Waves to Weather

Newsletter Oct/Dec 2017

Welcome to the Waves to Weather Newsletter!
We are now in the second half of our first four-year phase and the early career scientists are producing many new and interesting results. In this issue we highlight contributions on the predictability of winter storms, convective-scale data assimilation, accurate numerical methods, and the effects of three-dimensional radiative transfer. A big highlight of our recent annual meeting was four new members joining our consortium, who will broaden and deepen our expertise as we prepare to apply for our second phase of funding.
On behalf of all of us at Waves to Weather, I wish you all the best for the holidays and great start to the new year!

George Craig

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Upcoming events

- The **3rd NAWDEX Workshop** (CCA Campaign Data workshop) will take place in Munich from February 28th to March 2nd 2018. For more information, visit: http://www.wavestoweather.de/meetings/nawdex_w2w-workshop_2018
- The **6th International Symposium in Data Assimilation** will take place from March 5th – 9th 2018 at the LMU in Munich. For further details, please visit the conference website: http://www.wavestoweather.de/meetings/isda-2018

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

Please contact us if you have any questions.

News

New W2W members

We wish a warm welcome to the new members who joined W2W at the last General Assembly of W2W in November 2017:

Annette Miltenberger (currently at University of Leeds, U.K.)

Hella Garny (DLR, Oberpfaffenhofen)

Christian Grams (KIT, Karlsruhe)

Holger Tost (JGU, Mainz)

More information is available here: http://www.wavestoweather.de/people/members

Past activities

3rd Annual Meeting of W2W

The meeting took place from November 6th – 8th 2017 in Kempten, Germany. It featured overview presentations on W2W, the research areas and the cross-cutting activities, 2-minute lightning talks by the Early Career Scientists (ECS) to introduce themselves and their poster, extended poster sessions, keynote presentations, and breakout group discussions focused on ongoing research and future plans in W2W.

About 75 participants took part in the meeting. The poster sessions were lively and new collaborations have been identified and discussed. The invited guests, including Sue van den Heever (CSU, USA), Ryan Torn (SUNY, USA), Ron McTaggart-Cowan (Canadian Meteorological Center) and Daniel Rieger (DWD) contributed to the overall success of this meeting by discussing with the ECS about their results and by providing stimulating and constructive feedback on W2W.

Participants of the 3rd Annual Meeting of W2W in Kempten

For more information about the meeting, visit:
http://www.wavestoweather.de/meetings/3rd-annual-meeting2017

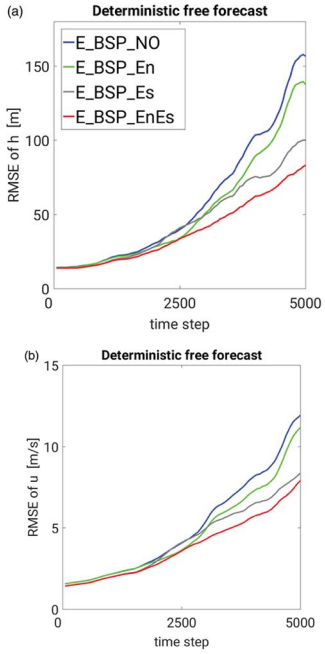
For more information about the newly elected ECS representatives, visit:
http://www.wavestoweather.de/early-career

For more information about the newly elected Equal Opportunity (EO) committee, visit:
http://www.wavestoweather.de/equal_opportunity

Research Highlights

Here are some examples of recently published research from W2W.

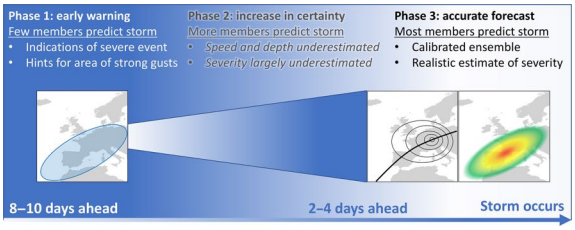
1. Ensemble-Type Kalman Filter Algorithm conserving Mass, Total Energy and Enstrophy (Y. Zheng, T. Janjic, Y. Ruckstuhl, and M. Verlaan)



For numerical discretization schemes, the violation of enstrophy conservation causes a systematic and unrealistic energy cascade towards high wave numbers. The same occurs in data assimilation schemes, where the total energy, enstrophy and divergence could be strongly affected. In this article, we construct an ensemble data assimilation algorithm that conserves mass, total energy and enstrophy and demonstrate its profits on using the shallow water model. The figure shows that the RMSE of a 14-day deterministic free forecast, starting from the initial condition enforced by both total energy and enstrophy constraints (red) yields the best forecasts.

Read the full article: http://onlinelibrary.wiley.com/doi/10.1002/qj.3142/abstract

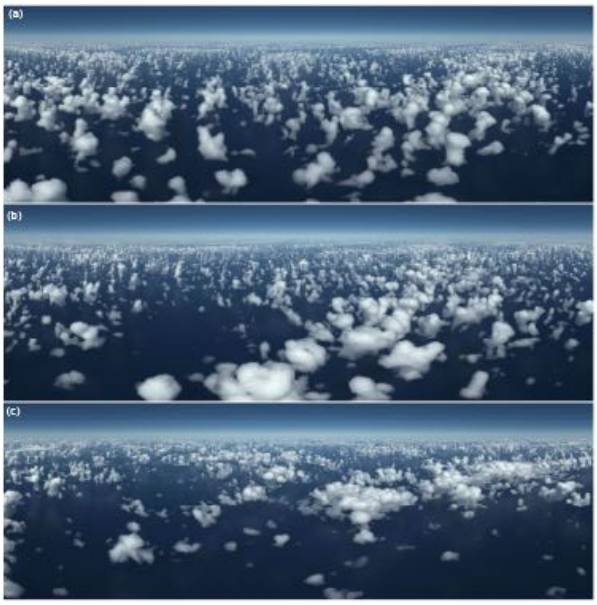
2. Revisiting the synoptic-scale predictability of severe European winter storms using ECMWF ensemble reforecasts (F. Pantillon, P. Knippertz, and U. Corsmeier)



The predictability of 25 historical winter storms over Europe is revisited by taking advantage of a homogeneous dataset of retrospective forecasts for the 1995–2015 period. The forecasts well predict the storms up to 2–4 days ahead only but also show clear potential for the early warning of storms up to 10 days ahead. However, the predictability of individual storms exhibits large variability and physical characteristics are identified for outliers with a poor predictability.

Read the full article: https://www.nat-hazards-earth-syst-sci.net/17/1795/2017/

3. Effects of 3-D thermal radiation on the development of a shallow cumulus cloud field (C. Klinger, B. Mayer, F. Jakub, T. Zinner, S.-B. Park, and P. Gentine)

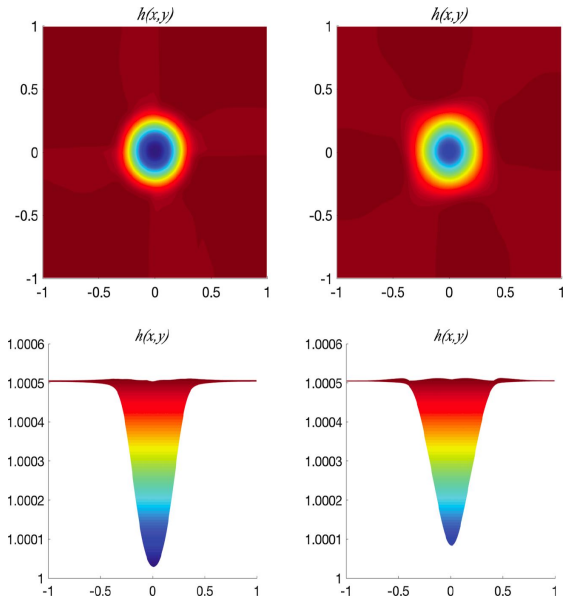


The effect of 1D and 3D thermal radiation on the development of a shallow cumulus cloud field was investigated in a comprehensive study.

We compared interactive local and horizontally averaged radiative heating rates and their impact on cloud development. We found that local thermal radiation causes changes in the cloud circulation (stronger updrafts and subsiding shells) and a change in the cloud field morphology through changed cloud field organization compared to a horizontally averaged radiation application. Local thermal radiation causes a development of cell-like structures and converges into large patches of clouds, while the homogenized radiation produces non-organized, independent shallow clouds, which, eventually converge to a larger patch in a very late stage of the simulations. 3D thermal radiative effects were found to be generally stronger than 1D thermal radiative effects.

Read the full article: https://www.atmos-chem-phys.net/17/5477/2017/acp-17-5477-2017.pdf

4. Well-Balanced Schemes for the Shallow Water Equations with Coriolis Forces (A. Chertock, M. Dudzinski, A. Kurganov, and M. Lukacova-Medvidova)



Stationary vortex computed at T = 10 by the well-balanced (left) and non-well balanced (right) CU schemes. Top view (top row) and the 1-D slice along y = 0 (bottom row)

We studied the simplified atmospheric model: two-dimensional shallow water system with Coriolis forces. Here we derived new finite volume methods that take the underlying physically relevant equilibrium states, such as geostrophic equilibrium, explicitly into account. More precisely, numerical errors or round-off errors will not destroy such equilibrium and they are now exactly preserved for the discrete data. These structure-preserving schemes are inevitable for robust and correct long-time computer simulations.
The numerical experiments comparing the newly developed well-balanced and non-well-balanced schemes are compared. The well-balanced methods appear to preserve two-dimensional geostrophic equilibria in much more accurate way (see figure).

Read the full article: https://www.numerik.mathematik.uni-mainz.de/files/2017/11/Journals-49.pdf

5. Convergence of a mixed finite element finite volume scheme for the isentropic Navier-Stokes system via dissipative measure-valued solutions (E. Feireisl, and M. Lukacova-Medvidova)

The convergence of a mixed finite element–finite volume numerical scheme for the compressible Navier–Stokes system is investigated. The Young measure generated by numerical solutions is shown to represent a dissipative measure-valued solution of the limit system. They coincide with the classical (strong) solutions as far as the latter exists.

Read the full article: https://link.springer.com/article/10.1007%2Fs10208-017-9351-2

6. Asymptotic preserving error estimates for numerical solutions of compressible Navier-Stokes equations in the low Mach number regime (E. Feireisl, M. Lukacova-Medvidova, S. Necasova, A. Novotny, and B. She)

The aim is to show by rigorous numerical analysis that asymptotic preserving schemes, which belong to the class of sound-proof models used for atmospheric simulations, indeed converge uniformly with respect to the Mach number. It means that the convergence rates are independent of possibly varying Mach number. Such structure-preserving schemes are inevitable for robust and correct computer simulations.

Read the full article: https://www.numerik.mathematik.uni-mainz.de/files/2017/11/Journals-63.pdf

Additional W2W publications and 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

AMS Special Collection "W2W"
An AMS Special Collection has been created for W2W. The first W2W articles have already been flagged. They will appear on the AMS journals website soon:
http://journals.ametsoc.org/page/collection

Joint outreach initiative with weather services and the media
A dissemination team consisting of W2W researchers has been created to organize a joint outreach initiative with DWD (German weather service), DMG (German Meteorological Society) and ZDF (German TV channel) among others. This team will meet regularly to discuss the steps forward.

Equal Opportunity (EO)

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

Winter's highlight

Frozen weather and transmission masts on the Hornisgrinde, Germany, Jan. 2015 (photo: Pila Bossmann)

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