April 2019

Preparations for the UNISDR Global Platform on Disaster Risk Reduction **(GPDRR 2019)** and the second Multi-Hazard Early Warning Conference **(MHEWC-II)** have been dominating HIWeather of late. For the MHEWC, I have been co-organising two sessions: Session 1 on the Last Mile and Session 3 on Science, Technology & Innovation. David Johnston will be moderating the Last Mile session with Julia Chasco (Evaluation task team) as keynote speaker, so HIWeather will be well represented. For the Science, Technology & Innovation session, Paul Davis (Met Office Chief Meteorologist) is keynote speaker and will highlight HIWeather in his talk. Session 2 is dedicated to Impact Based Forecasting and there is a side event on Health Impacts, in which the keynote speaker is Advisory Board member Virginia Murray. A set of six issue briefs has been prepared for the conference web site, of which I edited four using material from HIWeather. In the GPDRR itself, David Johnston and I sit on three of the session organising committees, and David is organising an Ignite Stage presentation on the Communications Team's special journal issue. Finally, the Global Assessment Report on Disaster Risk Reduction, which will be issued for the Global Platform, contains a HIWeather authored report focused around using the Value Chain to optimise warning systems.

Meanwhile, in March I joined Advisory Board member Jennifer Sprague Hildebrand and ex-Evaluation Team member Jeff Lazo, with others, in a panel discussion on Valuing Weather Services at the AMS Washington Forum. This was a very different style of conference from any I have been to before, with the emphasis on policy issues and on communication between the meteorological community and policy makers in government. To facilitate this, much of the forum was conducted according to modified Chatham House Rules, i.e. material could be quoted but not attributed. This enabled government employees to be slightly more open than usual. The panel discussion aimed to make the case for service evaluation being a routine component of the weather service rather than something done occasionally as required, using a new approach each time. Routine evaluation with a standardised approach would permit longitudinal analysis, while evaluation along the value chain would permit targeting of investment in those areas that would provide greatest payback.

In April, Qinghong attended Conference on Mesoscale Convective System and High Impact Weather (ICMCS-XIII) in Okinawa. She introduced HIWeather Project to attract more attention among Asia-Pacific region. Besides, she joined in the workshop of World Meteorological Centres in Beijing China to contribute the refining work of seamless GDPFS Implementation Plan.

The RISK Knowledge Action Network (RISK-KAN) development group has begun its work and is considering what topics should be covered by the first set of working groups. It is likely that the main linkage with HIWeather will be through one of these. Meanwhile the group plans to meet briefly at the GPDRR in May and then for a longer session at the Herenhausen conference on Extreme Events: Building Climate Resilient Societies in Hannover in October.

My task after getting back from the GPDRR in May will be to write and circulate an outline for a proposed book on HIWeather, which will be structured around the Warnings Value Chain, as represented in the Five Valleys of Death diagram. This will be a big undertaking, and will need the commitment of task team members and others to prepare the text. I look forward to sharing more about this in the next newsletter.

Wishing you all every success in your HIWeather activities.

Brian Golding, co-chair

1. The Project

Steering Group and Task Teams

Co-chairs: Brian Golding, UK, brian.golding@metoffice.gov.uk and David Johnston, New Zealand, D.M.Johnston@massey.ac.nz

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

Processes & Predictability (P&P) theme – lead: Michael Riemer, Germany, mriemer@uni-mainz.de.
Members: John Knox, Peter Knippertz, Andreas Schäfler, Juan Fang, Shira Rabeh-Ruvin, Linus Magnusson, Deanna Hence, Yali Luo, Linda Schlemmer, Robert Rogers

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, Nusrat Yussout.

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, Emily Campbell.

Evaluation theme – lead: Beth Ebert, Australia, e.ebert@bom.gov.au
Members: Amanda Anderson, Barb Brown, Julia Chasco, Martin Goeber, Masa Haraguchi, Rainer Kaltenberger, Chiara Marsigli, Marion Mittermaier, Anna Scolobig, Helen Titley, Xudong Liang, liangxd@cma.gov.cn

NEW MEMBERS:

Yali Luo (P&P) ylluo@cma.gov.cn
Yali Luo is a Senior Scientist at the State Key Laboratory of Severe Weather of the Chinese Academy of Meteorological Sciences. Her major research interests are in understanding heavy-rain or damaging-wind-producing convective systems in China, past and future changes of climate extremes, impacts of data assimilation on convective systems, and the evaluation and improvement physics parameterization schemes.
She is the chief scientist of the Southern China Monsoon Rainfall Experiment (SCMREX), a WMO/WWRP Research & Development Project (RDP). This RDP has two scientific objectives: First, To better understand development of the heavy-rain-producing storms focusing on processes governing convective initiation & development, as well as storm-internal processes; Second, to improve QPF skill by better understanding multi-scale precipitation processes, and by carrying out DA impact study, model physics scheme improvement, and ensemble forecast experiments at convection-permitting scale. The extensive collaboration has resulted in continuous progresses in the three related research fields, namely, the physical mechanism study, the NWP study, and development of new remote sensing instruments and retrieval technique.

Linda Schlemmer (P&P) Linda.Schlemmer@dwd.de
Linda Schlemmer is co-leading a team on boundary-layer processes and turbulence within the Hans-Ertel Centre for Weather Research (HErZ) at the German Weather Service. She has been working on numerical modeling of moist convection and land-atmosphere coupling, including studies on the importance of cold pools for the initiation of new convective cells, convective momentum transport, the role of land-surface heterogeneities for the triggering of moist convection as well as the soil-moisture precipitation feedback. Currently she is involved in preparing a field campaign focusing on sub-mesoscale variability (Field Experiment on submesoscale spatio-temporal variability in Lindenberg – FESSTVaL). With respect to the source of submesoscale variability, the measurement campaign focuses on three different topics: boundary layer patterns, cold pools, and wind gusts. Furthermore, usability of citizen-science-based measurements for the campaign and the effect of citizens' involvement on warning reception will be investigated.

Robert Rogers (P&P) robert.rogers@noaa.gov
Robert Rogers is Lead Meteorologist at the Hurricane Research Division within the U.S. National Oceanic and Atmospheric Administration (NOAA). His main areas of research involve studying the role of convective- and vortex-scale processes in tropical cyclone (TC) structure, intensity change, and rainfall, using a combination of aircraft observations and numerical models.   He has worked extensively with airborne Doppler datasets to examine structural characteristics associated with TCs that rapidly intensify. He has also been instrumental in the development of the plan for the next-generation NOAA Hurricane Forecast Improvement Project (HFIP),

whose focus will be on mitigating impacts from a variety of TC hazards (wind, storm surge, rainfall, severe weather) rather than just TC position and intensity. He has many national and international collaborations, including serving as Chair of the International Science Steering Committee for the project Understanding and Predicting Rainfall from Landfalling Tropical Cyclones (UPDRAFT), led by Nanjing University in China.

Nusrat Yussout (MSF) nusrat.yussouf@noaa.gov
Nusrat is the lead of the NSSL Warn-on-Forecast effort. She is expected to play an important role in activities involving high-resolution data assimilation and short-term HIW prediction.

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 can support 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 has been formally opened during the workshop in November 2018. The ICO is taking over organisation of Steering Group, Advisory Board and Task Team teleconferences, and the web pages for the project will be seen in May 2019.

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 has decided to increase the frequency of its meetings to quarterly by teleconference.

2. Relevant Scientific Activities

1) Call for special issue on ***Development and Application of Seamless Prediction Systems*** in Meteorologische Zeitschrift (MZ).
   Major components of a seamless prediction system are 1) observations, 2) observation and NWP based nowcasting systems, 3) (ensemble-based) numerical weather prediction systems, 4) postprocessing and 5) applications to reduce weather related hazards. Your contribution might focus on one or more key components of a seamless predictions system or present several outputs in a seamless way already. Please submit your manuscript to the MZ latest until **31.12.2019. The journal section "Seamless Prediction Systems" has to be chosen under submission. This guarantees the automated forwarding of the manuscripts to the editors in charge of this special issue.**

2) **WMO MHEWS** 11-12 May 2019, Geneva, Switzerland. Registration now closed. Sessions will cover the whole range of HIWeather.

3) **UNISDR Global Platform**, 13-17 May 2019, Geneva, Switzerland. Registration now closed. See https://www.unisdr.org/conference/2019/globalplatform/home

4) **27th IUGG General Assembly**, 8-18 July, 2019, Montreal, Canada, see http://iugg2019montreal.com/.
   Several sessions of interest to HIWeather including:
       High-impact Weather and Climate Extremes
       Hydrometeorologic and coastal extremes in current and future climates
   Abstract submission and early registration now closed.

5) **European Meteorological Society Annual Meeting**: Copenhagen, Denmark, September 9-13 2019. (https://www.ems2019.eu/) Abstract submissions are closed. Early registration rate available until 23rd July.

6) Herrenhausen conference on "**Extreme Events: Building Climate Resilient Societies**", Hanover, Germany, October 9-11, 2019. (https://www.volkswagenstiftung.de/en/events/calendar-of-events/herrenhausen-conferences/extreme-events-building-climate-resilient-societies). Registration is limited and is currently open. There is no registration fee.

7) **WMO High Mountain Summit**, 29-31 October 2019, Geneva, Switzerland, see https://highmountainsummit.wmo.int/en

8) **AGU** Fall Meeting, 9-13 December 2019, San Francisco, USA

9) **AMS**, Annual Meeting, 12-20 January 2020, Boston, USA

3. 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 in 2019.

The HIWeather approach to using the value chain was presented as part of a panel discussion on Valuing Weather Services at the AMS Washington Forum, 27-29 March 2019. A review paper has been accepted for the Global Assessment Review of Disaster Risk Report 2019.

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
The writing team is being drafted and it is planned to submit to BAMS in 2019.

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
Had an email discussion with the co-chairs of the Data Assimilation and Observations System (DAOS) working group regarding the possible collaboration on an high-resolution HIW forecasting system intercomparison project. The next is to have a small group meeting call to discuss the scope and how to proceed.

d. UK Environmental Prediction (UKEP) project
Lead: Huw Lewis
Research and technical development has continued within the UK Environmental Prediction collaboration on regional atmosphere-ocean-wave coupled modelling. A number of recent research papers related to this activity are now accepted or in review, including a study of the impact of ocean-atmosphere coupling on prediction of fog formation over the North Sea (Fallmann et al., 2019). The focus areas for the coming year includes continuation of process studies, demonstrating benefits for operational systems, demonstrating climate applications, new work on concurrent hazards and introduction of weakly coupled data assimilation. A workshop to motivate further research using the regional coupled system is to be held in June 2019. For further information, please contact huw.lewis@metoffice.gov.uk

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. **Warning response**
Link: Anna Scolobig and Philippe Weyrich
Collecting real-time storm warning and response data from an app from a private company; still waiting for a type3 warning to occur to test the response to impact-based and non-impact-based warnings.
Running serious (simulation) games to understand how social media communication and searching are used in warning. A flood simulation game will be tested in May 2019 at a training course for professionals in disaster risk reduction held at the University of Geneva. Another simulation game is tentatively planned for the Bureau of Meteorology and emergency management partners in Melbourne, Australia.
Looking at people's behaviour as measured by post-event surveys, comparing 10 years ago and now.

h. **Review & classification of impact modelling**
Leads: Brian Mills & HIVR task team
The scope of the review is being prepared.

i. **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 available externally on a password protected website. It is being trialed with the Severe Weather FDP, hopes to add ShelterBox, an international disaster relief charity that provides temporary shelters after disaster events.

j. **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. Brian Golding will contribute to a panel on this topic in the AMS Washington Forum in March 2019.

k. **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 were presented at the Beijing workshop, and will be used to quantify the current level of forecasting skill for TC intensity in global ensemble forecasts.

A new study is underway to investigate ensemble-based predictability of flooding in TCs using the Global Flood Awareness System (GLOFAS).

l. **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)

m. **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 " was published in BAMS at https://journals.ametsoc.org/doi/full/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*.

d. **Verification 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 2nd verification challenge will be held in 2020 with the theme of "Using unconventional observations to verify forecasts and warnings".

e. **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.

f. **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.

g. **Review of the role of trust, salience and beliefs on people's responses to weather warnings.**
Leads: Shannon Panchuk and Linus Magnusson
HIW case studies of the forecast value chain. 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. Linus Magnusson has assembled discussions of severe weather events from the ECMWF newsletters 2014 - 2019. The collection of articles is: https://www.ecmwf.int/sites/default/files/medialibrary/2019-04/ecmwf_nl_severe.pdf

h. **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.

i. **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.

j. **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. The Platform is expected to be launched shortly.

k. NAWDEX (North Atlantic Waveguide and Downstream Impacts Experiment):
Lead: Andreas Schäfler (Processes & Predictability task team)
A description of the field experiment and its results is available in the BAMS review paper by Schaefler et al (2018) at https://doi.org/10.1175/BAMS-D-17-0003.1

l. **HIGHWAY** (**Lake Victoria Basin Nowcasting project)**
HIWeather link: Andrea Taylor
The "HIGH impact Weather lAke sYstem" project falls in the UKAid WISER 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. In Spring 2019 the international partners participating in HIGHWAY supported an Enhanced Observing Period field campaign over Lake Victoria Basin, coordinated by NCAR. This has collected surface station observations, radar and forecasting reports from both National Meteorological Services and private networks. In parallel, work has been progressing on interpreting lightning observations over the Lake. All the observations collated will be used to understand the meteorology of Lake Victoria and its surrounding region. To complement the aims of HIGHWAY and its field campaign and additionally aligning with the aims of the GCRF African-SWIFT project, the HyVic-Pilot flight campaign was conducted in January 2019. The NERC/Met Office FAAM aircraft was deployed over Lake Victoria and successfully completed two flights across the lake. The flights sampled the diurnal shift in the land-lake and lake-land breezes, as well as the humidity at lower levels over the lake which contributes to night time thunderstorms. See https://www.metoffice.gov.uk/about-us/what/international/projects/wiser/highway.

m. GCRF African Science for Weather Information and Forecasting Techniques (GCRF African SWIFT)
Link: Andrea Taylor (Communication TT)
A 4-year UKAid project to improve African hourly to seasonal forecasting capabilities, funding 80 scientists in 5 UK and 10 African institutions, with WMO as an advisory member. During 23 April-6 May, a team of GCRF African SWIFT researchers and operational forecasters is meeting in Nairobi, Kenya to conduct a weather forecasting testbed. Hosted by SWIFT partners, the Kenya Meteorological Agency (KMD), the testbed brings together researchers and operational forecasters from across West and East Africa, to engage in the developmental testing of forecasting systems in a quasi-operational environment. The SWIFT testbed will evaluate the NWC SAF Nowcasting software, to determine how the tools can be adapted to African weather systems, and so advance forecasting techniques in Africa. They will also test and evaluate **convection permitting ensemble (CP ensemble)** forecasts, designed by SWIFT partners at the UK Met Office specifically for the Testbed, to provide measures of confidence in the accuracy of forecasts of storms. During the testbed, the Nairobi teams are engaging directly with African forecast user groups at a **Stakeholder Workshop** that is running concurrently with the testbed. See https://africanswift.org/

n. 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 (SMN) and Brazil's space agency (INPE). Observations during the main observing period, Nov-Dec 2018, successfully captured many storms. See press report at: https://www.abc.net.au/news/2019-01-23/weather-scientists-find-one-of-worlds-largest-hail-stones/10735666

o. **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.

p. **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.

q. **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.

r. **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.

s. **Multi-scale, multi-leadtime predictability of high-impact weather**
Leads: Shira Raveh-Rubin, Linus Magnusson, Michael Riemer
Objectives: Assess the predictability of different ingredients to HIW events as a function of leadtime and identify the physical processes that limit predictability. In collaboration with the Multiscale Forecasting theme, assess the role of assimilating high-resolution data to capture the mesoscale dynamics and improve short-term prediction. Starting with high-impact weather related to dry intrusions, develop general recommendations how to assess this insight for other types of high-impact weather.

t. **Societal and Economic Research Applications (SERA) Workshop**
Link: Martin Goeber
This workshop will be held in Berlin in 2020 or 2021, hosted by DWD's Hans Ertel Centre. It will have SERA themes similar to the NCAR's earlier WAS*IS (Weather and Society*Integrated Studies) workshops. The format will include a tutorial for students from weather services, etc., followed by a scientific conference.

u. **Value Chain review by WWRP SERA Working Group**
Link: Martin Goeber
This review will provide an overview and meta-analysis, based on the literature, of how the value chain is applied in different fields.

v. **Method(s) to measure avoided losses due to improved warnings**

Link: Masa Haraguchi and Michael Kunz
This study will do a literature search leading to a review paper. It will focus on heatwave and tropical cyclones, connecting to loss data from disaster reports from the World Bank.

w. **Impact data collection**
Link: Rainer Kaltenberger and Joanne Robbins
A review paper is being prepared on how met services collect and use impact data.

x. **Fire weather evaluation**
Link: Amanda Anderson
This project at NCAR is evaluating coupled fire-weather modelling. Currently looking at the forecast sensitivity to fuel moisture, terrain and ignition location, and benefit of spotting capability in the model.

4. National Programmes

US Contributions

A joint committee is formulating a US response to the three post-THORPEX projects and will shortly complete an inventory of existing relevant work. Prof. Michael Morgan leads this activity for HIWeather. 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. The Met Office recently completed implementation of its new hourly lagged convection-permitting ensemble. Trial results showed a substantial gain in performance (https://www.metoffice.gov.uk/research/news/2019/mogreps-uk-hourly-cycling-updates). Impacts work is largely carried out in the Natural Hazard Partnership (http://www.naturalhazardspartnership.org.uk/). The recently completed NERC/Met Office Flooding from Intense Rainfall project delivered new radar capability, advances in km-scale data assimilation & coupling with inundation models (http://www.met.reading.ac.uk/flooding/). UKRI funds two networks in its "Decision Making Under Uncertainty" theme. NERC/UKAid fund four research projects through the Science for Humanitarian Emergencies And Resilience (SHEAR) programme focusing on co-production of knowledge using a multi-disciplinary and problem-centred approach in sub-Saharan Africa and south Asia (http://www.nerc.ac.uk/research/funded/programmes/shear/). See also SWIFT and HIGHWAY, above. The UKRI Global Challenges Research Fund Urban Disaster Risk Hub, which is endorsed by HIWeather, is developing its plans for building resilience to natural hazards in Kathmandu, Nairobi, Istanbul and Quito (https://www.de.ed.ac.uk/project/gcrf-urban-disaster-risk-hub.

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.

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.

Developed pre-operational impact forecasts in partnership with the fire brigade; Collecting citizen science measurements as part of a field experiment, to be used in forecast verification. (Martin Goeber, DWD)

Australian Contributions

An Australian HIWeather community was established at the annual Australian Meteorological and Oceanographic Society (AMOS) meeting. 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.

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.

SMN is developing a new Early Warning Service in partnership with emergency managers and citizens. A training day/workshop with all the provincial directors of emergency agencies and their technical teams will be held in June to inform them about how the new EWS will work well in advance of its launch. An event in July in conjunction with the National Secretariat of Science and Technology will include a workshop with all technical scientific bodies that "depend" on the information of warnings and forecasts to issue other types of warnings, announcements or bulletins so they will be able to adjust their own systems. (Julia Chasco, SMN)

European contributions (Rainer Kaltenberger, ZAMG)

Work on International Fujita scale to assess tornado and wind damage (with European Severe Storms Lab) is still growing. Draft document on how to assess damage in the field will be ready early next year. The HIWeather Workshop in Beijing gave an opportunity to connect with respective people from CMA (who are working on a Chinese Enhanced Fujita Scale), further collaboration with several countries on different continents, poster contribution planned for EMS Annual Meeting, Copenhagen, 9-13.9.2019. Information and first IF-scale draft document (v 0.1) can be found at https://www.essl.org/cms/international-fujita-scale/, there is also an internal forum for experts to discuss case studies and further refinements, experts who are working in this field are welcome to join our initiative!

Evaluating MeteoAlarm survey in WMO RA6. 29 out of 37 countries replied so there is lots of data to analyse in the next few months. First results were presented at annual EUMETNET MeteoAlarm Partner Group Meeting 2nd-4th April 2019 in Zurich, final results and publication planned for second half of 2019.

European Weather Observer – European standard on weather and impact observations from volunteers. EUMETNET Crowdsourcing workshop in March in Exeter, UK defined several steps and actions in this field to take place in Europe in the next months.

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/

5. 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

6. Publications

2018-19 Publications by HIWeather IVR Members

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Schröter, K., D. Molinari, M. Kunz, and H. Kreibich, 2018. Preface: Natural hazard event analysis for risk reduction and adaptation, Natural Hazards and Earth System Sciences, 18:963-968.

Terti, G., I. Ruin, J.J. Gourley, P. Kirstetter, Z. Flamig, J. Blanchet, A. Arthur, and S. Anquetin, 2019. Toward probabilistic prediction of flash flood human impacts, Risk Analysis, 39(1):140-161.

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T. H. M. Stein, W. Keat, R. I. Maidment, S. Landman, E. Becker, D. F. A. Boyd, A. Bodas-Salcedo, G. Pankiewicz, S. Webster, 2019, An Evaluation of Clouds and Precipitation in Convection-Permitting Forecasts for South Africa, Wea & Forecast, 34, 233-254

Craig S. Schwartz, Glen S. Romine, Ryan A. Sobash, Kathryn R. Fossell and Morris L. Weisman, 2019, NCAR's Real-Time Convection-Allowing Ensemble Project, BAMS 321-343

Raj K. Rai., Larry K. Berg, Branko Kosovic, Sue Ellen Haupt, Jeffrey D. Mirocha, Brandon L. Ennis, Caroline Draxl, 2019, Evaluation of the Impact of Horizontal Grid Spacing in Terra Incognita on Coupled Mesoscale–Microscale Simulations Using the WRF Framework, Mon Wea Rev 1007-1027

Daniele Nerini, Loris Foresti, Daniel Leuenberger, Sylvain Robert, Urs Germann, 2019, A Reduced-Space Ensemble Kalman Filter Approach for Flow-Dependent Integration of Radar Extrapolation Nowcasts and NWP Precipitation Ensembles, Mon Wea Rev, 987-1006

Lisa Bengtsson, Jian-Wen Bao, Philip Pegion, Cecile Penland, Sara Michelson, And Jeffrey Whitaker, 2019, A Model Framework for Stochastic Representation of Uncertainties Associated with Physical Processes in NOAA's Next Generation Global Prediction System (NGGPS), Mon Wea Rev, 893-911

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Weyrich P., Scolobig A., Patt A. (2019), "Dealing with inconsistent weather warnings: Effects on warning quality and intended actions", Meteorological Applications https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/met.1785

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