver operating characteristic (ROC) curves: equivalences, beta model, and minimum distance estimation (T. Gneiting and P. Vogel)



Receiver operating characteristic (ROC) curves are used ubiquitously to evaluate scores, features, covariates or markers as potential predictors in binary problems. We characterize ROC curves from a probabilistic perspective and establish an equivalence between ROC curves and cumulative distribution functions (CDFs). These results support a subtle shift of paradigms in the statistical modelling of ROC curves, which we view as curve fitting. We propose the flexible two-parameter beta family for fitting CDFs to empirical ROC curves and derive the large sample distribution of minimum distance estimators in general parametric settings. In a range of empirical examples, the beta family fits better than the classical binormal model, particularly under the vital constraint of the fitted curve being concave.

Read the full article: https://doi.org/10.1007/s10994-021-06115-2

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

Past activities

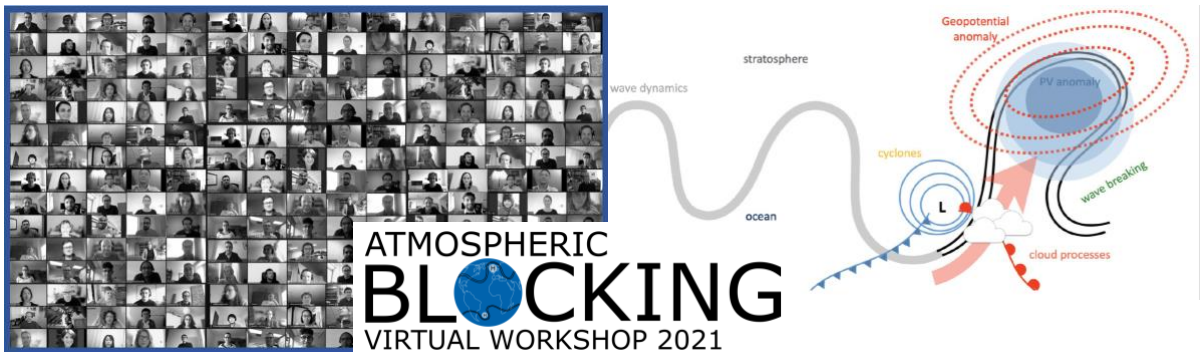
Atmospheric Blocking Workshop

The Atmospheric Blocking Workshop organized by W2W took place from September 27-29 2021 on QiqoChat. The focus of this workshop was set on the understanding of dynamics and physical processes in atmospheric blocking, with special focus on

- the role of dry and moist dynamics in the formation, maintenance, and decay of blocking,
- teleconnections and external forcing associated with blocking, and
- model representation and predictability of blocking dynamics and physical processes.

Nearly 60 abstracts were submitted by scientists from all parts of the world and with more than 170 participants, the workshop was a great success.
The 3-day program of the workshop consisted of seven oral sessions, two poster sessions and two breakout group discussions dedicated to the topics mentioned above. The talks and

poster presentations were of very high quality and stimulated very fruitful discussions. Overall, the workshop went really smoothly without technical difficulties, and although the program was very dense, there was enough time for further exchange during the coffee breaks. We would like to thank all the participants for their active participation that led to exciting discussions.
Regarding the content of the discussions and breakout sessions, the major takeaway was that blocking is a very complex phenomena with a range of different processes involved. There is not one process dominating, but strong interactions and case-to-case variability in pathways to blocking. Recent studies, which were presented at the workshop, contribute to an improved understanding of the dynamics of blocking. It remains our duty as a community to map out the variability of pathways that lead to the formation and maintenance of blocking and to further raise awareness of its complexity in the more general science community.

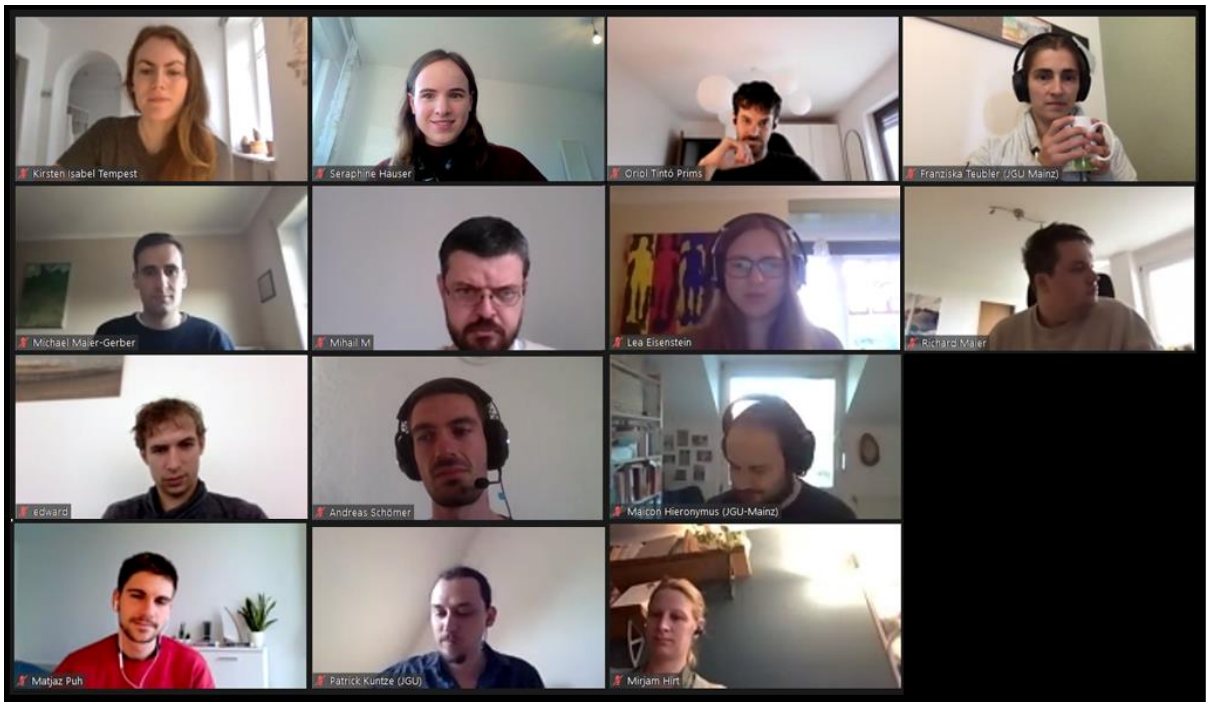


More detailed information about the workshop can be found on the workshop website: https://blocking-workshop-2021.wavestoweather.de
Or here https://www.wavestoweather.de/meetings/blocking-workshop-2021

Time management workshop for Early Career Scientists

A virtual, interactive workshop on "Time Management for Early Career Scientists" was held in October 2021. The workshop was divided into two parts with a 2-week interval between them, so that what was learned on the first day of the workshop could be put into practice and then reflected on the second day of the workshop. In total, 16 ECS from W2W took this opportunity to work on their self- and time-management.
The first workshop day took place on October 8 and started with an interactive introduction round, so that the coach could record which methods had been used till then for time management by each of the participants. The coach introduced several techniques which help make planning the week more effectively by setting priorities, e.g., S.M.A.R.T. goals and the Eisenhower-Matrix. A lively discussion took place about typical "time thieves" in daily life which vary from self-doubt and procrastination to writing emails and multitasking. At the end of the first workshop day, the importance of work-life balance was discussed with a direct exercise in which the ECS were asked to plan daily schedules and audit their time in detail in smaller breakout groups. The ECS were then encouraged to take the next two weeks to reflect on their self-management, goals, and bad habits.
The second workshop day covered the morning of October 22, and the focus was set on reporting what changes one had noticed in the past two weeks due to the use of newly

learned time management methods. In general, the ECSs noticed positive changes and questions about time management that came up during the 2-week period could be clarified in detail in the group and through the experience of the coach.



Some participants of the time-management workshop

Read more about this event here:
https://www.wavestoweather.de/meetings/time-manag-2021

W2W Career Workshop

An online W2W Career Workshop took place on 20-21st October 2021. Fifteen W2W PIs and alumni from Phase 1 shared their experiences from throughout their career path. They introduced themselves on the first day and had their own breakout rooms where ECSs had opportunities to ask questions. The first day was focused on academic career, which included a discussion session about funding and proposal writing, and the second day on sectors outside of academia. The general session and breakout rooms were filled up with many questions by ECSs and live discussions. The workshop was closed with a final discussion.

Thank you to all the invited alumni and PIs for sharing your experience! Thank you, Kirsten, for organizing the workshop, and thank you to the ECSs who chaired the sessions! Finally, thank you to all the participants for your engagement and many excellent questions!
One of the invited alumni, Alexander Kumpf, wrote: "The organization was perfect and I personally would have loved to have such a session in Phase 1!"

Participants of the Career Workshop on 20 October 2021

To read more about this event, visit:
https://www.wavestoweather.de/meetings/career-workshop-2021

W2W Annual Meeting

The Annual Meeting of W2W took place from 8-10 November 2021 for the first time in a hybrid format, both in Eibelstadt and online. About 90 participants, 65 in person and 25 remotely, took part in this intense three-day event. The extended poster sessions and the many coffee breaks were great occasions to finally get to know each other, to catch up, and to discuss scientific results with colleagues from all locations, and with international colleagues.

The **keynote speakers** were:

- Jill Johnson (Univ. Sheffield)
- Douglas Parker (Univ. Leeds)
- Carolyn Reynolds (NRL and Scientific Advisory Board member)
- Ron McTaggart-Cowan (Canadian Environ. Center and SAB member)

Further international guests included the other SAB members: Michael Morgan, Sue van den Heever and Tim Hewson.

A **new ECS committee** was elected for a period of one year and consists of:

- Sheena Löffel (DLR, main representative)
- Behrooz Keshtgar (KIT)
- Edward Groot (JGU)

A **new EO committee** was elected for a period of two years and consists of:

- Corinna Hoose (KIT)
- Christian Barthlott (KIT)

- Markus Bachmayr (JGU)
- Kirsten Tempest (LMU)
- Mirjam Hirt (LMU, upon confirmation)
- Philip Rupp (LMU)

A big thank you to all the participants and the newly elected committee members for actively making W2W an enthusiastic, exciting, creative and dynamic community!

Participants of the W2W Annual Meeting on 9 Nov. 2021

For more information about the program and the venue, visit:
https://www.wavestoweather.de/meetings/annual_meeting2021

ECS Annual Meeting (by Behrooz Keshtgar, Edward Groot and Sheena Löffel)

The ECS gathered virtually for their annual meeting on the 7th and 8th of December 2021. The meeting was originally planned to be held in person in Speyer, but it changed to an online format due to the COVID pandemic.
On the first day, the ECS participated in a workshop on "Designing Confidence, Dealing with Imposter Syndrome". In two separate groups, two coaches explained vocal, verbal and nonverbal communication strategies. The ECS worked on learning about the impact of stressors on perception and performance and how to improve their confidence especially in oral presentations with one coach. With a focus on the power of the words in shaping confidence, the second coach worked with the ECS to exercise a confident and assertive speech. Overall, the workshop provided the opportunity for the ECS to interact and talk about these topics and their ideas in smaller groups.

On the second day the meeting started with two keynote presentations. Patrick Ludwig from KIT talked about "Climate Change and Extremes". In his talk, he explained the fundamental physics of climate change, climate model development, and focused on some recent results of the IPCC report. Next, Georgios Fragkoulidis (JGU, former PhD student in W2W) talked about the local Rossby wave packet (RWP) properties and temperature extremes. After explaining the RWP diagnosis, Georgios explained the role of RWP in European temperature extremes and their interannual-to-decadal variability.
Dr. Yeon Joo Lee was invited on behalf of the IAMAS ECS to the meeting and presented an overview of IAMAS, their ECS activities and possible collaboration between W2W and IAMAS, for example a webinar series and ECS events in 2022. After this, the ECS committee gave a short overview of possibilities and activities within W2W for ECS and had discussions on future meetings.

We would like to thank everybody who helped to organize and make this meeting happen. Overall 32 ECS joined the meeting but some are missing on the group photo below.

Participants of the W2W ECS annual meeting on 8th December 2021

For more information about this event, visit:
https://www.wavestoweather.de/meetings/ecs-meeting-dec_2021

Seminars and guest program

Read about the **W2W Fellows program** here:
https://www.wavestoweather.de/guest

Information about previous **guest scientists** invited by W2W is posted 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 this newsletter

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

Outreach

Interview in German issue of MIT Technology Review

Sebastian Lerch has been interviewed in the German version of the MIT Technology Review on artificial intelligence and weather forecast. Read more here:
https://www.wavestoweather.de/communication/outreach-activities/press-releases/interview-techno-review-2021

Collaboration with the Deutsches Museum in Munich

Corinna Hoose (KIT) gave a presentation on “Clouds: water, ice, weather, climate” at the Deutsches Museum in Munich on 13 October 2021. This event was part of the seminar series “Wissenschaft für jedermann” addressed to the general public. About 70 people attended in person and many others streamed the presentation. A lively and friendly round of questions closed the event. Thank you, Corinna, for the exciting and instructive evening!
Find out more here:
https://www.wavestoweather.de/communication/outreach-activities/presentations-general-public/deutsches-museum-oct-2021

Corinna Hoose on 13 Oct. 2021 at the Deutsches Museum. Photo: A. Laurian

Interview in the Badische Neueste Nachrichten

Peter Knippertz (KIT) was interviewed on 21 October 2021 by the newspaper "Badische Neueste Nachrichten". W2W was prominently presented in the article. Read more here: https://www.wavestoweather.de/communication/outreach-activities/press-releases/article-in-bnn-oct2021

Interview in the Frankfurter Allgemeinen Sonntagszeitung

Volkmar Wirth was interviewed on 7 November 2021 by the newspaper "Frankfurter Allgemeinen Sonntagszeitung" about the Jetstream, atmospheric blockings, extreme weather, and W2W. To read more, visit: https://www.wavestoweather.de/communication/outreach-activities/press-releases/article-in-faz_nov_2021

Equal opportunity (EO) activities

Updates on the "Of course!" comic book

1. Read the latest interviews of Sue van den Heever, Til Birnstiel and Hella Garny: https://www.wavestoweather.de/equal_opportunity/activities/comic-book/
   Sue, thank you for taking part in this project and for your exciting contribution!
   Hella, thank you for sharing your personal and inspiring story!
2. Our blog post "What can we do to improve gender diversity in the workplace?" (https://blogs.egu.eu/divisions/as/2021/04/07/what-can-we-do-to-improve-gender-diversity-in-the-workplace/) presenting the "Of course!" comic book is nominated

for EGU's Blog of the Year 2021. The competition is open **until 20 January 2022**, here: https://blogs.egu.eu/geolog/2021/12/03/egus-blog-of-the-year-competition-is-back-vote-now-for-your-favourite-division-blog-post-of-2021/.
Thank you for your support!

Sofya Kovalevskaya - Her pioneering role as a female mathematician, by B. Wiebe and M. Bachmayr

Sofya Kovalevskaya was born in Moscow on January 15, 1850 and spent her early childhood in Russia, where her parents provided her with a good early education and private tutoring in mathematics, for which she showed great talent. However, in Russia, as in most other countries at the time, women were not allowed to attend universities. For travelling and studying abroad, women needed to be accompanied by their fathers or husbands. She overcame this obstacle by contracting a fictitious marriage with Vladimir Kovalevskij when she was 18 years old. They moved together to Heidelberg in Germany. There she obtained permission to attend classes subject to the professors' approval and studied physics and mathematics. In 1870, Kovalevskaya moved to Berlin where she began to take private lessons with Karl Weierstraß, since the university would not allow her even to attend courses. With Weierstraß' support, she earned a doctorate in mathematics summa cum laude at the university in Göttingen in 1874. Kovalevskaya thus became the first woman to have been awarded a doctorate in mathematics in modern Europe. One of her papers presented for the doctoral dissertation is work on partial differential equations and contains what is now commonly known as the Cauchy-Kovalevskaya theorem, which establishes the existence of local solutions for a large class of partial differential equations, including initial value problems such as in fluid dynamics. From 1874 to 1883 she and her husband lived in Russia, where she could not pursue a career in academia because of her gender and the couple faced financial difficulties. In 1878 their daughter Sofia was born. Kovalevskaya devoted almost two years to raising her, but then put her under the care of relatives and friends to resume her work in mathematics. She left her husband, who had become psychologically unstable and committed suicide in 1883. The same year, with the help of Gösta Mittag-Leffler, a fellow student of Weierstraß, Kovalevskaya was able to secure a position as a "privat-docent" at Stockholm University in Sweden. Although her appointment faced some severe opposition, she became assistant professor in 1884 and full professor in 1889, making her the first woman appointed to such a position in Europe since the 18th century. At this time, she became editor of Acta Mathematica as one of the first women to work for a scientific journal as an editor and she won the Prix Bordin of the French Academy of Science in 1888. Kovalevskaya died of epidemic influenza on February 10th in 1891 at the age of 41. She is said to be the greatest known woman scientist before the twentieth century, who had a pioneering role as a female mathematician in an almost exclusively male-dominated field.

Sofja Wassiljewna Kowalewskaja (approximately 1800).
Image: collection of the Swedish Academy of Sciences

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

Sunset with a southwestward view across Riegsee, Werdenfelser Land, March 2021. Photo: Volkmar Wirth

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