Waves to Weather

Newsletter Jan/Mar 2020

Welcome to the completely-safe-to-read W2W virtual newsletter! I hope that you and your colleagues and loved ones are healthy and coping well with the current crisis. In Germany, almost all aspects of our daily lives have been impacted by the COVID-19 restrictions, but we carry on as best we can. For W2W, many of us are on home office, and in-person meetings are not possible. At the moment we do not have any information about how long the measures will last. The Research Area meetings, as well as our PI retreat (postponed from February because of severe weather), are scheduled for May and June, so we are investigating video-conferencing and other virtual technologies for the likely event that we cannot travel. The plus side is that there might be a little more time to catch up on the latest research, and as usual we have a selection of highlights that we hope will interest you. Stay healthy!

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

Due to the current situation, some of the upcoming meetings might have to be virtual ones.

- The **Research Area B meeting** will take place on May 20th 2020 in Munich. More information will be available here shortly: https://www.wavestoweather.de/meetings/rabmeeting2020
- The **Research Area A meeting** will take place from May 27th – 28th 2020 in Mainz. More information will be available here shortly: https://www.wavestoweather.de/meetings/raameeting2020
- The **Research Area C meeting** will take place on June 3rd 2020 in Karlsruhe. More information will be available here shortly: https://www.wavestoweather.de/meetings/racmeeting2020
- The **PI retreat** has been postponed due to the storm Sabine. The new dates for this meeting are June 15 – 16th 2020. https://www.wavestoweather.de/meetings/pi_retreat2020
- The **Kompaktseminar Numerik workshop** will be organized from 9 – 11th September 2020 in the Pfalzakademie Lambrecht. More information will be available here: https://www.wavestoweather.de/meetings/kompaktseminar2020

- The **annual meeting of the W2W early career scientists** will take place from 28 – 30th September 2020. More information will be available here soon: https://www.wavestoweather.de/meetings/ecs-annual-meeting-2020
- A **machine learning workshop** will be organized by and for the W2W early career scientists from 12 – 14th October 2020. More information will be available here soon: https://www.wavestoweather.de/meetings/ecs-ml-workshop2020
- A **presentation skill workshop** will be organized by and for the W2W early career scientists from 28 – 30th October 2020. More information will be available here soon: https://www.wavestoweather.de/meetings/ecs-presentation-workshop2020
- The **6th W2W Annual Meeting** will take place from 16 – 18th November 2020 in Untermarchtal. More information will be available here: https://www.wavestoweather.de/meetings/annual_meeting6
- The **7th W2W Annual Meeting** will take place from 8 – 10th November 2021 in Eibelstadt.

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

Please contact us if you have any questions.

News

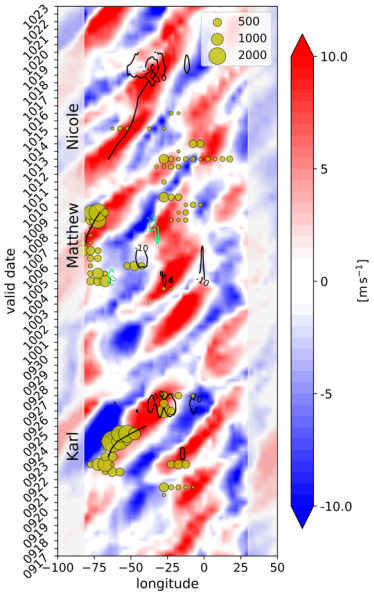
Terms of Reference for the Scientific Advisory Board (SAB)

This document defines the composition of the SAB and its responsibilities. It is available here: https://www.wavestoweather.de/about_us

Research Highlights

Here are some examples of recently published research from W2W.

1. The impact of dropsonde and extra radiosonde observations during NAWDEX in autumn 2016 (M. Schindler, M. Weissmann, A. Schäfler and G. Radnoti)



Utilizing a multitude of in situ and remote sensing instruments, a comprehensive dataset was collected during the transatlantic field campaign NAWDEX and the NOAA affiliated SHOUT mission in autumn 2016. Cycled data denial experiments with the ECMWF IFS showed that additionally collected dropsonde and radiosonde observations contributed to a reduction in the short-range forecast error, with the most prominent error reductions being linked to tropical storm events and their subsequent interaction with the mid-latitude waveguide. The evaluation of the Forecast Sensitivity to Observation Impact (FSOI) diagnostic indicates that the largest impact is due to dropsondes near tropical storms and cyclones, followed by dropsondes over the North Atlantic basin and additional Canadian radiosondes.

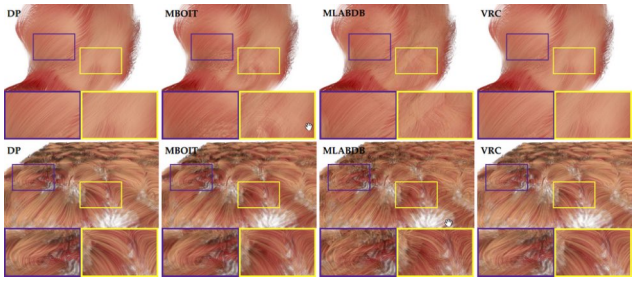
Read the full article: https://doi.org/10.1175/MWR-D-19-0126.1

2. Remember the past: a comparison of time-adaptive training schemes for non-homogeneous regression (M. N. Lang, S. Lerch, G. J. Mayr, T. Simon, R. Stauffer and A. Zeileis)

This study compares different time-adaptive training schemes for post-processing temperature forecasts across central Europe to adjust for seasonally varying error characteristics between ensemble forecasts and corresponding observations. "Remembering the past" from multiple years of training data is typically superior to the classical sliding-window approach even when the ensemble prediction system is affected by model changes. Thus, reducing the variance of the model estimates due to increased training data appears to be more important than reducing its bias by adapting rapidly to the most current training data only.

Read the full article: https://doi.org/10.5194/npg-27-23-2020

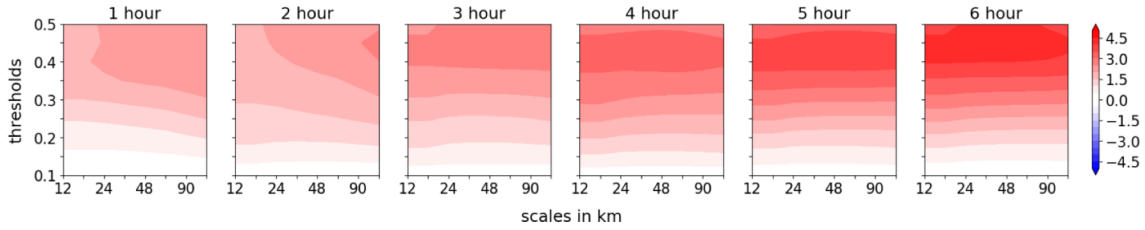
3. A Comparison of Rendering Techniques for 3D Line Sets with Transparency (M. Kern, C. Neuhauser, T. Maack, M. Han, W. Usher and R. Westermann)



In the visualization community prior work has shown that transparency is a highly effective tool to reveal important structures. It is in particular useful for exploratory visualization tasks where users map data values along the trajectories to transparency. Unfortunately, rendering transparency comes at the cost of performance when rendering large line sets with thousands of transparent layers. In this work, we present a comprehensive study of rendering techniques for 3D space-filling line sets with transparency. We introduce object-order techniques which make use of GPU rasterization and image-order techniques which are based on ray tracing. For both categories, we discuss approximate and exact techniques and thoroughly compare all approaches in terms of performance, memory consumption, and image quality and provide a final summary to recommend specific techniques for different line set scenarios.

Read the full article: https://ieeexplore.ieee.org/document/9007507

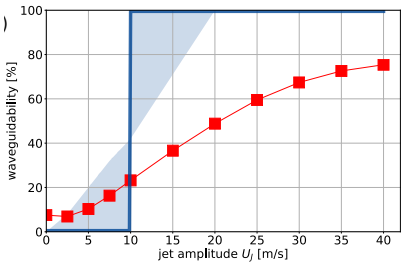
4. Combined state-parameter estimation with the LETKF for convective-scale weather forecasting (Y. Ruckstuhl and T. Janjic)



We investigate the feasibility of addressing model error by perturbing and estimating uncertain static model parameters using the localized ensemble transform Kalman filter (LETKF). We use the augmented state approach, where parameters are updated by observations via their correlation with observed state variables. We show in a nearly-operational convection-permitting configuration that the prediction of clouds and precipitation with the COSMO-DE model is improved if the two-dimensional roughness length is estimated with the augmented state approach.

Read the full article: https://journals.ametsoc.org/doi/abs/10.1175/MWR-D-19-0233.1?mobileUi=0

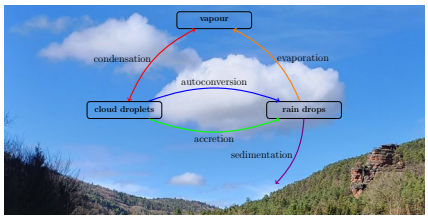
5. Waveguidability of idealized midlatitude jets and the limitations of ray tracing theory (V. Wirth)



This paper investigates the waveguidability of midlatitude jets, i.e., their ability to duct Rossby waves in the zonal direction. Waveguidability is quantified in the framework of an idealized numerical model and compared with the predictions from two complementary theoretical concepts. It is found that the concept of ray tracing, which has been used extensively in the past, does not provide a satisfactory explanation for the numerical results. Further analysis uncovers the underlying reasons.

Read the full article: https://www.weather-clim-dynam-discuss.net/wcd-2020-3/

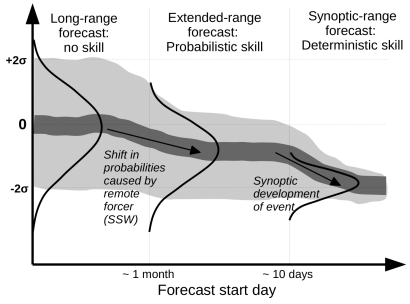
6. Unique Solvability of a System of Ordinary Differential Equations Modeling a Warm Cloud Parcel (M. Hanke and N. Porz)



We analyze the solvability of a system of ordinary differential equations modeling the microphysical processes in a warm cloud. A unique feature of this model is the automatic onset of nucleation. This is made possible by a non-Lipschitz right-hand side of the differential equation. We prove under mild assumptions that this system of equations has a unique physically consistent solution.

Read the full article: https://epubs.siam.org/doi/abs/10.1137/19M1267751

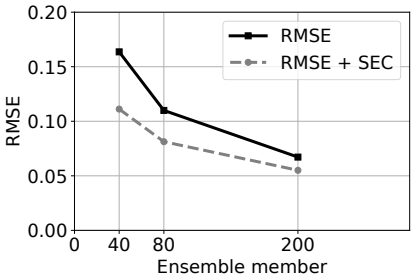
7. Enhanced extended‐range predictability of the 2018 late‐winter Eurasian cold spell due to the stratosphere (L.-A. Kautz, I. Polichtchouk, T. Birner, H. Garny and J.G. Pinto)



Stratospheric influence on the late winter 2018 Eurasian cold spell predictability is investigated in extended-range ensemble forecasts. While this event was predicted with the observed strength 10 days before, the probability of occurrence was doubled up to 25 days before, when a sudden stratospheric warming (SSW) occurred. Experiments with the observed stratosphere imposed show that rather than the occurrence of the SSW itself, it is the subsequent lower-stratospheric evolution following the SSW that is crucial in coupling to the troposphere.

Read the full article: https://rmets.onlinelibrary.wiley.com/doi/epdf/10.1002/qj.3724

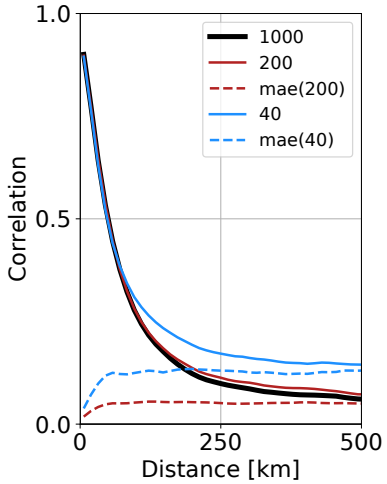
8. Sampling Error Correction Evaluated Using a Convective-Scale 1000-Member Ensemble (T. Necker, M. Weissmann, Y. Ruckstuhl, J. Anderson and T. Miyoshi)



State-of-the-art ensemble prediction systems usually provide ensembles with only 20-250 members for estimating the uncertainty of the forecast and its spatial and spatiotemporal covariance. Given that the degrees of freedom of atmospheric models are several magnitudes higher, the estimates are therefore substantially affected by sampling errors. Our study evaluates a statistical approach for correcting sampling errors. The applied sampling error correction (SEC) is a lookup table-based approach and therefore computationally very efficient. We show that this approach substantially improves both the estimates of spatial correlations for data assimilation as well as spatiotemporal correlations for ensemble sensitivity analysis. The sampling error correction reduces both random and systematic errors for all variables, ensemble sizes, and lead times.

Read the full article: https://doi.org/10.1175/MWR-D-19-0154.1

9. A convective-scale 1,000-member ensemble simulation and potential applications (T. Necker, S. Geiss, M. Weissmann, J. Ruiz, T. Miyoshi and G.-Y. Lien)



This study presents the first convective-scale 1,000-member ensemble simulation over central Europe, which provides a unique data set for various applications. A comparison with the operational regional 40-member ensemble of Deutscher Wetterdienst shows that the 1,000-member simulation exhibits realistic spread properties overall. Based on this, we discuss two potential applications. First, we quantify the sampling error of spatial covariances of smaller subsets compared with the 1,000-member simulation. Knowledge about sampling errors and their dependence on ensemble size is crucial for ensemble and hybrid data assimilation and for developing better approaches for localization in this context. Secondly, we present an approach for estimating the relative potential impact of different observable quantities using ensemble sensitivity analysis.

Read the full article: https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/qj.3744

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

Past activities

Course on machine learning

A three-day introductory course on machine learning was held by Sebastian Lerch and Eva-Maria Walz at KIT within the framework of a graduate school of the KIT Center "Mathematics in Sciences, Engineering and Economics" (MathSEE). Around 25 early career scientists (of which 4 W2W PhD students) from a wide range of disciplines including mathematics, meteorology, economics, mechanical engineering, computer science, computational chemistry and architecture learned about basics of machine learning modelling and state of the art techniques such as random forests, gradient boosting machines and neural networks. Lectures were accompanied by hands-on programming exercises using scientific and real-world datasets.

Participants of the course on Machine Learning on Feb. 19th 2020. Photo: Alexander Glauner (KIT).

For more information, visit:
https://www.wavestoweather.de/meetings/machine-learning-2020

Seminars and guest program

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

Team

Dissemination team

The dissemination team held its first teleconference on January 24th 2020. The dissemination and outreach strategy for W2W was discussed in detail and next steps have been planned.
The W2W website has been updated to reflect the dissemination and outreach strategy (https://www.wavestoweather.de/communication) and a section in German is now on the W2W website to appeal to the general public:
https://www.wavestoweather.de/wer_sind_wir.

Dissemination

Article in weather forecast and AI

Sebastian Lerch wrote an article on weather forecasts and artificial intelligence for the magazine "Fokus" of the Aargau Naturalist Society.
To read more, visit:
https://www.wavestoweather.de/communication/outreach-activities/press-releases/weatherforecast-and-ai

Emulator Day in Heidelberg

On January 27th 2020 the "Emulator Day" took place at HITS in Heidelberg. This event was an interdisciplinary meeting between the Astrophysik - Physics of Stellar Objects, the Molecular Biomechanics, and the Computational Statistics groups at HITS. Tilmann Gneiting invited Corinna Hoose and Constanze Wellmann (PhD student in B1 during Phase 1) to give a presentation about the use of emulators in cloud physics. Corinna Hoose opened the event with a lecture at the HITS colloquium on the simulation of deep convective clouds. The video of the lecture is available here: https://www.youtube.com/watch?v=lyAPRBduI18.
In the afternoon, Constanze Wellmann, Tilmann Gneiting among other participants presented their work. Informal discussions finally took place in small groups.

For more details about this event, visit:
https://www.wavestoweather.de/communication/dissemination-activities/meetings

Tilmann Gneiting and Corinna Hoose at HITS on Emulator Day. Photo: HITS

Mathematical colloquium

On 10th July 2020 Tilmann Gneiting will give a presentation on a mathematical perspective on the successes and limitations of weather forecast at the mathematical colloquium of the Ulm University. More information is available here:
https://www.wavestoweather.de/communication/dissemination-activities/meetings

Past issues of this newsletter

You will find the previous issues of this newsletter here:
https://www.wavestoweather.de/communication/dissemination-activities/publications/quarterly_newsletter

Outreach

Presentation at the Carl Bosch museum

On January 29th 2020, Tilmann Gneiting was invited to the Carl Bosch museum in Heidelberg to talk about the role of coincidence in weather forecast (title in German: "Wettervorhersage: Welche Role spielt der Zufall?"). This presentation was within the special exhibition "What a coincidence!" (in German: "Was für ein Zufall!").
Tilmann Gneiting gave an insight into the interactions between deterministic, numerical and statistical models and weather forecast. He highlighted in particular the roles of "chaos" and "coincidence".

For more information, visit: https://www.wavestoweather.de/communication/outreach-activities/presentations-general-public

Tilmann Gneiting at the Carl Bosch museum

Tilmann Gneiting and Sabine König (Carl Bosch museum) at the museum (Photos: Angela Michel, HITS)

Presentation on weather forecasting in the town hall of Karlsruhe

On January 29th 2020 Peter Knippertz gave a public presentation entitled "Vom Bauernkalender zum Supercomputer – Die stille Revolution der Wettervorhersage" in the town hall of Karlsruhe. The talk was part of the series "KIT im Rathaus", this time featuring KIT's Centre for Climate and the Environment. The "Bürgersaal", where parliamentary debates usually take place, was filled almost to the last seat (ca. 300 people). A lively discussion followed the presentation touching upon topics from local thunderstorm behavior to the current mistrust of scientists.

More information can be found here:
https://www.wavestoweather.de/communication/outreach-activities/presentations-general-public/kit_im_rathaus_29jan2020

Peter Knippertz in the Karlsruhe city hall on Jan. 29th 2020. Photo: Eva Walz.

Presentation at the Deutsches Museum in Munich

Thomas Birner has been invited to give a presentation at the Deutsches Museum in Munich within the seminar series "Wissenschaft für jedermann" on October 14th 2020. The collaboration between W2W and the Deutsches Museum started in 2017. With this third presentation by a W2W project leader, W2W will become an official partner of the Museum. To read more about this, visit:
https://www.wavestoweather.de/communication/outreach-activities/presentations-general-public/deutsches-museum-oct-2020

Equal opportunity (EO) activities

EO committee

The EO committee held its first teleconference on January 13th 2020. The aim of this meeting was to agree on the Terms of Reference (TOR) for the EOC, and to identify activities to organize in W2W. The TOR are available here:
https://www.wavestoweather.de/equal_opportunity
The next EO committee teleconference will take place on April 7th 2020.

Girls' Day

Girls' Day has been cancelled countrywide this year because of the coronavirus situation. For more information, visit:
https://www.wavestoweather.de/equal_opportunity/activities/girlsday-2020

Mädchen machen Meteorologie

A two-day workshop will be offered at the meteorological institute in Munich on September 2nd - 3rd 2020 to school girls between 12 and 14 years old. The participants will discover how exciting and challenging research in meteorology can be.

For more information, visit:
https://www.wavestoweather.de/equal_opportunity/activities/maedchenmachenmeteo2020
Special thanks to Leonhard Scheck who designed the logo!

Internships

In addition to the EO activities organized by W2W, school girls are invited for internships to the W2W partner institutes to experience research in meteorology close up. As an example, two school girls of age 16 and 17 visited the meteorological institute in Munich for a one-week internship from 24-28 February 2020.
You can read more about this, and other EO activities in W2W 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

Summer's highlight

Clouds. 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