2nd Annual Meeting of W2W

November 8th -11th, 2016 in Speyer, Germany

Program

Tuesday 8th November

12:00-12:30 *Registration + Lunch buffet*

Welcome and overview (chair: H. Volkert)

12:30-13:15 General overview (G. Craig)

13:15-13:25 Overview Research Area A (M. Riemer)

13:25-13:35 Overview Research Area B (P. Spichtinger)

13:35-13:45 Overview Research Area C (A. Fink)

13:45-13:55 Overview Cross-Cutting Activity (CCA) “Ensemble Tools“ (R. Redl)

13:55-14:05 Overview CCA “Campaign Data“ (A. Schäfler)

14:05-14:15 Overview CCA “Visualization“ (M. Rautenhaus)

14:15-14:25 Overview Early Career Scientists (ECS) (P. Bossmann)

14:25-15:00 *Coffee break*

Current research and future plans in Research Area C (chair: P. Spichtinger)

15:00-16:00 Geographically Separated and Dynamically Linked Extreme Weather Events (L. Bosart, Univ. at Albany) (see abstract below)

16:00-16:15 Modulation of precipitation over West Africa by equatorial waves (A. Schlüter)

16:15-16:30 Forecasting for precipitation over West Africa (P. Vogel)

16:30-16:45 Dynamics and predictability of medicane storms (E. Di Muzio)

16:45-17:00 Predictability of Tropical Transition in the North Atlantic Ocean (M. Maier-Gerber)

17:00-17:30 *Coffee break*

17:30-17:45 Model vs. observation - how well can the ERA Interim Reanalysis represent extreme hot events in Europe (A. Fink)

17:45-18:00 The connection between Northern Hemisphere heat waves and large-amplitude quasi-stationary Rossby wave packets (G. Fragkoulidis)

18:00-18:15 Predictability of winter storms in the ECMWF ensemble re-forecast (F. Pantillon)
18:15-18:30 Statistical post-processing of ensemble forecasts (S. Lerch)
18:30-18:45 Investigations of the cloud-storm track coupling within HD(CP)2 (A. Voigt)
18:45-19:15 Discussion
19:15-20:00 *Ice breaker*
20:00 *Dinner at the hotel*
21:30-22:30 Discussion: Future plans and cooperations with external partners

Wednesday 9th November

Current research and future plans in Research Area B (chair: M. Riemer)

08:30-09:30 How to assess the impact of a physical parameterization in simulations of moist convection? (W. Grabowski, NCAR and Univ. of Warsaw) (see abstract below)
09:30-09:45 Effect of Convection Trigger and CCN Concentration on Deep Convective Cloud Simulations (C. Fischerkeller)
09:45-10:00 Impact of microphysics and aerosol on hailstorms simulated by COSMO-ART (A. Barrett)
10:00-10:15 The impact of soil heterogeneities on the initiation of deep convection (L. Schneider)
10:15-10:30 Sensitivity to soil-moisture heterogeneities (F. Baur)
10:30-11:00 *Coffee break*
11:00-11:20 Quantifying bias of 1D COSMO heating rates (N. Crnivec)
11:20-11:35 Clustering and its spatial sensitivities - Visualization as a tool to interpret ensemble forecast scenarios (A. Kumpf)
11:35-11:50 Parameter estimation for an improved representation of clouds (Y. Ruckstuhl)
11:50-12:05 Online parameter identification on a cloud model (N. Porz)
12:05-12:35 Discussion
12:35-14:00 *Lunch*
14:00-15:00 Numerical Weather Prediction at the Deutscher Wetterdienst (D. Majewski, DWD) (see abstract below)

15:00-16:30 General assembly (see separate agenda) **- all PIs -** (chair: G. Craig; minutes: A. Laurian)

15:00-16:30 Early Career Scientists meeting **- all ECS -** (chair: F. Pantillon; minutes: ?)

16:30-17:00 *Coffee break*

17:00-19:00 Research area breakout groups (see list attached)

19:30 *Dinner at the Hausbrauerei Domhof*

22:00 Core group meeting / ECS meeting

Thursday 10th November

Current research and future plans in Research Area A (chair: A. Fink)

08:30-09:30 The influence of the spatial scale of initial-condition errors on atmospheric predictability (D. Durran, U. Washington) (see abstract below)

09:30-09:45 Forecast error growth from a quantitative PV perspective (M. Baumgart)

09:45-10:00 Estimation of intrinsic limits of predictability using a stochastic convection scheme (T. Selz)

10:00-10:15 Identifying Rossby Wave packets and quantifying the importance of non-conservative processes in their propagation (P. Ghinassi)

10:15-10:30 Theoretical aspects of upscale error growth on the mesoscales (L. Bierdel)

10:30-11:15 *Group Picture + Coffee break*

11:15-11:30 Modeling of Microphysical Processes in Clouds (J. Rosemeier)

11:30-11:45 Structure formation in cloud models using a weakly compressible model (B. Wiebe)

11:45-12:00 First overview on the NAWDEX field campaign (A. Schäfler)

12:00-12:15 Assessment of model errors in warm conveyor belts (WCBs) and their impacts on downstream dynamics using data denial experiments (M. Weissmann)

12:15-12:30 Evolution and predictability of storm structure during extratropical transition of tropical cyclones (C. Euler)

12:30-12:45 3D approximation of air parcel trajectories - a summary and outlook (T. Kremer)

12:45-13:45 *Lunch*

13:45-15:45 *Excursion (guided tour of Speyer)*

15:45-16:00 *Coffee break*

16:00-16:15 Does the uncertainty in the representation of terrestrial water flows affect precipitation predictability? A WRF-Hydro ensemble analysis for Central Europe (J. Arnault)

16:15-16:30 Convective variability in real mid-latitude weather (S. Rasp)

16:30-16:45 Detection and Visualization of Jetstream Core Lines in Ensemble Forecasts (M. Kern)

16:45-17:00 Visualization of Coherence in Flow Field Ensembles (O. Klein)

17:00-17:30 Discussion

17:30-18:30 Ensemble Data Assimilation - Operational System and New Results on Hybrid Ensemble Variational Techniques and Particle Filters (R. Potthast, U. Reading and DWD) (see abstract below)

18:30-20:00 Group discussions SG/Lead PIs (1)

20:00 *Dinner at the hotel*

22:00 Discussion: Future plans and cooperations with external partners

Friday 11th November

09:00-10:00 Feature-based Visualization (T. Weinkauf, KTH Stockholm)

10:00-10:45 Report on group discussions (chair: G. Craig; minutes: A. Laurian)

10:45-11:30 *Coffee break*

11:30-11:45 Feedback (R. Mc Taggart-Cowan, Canadian Meteorological Center)

11:45-12:15 Final Discussion (chair: G. Craig; minutes: A. Laurian)

12:15-13:00 *Lunch*

13:00 *End of Meeting*

General remarks

- *The **keynote presentations** are 45-min long + 15 minutes for questions.*
- *The **ECS** are strongly encouraged to ask questions throughout the meeting.*

Research area breakout groups

(Wednesday 9th, 17:00 – 19:00 PM)

Research Area A Upscale Error Growth *chair: Michael Riemer*	**Research Area B** Cloud-scale Uncertainties *chair: Peter Spichtinger*	**Research Area C** Predictability of local Weather *chair: Andreas Fink*
Joel Arnault Marlene Baumgart Lotte Bierdel George Craig (PI) Theresa Diefenbach Christian Euler Paolo Ghinassi Andreas Hildebrandt (PI) Mirjam Hirt Michael Kern Ole Klein Harald Kunstmann (PI) Tobias Kremer Maria Lukacova (PI) Anne Martin Stephan Rasp Marc Rautenhaus Juliane Rosemeier Filip Sadlo (PI) Andreas Schäfler Elmar Schömer (PI) Tobias Selz Rüdiger Westermann (PI) Bettina Wiebe	Mares Barekzai Andrew Barrett Christian Barthlott (PI) Florian Baur Nina Crnivec Constanze Fischerkeller Martin Hanke-Bourgeois (PI) Corinna Hoose (PI) Tijana Janjic-Pfander (PI) Christian Keil (PI) Alexander Kumpf Michael Kunz (PI) Bernhard Mayer (PI) Nikolas Porz Yvonne Ruckstuhl Linda Schneider Bernhard Vogel (PI) Martin Weissmann (PI) Peter Knippertz (PI)	Pila Bossmann Ulrich Corsmeier (PI) Enrico Di Muzio Georgios Fragkoulidis Timann Gneiting (PI) Federico Grazzini Peter Knippertz (PI) Sebastian Lerch Michael Maier-Gerber Florian Pantillon Sophia Schäfer Andreas Schlüter Peter Vogel Volkmar Wirth (PI)
→ Purrmann room (1)	**→ „Bibliothek“ room**	**Purrmann room (2)**

Note: If you are a PI involved in different research areas, please feel free to change group.

Keynote presentations

Lance Bosart (Univ. at Albany, USA) Tue. 8th, 15:00-16:00

Title: Geographically Separated and Dynamically Linked Extreme Weather Events

Abstract: Observations and model reanalyses are used to examine multi-scale dynamical processes associated with four high-impact extreme weather events (EWEs) over North America during late October 2007. The EWEs consisted of wind-driven wildfires in California, persistent anomalous cold in Mexico, heavy rainfall in the eastern United States, and severe flood-producing heavy rainfall in southern Mexico. The EWEs involved a pronounced large-scale flow reconfiguration across the North Pacific and North America in conjunction with the formation of a high-amplitude Rossby wave train. The flow reconfiguration involved perturbations to the North Pacific jet stream linked to polar, midlatitude, and tropical disturbances, including three tropopause-level polar disturbances originating over northeastern Asia, transient extratropical cyclones, a diabatic Rossby vortex, and western North Pacific Tropical Cyclone Kajiki.

Eulerian and Lagrangian diagnostics indicate that ridge amplification within the wave train was enhanced in connection with latent heat release along warm conveyor belts rooted in the tropics and subtropics over the North Pacific. Two anticyclonic Rossby wave breaking events over North America established synoptic-scale conditions that supported the EWEs. The results highlight how the large- and synoptic-scale flow can evolve to facilitate multiple geographically separated but dynamically linked EWEs. Based on the results, it is posited that during autumn the North Pacific jet stream may be particularly conducive to large-scale flow amplification—possibly resulting in EWEs—in response to perturbations associated with tropical, midlatitude, and polar disturbances. These results are generalized in more recent examples that also illustrate the sensitivity of large-scale predictability horizons to the details of the synoptic-scale flow evolution and the associated tropical, midlatitude, and polar perturbations to the North Pacific jet stream.

Wojciech Grabowski (NCAR and Univ. of Warsaw, Poland) Wed. 9th, 08:30-09:30

Title: How to assess the impact of a physical parameterization in simulations of moist convection?

Abstract: A numerical model capable in simulating moist convection (e.g., cloud-resolving model or large-eddy simulation model) consists of a fluid flow solver combined with required representations (i.e., parameterizations) of physical processes. The later typically include cloud microphysics, radiative transfer, and unresolved turbulent transport. Traditional approaches to investigate impacts of such parameterizations on convective dynamics involve parallel simulations with different parameterization schemes or with different scheme parameters. Such methodologies are not reliable because of the natural variability of a cloud field that is affected by the feedback between the physics and dynamics. For instance, changing the cloud microphysics typically leads to a different

realization of the cloud-scale flow, and separating dynamical and microphysical impacts is difficult. This presentation will introduce a novel modeling methodology, the piggybacking, that allows studying the impact of a physical parameterization on the cloud dynamics with confidence. The focus will be on the impact of cloud microphysics parameterization. Specific applications of the piggybacking approach will include studies concerning the hypothesized deep convection invigoration in polluted environments and the validity of the saturation adjustment in modeling condensation in shallow and deep convection.

Detlev Majewski (DWD) Wed. 9th , 14:00-15:00

Title: Numerical Weather Prediction at the Deutscher Wetterdienst (DWD)

Abstract: To meet the requirements of its key customers like emergency response agencies, military, energy sector and aviation, the Deutscher Wetterdienst (DWD) operates a comprehensive numerical weather prediction (NWP) system consisting of deterministic and probabilistic components.
The deterministic modelling suite consists of the global nonhydrostatic model ICON with a grid spacing of 13 km and 90 layers up to 75 km above mean sea level (6.5 km and 60 layers for the European two-way nesting area) and the regional convection-permitting COSMO-DE model (http://cosmo-model.org/) with a grid spacing of 2.8 km and 50 layers for Germany and its surroundings. New ICON forecasts are computed (within 55 minutes wall clock time) every three hours, based on 00 and 12 UTC analyses up to 180 hours, based on 06 and 18 UTC up to 120 hours, and based on 03, 09, 15 and 21 UTC analyses up to 33 hours. New COSMO-DE forecasts are also computed every three hours, based on the 03 UTC analysis up to 45 hours and up to 27 hours for the other starting times.
The probabilistic, ensemble-based modelling suite consists of the 40-member global ICON-EPS with a grid spacing of 40 km and of the 20-member regional COSMO-DE-EPS with a grid spacing of 2.8 km. New ICON-EPS forecasts are computed based on 00 and 12 UTC analyses up to 180 hours, based on 06 and 18 UTC up to 120 hours, and based on 03, 09, 15 and 21 UTC analyses up to 33 hours. New COSMO-DE-EPS forecasts are computed every three hours, based on the 03 UTC analysis up to 45 hours and up to 27 hours for the other starting times.
Initial states for the NWP systems are based on comprehensive 40-member ensemble-based data assimilation suites, for ICON a hybrid LETKF – 3DVAR approach has been chosen and for COSMO-DE a LETKF scheme including the assimilation of radar data. The global data assimilation exploits mostly data of polar orbiting and geostationary satellites, about 20 Million of observations are processed each day. The total output of forecast fields of DWD's NWP system exceeds 15 TByte / day which are stored in online data bases.
The ICON modelling framework (http://www.mpimet.mpg.de/en/science/models/icon.html) has been developed together with the Max-Planck-Institute for Meteorology (MPI-M) in Hamburg where it is forming the atmospheric component of an earth system model. Important development goals have been:

- Unified modelling system for NWP and climate prediction in order to bundle knowledge and to maximize synergy effects between DWD and MPI-M
- Better conservation properties, i.e. mass of dry air and tracers
- Flexible grid nesting in order to replace both the former global and the regional Europe-wide models in the operational suite of DWD

- Nonhydrostatic dynamical core for capability of seamless prediction
- Scalability and efficiency on O(10^4+) computer cores.

ICON uses the icosahedron for macro triangulation and triangles as the primal cells with a C-type staggering where velocity is defined at edge midpoints and mass at cell circumcenter. Local higher resolution subdomains (‚nests') can be defined arbitrarily and are linked to the global domain via two-way interaction.

In cooperation with the Karlsruhe Institute of Technology (KIT) ICON has been extended to environmental modelling: ICON-ART (Aerosols and reactive trace gases) including e.g. the global transport and dispersion of volcanic ash and mineral dust.
The presentation will outline the current state and future development of DWD's operational NWP system.

Dale Durran (Univ. of Washington, USA) Thu. 10th, 08:30-09:30

Title: The influence of the spatial scale of initial-condition errors on atmospheric predictability (in collaboration with Jonathan Weyn)

Abstract: One important limitation on the accuracy of weather forecasts is imposed by unavoidable errors in the specification of the atmosphere's initial state. Much theoretical concern has been focused on the limits to predictability imposed by small-scale errors, potentially even those on the scale of a butterfly. Very modest relative errors at much larger scales may nevertheless pose a more important practical limitation. We demonstrate the importance of large-scale uncertainty by analyzing ensembles of idealized simulations of mesoscale convective systems. We consider several environments with different low-level shears and pairs of ensembles with equal amplitude large- or small-scale perturbations in the surface moisture.

As foreshadowed by results obtained with a simple barotropic model in a largely overlooked section of Lorenz's classic 1969 paper "The predictability of a flow which possesses many scales of motion," equal-amplitude initial perturbations at wavelengths of 8 and 128 km produce identical losses of predictability after five hours of simulation. These results imply that minimizing initial errors on scales on the order of 100 km is at least as likely to extend the accuracy of forecasts at lead times longer than 4-5 hours than potentially expensive efforts to minimize initial errors on much smaller scales.

These simulations also demonstrate that convective systems, triggered in a horizontally homogeneous environment with no initial background circulations, can generate a background mesoscale kinetic energy spectrum with a slope proportional to the -5/3 power of the wave number, similar to that observed in the atmosphere. The horizontally divergent and rotational parts of the kinetic energy spectrum are examined along with their relative contributions to the -5/3 spectrum.

Roland Potthast (Univ. of Reading, UK and DWD, Germany) Thu. 10th, 17:30-18:30

Title: Ensemble Data Assimilation - Operational System and New Results on Hybrid Ensemble Variational Techniques and Particle Filters

Abstract: Ensemble Data Assimilation (EDA) methods such as the Ensemble Kalman Filter (EnKF) or the hybrid Ensemble Variational Data Assimilation (EnVAR), which couples a local ensemble transform Kalman filter (LETKF) with a variational minimization of the observation mismatch plus a background term, are operational today for the global numerical weather prediction system of Deutscher Wetterdienst (DWD). We will describe the methods and show results which demonstrate the quality of these schemes in a large-scale operational environment. It is shown that the systems are of similar quality than operational 4D-VAR systems used in many centers today.
EnVAR based data assimilation systems do not only calculate a deterministic analysis, but also also efficiently and naturally provide initial conditions for ensemble prediction. At DWD, a consistent approach which employs these techniques both on the global and the convective scale have been developed. We demonstrate the quality of this system by showing new results from the EDA driven COSMO-DE-EPS which is in preoperational state at DWD.
In a second part of the talk, we discuss the realization of localized particle filters in a large-scale environment. We show a case study with a hybrid particle filter variational method by Walter et al. for the ICON NWP model. Further, the design of a Local Markov Chain Particle Filter (LMCPF) is described which carries out particle filtering in a large-scale environment. We also discuss different variants of particle filtering for the COSMO model which are under development at ETH and the University of Potsdam in cooperation with DWD.

Tino Weinkauf (KTH Stockholm, Sweden) Fri. 11th, 10:00-11:00

Title: Feature-based Visualization

Abstract: Analyzing large and high-dimensional data sets is a challenging task and ideally carried out using sophisticated tools, which allow to concentrate on the most relevant information and to automate the analysis. These goals can be achieved using feature-based methods, which foster target-oriented studies of the most important aspects of a data set.

This talk gives an overview of algorithms and mathematical models to analyze the features of data sets from a variety of different domains such as fluid dynamics, cell biology, and climatology. The basis of our work is discrete Morse theory, as it allows robust, parameter-free, and topologically consistent computations. Our goal is to develop solutions to the open problems of discrete Morse theory in order to make discrete approaches applicable for a large number of practical applications.

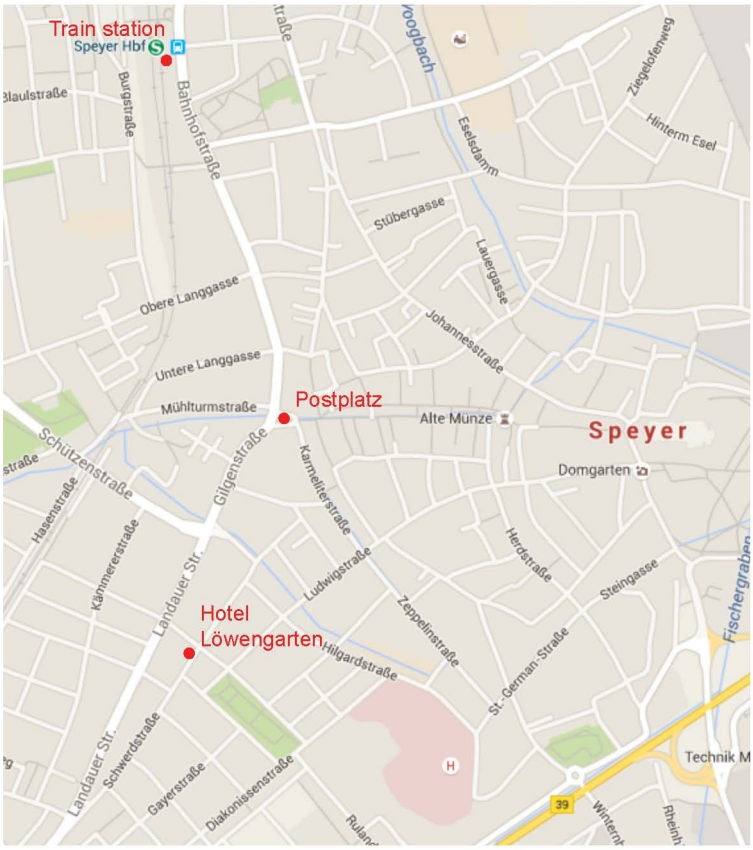
Questionnaire for W2W people

Your name (optional):

Equal Opportunity (EO): Would you like to benefit from EO measures? If yes, which ones?
Outreach: Do you have any suggestions or plans for outreach activities related to W2W?
Management team: Do you have any comments or suggestions to improve the management of W2W?

How to get there?

The 2nd Annual Meeting of W2W will take place in the **Hotel Löwengarten** in Speyer (www.hotel-loewengarten.de). The hotel is located in the Schwerdstraße 14, 1.5 km away from the Speyer train station.
From the train station, you can walk or take the bus 564 or 565 (direction „Flugzeugwerke“), or 568 (direction „Römerberg“) and get off at „Postplatz“. The hotel is 650 meters away (see map below).



- If you come **by train**, the trip lasts about 1h from Karlsruhe, 1h15 from Mainz, 45 minutes from Heidelberg, and 4h from Munich.
- If you come **by plane**, the trip lasts about 1h20 from Frankfurt airport and 2h from Stuttgart airport. You can buy a train ticket online (http://reiseauskunft.bahn.de/bin/query.exe/) or in the train station.
- If you come **by car**, there is a customer parking lot in front of the hotel.