WAVES TO WEATHER

Annual Meeting - 8-10 November 2021

Eibelstadt, and hybrid

Program

Monday 8th November 2021		*Chairs: B. Wiebe and X. Chen*
12:30 – 14:00	General Assembly (see separate agenda)	W2W members only
12:30 – 14:00	ECS General Assembly	ECS only
14:00 – 14:30	Coffee Break	
Official start of the meeting for guests		
14:30 – 15:10	Overview of W2W (G. Craig and RA coordinators)	All participants
15:10 – 15:55	Gaussian process emulation to rigorously explore uncertainty in complex models of the atmosphere and climate (Jill Johnson)	All participants
15:55 – 16:30	Lightning talks by ECS in RA-B	All participants
16:30 – 17:00	Coffee Break + "Meet the speaker"[1] for the ECS	
17:00 – 19:30	Poster session RA-B (15 posters)	All participants
19:30 –	Ice Breaker and dinner at "Weingut Leo Sauer"	All participants
Tuesday 9th November 2021	*Chairs: H. Jung and R. Maier / C. Fischer and A. Satheesh*	
08:00 – 09:00	SG breakfast	SG only
09:00 – 09:15	Report on Z2 activities (R. Redl and O. Tinto)	All participants
09:15 – 09:30	Report on Z1 activities (A. Laurian)	All participants
09:30 – 09:45	Report on Equal Opportunities activities (C. Hoose)	All participants
09:45 – 10:00	Report on Communication activities (P. Knippertz)	All participants
10:00 – 10:30	Coffee Break + group picture	
10:30 – 11:15	Improving weather prediction for Africa: a call to arms (D. Parker)	All participants
11:15 – 11:45	Lightning talks by ECS in RA-C	All participants
11:45 – 13:00	Lunch	
13:00 – 15:30	Poster session RA-C (15 posters)	All participants
15:30 – 16:00	Coffee Break + "Meet the speaker" for the ECS	
16:00 – 16:45	The U. S. Naval Research Laboratory's Global Coupled Prediction System (C. Reynolds)	All participants
16:45 – 17:15	Lightning talks by ECS in RA-A	All participants
17:15 – 18:30	Early dinner + "Meet the speaker" for the ECS	
18:30 – 21:00	Poster session RA-A (13 posters)	All participants

[1] "Meet the speaker" is a 30' time slot for all the ECS to meet the keynote speaker who just presented. It is intended as an informal conversation on research interests, professional and personal experience, etc.

Wednesday 10th November 2021		*Chairs: F. Farokhmanesh and C. Polster*
09:00 – 12:00	Social media workshop (Barnbeck/Nguyen, online)	All participants
12:00 – 13:00	Lunch	
13:00 – 13:45	The Importance of Known Unknowns: Representing Uncertainty in Ensemble NWP (R. McTaggart-Cowan)	All participants
13:45 – 14:15	Coffee Break + "Meet the speaker" for the ECS	
14:15 – 15:45	Breakout group discussions (see table below)	All participants
15:45 – 16:15	Coffee Break	
16:15 – 17:30	Reports on GA, ECS, RAs, and SAB discussions	All participants
End of the meeting		

Breakout group discussions per Research Area
Wednesday 10th November from 14:30-16:00

RA-A breakout group discussion	RA-B breakout group discussion	RA-C breakout group discussion
Note: Participants in *italic* take part remotely. Guests and SAB members are in purple.		
Bachmayr Markus	Bardachova Tatsiana	Beckert Andreas
Champion Nicholas	Barthlott Christian	Birner Thomas
Craig George	Borne Maurus	Brinkmann André
Farokhmanesh Fatemeh	*Beata Czajka*	Chen Xiaoyang
Giebl Benedikt	Frey Lena	Chung Brett
Grams Christian	*Hanke-Bourgeois Martin*	Eisenstein Lea
Groot Edward	Hieronymus Maicon	Fink Andreas
Hauser Seraphine	Höhlein Kevin	Fischer Christoph
Hirt Mirjam	*Hoose Corinna*	Garny Hella
Krüger Kontantin	*Jakub Fabian*	*Gneiting Tilmann*
Lukacova Maria	Janjic-Pfander Tijana	*Grazzini Federico*
McTaggart-Cowan Ron	*Johnson Jill*	Hewson Tim
Morgan Michael	Jung Hyunju	Kaufhold Christine
Polster Christopher	Keil Christian	*Kautz Lisa-Ann*
Prestel Isabelle	Keshtgar Behrooz	Kriening Marvin
Puh Matjaz	Knippertz Peter	Lemburg Alexander
Redl Robert	Kuntze Patrick	Lerch Sebastian
Reynolds Carolyn	*Kunz Michael*	*Löffel Sheena*
Riemer Michael	*Legler Stefanie*	*Maier-Gerber Michael*
Sadlo Filip	Lüttmer Tim	Modali Kamesh
Schäfler Andreas	Maier Richard	Parker Doug
Schmidt Sören	Manev Mihail	Pinto Joaquim
Schwab Stefanie	Matsunobu Takumi	Satheesh Athul
Selz Tobias	*Mayer Amelie*	Rautenhaus Marc
Spichtinger Peter	Mayer Bernhard	Rupp Philipp
Tempest Kirsten	*Miltenberger Annette*	Schömer Elmar
Teubler Franziska	Oertel Annika	Schulz Benedikt
Tost Holger	Ruckstuhl Yvonne	Späth Jonas
Werth Kai	*van den Heever Sue*	Tinto Oriol
Wiebe Bettina	*Voigt Aiko*	Walz Eva-Maria
Wirth Volkmar	*Volkert Hans*	
	Weissmann Martin	
	Zarboo Amir	

Keynote presentations

Jill Johnson (University of Sheffield, UK) *Mon. 8th, 15:10 – 15:55*

Title: **Gaussian process emulation to rigorously explore uncertainty in complex models of the atmosphere and climate**

Abstract:
The effects of aerosols (small particles suspended in the air) on the Earth's energy balance since pre-industrial times (aerosol radiative forcing) has significantly and repeatedly dominated the uncertainty in reported estimates of global temperature change from the Intergovernmental Panel on Climate Change (IPCC). Climate models are used to simulate the global distribution of aerosols and predict the aerosol radiative forcing. However, these models are extremely computationally expensive to run and such predictions are very uncertain as the models have many inputs (parameters), the values of which are uncertain. It is not feasible to densely sample the parametric uncertainty of a climate model directly, but using statistical emulators we can rigorously explore it.
In this presentation, I will describe the approach of 'Gaussian process emulation' – a statistical modelling approach by which we construct a surrogate model of an aspect of an expensive model simulator that can be sampled at a very low computational cost – and highlight how this technique has opened the door to exploring parametric uncertainty in complex models of the atmosphere and climate. I will then show results from a recent study where we quantify the range of possible aerosol forcings in the HadGEM3-UKCA aerosol-climate model caused by parametric uncertainty, and then attempt to constrain that forcing uncertainty via statistical 'history matching' using an extensive set of (9000+) aerosol measurements (including aerosol optical depth, and PM2.5, N50 and sulphate concentrations) from ships, flight campaigns and ground stations. We found that despite a very large reduction in plausible parameter space, and reasonable constraint on global and regional mean aerosol properties, the observational constraint only mildly reduced the range of aerosol radiative forcings from the model. This work has highlighted several key statistical challenges to address in order to improve the model-observation comparison process for constraint.

Douglas Parker (University of Leeds, UK) *Tue. 9th, 10:30 – 11:15*

Title: **Improving weather prediction for Africa: a call to arms**

Abstract:
The international community has an opportunity to transform weather prediction skill for tropical Africa, and we have a responsibility to take action immediately. The key to improved African weather forecasts will be the handling of uncertainty in convective rainfall. Broadly, we understand the mechanisms causing individual storms to be triggered, and the physical processes controlling storm lifecycles, but convective parametrisations have major biases while the explosive growth of deep convection mean that errors grow fast. For these reasons, numerical weather prediction for African rainfall has poor skill. The GCRF African Science for Weather Information and Forecasting Techniques (SWIFT) project has been making first steps

to improve tropical African forecasts across a range of timescales. On the subseasonal timescale, the availability of ensemble forecasts has been enabling rapid progress, making use of tropical wave activity to enhance predictive skill for rainfall, and using statistical relationships to improve spatial patterns. On shorter, synoptic timescales, convection-permitting models offer a possible solution to the deadlock of convective parametrisation biases. In SWIFT, convection-permitting ensembles also been trialled, for different regions and test-cases; first results indicate that the ensembles are under-dispersed, and the convection-permitting physics provides greater benefits than the ensemble system. Given the inherent uncertainty in convective rainfall, nowcasting is a vital solution for Africa, but is almost non-existent outside South Africa and the Mediterranean countries. SWIFT has begun to implement satellite-based nowcasting in its partner countries, and to explore improved nowcasting algorithms. Evidence shows that useful nowcasts of up to 4 hours are possible.
Common to all the timescales, from nowcasting to seasonal, is the importance of statistical prediction of the convective rainfall. Across all the timescales there are coherent sources of convective organisation. Tropical waves, from fast gravity waves to subseasonal tropical modes, organise the rainfall in time and space. The topography of the land surface, vegetation, and the dynamics of soil moisture, also control the rainfall. Exploiting the understanding of these physical controls in terms of practical forecasting remains limited, but it is likely that merged statistical methods will emerge in the coming years, to blend between observationally-based nowcasting and numerical weather prediction, and making use of the underlying dynamics of the land-atmosphere system.
Effective weather predictions in Africa save lives and protect economic interests, from the livelihoods of vulnerable people to the activities of corporations and governments: climate change only makes these priorities more urgent. Over recent years, progress has been held back by an assumption that the scientific methods are "solved" and that implementation of forecasts is only limited by lack of user engagement: in fact, the skill of scientific forecasts for tropical Africa has been low for many years, primarily because of the uncertainty of predicting convective rainfall. However, for the first time scientific solutions to the weather forecasting challenges facing Africa, on timescales from hours to months, are within our reach if suitable effort is made.

Carolyn Reynolds (NRL, USA) *Tue. 9th, 16:00 – 16:45*

Title: **The U. S. Naval Research Laboratory's Global Coupled Prediction System**

Abstract:
The U. S. Navy Earth System Prediction Capability (Navy ESPC) is a global coupled atmosphere-ocean-sea ice forecast system developed to meet U. S. Navy needs for high-resolution global environmental forecasts out to subseasonal timescales. What distinguishes Navy ESPC from other operational global coupled forecast systems is the fine resolution (1/12o) of the ocean and ice components. The motivation for fine resolution in the ocean (including the relatively small scales of ocean "weather" and the importance of bathymetry and internal tides) will be presented. This will be followed by a brief description on system performance and current research on enhancing capabilities and addressing short-comings.

Ron McTaggart-Cowan (Canadian Meteorological Center) *Wed. 10th, 13:00 – 13:45*

Title: **The Importance of Known Unknowns: Representing Uncertainty in Ensemble NWP**

Abstract:
Numerical weather prediction (NWP) systems contain a myriad of uncertainties, including those associated with observations, data assimilation techniques, and forecast models. Each of these uncertainties can serve as a seed for error growth within the system that limits practical predictability. One of the primary goals of ensemble NWP is to represent these uncertainties accurately within both the analysis cycle and forecast integrations.
This session provides an overview of the treatment of uncertainties in all components of global ensemble analysis and forecasting systems. Investigation of the state estimation (data assimilation) problem highlights the importance of relationships between observation and background error estimates, with a particular focus on flow-dependent background error statistics. The impact of the associated uncertainties on the initial conditions for medium-range forecasts is found to have a leading-order impact on the ability of the system to accurately depict the reliability of the resulting predictions. Sources of potential forecast error within the numerical model itself are described thereafter, with a particular focus on stochastic representations of uncertainty. In particular, the stochastically perturbed parameterization (SPP) technique is shown to be capable of serving as the primary model uncertainty estimate in the Canadian global ensemble forecasting system.
Uncertainty within the different components of NWP system are linked to each of the W2W Research Areas. As a result, it is clear that W2W has the potential to improve our understanding of the challenges introduced by uncertainty within complex NWP systems. Such insight will help to develop strategies to better represent the "known unknowns", thereby improving our ability to make accurate predictions in the future.

Poster sessions per Research Area

(Names in *italic* will present remotely)

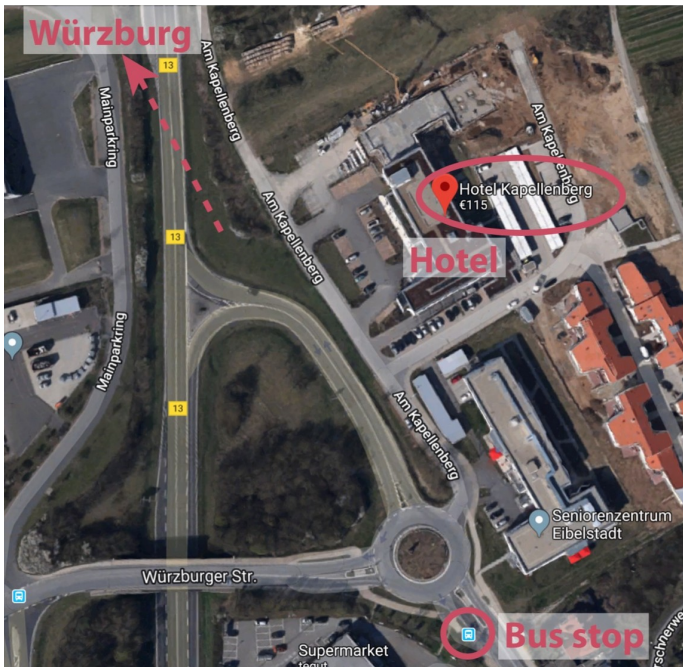
RA-A Tuesday, 17:45 – 20:15	RA-B Monday, 17:00 – 19:30	RA-C Tuesday, 13:00 – 15:30
N. Champion	M. Borne	A. Beckert
F. Farokhmanesh	L. Frey	X. Chen
E. Groot	M. Hieronymus	L. Eisenstein
S. Hauser	K. Höhlein	C. Fisher
K. Krüger	H. Jung	*F. Grazzini*
C. Polster	B. Keshtgar	A. Lemburg
M. Puh	P. Kuntze	*S. Löffel*
F. Sadlo	T. Lüttmer	*M. Maier-Gerber*
S. Schmidt	R. Maier	*A. Mayer*
S. Schneider	M. Manev	K. Modali
T. Selz	T. Matsunobu	A. Satheesh
K. Tempest	A. Oertel	P. Rupp
F. Teubler	Y. Ruckstuhl	B. Schulz
B. Wiebe	O. Tinto	J. Späth
	A. Zarboo	E. Walz

Venue

The W2W Annual Meeting will take place in the **Hotel Kapellenberg** in Eibelstadt (https://www.hotel-kapellenberg.de/hotel-kapellenberg.html?&L=1). The hotel is located about 10 km south-east of Würzburg central station ("Würzburg Hauptbahnhof").

To get from Würzburg central station to the hotel **by public transport**, you can take the **bus 554** (direction "Unteres Tor, Frickenhausen a. Main") from "Busbahnhof, Würzburg" to "Industrie-Siedlung, Eibelstadt" (11 stops, ca. 25 minutes) or the **bus 555** (direction "Bahnhof, Ochsenfurt") from "Busbahnhof, Würzburg" to "Industrie-Siedlung, Eibelstadt" (13 stops, ca. 25 minutes), running once per hour.

The hotel is 150 m away from the bus stop "Industrie-Siedlung, Eibelstadt" (see map below).



- If you are coming **by train**, the trip to Würzburg central station lasts about 3h from Karlsruhe, 2h from Mainz, and 2h from Munich.
- If you are coming **by plane**, the trip to Würzburg central station lasts about 2h from Frankfurt airport (FRA), 3h from Munich airport (MUC), and 4h from Stuttgart airport (STR).
- If you come **by car**, there is a customer parking lot at the hotel.

Hotel rooms are reserved and paid centrally by W2W for all participants.

Ice breaker on Monday 8th November at 19:30

The ice breaker will take place at the "**Weingut Leo Sauer**" located in the Würzburger Straße 33 in Eibelstadt (https://weingut-leo-sauer.jimdofree.com), about 400m away from the hotel.