Met Office, FitzRoy Road, Exeter EX1 3PB
Tel: +44-7767-438583
Email: brian.golding@metoffice.gov.uk

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I've been taking it easy since the last newsletter – no international travel, but lots of teleconferences! That has given me the time to do some thinking and some writing and to spend time on preparations for our **Beijing Workshop on 20-22 November** this year. The workshop looks set to bring together a very broad spectrum of scientists working in and across the disciplines addressed by HIWeather. It will be our first whole project get-together since Exeter in 2016 and I am looking forward to seeing many of you there.

I have also been spending time contributing to the preparations for the **UNISDR Global Platform 2019** (GP2019). Picking up on last year's workshops on the Value Chain in Berlin and Melbourne, a group of us put together an overview of how the Value Chain concept relates to hazard warnings in a paper for the next Global Assessment Report on Disaster Risk Reduction, a publication that is issued to support each Global Platform. Between us, David and I are also contributing to the organisation of three of the sessions at GP2019, which will no doubt keep us well occupied through the next nine months.

Following our Advisory Group teleconference in June, we have had discussions with three related groups who offer possibilities for collaboration and growth. The first is a proposed new RISK Knowledge Action Network (RISK-KAN) being created by Future Earth, IRDR and WCRP. It will focus on emergent risk: where coinciding or cascading risks create new risk, such as when a natural hazard leads to major infrastructure failures. The second is the US Global Change Research Programme, a major US programme focused on climate timescales, but with considerable interest in weather extremes, risk communication and response. The last is the Global Heat Health Information Network, a joint WMO/WHO initiative aimed at promoting heat wave response plans, with a direct link to our hazard focus on Urban Heat and Air Pollution.

During last winter, I read through some past reviews of the "governance" of our UK severe weather warning service. By the time of the 1987 windstorm disaster, NWP had already gained a day of extra predictability, but the warning system remained fossilized in a pre-NWP structure based on observations, with a maximum permitted warning lead time of 3 hours. As a result, warnings of a storm arriving at 3am were not seen by most people until after the event. The resulting switch to a warn-on-forecast system capitalised on the increased NWP ability and has enabled subsequent development. I conclude that scientists should be engaged in looking for where the next failure might occur and whether the capabilities already exist to prevent it. We shouldn't wait for the inquiry after the disaster to make improvements.

Coming back to the near future, I shall be attending the annual WWRP Scientific Steering Committee in October, to report on our progress and plans. The SSC is a really important forum, there to challenge and correct us if we appear to be losing our way. Fortunately their criticism is always friendly and constructive. This report is always a challenge to present with such a diversity of work going on in HIWeather. However, this year we have several completed activities, which will enable me to focus on tangible outcomes.

David Johnston attended the Workshop on Advancing the Total Warning System Concept in Auckland, New Zealand earlier this month. It was organized by the WWRP Working Group on Tropical Meteorology Research, in response to a recommendation of the 8th International Workshop on Tropical Cyclones in 2014, to conduct a scientific meeting between tropical cyclone experts and social scientists. David will be attending the 20th Scientific Committee Meeting of the IRDR on 15 October in Chengdu, China, followed by the International Conference on Integrated Science & Technology Contributions for Informed National Policy-Making and Action for the Implementation of the Sendai Framework. He will also be going to the AGU in Washington DC in December, while I shall be at the AMS Annual Meeting in Phoenix in January.

As well as the usual entries, this edition includes an impressive list of recent papers from the Waves-2-Weather project in Germany, which is affiliated to HIWeather. Some excellent progress has been made in several of the focal areas of the Processes and Predictability theme.

Wishing you all every success in your HIWeather activities.

The Project

Steering Group and Task Teams

Co-chairs: Brian Golding, UK, brian.golding@metoffice.gov.uk and David Johnston, New Zealand, David.Johnston@gns.cri.nz.

ICO: Qinghong Zhang, Liye Li, China, hiwico@cma.gov.cn.

Processes & Predictability (PP) theme – lead: Michael Riemer, Germany, mriemer@uni-mainz.de.
Members: John Knox, Peter Knippertz, Andreas Schäfler, Juan Fang, Shira Rabeh-Ruvin, Linus Magnusson.

Multi-Scale coupled Forecasting (MSF) theme – lead: Jenny Sun, USA, sunj@ucar.edu.
Members: Paul Joe, Peter Steinle, Sharan Majumdar, Jianjie Wang, Jim Dudhia, Krushna Chandra Gouda.

Human Impacts, Vulnerability & Risk (HIVR) theme – lead: Brian Mills, Canada, bmills@uwaterloo.ca.
Members: Joanne Robbins, Michael Kunz, Isabelle Ruin, Melanie Gall.

Communication theme – co-leads: Andrea Taylor, UK, a.l.taylor@leeds.ac.uk & Shannon Panchuk, Australia s.panchuk@bom.gov.au
Members: Abi Beatson, Greg Carbin, Melanie Harrowsmith, Amber Silver, Rutger Dankers, Thomas Kox, Claudia Adamo, Jose Galvez, Kiernan McGill, Linda Anderson-Berry, Tim Brown, Vankita Brown.

Evaluation theme – lead: Beth Ebert, Australia, e.ebert@bom.gov.au
Members: Julia Chasco, Barb Brown, Anna Scolobig, Manfred Dorninger, Martin Goeber, Helen Titley, Marion Mittermaier, Jing Chen, Chiara Marsigli

Advisory Board

John Rees, British Geological Survey and Research Councils UK, representing funding agencies
Jan Polcher, Laboratoire de Meteorologie Dynamique of Centre National de la Recherche Scientifique, France, representing Climate Science
Jennifer Sprague-Hilderbrand, National Oceanic and Atmospheric Administration, USA, representing users
Virginia Murray, Public Health England and UNISDR, representing the UN family
Michael Reeder, Monash University, Australia, representing academia

Funding. The Trust Fund supports HIWeather conference attendance by delegates from developing countries. New contributions are needed to develop and facilitate the work of the project.

International Coordination Office: The ICO in the Chinese Academy of Meteorological Sciences is in development and you will have seen their web pages for the Workshop in November. The ICO is taking over organisation of Steering Group, Advisory Board and Task Team teleconferences, the newsletter and web site from the WWRP secretariat in Geneva. It is planned to formally open the ICO during the workshop in November.

Secretariat: Julia Keller provides valuable assistance within the WMO secretariat. Paolo Ruti provides the link to the World Weather Research Programme.

Communication: The HIWeather web site can be reached at http://bit.ly/1RKapbc. It contains the Implementation Plan, Steering Group and Task team membership and HIWeather presentations. It is available for task teams to post meetings and progress. A communications web platform for the project has been set up at Massey University, New Zealand and is currently being populated. I use Linked-In to post items of interest about HIWeather and copy my posts to Twitter using the hashtag #HIWeather.

Meetings: The Steering Group meets quarterly, usually by teleconference. The next physical meeting will be following the Beijing workshop in November. Task teams meet by teleconference at intervals to suit their work. The Advisory Board meets quarterly by teleconference and aims to meet in person sometime in the next year.

Relevant Scientific Meetings

IDRiM (International Society for Integrated Disaster Risk Managament) 9th conference, 2-4 October 2018, Sydney, Australia. http://www.idrim.org/?p=1730

International Conference on Integrated Science & Technology Contributions for Informed National Policy-Making and Action for the Implementation of the Sendai Framework, 16-17 Oct 2018, Chengdu, China

14th IEEE International eScience conference, 29 Oct – 1 Nov, Amsterdam. Session on Weather & Climate in the Digital Era. https://www.escience2018.com/page/419729

ISCRAM Asia-Pacific Conference, 4-7 November, 2018, Wellington, New Zealand. Registration open. http://www.confer.co.nz/iscramasiapacific2018/

HIWeather Workshop, Beijing, 20-22 November 2018. This will be our first meeting of all the HIWeather task teams since Spring 2016, so we look forward to bringing everyone together again, to hearing about successes & challenges in the intervening 30 months, and to planning future activities. See https://www.wmo.int/pages/prog/arep/wwrp/new/documents/HIWeather_workshop_China_Nov_2018_call_for_applications.pdf

M2D Workshop in Communicating Uncertainty, 26-27 November, 2018, Berkshire, England. https://wintoncentre.maths.cam.ac.uk/news/winton-centre-m2d-workshop-communicating-uncertainty. Applications invited, deadline 1st October.

FfIR final assembly, 27 November 2018, Royal Society, London. http://blogs.reading.ac.uk/flooding/royal-society-open-event-on-flooding-from-intense-rainfall/

9th International Workshop on Tropical Cyclones (IWTC-9), 3-7 December, Honolulu, USA. By invitation. https://www.wmo.int/pages/prog/arep/wwrp/IWTC-9.html

AGU Fall Meeting, 10-14 December, Washington DC, USA. Abstract submissions open mid-June. https://fallmeeting.agu.org/2018/welcome/

Global Heat Health Information Network Forum, 17-20 December 2018, Hong Kong, China. https://ghhin.org/ghhin-forum-info

AMS Annual Meeting, 6-10 January 2019, Phoenix, USA. Abstract deadlines have passed. Registration is open at https://annual.ametsoc.org/index.cfm/2019/registration/

AMS Washington Forum, 27-29 March 2019, Washington, USA.

UNISDR Global Platform, 13-17 May 2019, Geneva, Switzerland.

IUGG General Assembly, 8-18 July, 2019, Montreal, Canada

HIWeather Research

a. Review the state of wind hazard forecasting
Lead: John Knox
Identify wind metrics that relate to impacts; describe the state-of-the-art in observing and predicting them; identify processes that lead to high impacts; make recommendations for targeted work to address weaknesses in understanding, observing and prediction. The writing team is working to a target of completion no later than December 2018.

b. Review the current state of nowcasting & forecasting high impact weather
Leads: Sharan Majumdar and Jenny Sun
Objectives: Document current state of high impact weather nowcasting/forecasting with an emphasis on flood and high wind warnings; Identify gaps
A draft was prepared ahead of the Conference on Predictability & Multi-Scale Prediction of High Impact Weather in October 2017. BAMS have accepted the proposal and submission is scheduled for October 2018.

c. Intercomparison of km-scale DA & nowcast/forecast systems
Lead: Jenny Sun
Objectives: Demonstrate state-of-the-art of km-scale DA & nowcast/NWP systems for HIW warning with an emphasis on floods & high winds
Following discussion at the Conference on Predictability & Multi-Scale Prediction of High Impact Weather in October, it is proposed initially to compare the relative performance of nowcasting and NWP in NHMSs.

d. UK Environmental Prediction (UKEP) project
NERC/Met Office programme to develop a coupled km-scale atmosphere, ocean, land surface hydrology prediction system has started phase 2, having successfully demonstrated sensitivity to coupling in short range forecasts. See
https://www.metoffice.gov.uk/research/collaboration/ukenvironmentalprediction

e. Formal (statistical) impact model intercomparison
Lead : Martin Goeber with input from HIVR and Evaluation task teams

Develop Masters student module to examine simple and physically-based impact models

f. Evaluating the effectiveness of impact-based, extreme weather warnings and behavioural recommendations.

Leads: Philippe Weyrich, Anna Scolobig & Anthony Patt, ETH Zurich

A survey of expected responses to impact-based and non-impact-based warnings amongst Swiss people was carried out. Overall, the results support the conclusion that impact information coupled with behavioural recommendations in warning messages, promote more effective decisions than standard warnings.

g. Review & classification of impact modelling

Leads: Brian Mills & HIVR task team

A review of impact modelling is being prepared aiming to have a draft for the workshop in November.

h. Global Hazard Map

Leads : Helen Titley and Joanne Robbins, UK Met Office

The Global Hazard Map (GHM) summarises the risk of high-impact weather across the globe over the coming week using forecasts from the Met Office and ECMWF global ensembles. It includes forecast layers for tropical cyclones (strike probability and tracks), 24-hour precipitation accumulation, maximum wind gust in a 24-hour period, 24-hour snowfall accumulation, as well as severe heat waves and cold waves. Performance is evaluated by comparing daily gridded precipitation forecasts against observations, and by assessing the ability of the multi-model precipitation summary layer to highlight events which cause community impacts as recorded in an impact database. The Global Hazard Map is currently being trialled with the Severe Weather Forecast Demonstration Projects (SWFDP).

i. Weather Information Value Chain

Lead: Brian Golding

Workshops, in Berlin in May and Melbourne in August 2017, explored the Weather Information Value Chain as a process for understanding the end-to-end flow of information and value from weather to community benefit, including: what constitutes "value"; what an end-to-end user-driven value chain looks like; how value is added/subtracted as information flows along the chain; ways to measure value; using the value chain to guide investment. A review paper has been submitted to the Global Assessment Review of Disaster Risk Report 2019.

j. Probabilistic forecasting and evaluation of Tropical Cyclones

Leads: Helen Titley, Munehiko Yamaguchi, Linus Magnusson

Ensemble forecasting of tropical cyclones is vital in capturing the situation-dependent uncertainty in the track and intensity forecasts for existing storms, and in providing probabilistic information about tropical cyclone genesis. We aim to enhance collaboration amongst the research and operational community to aid the development of new and innovative ways to display and verify ensemble probabilistic tropical cyclone forecasts including tracks, strike probability, genesis, intensity, and potential impacts. We will work with the operational TC forecasting community to gather their current and future user requirements and demonstrate the benefits of using ensemble forecasts, with a view to increasing the use of probabilistic information in tropical cyclone forecasting. A questionnaire has been sent to all operational TC forecasting centres asking them about their use of ensemble forecasts including: examples where probabilistic forecasts have been successfully integrated in to operations, occasions where hurdles have prevented them from being fully utilised, and where further model or product development and/or user-oriented evaluation would help encourage their wider use. Results will be used to quantify the current level of forecasting skill for TC intensity in global ensemble forecasts. Results will be presented at the 9th International Workshop on Tropical Cyclones in December

k. Unconventional data sources for impact modelling, evaluation & communication

Lead: Abi Beatson

An unconventional data research network has been formed. Several activities are underway to investigate tools for gathering social media data from the public, and on the use of weather warnings by the public using data from social media. Activities include:

- Real-time reporting and social data intelligence: Abi Beatson (JCDR, New Zealand)
- Twitter data analysis: Hywel Williams (U. Exeter, UK)
- Use and interpretation of warnings on social media by the public: Amber Silver (U. at Albany, US), Shannon Panchuk (BoM, Australia)
- Citizen science: Lisa McLaren (JCDR, New Zealand)
- Role of social media for impact models & warnings: Sara Harrison, Sally Potter, Abi Beatson (New Zealand)

l. **Mesoscale Verification Inter-comparison over Complex Terrain (MesoVICT)**.

Leads: Manfred Dorninger and Marion Mittermaier, Evaluation Team

The project continues to encourage investigation of spatial verification methods in complex terrain, including for ensemble forecasts and uncertain observations. A paper entitled, "The set-up of the Mesoscale Verification Inter-Comparison over Complex Terrain (MesoVICT) Project " is available in BAMS on early release at https://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-17-0164.1 and a special collection of articles related to MesoVICT is planned for *Monthly Weather Review* and *Weather & Forecasting*.

m. **User-oriented metrics challenge**.
Lead: JWGFVR and evaluation task team
A competition for evaluation metrics relevant to end users run by the Joint Working Group on Forecast Verification Research (see http://www.wmo.int/pages/prog/arep/wwrp/new/Forecast_Verification.html) was a great success with 17 entries from 11 countries. See overview paper at https://www.schweizerbart.de/papers/metz/detail/prepub/89677/The_WMO_Challenge_to_Develop_and_Demonstrate_the_B?af=crossref. The JWGFVR plans to run another challenge in 2020.

n. Review of approaches to communicating high impact weather.
Lead: Andrea Taylor, Communication task team.
A special issue of the International Journal of Disaster Risk Reduction under the title, “Communicating High Impact Weather: Improving warnings and decision making processes” is available at https://www.sciencedirect.com/journal/international-journal-of-disaster-risk-reduction/vol/30/part/PA.

o. Training Materials
Lead: Shannon Panchuk
Current plans are to link into the work of the WMO Expert Team on Impact-Based Forecasting & Warning and to NOAA in the USA.

p. Review of the role of trust, salience and beliefs on people’s responses to weather warnings.
Lead: Sally Potter
Reviewing the role of influences on response to weather warnings, such as risk perceptions, trust, salience and beliefs. We aim to Review previous literature, Understand the variables on achieving an optimal behavioural response, Produce guidelines on how to best communicate weather information. Recent work in the Bushfire CRC is being picked up.

q. Communicating uncertainty
Lead: Sally Potter
Review and publish the implications of uncertainty in weather forecasts and warnings across the whole spectrum of HIWeather. Literature review underway. Once completed, materials and research will be summarised and guidelines developed for weather forecasters to communicate uncertainty better.

r. Post-event case studies
Lead: Shannon Panchuk
An index of previous WMO surveys of weather service severe weather warnings has been prepared by Juyeon Bae and will be used by this and other activities as a starting point.

s. Communication platform
Lead: Emily Campbell.
Outputs from HIWeather communication activities will be freely available on the HIWeather Communication Platform, including best practice guidelines and reviews. An early version was reviewed and some enhancements are under development with a soft launch expected shortly.

t. NAWDEX (North Atlantic Waveguide and Downstream Impacts Experiment):
Lead: George Craig and Processes & Predictability task team.
The field phase completed in October 2016 and acquired excellent data including the extratropical transition of Tropical Cyclone Karl. See overview paper in the latest BAMS at https://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-17-0003.1.

u. **HIGHWAY** (**Lake Victoria Basin Nowcasting project)**
The “HIGH impact Weather lAke sYstem” project falls under the UK’s Department for International Development (DFID) WISER (Weather and Climate Information SERvices for Africa) programme and runs from October 2017 to March 2020. The expected outcome of HIGHWAY is increased access to and use of co-designed and sustainable early warning systems to inform regional, national, sub-national and community level planning and decision-making in the East African region and to improve resilience and reduce the loss of life and damage to property supporting sustainable economic development in the East African region. Meetings have been held in February and May with stakeholders, including local fishing communities. See https://www.metoffice.gov.uk/about-

us/what/international/projects/wiser/highway and https://www.wmo.int/amcomet/sites/default/files/field/doc/events/highway_meeting_report_final.pdf

v. GCRF African Science for Weather Information and Forecasting Techniques (GCRF African SWIFT)

Lead: Doug Parker and Alan Blyth (University of Leeds / National Centre for Atmospheric Science). A 4-year project, funded by UK's Global Challenge Research Fund (GCRF), to improve African forecasting capabilities on hourly to seasonal timescales, funding 80 scientists in 5 UK and 10 African institutions, with WMO as an advisory member. Work is organised in 3 Strands:

- **User engagement/forecast evaluation**: links user engagement with forecast accuracy evidence.
- **Physical science research**: disciplinary research to deliver quality-controlled weather predictions.
- **Knowledge exchange, training and documentation**: provide a legacy to project outcomes.

WMO/WWRP supported the planning of the project, and a strong collaboration with the recently-funded ***Highway*** project in the Lake Victoria Basin has been planned. GCRF African SWIFT aims to engage with and contribute to ***HIWeather's*** programme of work. Andrea Taylor, who is jointly leading GCRF African SWIFT's work on user engagement, is a member of the HIWeather Communication task team. See https://www.ncas.ac.uk/en/swift-project or contact NCASSwift@leeds.ac.uk

w. RELAMPAGO-CACTI (Remote sensing of Electrification, Lightning, And Meso-scale/micro-scale Processes with Adaptive Ground Observations - Cloud Aerosols and Complex Terrain Interactions)

Linked to HIWeather through the WGNMFR

RELAMPAGO is funded by the US National Science Foundation to observe convective storms that produce high impact weather in the lee of the Andes in Argentina. It also involves contributions from NASA, NOAA, Argentina (MINyCT), Brazil (CNPq and FAPESP), Chile (CONICYT), universities across the region, Argentina's national meteorological service (Servicio Meteorológico Nacional, SMN) and Brazil's space agency (INPE) that governs Brazil's weather and climate prediction service (CPTEC). Extended Observing Period is 15 Aug 2018–30 Apr 2019; Intensive Observing Period is 1 Nov–15 Dec 2018. CACTI is a US Department of Energy (DOE) funded project to study orographic clouds and their representation in multi-scale models for 15 Aug 2018–31 Mar 2019, involving the AMF-1 cloud-aerosol-radiation observatory, the Mobile Aerosol Observing System (MAOS) and the CSAPR-2 precipitation radar. It will also bring intensive airborne observations during RELAMPAGO through deployment of the G-1 aircraft. See: https://drive.google.com/file/d/0B6Z5EcBIjxY2S1llakstc3o1cUU/view?usp=sharing

x. SURF (Study of Urban Rainfall and fog/haze)

Lead Miao Shiguang (CMA/IUM).

Linked to HIWeather through GURME and the MSF task team

The Institute of Urban Meteorology is carrying out the SURF field experiment to study urban pollution and extreme precipitation in Beijing. 2017 was the third season of field data collection. Case study results were presented in the Conference on Predictability & Multi-Scale Prediction of High Impact Weather in October 2017.

y. ICE-POP2018 (RDP/FDP alongside the Pyeongchang Winter Olympic Games in South Korea)

Led by KMA and linked to HIWeather through the WGNMFR and MSF task team the IOP period is complete. See http://www.wmo.int/pages/prog/arep/wwrp/new/RDP-FDP.html for details.

z. SCMREX (Southern China Monsoon Rainfall EXperiment)

During the presummer rainy season (April–June), southern China often experiences frequent occurrences of extreme rainfall, leading to severe flooding. The China Meteorological Administration (CMA) initiated a nationally coordinated research project, SCMREX, endorsed by WMO, as a WWRP RDP, consisting of four major components: field campaign, database management, studies on physical mechanisms of heavy rainfall events, and convection-permitting numerical experiments including impact of data assimilation, evaluation/improvement of model physics, and ensemble prediction. Pilot field campaigns were carried out in 2013–15. See https://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-15-00235.1, which describes i) the scientific objectives, pilot field campaigns, & data sharing of SCMREX; ii) provides an overview of heavy rainfall events during SCMREX-2014; and iii) presents examples of preliminary research results and explains future research opportunities.

aa. MOUNTAOM (RDP alongside the 2022 Winter Olympic Games in Beijing)

China will be hosting the 2022 Winter Olympic Games in the mountains to the northwest of Beijing. A research activity is underway in the Chinese Meteorological Administration to develop capability in forecasting the relevant weather parameters in this area. The project has six research themes. It is planned to mount an annual field programme, the first of which was held in winter 2017. LES modelling experiments are being conducted with nested grids from 1km down to 37m. The project has an International Advisory Committee, the chair of which is Prof Joe Fernando.

National Programmes

US Contributions

A joint committee is formulating a US response to the three post-THORPEX projects. The US has a wide range of relevant work underway including the Hydrometeorology Testbed (HMT), focusing on rainfall and flood forecasting, and the Hazardous Weather Testbed, focusing on tornado, wind and hail forecasting. CAPS is running 3-km CONUS-domain cycled EnKF data assimilation, including radar data, for selected periods and discussing coupling with hydrology/river stream models for HMT. The National Weather Service FACETS project (http://www.nssl.noaa.gov/projects/facets/) is closely aligned with several aspects of HIWeather. The related Weather Ready Nations initiative is particularly relevant and Dr Jennifer Sprague-Hilderbrand is a member of the HIWeather Advisory Group.

UK Contributions

Relevant areas of work include unconventional data sources, km-scale data assimilation and ensemble prediction, km-scale coupled modelling, hazard impact modelling and risk communication. Impacts work is largely carried out in the Natural Hazard Partnership (http://www.naturalhazardspartnership.org.uk/). The NERC/Met Office funded FfIR (Flooding from Intense Rainfall) project addresses new radar capability, km-scale data assimilation & coupling with rural & urban inundation models and will complete at the end of 2018 (http://www.met.reading.ac.uk/flooding/). Research Councils UK is funding two networks in its "Decision Making Under Uncertainty" theme. The M2D network is running a workshop on communicating uncertainty in November (see forthcoming meetings).

The UK Natural Environment Research Council (NERC) and Department for International Development (DfID) fund four research projects through the Science for Humanitarian Emergencies And Resilience (http://www.nerc.ac.uk/research/funded/programmes/shear/) programme, targeting lower to middle income countries in sub-Saharan Africa and south Asia, focusing on co-production of knowledge using a multi-disciplinary and problem-centred approach. ForPAc (towards Forecast-based Preparedness Action: Probabilistic forecast information for defensible preparedness decision-making and action) focuses on flooding and drought in East Africa (primarily Kenya) promoting the use of risk information for preparedness action (http://gtr.rcuk.ac.uk/projects?ref=NE%2FP000568%2F1). LANDSLIP (Landslide Multi-Hazard Risk Assessment, Preparedness and Early Warning in South Asia: Integrating Meteorology, Landscape and Society), focuses on early warning of landslides in India (http://www.landslip.org/). FATHUM (Forecasts for AnTicipatory HUManitarian action) focuses on flooding in Africa (https://www.insis.ox.ac.uk/forecasts-anticipatory-humanitarian-action-fathum) and "Citizen science for landslide risk reduction and disaster resilience building in mountain regions", focuses on landslides in Nepal (http://gtr.rcuk.ac.uk/projects?ref=NE%2FP000207%2F1). See also SWIFT and HIGHWAY, above.

German Contributions

W2W (Waves to Weather) is a Collaborative Research Center delivering the underpinning science needed to identify the limits of predictability in different weather situations so as to pave the way towards a new generation of weather forecasting systems. See http://w2w.meteo.physik.uni-muenchen.de/. The research programme is listed under the headings of Upscale Error Growth, Cloud-Scale Uncertainties and Predictability of local Weather. Recent publications are listed below. WEXICOM **(**Weather warnings: from EXtreme event Information to COMunication and action) is an interdisciplinary collaborative research project aimed at facilitating transparent and effective communication of risks and uncertainties for individual user groups. See http://www.geo.fu-berlin.de/en/met/wexicom/index.html.

Australian Contributions

An Australian HIWeather community was established at the annual Australian Meteorological and Oceanographic Society (AMOS) meeting in February in Canberra. The goal is to foster collaboration within Australia of physical and social scientists, forecasters, and users of forecasts of high impact weather. Anyone who is interested can contact HIWeather@bom.gov.au to join this community.

The Bureau of Meteorology and Geoscience Australia is running a small project on **impact prediction**, currently looking at impacts of rain and wind on infrastructure. Partners include forecasters and State Emergency Services. High resolution ensemble NWP is coupled to wind & rain damage functions to derive probabilistic spatial maps of damage severity, using East Coast Lows as demonstration events.

New Zealand Contributions

Colleagues of David Johnston and Sally Potter at Massey University and GNS Science are developing a portfolio of HIWeather related projects in the Communications theme. These include a project to provide

best practice recommendations on the optimal length, order and content of short warning messages for agencies that warn the public about a variety of hazards, including severe weather and flooding. The next HIWeather New Zealand workshop is planned for the NZ Hydrological Society & NZ Meteorological Society Joint Conference in December 2018, in Christchurch.

Argentine Contributions

The Alert.AR project finished in May 2018, having delivered a new warning system. A Health & Heatwave Early Warning System (https://www.smn.gob.ar/smn_alertas/olas_de_calor) was inaugurated this summer as a result of a joint research between the National Ministry of Health and the National Meteorological Service of Argentina. The warning system is based on mortality data and climatological information from the last 40 years for 57 cities of Argentina. A WMO regional workshop on Impact-Based Forecasting & Warning is being hosted in September.

Chinese Contributions

Recently, 4 projects lead by researchers from Chinese Academy of Meteorological Sciences (CAMS) have been approved as *National Key Technology Research and Development Plan*:
1) "*Development of High Resolution Data Assimilation Techniques and East Asia Atmospheric Reanalysis Datasets*" (Xudong LIANG). The aim is for a 3km grid, decade long reanalysis for East Asia.

2) "*Research on Thunderstorm Electrification-discharge Processes and Lightning Effects*" (Weitao LYU). This project will include basic observational and theoretical approaches to understanding lighting and will use AI approaches to develop a lightning forecasting and warning platform.

3) "*Aerosol-Convective Cloud Interaction Mechanism and Its Model Application Demonstration over Beijing-Tianjin-Hebei Region*" (Jianping GUO https://www.researchgate.net/profile/Jianping_Guo6). This projects aims to improve 24-hour precipitation scores in the Beijing-Tianjing-Hebei region by developing improved mixed-phase parametrization scheme that incorporate aerosol effects. The parametrizations will be developed on the basis of field campaigns.

4) "*Development of Seamless Weather-Climate Model Dynamic Core on Unstructured Grid*" (Jian LI). The aim is to develop a core that gives more accurate solutions and is suitable for future supercomputing architectures.

A five-year Project, named as "*Key Dynamic and Thermodynamic Processes and Prediction for the Evolution of Typhoon Intensity and Structure*" of the Ministry of Science and Technology is led by Prof. Zhemin Tan from Nanjing University and aims to deliver forecast products of track, intensity and structure of typhoon 3-7 days in advance, see: http://meso.nju.edu.cn/web/typhoon/

Related Activities

GHHIN (Global Heat Health Information Network). A professional network of academics, government representative at all levels, professional organisations, international organisations, donor organisations, private sector and non-governmental organisations eager to share and engage in issues around heat and health. See http://www.ghhin.org/

VORTEX-SE (Verification of the Origins of Rotation in Tornadoes Experiment – SouthEast)
A research program to understand how environmental factors characteristic of the southeastern United States affect the formation, intensity, structure, and path of tornadoes. It will also determine the best methods for communicating forecast uncertainty related to these events to the public, and evaluate public response. See http://www.nssl.noaa.gov/projects/vortexse/

PECAN (Plains Elevated Convection At Night)
A large field project that focused on night-time convection in the Central USA. It was conducted across northern Oklahoma, central Kansas and south-central Nebraska from 1 June to 15 July 2015. A description of the field programme and preliminary results was published in the April 2017 issue of BAMS.

I-REACT
EU Horizon2020 project on Improving Resilience to Emergencies through Advanced Cyber Technologies (I-REACT), involving 20 partners, will integrate existing systems to facilitate early planning of weather-related disaster risk reduction activities. I-REACT will co-operate with the European Flood Awareness System (EFAS), European Forest Fire Information System (EFFIS), European Global Navigation Satellite System (E-GNSS), Copernicus, etc. See http://www.i-react.eu/

ANYWHERE
An EU Innovation action designed to bridge the gap between R&D in forecasting and warning high impact weather and climate so as to enhance response by emergency managers and first responders across Europe http://www.anywhere-h2020.eu/. Work packages include translating weather forecasts into impact

forecasts, developing a platform for communicating information to emergency managers. The project is working on 5 pilot sites: Ligurian Sea, Catalonia, Finland/Norway, Swiss Alps. It is a partnership of operational authorities, R&D institutes and private sector businesses. The project catalogue contains a large collection of forecasting algorithms, many developed in previous EU actions. Mostly they concern prediction of the hazard, but a few also deal with the impact. See http://anywhere-h2020.eu/catalogue/

Aristotle
Aristotle will deliver multi-hazard capability to the EU Emergency Response Coordination Centre (ERCC), which is responsible for the coordination of human aid upon request of the government of a country affected by natural (and other) hazards. It offers a scalable scientific network including new hazard related services and a pool of experts in the field of Hydro-Meteorology and Geophysics that can support ERCC in crisis situations worldwide. See http://aristotle.ingv.it/

European Disaster Risk Management Knowledge Centre
This centre will work at the science-policy interface to help EU Member States respond to emergencies, prevent and reduce the impact of disasters. See http://drmkc.jrc.ec.europa.eu/, https://ec.europa.eu/jrc/en/news/new-knowledge-centre-help-eu-minimise-risk-disasters

S2S (Sub-seasonal-to-Seasonal Prediction)
Latest news is available at http://www.s2sprediction.net/static/news

PPP (Polar Prediction Project)
Latest news is available at http://www.polarprediction.net/news.html.

TIGGE (THORPEX Interactive Grand Global Ensemble) and TIGGE-LAM (-Limited Area Model)
The TIGGE dataset (https://www.ecmwf.int/en/research/projects/tigge) is one of the major achievements of THORPEX. It now contains over 10 years of global data. On a smaller scale, the TIGGE-LAM dataset provides 5 years of multi-model ensemble data at mesoscale resolution for limited areas. These datasets have been used to investigate a variety of atmospheric processes and there is scope for more use in the context of HIWeather. Opportunities may be driven by analysis of weather phenomena or weather variable thresholds associated with high impact. Within the S2S project, activities related to specific weather phenomena are brought together at http://s2sprediction.net/ under topic wiki pages. There may be opportunities to do something similar for phenomena relevant to HIWeather. If you are interested, please contact John Methven at Reading University.

CODATA: the Committee on Data of ICSU
CODATA exists to promote global collaboration to improve the availability and usability of data for all areas of research. CODATA supports the principle that data produced by research and susceptible to be used for research should be as open as possible and as closed as necessary. CODATA works also to advance the interoperability and the usability of such data: research data should be intelligently open or FAIR. The group is working with relevant domain experts to develop proposals for major cross-disciplinary data integration projects to advance solutions for three important global challenges in **infectious disease**, **sustainable cities**, and **disaster risk reduction**. See www.codata.org/task-groups/linked-open-data-for-global-disaster-risk-research

The Young Earth System Scientists (YESS) Community

The YESS Community is an international multidisciplinary Early Career Researcher (ECR) network with more than 1000 members from over 80 countries. The network aims on bringing together early career scientists, both from natural and social sciences, who are working in a field of Earth system science. YESS is a bottom-up initiative and fully relies on the engagement and activities of its active members. YESS works closely with WWRP, GAW and WCRP to get ECRs involved and to provide them with a collective voice. YESS invites interested HIWeather master students, Ph.D. students and postdocs (within 5 years after their last degree) to join and engage in the community. See www.yess-community.org and follow YESS on Facebook: www.facebook.com/yesscommunity, Twitter: twitter.com/YESSCommunity or LinkedIn: www.linkedin.com/company/yess-community.

Journal of International Crisis and Risk Communication Research: open access journal dedicated to human and mediated communication issues associated with crises, risks, and emergencies around the world. It is supported by an international editorial board comprised of top risk and crisis communication scholars. The Journal invites manuscripts of a philosophical, theoretical, methodological, critical, applied, pedagogical or empirical nature. Its scope includes community or regionally based events and risks, such as hurricanes, floods, wild fires, infectious disease outbreaks or similar threats. See www.jicrcr.com

Int. J. Dis. Risk Red. Special Issue Papers

https://www.sciencedirect.com/journal/international-journal-of-disaster-risk-reduction/vol/30/part/PA

Communicating high impact weather: Improving warnings and decision making processes, Andrea Louise Taylor, Thomas Kox, David Johnston, Pages 1-4

Sending a message: How significant events have influenced the warnings landscape in Australia, Linda Anderson-Berry, Tamsin Achilles, Shannon Panchuk, Brenda Mackie, ... Deanne K. Bird, Pages 5-17

Deconstructing the binary between indigenous and scientific knowledge in disaster risk reduction: Approaches to high impact weather hazards, Marjorie Balay-As, Jay Marlowe, J.C. Gaillard, Pages 18-24

An empirical assessment of impact based tornado warnings on shelter in place decisions, Mark A. Casteel, Pages 25-33

The influence of impact-based severe weather warnings on risk perceptions and intended protective actions, Sally H. Potter, Peter V. Kreft, Petar Milojev, Chris Noble, ... Sarah Gauden-Ing, Pages 34-43

Is storm surge scary? The influence of hazard, impact, and fear-based messages and individual differences on responses to hurricane risks in the USA, Rebecca E. Morss, Cara L. Cuite, Julie L. Demuth, William K. Hallman, Rachael L. Shwom, Pages 44-58

Decision making with risk-based weather warnings, Di Mu, Todd R. Kaplan, Rutger Dankers, Pages 59-73

Towards user-orientated weather warnings, Thomas Kox, Harald Kempf, Catharina Lüder, Renate Hagedorn, Lars Gerhold, Pages 74-80

Understanding the use of 2015–2016 El Niño forecasts in shaping early humanitarian action in Eastern and Southern Africa, Arielle S. Tozier de la Poterie, Wasswa Eddie Jjemba, Roop Singh, Erin Coughlan de Perez, … Julie Arrighi, Pages 81-94

The need to trust: How features of the forecasted weather influence forecast trust, Joy E. Losee, Susan Joslyn, Pages 95-104

Eyeing the storm: How residents of coastal Florida see hurricane forecasts and warnings, Ann Bostrom, Rebecca Morss, Jeffrey K. Lazo, Julie Demuth, Heather Lazrus, Pages 105-119

The politics of participation in community-based early warning systems: Building resilience or precarity through local roles in disseminating disaster information?, Sierra Gladfelter, Pages 120-131

Perceptions and reactions to tornado warning polygons: Would a gradient polygon be useful?, Ihnji Jon, Shih-Kai Huang, Michael K. Lindell, Pages 132-144

Early detection and information extraction for weather-induced floods using social media streams, C. Rossi, F.S. Acerbo, K. Ylinen, I. Juga, ... A. Alikadic, Pages 145-157

Selected W2W Publications List

- Baran, S., and **S. Lerch**: Combining predictive distributions for the statistical post-processing of ensemble forecasts, *Int. J. Forecast.*, **34**, 477-496. (Link to online article) Fundamental discussion of how we can combine information from different observational sources (e.g. different weather stations) to better correct for biases and dispersion errors in forecasts.
- **Baumgart, M.**, **M. Riemer**, **V. Wirth**, F. Teubler, S. T. K. Lang: Potential-vorticity dynamics of forecast errors: A quantitative case study, *Mon. Wea. Rev.*, early online, DOI:10.1175/MWR-D-17-0196.1. (Link to online article) Illustrative example of how a recently developed potential vorticity error tendency equation can be used to better analyse contributions to forecast errors from different dynamical processes.
- **Craig, G. C.**, and **T. Selz**: Mesoscale dynamical regimes in the midlatitudes, *Geophys. Res. Lett.*, **45**, DOI:10.1002/2017GL076174. (Link to online article) Introduction and discussion of five dynamical regimes (quasi-geostrophic, propagating/stationary gravity waves, acoustic modes, diabatic heating) based on governing equations and spectral analysis.

- **Fragkoulidis, G.**, **Wirth, V.**, **Bossmann, P.** and **Fink, A.H.**: Linking Northern Hemisphere temperature extremes to Rossby wave packets, *Q.J.R. Meteorol. Soc.,* **144**, 553-566, doi:10.1002/qj.3228 (Link to online article) Statistical analysis of how strongly warm and cold temperature extremes are related to particular characteristics of Rossby waves (e.g. large amplitude) and their longitudinal extent.
- 1) Gentine, P., M. Pritchard, **S. Rasp**, G. Reinaudi and G. Yacalis, 2018: Could machine learning break the convection parameterization deadlock?, *Geophys. Res. Lett.* (Link to online article)
  2) **Rasp, S.**, M. S. Pritchard, and P. Gentine: Deep learning to represent sub-grid processes in climate models. *Proc. Natl. Acad. Sci.*, doi: 10.1073/pnas.1810286115. (Link to online article)
  Two papers discussing how new approaches from computer science can be used in atmospheric science to improve longstanding problems with parametrizations.
- 1) **Kern M.**, T. Hewson, **A. Schäfler**, **R. Westermann**, and **M. Rautenhaus**: Interactive 3D Visual Analysis of Atmospheric Fronts, *IEEE Transactions on Visualization and Computer Graphics*, doi:10.1109/tvcg.2018.2864806. (Link to online article)
  2) **Rautenhaus, M.**, M. Böttinger, S. Siemen, R. Hoffman, R.M. Kirby, M. Mirzargar, N. Röber, and **R. Westermann**: Visualization in Meteorology - A Survey of Techniques and Tools for Data Analysis Tasks, *IEEE Transactions on Visualization and Computer Graphics*, doi: 10.1109/TVCG.2017.2779501 (Link to online article)
  3) **Kumpf, A.**, B. Tost, **M. Baumgart**, **M. Riemer**, **R. Westermann**, and **M. Rautenhaus**: Visualizing confidence in cluster-based ensemble weather forecast analyses, *IEEE Transactions on Visualization and Computer Graphics*, **24**, doi: 10.1109/TVCG.2017.2745178. (Link to online article)
  Three papers illustrating and summarising the opportunities provided by new developments in visualisation to better identify atmospheric features, understand dynamics of weather systems and to analyse forecast uncertainty interactively.
- **Pantillon, F.**, **Lerch, S.**, **Knippertz, P.** and **Corsmeier**, **U.**: Forecasting wind gusts in winter storms using a calibrated convection-permitting ensemble. *Q. J. R. Meteorol. Soc.* Accepted Author Manuscript. doi:10.1002/qj.3380. (Link to online article) Illustration of quality of gust forecasts in a convection-permitting regional ensemble forecast system including the scope for improvements using postprocessing.
- **Schneider, L.**, **C. Barthlott**, **A.I. Barrett**, **C. Hoose**: The precipitation response to variable terrain forcing over low-mountain ranges in different weather regimes, *Q. J. Roy. Meteorol. Soc.*, doi:10.1002/qj.3250 (Link to online article) Very high resolution (500m grid-spacing) sensitivity experiments investigating the role of hilly terrain on convective triggering and evolution as well as on frontal rainfall.
- **Vogel, P.**, **P. Knippertz**, **A. Fink**, **A. Schlueter**, and **T. Gneiting**: Skill of Global Raw and Postprocessed Ensemble Predictions of Rainfall over Northern Tropical Africa, *Wea. Forecasting*., **33**, 369-388, doi:10.1175/WAF-D-17-0127.1 (Link to online article) Demonstration that even sophisticated ensemble postprocessing and multi-model approaches applied to global state-of-the-art NWP models hardly outperform a simple climatological rainfall forecast in tropical Africa.
- **Wirth, V.**, **M. Riemer**, E. K. M. Chang, O. Martius: Rossby Wave Packets on the Midlatitude Waveguide - A Review, *Mon. Wea. Rev*., doi:10.1175/MWR-D-16-0483.1, in press. (Link to online article) Broad discussion on where science stands today with respects to Rossby wave analysis, physical understanding and relevance for weather prediction.
- There is also an AMS special issue for W2W at https://journals.ametsoc.org/topic/W2W, currently containing 11 papers.

Other Recent Relevant Publications:

Schafler, A. et al, 2018, The North Atlantic Waveguide and Downstream Impact Experiment . BAMS, https://doi.org/10.1175/BAMS-D-17-0003.1

Sillman, J. et al, 2018, From Hazard to Risk. BAMS, https://doi.org/10.1175/BAMS-D-17-0327.1

Kwon, I., et al, 2018, Assessment of progress and status of data assimilation in Numerical Weather Prediction. BAMS, DOI:10.1175/BAMS-D-17-0266.1

Rodwell, M.J. et al, 2018, Flow dependent reliability: a path to more skilful ensemble forecasts. BAMS, DOI:10.1175/BAMS-D-17-0027.1

Jonkman, S.N. et al, 2018, Loss of life due to Hurricane Harvey. Nat. Haz. Earth Sys.Sci., https://doi.org/10.5194/nhess-18-1073-2018

Pardowitz, T., 2018, A statistical model to estimate local vulnerability to severe weather. Nat. Haz. Earth Sys.Sci., https://doi.org/10.5194/nhess-18-1617-2018

Metin, A.D., et al, 2018, How do changes along the risk chain affect flood risk. Nat.Haz.EarthSys.Sci. https://doi.org/10.5194/nhess-2018-155

Lane, K., et al, 2018, Burden and risk factors for cold-related illness and death in New York City. Int.J.Env.Res & Pub.Health. doi:10.3390/ijerph15040632

Flora,M.L., et al, 2018, Practical predictability of supercells: exploring ensemble forecast sensitivity to initial condition spread. Mon Wea Rev DOI: 10.1175/MWR-D-17-0374.1

Liang,X., et al, 2018, SURF: Understanding and predicting urban convection and haze, BAMS, DOI:10.1175/BAMS-D-16-0178.1

Clark, A.J., 2018, The community leveraged unified ensemble (CLUE) in the 2016 NOAA/Hazardous Weather Testbed Spring Forecasting Experiment. BAMS DOI:10.1175/BAMS-D-16-0309.1

Scortichini,M. et al, 2018, Short-Term Effects of Heat on Mortality and Effect Modification by Air Pollution in 25 Italian Cities, Int.J.Env.Res.&Pub.Health, doi:10.3390/ijerph15081771

Pyrgou,A. & M. Santamouris, 2018, Increasing Probability of Heat-Related Mortality in a Mediterranean City Due to Urban Warming, Int. J. Env. Res. Public Health. doi:10.3390/ijerph15081571

Meheriz,K., 2018, The Effect of an Automated Phone Warning and Health Advisory System on Adaptation to High Heat Episodes and Health Services Use in Vulnerable Groups—Evidence from a Randomized Controlled Study, Int. J. Environ. Res. Public Health, doi:10.3390/ijerph15081581

Madrigano,J. et al 2018, Awareness, Risk Perception, and Protective Behaviors for Extreme Heat and Climate Change in New York City, Int. J. Environ. Res. Public Health. doi:10.3390/ijerph15071433

Woodhams,B.J. et al, 2018, What Is the Added Value of a Convection-Permitting Model for Forecasting Extreme Rainfall over Tropical East Africa?, Mon Wea Rev. DOI: 10.1175/MWR-D-17-0396.1

Radanovics et al, 2018, Spatial Verification of Ensemble Precipitation: An Ensemble Version of SAL, Wea & Forecast, DOI: 10.1175/WAF-D-17-0162.1

Call,D.A. et al, 2018, Hazardous weather conditions and multiple-vehicle chain-reaction crashes in the United States, Meteor. Appl., DOI: 10.1002/met.1714

Wagner, A. et al, 2018, Explicit Convection and Scale-Aware Cumulus Parameterizations: High-Resolution Simulations over Areas of Different Topography in Germany, Mon Wea Rev. DOI: 10.1175/MWR-D-17-0238.1

Karstens, C.D.K. et al, 2018, Development of a Human–Machine Mix for Forecasting Severe Convective Events, Mon Wea Rev DOI: 10.1175/WAF-D-17-0188.1