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HIWeather

February 2018

I have just returned from a week in Beijing followed by a week in Tagaytay, Philippines. In Beijing I joined Paulo Ruti and Julia Keller from the WMO secretariat and David Johnston my co-chair to discuss setting up the HIWeather International Co-ordination Office (ICO) in the Chinese Meteorological Administration, CMA. The discussions were very productive and we look forward to a gradual transfer of activities from Geneva to Beijing over the next 6 months, culminating in a formal opening at the HIWeather workshop, which will be in Beijing on 20-22 November 2018. As part of the handover, we plan for the next newsletter to be produced in Beijing.



Outside the CMA headquarters in Beijing

While in Beijing, we also had fruitful discussions with the International Programme Office of IRDR, (Integrated Research on Disaster Risk), about potential closer links in the future. David Johnston will be attending their Scientific Committee meeting in April. After a cold but clear Beijing, Tagaytay brought tropical temperatures for the AOGS-EGU conference on New Dimensions for Natural Hazards in Asia. The location, overlooking the Taal volcano in the middle of its caldera lake, reminded attendees forcibly of hazards faced daily by people in many parts of the world, especially the Philippines, where the ongoing eruption of the Mayon volcano was keeping local scientists and emergency managers very busy. The conference was an interesting mix of presentations, posters and discussions. As well as presenting HIWeather, I took part in a discussion on the use of heuristic, deterministic and stochastic methods in hazard forecasting and warning.

It has been great to hear from the task teams about progress in their activities, reported below, and I would like to welcome the new coordinator of the Processes and Predictability task team, Michael Riemer of Mainz University. Members of that team have reminded me that the TIGGE datasets offer a valuable source of multi-model ensemble data that can be used to explore high impact weather phenomena. See below under “related activities” for more information.

Virginia Murray, Advisory Board member, attended the World Bosai Conference in Japan in November and presented a poster on behalf of HIWeather, which was very well received.

Our Communications task team organised a special session at the AMS annual meeting in Austin in January on 'Communicating about High Impact Weather: Uncertainty, the influence of risk perceptions, and sharing best practice' in the 13th Symposium on Societal Applications: Policy, Research and Practice. Julie Demuth presented a paper on the activities of the task team and Advisory Board member Jennifer Sprague-Hilderbrand facilitated two discussion sessions.

WWRP Scientific Steering Committee's annual meeting was held in October, just after our last newsletter. Reports were presented from the WWRP working groups and from the three post-THORPEX projects, including HIWeather. There was recognition that good progress was being made in HIWeather and encouragement to keep up the momentum.

We held a second advisory board teleconference in January following circulation of the annual report and progress information from the task teams. The board supported the current direction of work but suggested that there was a need for publications on HIWeather. The board plans to meet every quarter. The Steering Group met by teleconference in the last week of January. It reviewed progress in the task teams, considered

feedback from the annual report and the advisory board, and recommended a structure for the autumn workshop in Beijing.

The October issue of the WMO Bulletin contained a description of HIWeather, together with a special focus on the HIGHWAY project on Lake Victoria.

The US National Academies of Sciences, Engineering, and Medicine issued a report in 2017 titled "Integrating Social and Behavioural Sciences within the Weather Enterprise", <http://dels.nas.edu/Report/Integrating-Social-Behavioral-Sciences-Within/24865?bname=basc>, that references HIWeather. Sponsored by NOAA and the Federal Highways Administration, it makes recommendations in the following areas:

- Invest in Leadership to Build Awareness
- Build Capacity Throughout the Weather Enterprise
- Focus on Critical Knowledge Gaps

Of particular relevance to HIWeather, it recommends the weather enterprise to support research in:

- **Weather enterprise system-focused research:** system-level studies of weather information production, dissemination & evaluation; studies of how forecasters, broadcast media, emergency and transportation managers, and private weather companies create information, interact & communicate among themselves; studies of forecaster decision making, such as what observational platforms and numerical weather prediction guidance forecasters use & how they use them; studies of how to assess the economic value of weather services; studies of team performance & organizational behavior within weather forecast offices & other parts of the weather enterprise.
- **Risk assessments and responses, and factors influencing these processes:** how to better reach & inform special-interest populations that have unique needs, such as vehicle drivers & others vulnerable to hazardous weather due to their location, resources & capabilities; how people's interest in, access to & interpretation of weather information, as well as their decisions & actions in response, are affected by their specific social or physical context, prior experiences, cultural background & personal values.
- **Message design, delivery, interpretation, and use:** how communicating forecast uncertainties in different formats influences understanding & action; how to balance consistency in messaging with needs for flexibility to suit different geographical, cultural & use contexts, including warning specificity & impact-based warnings; how new communication & information technologies—including the proliferation of different sources, content, & channels of weather information — interact with message design & are changing people's weather information access, interpretations, preparedness & response.

Wishing you all every success in your HIWeather activities.



The Project

Steering Group

Co chairs: Brian Golding, UK and David Johnston, New Zealand

Processes & Predictability (PP) theme – lead: Michael Riemer, Germany; members: John Knox, Peter Knippertz, Jeff Kepert.

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

Human Impacts, Vulnerability & Risk (HIVR) theme – lead: Brian Mills, Canada; members: Joanne Robbins, Jeff Lazo, Michael Kunz, Isabelle Ruin, Melanie Gall.

Communication theme – co-leads: Sally Potter, New Zealand and Shannon Panchuk, Australia; members: Abi Beatson, Greg Carbin, Melanie Harrowsmith, Amber Silver, Rutger Dankers, Andrea Taylor, Thomas Kox, Claudia Adamo, Jose Galvez, Kiernan McGill, Linda Anderson-Berry, Tim Brown, Vankita Brown.

Evaluation theme - Beth Ebert, Australia; 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 will 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: A plan for setting up the ICO in the Chinese Academy of Meteorological Sciences, part of CMA the Chinese Meteorological Administration, was agreed during our visit in January. Over the next 6 months, the ICO will take over organisation of Steering Group, Advisory Board and Task Team teleconferences, the newsletter and web site from the WWRP secretariat in Geneva.

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

Communication: The HIWeather administrative 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: Steering Group meetings are held approximately quarterly, usually by teleconference. The next teleconference will be in April and the next physical meeting will be at the Beijing workshop in November. Task teams meet by teleconference at intervals to suit their work and progress. The Advisory Board has decided to increase the frequency of its meetings to quarterly by teleconference.

Relevant Scientific Meetings

UK Alliance for Disaster Research annual conference: Complex Hazards & Complex Vulnerabilities, 27-28 March 2018, Bristol University, UK. <http://www.ukadr.org/conference2018.html>. Registration now open.

EGU, 8-13 April 2018 Vienna, Early registration deadline 1st March. Several sessions are relevant to HIWeather. <https://www.egu2018.eu/>

2nd Asian Science and Technology Conference for DRR, 17-18 April 2018, Beijing, China. <https://www.preventionweb.net/events/view/55879>

8th International GEWEX Science Conference on Extremes and Water on the Edge, Canmore, Alberta, Canada, 6-11 May 2018. <http://www.gewexevents.org/events/2018conference>. Early registration deadline 21st February.

29th Conference on Weather Analysis and Forecasting (WAF)/25th Conference on Numerical Weather Prediction (NWP), 4-8 June 2018, Denver, USA, <https://www.ametsoc.org/ams/index.cfm/meetings-events/ams-meetings/29th-conference-on-weather-analysis-and-forecasting-waf-25th-conference-on-numerical-weather-prediction-nwp/>. Abstract deadline extended to 19th February.

Royal Meteorological Society/NCAS Atmospheric Science Conference 2018: Weather, Climate & Air Quality, 3-4 July 2018, York University, UK . <https://www.atmosphericsscienceconference.uk/>. Deadline for paper submissions 16th March 2018.

10th International Conference on Urban Climate/14th Symposium on the Urban Environment, 6-10 August 2018, New York. <https://www.ametsoc.org/ams/index.cfm/meetings-events/ams-meetings/10th-international-conference-on-urban-climate-14th-symposium-on-the-urban-environment/>. Registration opens shortly.

EMS Annual Meeting: European Conference for Applied Meteorology and Climatology 2018 (EMS2018), 3–7 September 2018, Budapest, Hungary. Conference theme: Weather and climate: global change and local hazards. Abstract deadline 7th March 2018. <https://meetingorganizer.copernicus.org/ems2018/sessionprogramme>

International Conferences on Subseasonal to Decadal Prediction, 17-21 Sep 2018, NCAR, Boulder, USA. Abstracts deadline 16 March 2018. <https://www.wcrp-climate.org/s2s-s2d-2018-home>.

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

14th IEEE International eScience conference, 29 Oct – 1 Nov, Amsterdam. Session on Weather & Climate in the Digital Era. <https://www.escience2018.com/373100#topmenu>, select “Call for Abstracts on Weather & Climate in the Digital Era”.

HIWeather Workshop, Beijing, 20-22 November 2018. This will be our first meeting to include all of the HIWeather task teams since the kick-off meeting in Exeter in Spring 2016, so we are looking forward to bringing everyone together again, to hearing about successes and challenges in the intervening 30months, and to planning new activities for the coming years.

HIWeather Research

a. Review the state of wind hazard forecasting

Lead: John Knox

Objectives: Clarify the wind metrics that relate to impacts; describe the state-of-the-art in observing and predicting these metrics; identify processes that lead to high impacts; make recommendations for targeted work to address weaknesses in understanding, observing and prediction.

John is currently assembling a team of authors to write a review article on windstorms. In keeping with HIWeather themes, this article will look at extreme local wind events in terms of the pillars of these events' **processes, predictability, and impacts**. The events themselves will also be analysed in terms of their phenomenological origins: **extratropical cyclones** (e.g., sting jets); **tropical cyclones**; **mesoscale convection** (e.g., derechos); and **interactions with topography**. Confirmed authors include: **Dr. John Knox** (University of Georgia Department of Geography, lead author; processes; impacts; and extratropical cyclones); **Dr. Paul Miller** (post-doctoral researcher in the University of Georgia Dept. of Geography; predictability; mesoscale convection); **Dr. Sytske Kimball** (University of South Alabama Dept. of Earth Sciences; predictability; tropical cyclones); and **Dr. Chris Peterson** (University of Georgia Department of Plant Biology; ecological impacts). He plans to have the complete author slate finalized by the end of February, with the bulk of the writing and editing done by the early fall, and a completion date 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

Actions: Draft review (2017)

Workshop (October 2017)

Publication (2018)

A draft was prepared ahead of the Conference on Predictability & Multi-Scale Prediction of High Impact Weather in October 2017. Lead and contributors have been assigned for each section. A proposal to BAMS will be forwarded shortly, aiming at submission by the end of August.

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

Extreme weather warnings are only as valuable as the degree of appropriate behavioural change that they induce. There is evidence of suboptimal response to today's standard warnings (SWs), primarily due to too little behavioural change. In response, National Meteorological and Hydrological Services (NMHSs) have started to put greater emphasis on impact-based warnings (IBWs). Compared to standard warnings, which are based on the weather regardless of the potential effects of the event, IBWs are designed to provide people with more information about the hazard and its impacts on specific infrastructure and actions. In this study, we compared how the general public reacts to IBWs vs SWs, with vs. without behavioural recommendations. Indeed, standard warnings in several European countries such as Switzerland, and unlike in the USA, do not include precautionary or preparedness actions. Therefore, we also considered the possible effects of behavioural recommendations in this study conducted with a representative sample of the Swiss population in the German speaking cantons. In November 2017, we conducted an online experiment (N=1121) that investigated the public's

response to warning communication about a severe thunderstorm event in a hypothetical scenario. We randomly assigned respondents to one of four warnings types (SW; SW with behavioural recommendations; IBW; IBW with behavioural recommendations) and asked them to make decisions about their prospective behaviours. These included to not alter their plans, to adapt them, to interrupt them or to seek more information. We also asked respondents to evaluate the quality of the warning information in terms of clarity, understanding, credibility, as well as concern and threat evoked by the warnings. We observed both types – with or without behavioural recommendations - of IBWs to result in a higher likelihood to take immediate protective action compared to the two both types of SWs. At the same time, we also observed IBWs with recommendations to result in an even higher likelihood to engage in protective behaviour compared to IBWs without such recommendations. Moreover, recipients of warnings that included information about behavioural recommendations reported finding the warning clearer, easier to understand, and more credible, than recipients of warnings without these recommendations. They were also more concerned about their safety, and understood better the threat and behaviours to engage in. Finally, perceptions of credibility, concern and threat influence taking protective actions, as do general risk perception and warning experience. 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

The HIVR teleconference in July agreed to prepare an impact modelling review paper. Brian Mills will lead on a draft section (currently 'typology of models') to include interpretation and definition of 'impact modelling', impact forecasting, and related terms such as risk, vulnerability, exposure, and resilience; and for proposals for remaining chapters to be exchanged in the subsequent quarter. It is aimed to have a draft for the workshop in November.

h. Global Hazard Map

Leads : Helen Tittley and Joanne Robinson, 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. A symbol and polygon-based summary map provides an "at-a-glance" view of forecast high-impact weather for the week ahead. GHM also includes vulnerability and exposure layers to visualise where extreme weather may have potentially disruptive impacts. GHM runs routinely twice a day and is currently primarily used by Met Office operational meteorologists. 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 a number of the Severe Weather Forecast Demonstration Projects (SWFDP).

i. Weather Information Value Chain

Lead: Jeff Lazo & Evaluation task team

Successful Value Chain Workshops were held in Berlin in May and in Melbourne in August 2017.

Participants explored the Weather Information Value Chain as a process for understanding the whole 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 that value; using the value chain framework to guide investment in new capability and service improvements. It is planned to prepare a paper on the concept. An outline structure has been written and potential contributors will be contacted shortly.

j. Probabilistic forecasting and evaluation of Tropical Cyclones

Leads: Helen Tittley, 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. Future plans include:

- Coordinating a targeted session on this topic at the WMO/WWRP 9th International Workshop on Tropical Cyclones in 2018 (IWTC-9) (under consideration by organisers)

- Prior to IWTC-9, send out a questionnaire 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.
- Carry out a number of verification activities identifying the current level of forecasting skill for TC intensity from global ensemble forecasts.

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, "Mesoscale Verification Inter-Comparison over Complex Terrain" has been submitted to *BAMS* 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 innovative evaluation metrics relevant to end users was run by the Joint Working Group on Forecast Verification Research (see http://www.wmo.int/pages/prog/arep/wwrp/new/Forecast_Verification.html) and has been a great success. There were 17 entries from 11 countries and the winner was Helge Gössling from Alfred Wegener Institute in Germany with his entry "Integrated Ice Edge Error (IIEE) & Spatial Probability Score (SPS)". A selection of submissions are being published in a special issue of *Meteorologische Zeitschrift*. The JWGFVR plans to run another challenge ahead of its next workshop in 2020.

n. Review of approaches to communicating high impact weather.

Lead: Andrea Taylor, Communication task team.

Twenty-four abstracts were submitted in response to the Call for Papers for a special issue of the International Journal of Disaster Risk Reduction under the provisional title, "Communicating High Impact Weather: Improving warnings and decision making processes". The submitted articles are currently in revision.

o. Training Materials

Lead: Shannon Panchuk

Collection of existing training materials and research about communication of weather. Develop guidelines and materials for training meteorologists and emergency services personnel.

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.

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

Catalogue post-event case studies, identify similarities and differences, sources of hazard information, usage of advice in decision-making and good practice in evaluation.

s. Communication platform

Most of the outputs from HIWeather communication activities will go onto the HIWeather Communication Platform, which is under development. Best practice guidelines, reviews and other research outputs will be freely accessible by meteorologists, researchers, and emergency services personnel.

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. Further information can be found at <http://nawdex.ethz.ch/news.html>. The data are now available to research groups. Early results were presented at the symposium on High Impact Weather and Climate at the IAPSO-IAMAS-IGA assembly in Cape Town in August.

u. HIGHWAY (Lake Victoria Basin Nowcasting project)

The “HIGH impact Weather IAke sYstem” project falls under WISER (Weather and Climate Information SERvices for Africa) in the UK’s Department for International Development (DFID) regional East Africa/Lake Victoria programme. The project runs from October 2017 to March 2020. There is a need for improved, accurate weather related early warning systems, co-produced between scientists and users, to prevent deaths and damage due to severe convection and strong winds on the lake and in the East African region. 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. An preparatory meeting was held in December and the first full meeting of PIs and stakeholders will be held in Nairobi at the end of Feb 2018. 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). The UK’s Global Challenge Research Fund (GCRF) has funded a major new research and capacity-building programme, linked to HIWeather, with the aim of improving African forecasting capabilities on hourly to seasonal timescales. GCRF African SWIFT is a 4-year programme, which started in October 2017, with funding of around £9 million supporting 80 people in 5 UK and 10 African institutions, with WMO as an advisory member. The programme of work is organised in 3 Strands:

- **Strand 1: User engagement and forecast evaluation** will be responsible for the interdisciplinary engagement needed to link user engagement with the provision of quantitative measures of forecast accuracy.
 - **Strand 2: Physical science research** will coordinate the disciplinary research required to deliver quality-controlled weather predictions.
 - **Strand 3: Knowledge exchange, training and documentation** will deliver cross-cutting activities needed to increase research capability and provide a legacy to the 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 bring US resources to the field to observe convective storms that produce high impact weather in the lee of the Andes mountains in Argentina. It will also involve significant contributions from NASA, NOAA, Argentina (MINyCT), Brazil (CNPq and FAPESP), and Chile (CONICYT), as well as 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 will be 15 August 2018 – 30 April 2019, while the Intensive Observing Period will be 1 November – 15 December 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. It will involve the AMF-1 cloud-aerosol-radiation observatory, the Mobile Aerosol Observing System (MAOS), the CSAPR-2 precipitation radar, and a surface meteorological network. It will also bring intensive airborne

observations during RELAMPAGO through the deployment of the G-1 aircraft. For scientific programme, see: <https://drive.google.com/file/d/0B6Z5EcBljxY2S1llakstc3o1cUU/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. See <http://www.iuim.cn/en/animationInfo.aspx>

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 objectives of the RDP/FDP are similar to SNOW-V10 and FROST-2014, but with stronger emphasis on high-resolution data assimilation and modelling. 1.5km very short range DA & Prediction system developed by KMA for Korean Peninsula. The Intensive Observing Period is underway (see <http://www.wmo.int/pages/prog/arep/wwrp/new/RDP-FDP.html>).

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 and inundations. To expedite the efforts in improving the quantitative precipitation forecast (QPF) of the presummer rainy season rainfall, the China Meteorological Administration (CMA) initiated a nationally coordinated research project, namely, the Southern China Monsoon Rainfall Experiment (SCMREX) that was endorsed by the World Meteorological Organization (WMO) as a research and development project (RDP) of the World Weather Research Programme (WWRP). The SCMREX RDP (2013–18) consists 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. The pilot field campaigns were carried out from early May to mid-June of 2013–15. Results to date are available in a review paper at <https://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-15-00235.1>. This paper: i) describes the scientific objectives, pilot field campaigns, and data sharing of SCMREX; ii) provides an overview of heavy rainfall events during the SCMREX-2014 intensive observing period; 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 has recently joined the Advisory Group with a view to building links. The NCAR Societal Impacts Program at the Research Applications Laboratory is closely aligned with HIWeather and contributes strongly to the evaluation theme (<http://www.ral.ucar.edu/research/sip/>).

UK Contributions

Relevant areas of work include unconventional data sources, km-scale data assimilation and ensemble prediction, km-scale coupled modelling for the UK, hazard impact modelling and risk communication. The impacts work is largely carried out with partners in the Natural Hazard Partnership (<http://www.naturalhazardpartnership.org.uk/>). The NERC/Met Office funded FfIR (Flooding from Intense Rainfall) project is addressing several aspects of HIWeather, including new radar observations, km-scale data assimilation and coupling with rural & urban inundation models

(<http://www.met.reading.ac.uk/flooding/>). Research Councils UK has funded two new networks in its “Decision Making Under Uncertainty” theme. One of them “Models to Decisions (M2D)” will hold its first annual conference in July.

The UK Natural Environment Research Council (NERC) and Department for International Development (DfID) have funded four research projects through the Science for Humanitarian Emergencies & 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>). A HIWeather-related proposal has been made to the Global Challenge Research Fund on Intractable Challenges. See also SWIFT, 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. WEXICOM (Weather warnings: from EXtreme event Information to COMmunication 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. HIWeather New Zealand ran a workshop at the NZ Meteorological Society conference in Dunedin, November 2017.

Argentine Contributions

The Alert.AR project will finish by May 2018. Remaining work includes deliverable reports and a final 2-day workshop with the forecasters: about the capabilities of the WRF 4km Model; and with Civil Protection, to work with the new warnings.

A new 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.

Related Activities

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 3-year project on Improving Resilience to Emergencies through Advanced Cyber Technologies (I-REACT) involving a consortium of 20 partners will integrate existing systems and assets 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 Emergency Response Coordination Centre (ERCC) of EU DG ECHO, which is responsible for the coordination of human aid upon request of the government of a country affected by natural (and other) hazards. It has been designed to offer a flexible and scalable scientific network including 24/7 services that can provide new hazard related services to the ERCC and to create a pool of experts in the field of Hydro-Meteorology and Geophysics of Europe that can support the ERCC with regard to situation assessments in crisis situations worldwide. A website is being built at <http://aristotle.ingv.it/>

European Disaster Risk Management Knowledge Centre

This new 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 nearly 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. A discussion, held at the Royal Society on 13-15 November 2017, among a wide range of natural and social

scientists, agreed that the participants would work together with the broader research community to develop and apply solutions for interdisciplinary data integration; pursue this through data integration for major global challenges that can also act as exemplars of the power of its interdisciplinary potential; support, in parallel, the development of capacities to realise the potential of modern data resources across all the disciplines of science; and recognise that in many disciplines, foundational work needs to be undertaken to develop the specific vocabularies that are needed to enhance data discovery, use, interoperability and integration. The group will now work 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 <http://www.codata.org/>

The Young Earth System Scientists Community (YESS Community)

The YESS Community is a unified 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. Through side events at major conferences, dedicated early career researcher workshops, webinars and other activities, YESS enables the interaction and scientific exchange of young scientists with different backgrounds. YESS is a bottom-up initiative and fully relies on the engagement and activities of its active members.

YESS works closely with the World Weather Research Programme (WWRP) and Global Atmosphere Watch Programme (GAW) of WMO, and the World Climate Research Programme (WCRP), to get early career researchers involved in the programme's activities and to provide ECRs with a collective voice to the international research community.

YESS invites all interested HIWeather master students, Ph.D. students and postdocs (within 5 years after their last degree) to join and engage in the community. More information about YESS and its activities can be found at the YESS webpage (www.yess-community.org). To obtain the latest information about workshops, summer schools and other activities of interest to early career researchers, follow YESS on Facebook: www.facebook.com/yesscommunity, Twitter: twitter.com/YESSCommunity or LinkedIn: www.linkedin.com/company/yess-community.

Recent Publications:

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