

Waves to Weather



Newsletter Apr/June 2018

A crucial measure of success for a research program like W2W is scientific impact. In this context we are pleased to note that two papers published last year have been cited by their journals as being among the most downloaded. Congratulations to all the authors! Scientific highlights this quarter include review papers on Rossby wave packets and visualization in meteorology, new research results on PV dynamics of forecast errors and statistical post-processing of ensemble forecasts, and much more. We are also very proud to highlight our efforts to promote equal opportunities in atmospheric research. Each year in spring we host a variety of events for schools to introduce girls to the excitement of scientific research and to give them the opportunity to meet role models from the W2W community. At the end of the newsletter you will also find links that describe our full range of equal opportunity activities.

George Craig

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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 **7th Workshop on European Storms** will take place at KIT "Campus South" in Karlsruhe from October 10th – 12th 2018. The workshop is organized by Joaquim Pinto, Florian Pantillon and Patrick Ludwig and is sponsored by W2W. For more information, please visit: <http://www.wavestoweather.de/meetings/windstorm-2018>

The **4th Annual Meeting of W2W** will take place in Landau (Pfalz) from November 12th – 14th 2018. Information about the program, the venue, keynote speakers, etc. will be available here shortly: <http://www.wavestoweather.de/meetings/4th-annual-meeting-nov18>

The next **Cyclone Workshop** will be organized by W2W and will take place in Seeon (Bavaria, Germany) from September 30th – October 4th 2019. Save the date!

The website of the previous Cyclone workshop is here: <http://www.atmos.albany.edu/facstaff/rmctc/cw18/>

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

Please contact us if you have any questions.

News

Poster Award

Andreas Schlüter (C2) won an **Outstanding Poster Presentation Award** at the 33rd AMS Conference on Hurricanes and Tropical Meteorology for his poster on “Statistical Forecasting of Tropical Rainfall based on Spatio-Temporal Correlations and Equatorial Waves”, which was largely prepared by Peter Vogel (C2).

Only four out of approximately three hundred posters have received this award, so this is truly outstanding. Congratulations, Andreas and Peter!



Award winners at the AMS Conference 2018 (fifth from the left: Andreas Schlüter)

Top downloaded W2W articles

- The article of Maier-Gerber et al. (2017) “**Birth of the Biscane**” was one of the top 20 most downloaded recent papers published in *Weather*.
- The article of Janjic et al. (2017) “**On the representation error in data assimilation**” was one of the top 20 most downloaded recent papers published in *Quarterly Journal of the Royal Meteorological Society*.

This means that these two articles generated immediate impact and helped raise the visibility of W2W. Congratulations to all the authors!



George Craig accepted to be a member of the **Met Office Scientific Advisory Committee (MOSAC)**. For a period of four years, he will provide an independent assessment of the quality and relevance of the Met Office’s scientific research and will take part in fostering productive links with the international weather and climate community.



Bernhard Mayer has joined the Steering Group of W2W as the **new co-ordinator of Research Area B "Cloud-scale Uncertainties"**. In the name of the SG and all W2W researchers, we would like to thank Peter Spichtinger for having coordinated the RA-B during Phase 1 of W2W.



Marc Rautenhaus will start a new position as a research scientist at the Regionales Rechenzentrum at the University of Hamburg in June 2018 (<https://www.rrz.uni-hamburg.de>).



Florian Pantillon will start working as a permanent researcher at the Laboratoire d'Aérodynamique (CNRS) in Toulouse (France) next year. We would like to thank Florian for his rich and active contribution to W2W.

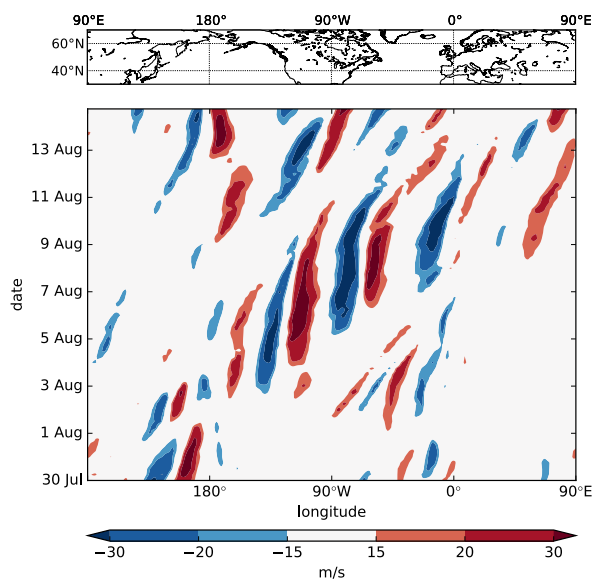


Lotte Bierdel started working as a Cognitive Consultant in the field "Watson AI and Data" at IBM on June 1st 2018. We would like to thank Lotte for her valuable inputs in W2W, and in particular in the A1 project.

Research Highlights

Here are some examples of recently published research from W2W.

1. Rossby Wave Packets on the Midlatitude Waveguide - A Review (V. Wirth, M. Riemer, E.K.M. Chang, and O. Martius)

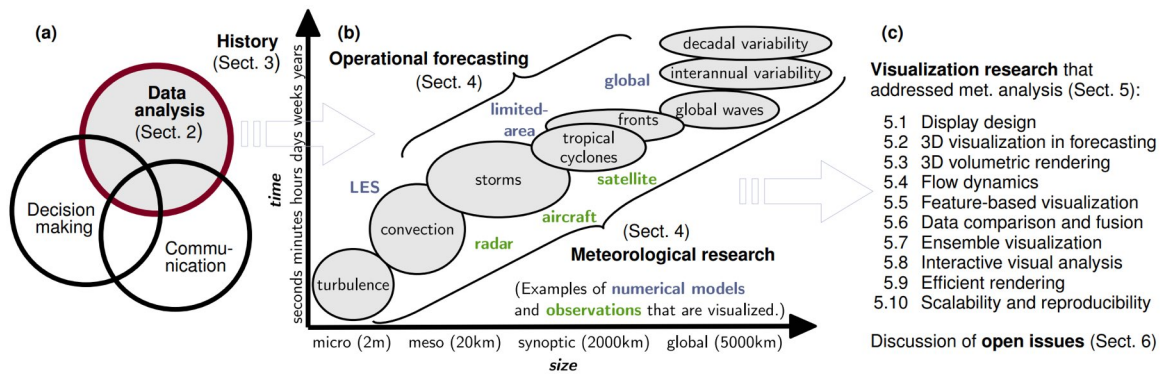


Rossby wave packets in the extratropical upper troposphere are interesting, because they can sometimes act as precursors to specific weather phenomena such as heat waves or strong surface cyclones. Our review paper summarizes novel approaches developed during the past 15 years to investigate both Rossby wave packets and the associated midlatitude waveguide. In addition, the paper includes general properties and principles dating back to the times of Rossby and Hovmoeller. An important aspect of Rossby wave packets is the phenomenon of “downstream development”. It means that the wave packet travels eastward faster than individual troughs and ridges, and this has important implications for forecasting. Novel techniques include object-based approaches as well as an analysis framework based on potential vorticity. The paper also points to open questions and avenues for future research.

Read the full article: <https://journals.ametsoc.org/doi/abs/10.1175/MWR-D-16-0483.1>

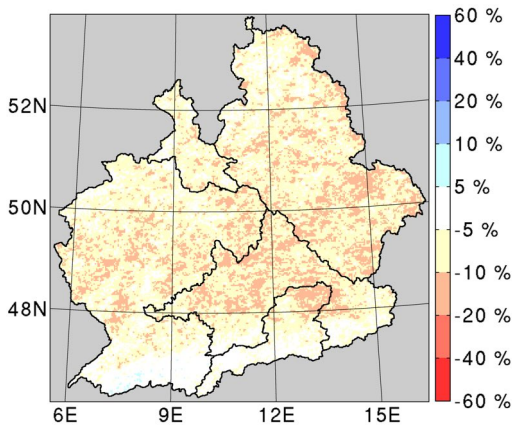
2. Visualization in Meteorology – A Survey of Techniques and Tools for Data Analysis Tasks (M. Rautenhaus et al.)

This article surveys the history and current state of the art of visualization in meteorology, focusing on visualization techniques and tools used for meteorological data analysis. We approach the topic from both the visualization and the meteorological side, showing visualization techniques commonly used in meteorological practice, and surveying recent studies in visualization research aimed at meteorological applications. Our overview covers visualization techniques from the fields of display design, 3D visualization, flow dynamics, feature-based visualization, comparative visualization and data fusion, uncertainty and ensemble visualization, interactive visual analysis, efficient rendering, and scalability and reproducibility, and discusses demands and challenges for visualization research targeting meteorological data analysis.



Read the full article: <http://ieeexplore.ieee.org/document/8126857/>

3. Precipitation sensitivity to the uncertainty of terrestrial water flow in WRF-Hydro – An ensemble analysis for Central Europe (J. Arnault, T. Ruml, F. Baur, S. Lerch, S. Wagner, B. Fersch, Z. Zhang, N. Kerandi, C. Keil, and H. Kunstmann)

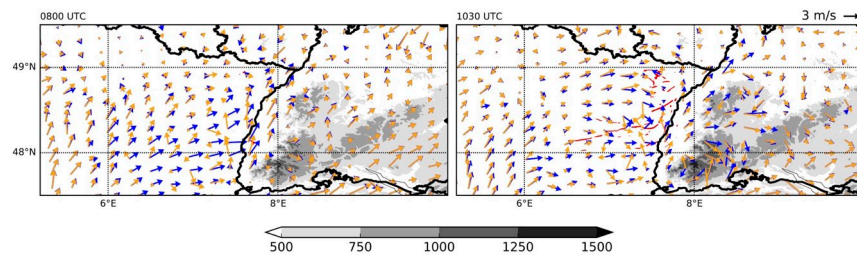


An ensemble of land-atmospheric simulations has been constructed in order to represent terrestrial water flow uncertainty and turbulence parameterization uncertainty in Central Europe, for the period Apr.-Oct. 2008. The uncertainty of terrestrial water flow noticeably increases the normalized ensemble spread of daily precipitation where topography is moderate, as well as where surface flux spatial variability is high, and the weather regime is dominated by local processes.

Read the full article: <https://journals.ametsoc.org/doi/abs/10.1175/JHM-D-17-0042.1>

4. The precipitation response to variable terrain forcing over low-mountain ranges in different weather regimes (L. Schneider, C. Barthlott, A. Barrett, and C. Hoose)

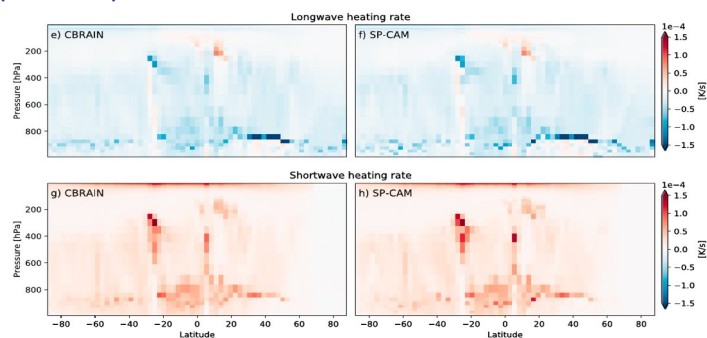
Several mechanisms are shown to affect amount, location and timing of precipitation over mountainous terrain. Despite showing that the low-level wind convergence is crucial for convection initiation during weak forcing conditions, its strength varies significantly, leading to various, almost contrary, precipitation responses, i.e. by promoting the formation of boundary layer rolls. Under strong forcing conditions, an interplay between large-scale advection and inhibited lifting in the absence of mountains is simulated, which results in a precipitation shift downstream.



Read the full article: <https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/qj.3250>

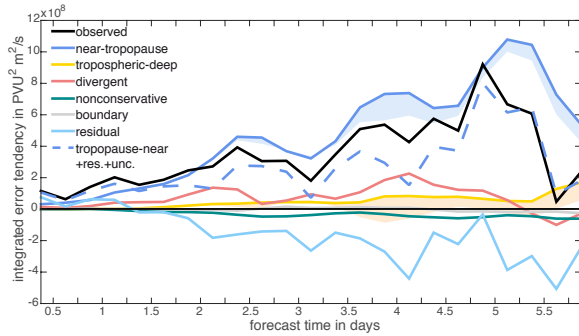
5. Could machine learning break the convection parameterization deadlock? (P. Gentine, M. Pritchard, S. Rasp, G. Reinaudi and G. Yacalis)

The representation of sub-grid clouds remains the largest source of uncertainty in climate models. Cloud-resolving models are much better at capturing these small-scale processes but are too expensive for climate change simulations. We explore whether deep neural networks can learn to represent sub-grid processes in climate models from cloud-resolving data. The neural network is shown to be able to accurately capture the temperature and moisture tendencies from convection and radiation. These results demonstrate that machine learning is a viable method for sub-grid parameterization development. The figure shows the thermal and solar heating rates predicted by the neural network (CBRAIN) compared to the truth (SP-CAM).



Read the full article: <https://doi.org/10.1029/2018GL078202>

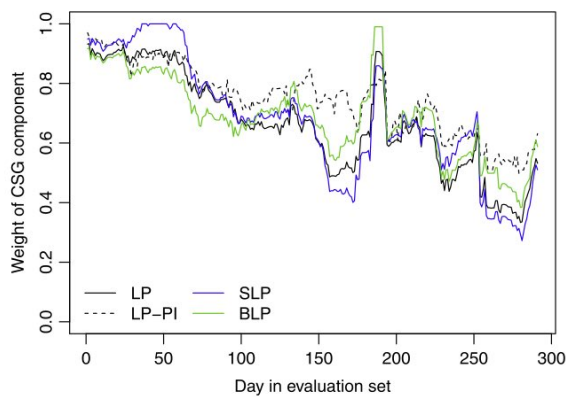
6. Potential-vorticity dynamics of forecast errors: A quantitative case study (M. Baumgart, M. Riemer, V. Wirth, F. Teubler, and S. T.K. Lang)



In this study the relative importance of four different processes to potential vorticity error growth near the tropopause is quantified in a case study of the operational ECMWF model. Mesoscale errors are in this case generated near the tropopause after around 2 forecast days, which directly project on the tropopause evolution and further amplify by differences in the non-linear Rossby wave dynamics. The direct impact of differences in the baroclinic instability on error growth is, in contrast, only weak.

Read the full article: <https://journals.ametsoc.org/doi/abs/10.1175/MWR-D-17-0196.1>

7. Combining predictive distributions for the statistical post-processing of ensemble forecasts (S. Baran and S. Lerch)

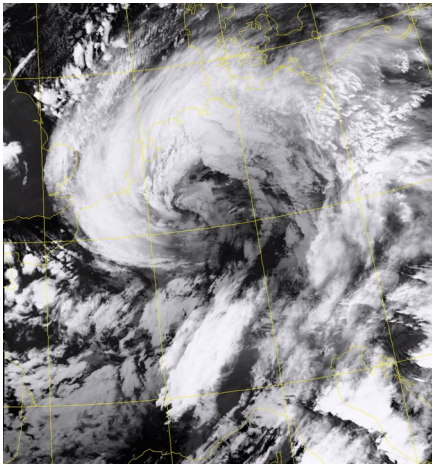


The choice of a suitable parametric family forecast distributions for statistical post-processing of ensemble weather forecasts often poses a substantial challenge for weather variables such as wind speed or precipitation. We assess the merits of a generally applicable route to improving the forecast performance where predictive distributions from individual models are combined as weighted mixtures. Several state-of-the-art aggregation schemes are compared in two case studies with wind speed and precipitation forecasts.

The image shows mixture weights of a gamma distribution-based component for precipitation forecasts.

Read the full article: <https://doi.org/10.1016/j.ijforecast.2018.01.005>

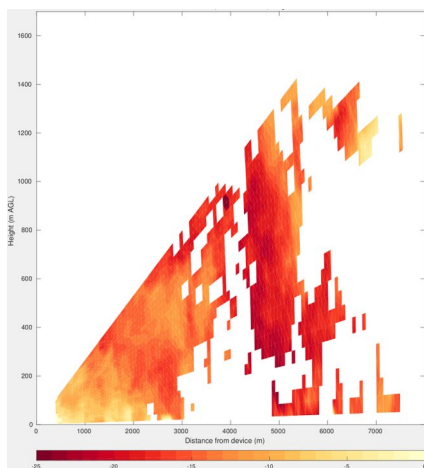
8. The devil in the detail of storms (P. Knippertz, F. Pantillon, and A.H. Fink)



This solicited Perspective article comments on some new research by *Oscar Martínez-Alvarado et al.* published in the same ERL issue on potential changes of sting jet occurrence and severity with climate change. The main point of this short contribution is that most damages from winter storms come from embedded mesoscale features like sting jets that are not resolved by standard climate models calling for new downscaling or pseudo-global warming studies.

Read the full article: <https://doi.org/10.1088/1748-9326/aabd3e>

9. Overview and first results of the Wind and Storms Experiment (WASTEX): a field campaign to observe the formation of gusts using a Doppler lidar (F. Pantillon, A. Wieser, B. Adler, U. Corsmeier and P. Knippertz)



The Wind and Storms Experiment (WASTEX) was conducted during the winter 2016–2017 in the Upper Rhine Valley to better understand the formation of wind gusts during the passage of storms. The key instrument of the field campaign was a scanning Doppler lidar, which provides accurate wind observations along its beam with high spatial and temporal resolutions and within a range of several km. Results from WASTEX should help improving the representation of wind gusts in weather and climate models.

Read the full article: <https://doi.org/10.5194/asr-15-91-2018>

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

Seminars and guest program

Information about 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.

Selected past and upcoming outreach activities

Article in “Earth System Knowledge Platform”

Andreas Fink wrote an article about flash floods in Africa in an issue of ESKP with special focus on mega cities under pressure. The article (in German) refers to the publication of *Vogel et al.* 2018. To read the article, please visit:

<http://www.wavestoweather.de/outreach/article-in-eskp-may2018>

Tag der Physik at LMU

On July 24th 2018, a few researchers at the meteorological institute at the LMU in Munich will offer workshops for 250 school children. The program includes a presentation by, and a discussion led by Bernhard Mayer on the predictability of climate change and weather, experiments in the lab to explain the Föhn, convection, and low-pressure systems, a visit of the roof instruments to explain clouds and fine particles above Munich, an interactive weather model to produce a weather forecast, and a workshop on how climate negotiations take place between countries and a discussion about what would happen if the 2°C limit would be exceeded.

Past issues of this newsletter are available here:

http://www.wavestoweather.de/outreach/quarterly_newsletter

Equal Opportunity (EO)

Girls' Day

This countrywide event aims at introducing schoolgirls to disciplines and careers in which women are usually underrepresented. It took place on April 26th 2018. W2W researchers organized hands-on workshops and short presentations in Munich, Mainz, Heidelberg and Karlsruhe to introduce schoolgirls to meteorology and weather forecasting, and studying and making a career in the field.

In **Munich**, 14 school girls between 12 and 17 years old learned about the water cycle in the atmosphere and the formation of clouds, they drew their own weather chart and compared it to real-time satellite images, they implemented the “Lewis Richardson’s Forecast Factory” by solving the temperature advection equation over Germany to predict the temperature in

Munich, and they asked about studying and working at the institute. About one third of the participants reported that they might consider doing an internship at the institute.



Participants and two volunteers on the roof of the meteorological institute in Munich

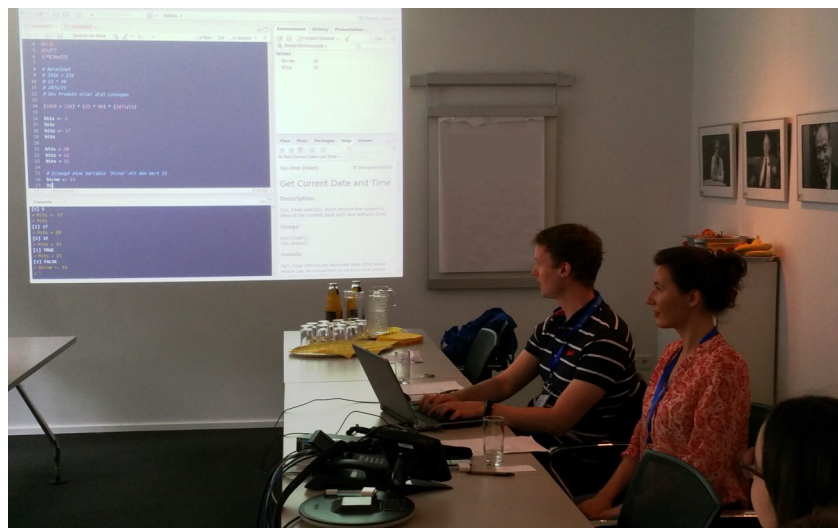
In **Mainz**, 16 school girls between 11 and 13 years old participated in the workshop "What is needed for a weather prediction?" Volkmar Wirth, head of the meteorological institute, gave a short introductory presentation about weather and climate, which the participants enjoyed very much and eagerly asked questions about. The school girls then constructed their own windmill, wind vane and thermometer. In the afternoon, they took a tour of the roof instruments, tested their self-made wind devices in the wind tunnel and watched clouds form in a cloud chamber.



Participants on the roof of the meteorological institute in Mainz

The **Heidelberg Institute for Theoretical Studies (HITS)** also participated in Girls' Day. The Computational Statistics (CST) group introduced how modern weather forecasts are pro-

duced, and showed the girls how to write a small computer program for analyzing DWD weather forecasts. Using a “forecast game” developed by a former group member, the participants could test their understanding of probabilities and ability to predict the weather by making probabilistic rainfall forecasts. The girls quickly learned how much science is needed to make weather forecasts reliable.



Sebastian Lerch explaining a computer program to the participants. Photo: Isabel Lacurie

At KIT in Karlsruhe, 15 school girls between 9 and 15 years old participated in the workshop „Clouds, weather, vortices, climate” and gained insight about the multifaceted work of a meteorologist. The female researchers introduced themselves and their research. The participants explained their motivation to take part in this workshop and tested their knowledge with a quiz. They then took part in the launching of a radiosonde. The participants made experiments, and the data of the radiosonde was finally discussed. All participants were very focused, curious, and enthusiastic about the workshop.

For more information on this event, please visit:

http://www.wavestoweather.de/equal_opportunity/activities/girlsday-2018

Mädchen machen Technik

This summer program is offered every year by the TUM in Munich. Building on last year's success, the meteorological institute at the LMU and W2W early career scientists will offer a two-day workshop to ten schoolgirls between 12 and 14 years old on weather, weather forecasting and climate change on September 3rd – 4th 2018.

For more information, visit:

http://www.wavestoweather.de/equal_opportunity/activities/maedchenmachentechnik2018

About EO measures within 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

Spring's highlight



Clouds over Füssen, Germany (photo: Matthias Schindler)

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>