HIWeather

WWRP WORLD WEATHER RESEARCH PROGRAMME

The Briefs of HIWeather

October 2019

October 2019

The HIWeather Steering Group (SG) gathered for its annual meeting in Geneva in the third week of October. There was feedback from the WWRP Scientific Steering Committee (SSC) to consider as well as new ideas from the task teams. In response to critical input from the SSC, the SG identified three cross-cutting projects to take forward. These build on previous work in HIWeather, but are bigger and altogether more ambitious. The first is the book proposal, which has been under preparation for a while and will be submitted shortly. The second was a major initiative in citizen science, described more fully below by David Johnston. The third is to build on the warning case study initiative with a more substantial study of reviews of end-to-end warning systems and how they have performed in critical severe weather events. A concept for this study will be generated by the end of the year.

Also in October, I was able to go to the conference on "Extreme Events - Building Climate Resilient Societies", organised by the Herrenhausen Foundation in Hannover, Germany. One of the topics for discussion was Compound Risk, something that HIWeather has touched on in our impact cascades. One of the contributors was Gordon Woo, who described a “parlour game” that he plays with fellow Catastrophe modellers, to find what he calls “downward counterfactuals” . The game starts with a historical disaster and proceeds by each player identifying a factor that could reasonably have been worse, and proceeds until the worst, reasonably plausible, scenario is reached.

Looking ahead, I shall be talking compound risk again at the end of November as I have been invited to a meeting of the DAMOCLES COST action on that subject in Tallinn. Following that, Qinghong Zhang and I will be in San Francisco in early December for the AGU. I am participating in the Risk-KAN Town Hall on multi-hazard and complex risk, and also presenting in a session on partnership in warnings. Then I hope to catch up with many North American colleagues in January at the AMS Annual Meeting.

With all good wishes

HIWeather Co-chairs

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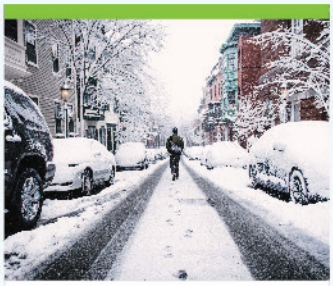
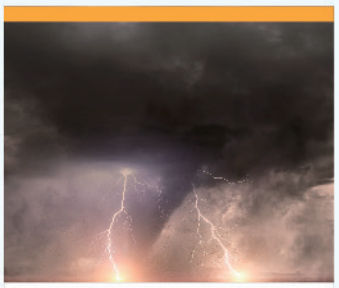
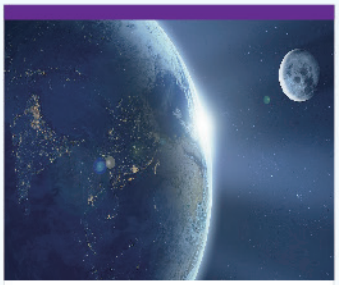






PART 1

THE PROJECT

The High Impact Weather project (HIWeather) is a ten year activity within the World Weather Research Programm.

“To promote cooperative international research to achieve a dramatic increase in resilience to high impact weather, worldwide, through improving forecasts for timescales of minutes to two weeks and enhancing their communication and utility in social, economic and environmental applications.”

HIGHLIGHTS

Steering Group Meeting in 2019

The annual meeting of steering group was held on 14-16 October in Geneva. World Weather Research Division (WWRD), Co-chairs, ICO, task team leaders of P&P, MSF, IVR, COMM, and Helen Titley on behalf of EVAL presented the meeting. Julia Becker from Massey University attended as citizen science group member. In addition, the advisory board and task team leader of EVAL joined the discussion remotely via video.

On the first day, Paolo Ruti (Chief of WWRD) introduced the reform of the WMO structure and WWRP SSC' s feedback to HIWeather. David Johnston presented the outcome from the Global Platform and citizen science initiative, then the ICO reported its yearly work and update from high impact-weather related activities in China.

During the next one and half days, task team leaders/reporters hosted sessions under their themes. Updates from each task team were shared and the guiding questions posted by WWRP SSC were discussed. In the final session, new HIWeather flagship activities were proposed and discussed. These include a citizen science project, high impact weather event catalogue, case study and survey, and HIWeather book draft.

From left to right: Liye Li (ICO Secretary), Jenny Sun (MSF Task Team Leader), Andrea Taylor (COMM Task Team Leader), David Johnston (Co-chair), Helen Hitley (EVAL Task Team member), Brian Golding (Co-chair), Brian Mills(IVR Task Team Leader),Julia Becker (Massey University), Qinghong Zhang (ICO Director), Michael Riemer (P&P Task Team Leader), Hugo Remaury (Project Officer)

HIWeather Citizen Science Project

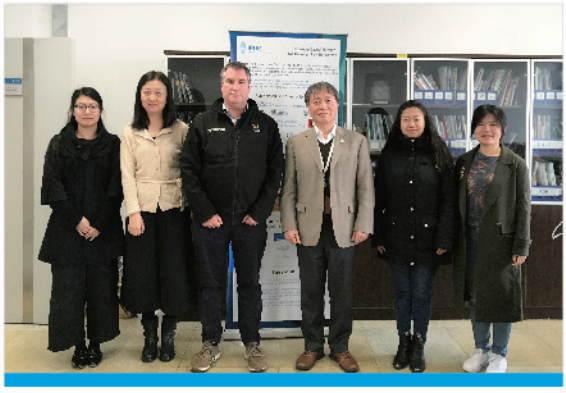
Citizen science is a broad term, which encompasses a variety of different types of projects where the public (citizens) work with various public and private organizations, including academic researchers, to undertake scientific research. Citizen science has its beginnings in the physical sciences but has expanded to others areas, including natural hazard research. The motivations, design, and outputs of citizen science projects vary widely. Some projects are highly participatory, where the citizens are involved in the project design, data collection and analysis. In others, citizens provide data to projects designed and coordinated solely by the science agencies. Both ends of this spectrum are effective for creating new scientific outputs and enhancing citizen involvement in science.

With many new and ongoing citizen projects planned or underway within the High Impact Weather community, this new project is designed to share information and to provide tools to help groups and agencies develop new activities. Five initial activities are planned and will be launched over the next few months: 1) Develop a guidance note for including citizen science in weather, climate and water projects; 2) Demonstration projects – current and new projects; 3) Journal Special Issue; 4) Workshops/conferences/training on citizen science and 5) Developing a Communication and Outreach Plan. The HIWeather Citizen Science Working Group will be open members of the HIWeather community and a smaller Steering Group will be formed to coordinate activities. More details and a concept note will be released in early December.

HIWeather ICO visit to Integrated Research on Disaster Risk (IRDR) International Programme Office (IPO)

On Monday 4 November the HIWeather ICO made a formal visit to the IRDR International Programme Office (IPO) in Beijing, to discuss enhancing cooperation and coordination across our collective activities.

Integrated Research on Disaster Risk (IRDR) is a decade-long research programme co-sponsored by the International Science Council (ISC) and the United Nations Office for Disaster Risk Reduction (UNDRR) (http://www.irdrinternational.org/). It is a global, multi-disciplinary approach to dealing with the challenges brought by natural disasters, mitigating their impacts, and improving related policy-making mechanisms. The IRDR programme promotion, coordination and related functions is undertaken by the IRDR International Programme Office (IPO) hosted by the Institute of Remote Sensing and Digital Earth (RADI) of the Chinese Academy of Sciences (CAS).



From left to right: Fang Lian (IRDR IPO Science Officer), Qinghong Zhang (HIWeather ICO Director), David Johnston (HIWeather Co-chair), Qunli Han (IRDR Executive Director), Lang Lang (IRDR IPO Administrative Officer), Liye Li (HIWeather ICO Secretary)

PART 2

HIWEATHER RESEARCH

HIGH-IMPACT WEATHER PROJECT LEADERS IDENTIFIED RESEARCH ACTIVITIES WORLDWIDE

PREDICTABILITY AND PROCESSES

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.

NAWDEX

(North Atlantic Waveguide and Downstream Impacts Experiment):

Lead: Andreas Schäfler (Processes & Predictability task team)

ECMWF workshop on "Observational campaign for better weather forecasts":

In June 2019 ECMWF organized a workshop aimed to increase the interactions between observation campaigns and numerical weather prediction (NWP) centres. The workshop involved contributions from NWP centres, past and future campaigns and operational activities that provide "special" observations. From the HIWeather community, for example the NAWDEX and Festival campaigns were represented. The workshop led to great discussions how to increase the interactions, and how to NWP centres can help to motivate future campaigns.

Read more about the workshop here:

https://www.ecmwf.int/en/about/media-centre/news/2019/experts-explore-how-observational-campaigns-can-improve-weather

▶ *Multi-scale, multi-lead-time 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 (see Di Muzio et al, 2019 for tropical-cyclone-like Mediterranean cyclones). 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 (Catto and Ravel-Rubin, 2019; Ravel-Rubin and Catto, 2019), develop general recommendations how to assess this insight for other types of high-impact weather.

Linus Magnusson has finalized his report: ECMWF Severe Event Catalogue for Evaluation of Multi-scale Prediction of Extreme Weather, which can be found here:

https://www.ecmwf.int/en/elibrary/19230-ecmwf-severe-event-catalogue-evaluation-multi-scale-prediction-extreme-weather

▶ *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

▶ *SCMREX*

(Southern China Monsoon Rainfall EXperiment)

Leads: Yali Luo

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 SCM-REX-2014; and iii) presents examples of preliminary research results and explains future research opportunities.

The fourth WMO Monsoon Heavey Rainfall Workshop (MHR-4) was held in Shenzhen, China on April 2019 to discuss recent advances in analysis, NWP studies and development of techniques for observing/forecasting monsoon heavy rainfall, and to review the progress of SCMREX. Above discussion has been summarized as a paper: Science and Prediction of Monsoon Heavy Rainfall. The accessible link is:

https://www.sciencedirect.com/science/article/pii/S2095927319305468?dgcid=author

Another review summarized the research progress of pre-summer rainfall over South China during 2008 to 2019:

http://jmsj.metsoc.jp/GA/JMSJ2020-002.html

▶ *PRECIP*

(Prediction of Rainfall Extremes Campaign in the Pacific)

Leads: Rob Rogers

The U.S. NSF has recently funded a project entitled Prediction of Rainfall Extremes Campaign in the Pacific (PRECIP), led by Michael Bell and Kristen Rasmussen (Colorado State University), which seeks to improve the fundamental understanding and predictability of the processes that produce extreme precipitation through an ingredients-based physical framework. Research observations will be collected during four event types that meet a global definition of 'extreme' rainfall across the spectrum of rainfall intensity and duration: (1) deep convective cores, (2) wide convective cores, (3) broad stratiform regions, and (4) tropical cyclones (TCs; termed "typhoons" in the West Pacific).

PRECIP will be conducted in collaboration with the Taiwan-area Atmospheric and Hydrological Observation and Prediction Experiment (TAHOPE) and Japanese Tropical cyclones-Pacific Asian Research Campaign for Improvement of Intensity estimations/forecasts (T-PARCII). An array of ground-based platforms will be situated on Taiwan island during summer 2020. There is also an effort underway to obtain funding to support the deployment of a NOAA WP-3D aircraft, which would operate out of Okinawa, Japan. The extreme rainfall and typhoon reconnaissance effort during the period leading up to the 2020 Tokyo Olympics will provide a focal point for an education and outreach effort promoting the positive role of international science collaboration to address global problems such as extreme weather.

MULTI-SCALE FORECASTING OF WEATHER-RELATED HAZARDS

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.

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.

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.

▶ *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.

▶ *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.

▶ *UK Environmental Prediction (UKEP) project*

Lead: Huw Lewis

The UK Environmental Prediction initiative is a national collaboration led by the Met Office, Centre for Ecology & Hydrology, National Oceanography Centre and Plymouth Marine Laboratory to develop and evaluate a fully coupled regional prediction system at kilometre scale. The latest research was discussed at a workshop in Reading with over 50 scientists from collaborating institutes in June 2019. The discussion focused on how to improve modelling and observation capabilities, closing gaps in the scientific knowledge and demonstrating the skill of coupled prediction tools through evaluation experiments.

The working groups were focused around three selected areas:

A. *Estuarine and coastal environments*

Project proposals include work to better simulate and assess the transport and evolution of pollutants from land to ocean, and work to represent the highly detailed estuary and coastline geographies better within modelling systems.

B. *Regional coupled prediction for environmental change*

Project proposals include work to characterise the impact of representing the interactions between atmosphere, land and oceans on the present-day climate in the UK and in other regions such as south-east Asia where air-sea interactions are known to be important.

C. *Concurrent and combined natural hazards*

Project proposals include work to assess the vulnerability of regions in the UK to worse-case scenarios when natural hazards from multiple sources combine and potentially interact, e.g. when strong storms, large waves, high tides, high river flows and saturated land occur at the same time.

The coupled prediction has system has been ported to the Bay of Bengal and is being assessed in a collaborative project within the WCSSP-India programme to investigate the risk from multi-hazard storm events.

For further information on the workshop outcomes and the UK Environmental Prediction collaboration, contact ***huw.lewis@metoffice.gov.uk***

IMPACTS, VULNERABILITY AND RISK

- *Formal (statistical) impact model intercomparison*
- *Impact data collection*
- *Fire weather evaluation*
- *Review & classification of impact modelling*

Formal (statistical) impact model intercomparison

Lead : Martin Goeber with input from HIVR and Evaluation task teams

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

Impact data collection

Link: Joanne Robbins and Rainer Kaltenberger

A review paper is being prepared on how met services collect and use impact data.

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. A likelihood map for spotting will be evaluated when ready. The assessment is also exploring how the sensitivity information can be conveyed to the user.

Review & classification of impact modelling

Leads: Brian Mills & HIVR task team

The scope of the review is being prepared.

COMMUNICATION

Unconventional data sources for impact modelling, evaluation & communication

Lead: Sara Harrison and Amber Silver

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:

- 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 (New Zealand)

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.

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.

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Leads: Shannon Panchuk

Current plans are to link into the work of the WMO Expert Team on Impact-Based Forecasting & Warning (next symposium is in Exeter, UK 2-4 December 2019) and to NOAA in the USA.

Communicating uncertainty

Lead: Sally Potter

Review and publish the implications of uncertainty in weather forecasts and warnings across the whole spectrum of HIWeather. A recent publication on communicating model uncertainty, associated with HIWeather, has been published:

Emma Hudson-Doyle and David Johnston from JCDR (Massey U., NZ) together with Richard Smith (Formerly EQC, NZ, now GNS Science) and Douglas Paton (Charles Darwin U., Aus) published a paper called “Communicating model uncertainty for natural hazards: A qualitative systematic thematic review”, in the International Journal of Disaster Risk Reduction, and affiliated to the Communicating Uncertainty theme of HIWeather. This paper sought to identify lessons for communicating the high number of uncertainties inherent to natural hazard models, which are highly challenging for crisis communications. The recent upsurge in research into uncertainty communication makes it important to identify key lessons, areas for future development, and areas for future research.

The authors present a systematic thematic literature review to identify methods for effective communication of model uncertainty. They also identify lessons and areas for future investigation, and propose a framework to manage the communication of model related uncertainty with decision-makers, by integrating typology components that help identify and prioritise uncertainties. This is vital, as uncertainties will only increase as the model (and event) complexities increase.

https://www.sciencedirect.com/science/article/pii/S2212420918306630?via%3Dihub

Additionally, a study is underway in New Zealand to understand the public’s perceptions of visual uncertainty in severe weather outlook maps that are produced by NZ’s MetService:

Sally Potter (GNS Science, NZ) Mary Anne Thompson (GNS Science / U. Auckland) and Emma
Hudson-Doyle (JCDR, Massey U., NZ), have developed an empirical case controlled survey to explore the different decisions people make depending on the presentation of uncertainty in severe weather outlook maps. This is being run in collaboration with New Zealand’s MetService as findings will help inform future improvement or potential development of their forecast products. After some initial questions that explore people’s use of MetService’s severe weather map, the survey presents participants with three experiments, each of which consider a different weather scenario and alter the presentation of information between randomly assigned participant groups. Different presentations of forecast days (time), forecast confidence, and phenomena are considered, and participants are asked to indicate their perceptions of likelihood of different weather phenomena occurring, and how the weather will influence a hypothetical decision scenario (e.g., to go camping, to go for a day walk, or to drive long distance). The parameters chosen for the survey are based upon previous reviews and research into the communicating of visual uncertainty through maps. The survey will be launched in late October, and findings will inform the Communicating Uncertainty theme of HIWeather.

▶ *Post-event case studies*

Lead: Shannon Panchuk and Linus Magnusson

HIW case studies of the forecast value chain will be reviewed. Tropical Idai in March 2019 will be the first case studied. 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

About Tropical Cyclone Idai:

In March 2019 the tropical cyclone Idai hit southern Mozambique, causing around a thousand fatalities. The event was a multi-hazard event, with extreme wind, rainfall and following flooding. ECMWF forecasts supported the humanitarian response to the disaster. The forecasts and the following response is described in ECMWF Newsletter 160. The case has also a potential for a multidisciplinary investigation of the forecast value chain within the HIWeather.

Read more here:

https://www.ecmwf.int/en/newsletter/160/news/ecmwf-works-universities-support-response-tropical-cyclone-idai

▶ *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.

▶ *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.***

New articles about HIGHWAY: ***https://www.dailycamera.com/2019/10/27/boulders-ncar-targets-improved-forecasting-at-lake-victoria/***

GCRF African Science for Weather Information and Forecasting Techniques

(African SWIFT)

Link: Andrea Taylor (Communication TT)

A 4-year Global Challenges Research Fund (GCRF) 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 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://african-swift.org/***

During the last twelve months the African SWIFT project has been exploring potential user demand for impact based forecasting in three West African countries (Ghana, Senegal, and Nigeria), through a series of national workshops. The workshops have shown strong support for this approach amongst decisions makers in climate sensitive sectors, who expressed a need for forecast information focussing on the consequences of severe weather. This has been echoed in workshop discussions with decision makers in Kenya. At the recent African SWIFT Science meeting and summer school, Andy Hartley (Met Office) provided an introduction to IBF to attendees from NMS and early career scientists.

EVALUATION

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.

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 type 3 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.

▶ 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. We are working with the University of Exeter to investigate if social media data could be used to evaluate the ability of GHM to identify events which cause community impacts.

▶ 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 panel discussion at the AMS Washington Forum in March 2019 discussed the importance of routine measurement of the value of weather services. A paper on the value chain was published as part of the Global Assessment Report on Disaster Risk Reduction 2019.

▶ Probabilistic forecasting and evaluation of Tropical Cyclones

Leads: Helen Titley, Munehiko Yamaguchi, Linus Magnusson

Ensemble forecasting of tropical cyclones (TCs) 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, but there is huge potential to increase the pull through of ensemble-based uncertainty and probabilistic data in to operational TC forecasts and warnings. A questionnaire for operational TC forecasters aimed to report a baseline on the current use of ensembles at global operational TC forecast centers to the 9th International Workshop on Tropical Cyclones (IWTC-9), and help shape future research and development in order to maximise the pull through of the benefits of ensemble forecasts in to operational tropical cyclone forecasts and warnings. The results were presented at the 9th International Workshop on Tropical Cyclones (IWTC-9) in Hawaii in December 2018, and a series of recommendations put forward to IWTC. A paper describing the questionnaire results was published in an IWTC-9 special issue of the journal Tropical Cyclone Research and Review in September (http://tcrr.typhoon.org.cn/EN/10.6057/2019TCRR03.05).

Additional work relevant to this HIWeather activity includes the following:

A. A Met Office evaluation of multi-model ensemble tropical cyclone strike probability forecasts across all global basins has been submitted for publication.

B. At the Japan Meteorological Agency (JMA), multi-model ensemble forecasts have been pulled through in to operational TC track forecasts for the 2019 typhoon season, in a great example of successfully transitioning ensemble-based products from research into operations.

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

▶ *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.

▶ *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.

▶ *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.

▶ *Verification challenge.*

Lead: JWGFVR and evaluation task team

A second competition for evaluation metrics using non-traditional observations (e.g. sensor networks, social media, citizen science, impact data, etc.) was launched at the European Meteorological Society Conference in September 2019, run by the Joint Working Group on Forecast Verification Research (JWGFVR) The contest is aimed to encourage the development and demonstration of verification approaches targeted to use new and non-traditional observations. New verification metrics and visualisations are encouraged.

The challenge is open to individuals and teams. Entries are due 15 February 2020. The winner will receive an all-expense paid attendance and keynote talk at 8th International Verification Methods Workshop to be held in Brazil in June 2020. The challenge supports the WWRP's HIWeather, Sub-seasonal to Seasonal Prediction (S2S), and Polar Prediction (PPP) projects.

▶ *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.

PART 3

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. The second 4-year phase has started July 2019. Results of the project are available in a QJRMS and an AMS journal special collection and on the W2W website (***https://www.wavestoweather.de/***)

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

Within New Zealand, Resilience to Nature's Challenges (https://resiliencechallenge.nz/), is a five-year Government-funded research programme that has recently started (1 July 2019). The Weather & Wildfire theme, co-led by Richard Turner (NIWA) and Sally Potter (GNS Science), is aiming to improve our understanding of extreme weather and wildfire impacts on communities and infrastructure, and co-design mitigation solutions (including improving impact-based warnings) with key stakeholders. We are using three scenarios – an ex-tropical cyclone, severe winter storm, and wildfire on a rural-urban interface. The programme has been aligned to support the goals of the WMO HIWeather programme. The Weather & Wildfire theme is linked to other themes within the programme, that will also contribute to HIWeather, notably the Resilience in Practice Model, co-led by Julia Becker (Massey University) and the Urban theme co-led by David Johnston (Massey University).

Sally Potter has completed a report that guides New Zealand stakeholders on how to write effective short warning messages, such as for social media and Emergency Mobile Alerts (available for free from https://shop.gns.cri.nz/sr_2018-002-pdf/).

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)

Joint initiative towards a International Fujita scale to assess tornado and wind damage (with European Severe Storms Lab) is still growing. Recently, there was a poster presentation at EMS Annual Meeting in 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. Next f2f-meeting of the IF-Scale steering committee is planned along with the ESSL Tornado and Windstorm Damage Assessment Workshop in August 2020 in Wr. Neustadt, Austria. https://www.essl.org/cms/upcoming-events/workshop-damage-assessment/ Spread the message!

The EUMETNET EMMA/Meteoalarm PM carried out a survey on implementation of impact-oriented warnings among Meteoalarm members in Europe in August 2018 – May 2019. 79 questions covered topics from warning format, production process of warnings, dissemination of warnings, verification of warnings, warning strategy, crowdsourcing and cross-border collaboration 32/37 of European NMHSs replied, making it a valuable dataset for potential initiatives on the regional / global scale in the field of IoW. Preliminary results were presented an input for the EUMETNET EMMA/Meteoalarm Workshop on Impact-oriented Warnings, 25th and 26th June 2019 in Vienna. Final results were presented at the EMS Annual Meeting in Copenhagen, 9-13.9.2019. Publication of results is planned for 2020.

European Weather Observer –ZAMG and ESSL are in contact with a number of European NMHSs to work on and refine a pan-European, standardized set of human-assessed (hydro, meteo, geo) crowdsourcing reporting parameters and enable exchange through a standardized API. In 2018 a first set of reporting parameters was defined by DHMZ, FMI, KNMI, ESSL, ZAMG and other ESSL collaborators (i.e. European spotter groups). Our common proposal is, that European NMHSs shall act as national data hubs for weather- and impact observations enabling exchange of data between NMHS level and European level. Currently a consortium of participating NMHSs is formed. A standardized API between all partners will enable real time data exchange using the MQTT protocol. NMHSs are invited to provide API to subnational collaborators (e.g. spotter groups, emergency authorities). API can be easily implemented in existing web pages and apps, e.g. https://wettermelden.at. Recently a presentation was held at EMS Annual Meeting in Copenhagen, 9-13.9.2019. https://meetingorganizer.copernicus.org/EMS2019/EMS2019-887-2.pdf

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/***

PART 4

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.***

> 80 ***countries***

The YESS Community is an international multidisciplinary Early Career Researcher (ECR) network with over 80 countries.

> 1000 ***members***

More than 1000 members of the 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

PART 5

RELEVANT SCIENTIFIC ACTIVITIES

Calls and requests

General Call

We would like to invite those who use Twitter to communicate about HIWeather relevant topics to add their Twitter name to the database that Emily Campbell has compiled: ***https://docs.google.com/spreadsheets/d/1Aw1B2FjW66T_yoL-CWSb6KzvDZR_e2wTBqYOsFFYRU5M/edit?usp=sharing***

Request

Sara Harrison (***S.Harrison@massey.ac.nz,*** Massey University) is looking for any researcher or practitioners who are looking at IBF and wildfires, and would appreciate being put in touch with anybody doing work in this space.

Call for special issue

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.Dec.2019

Activities

01 **Meteorological Society of NZ,**Annual Conference, 25 to 27 November 2019, Wellington, New Zealand

02 **AGU**,Fall Meeting, 9-13 December 2019, San Francisco, USA***https://www.agu.org/fall-meeting-***
Sessions of interest include: TH53A Town Hall organised by the Risk-KAN on 13th December at 12:30pm, and NH13B Centennial Overview: Prediction of Extreme Weather Events and Their Impacts as an Interdisciplinary Problem, currently scheduled as a poster session on Monday afternoon, but likely to become an oral session on 13th December 4-6pm.

03 **AMS**, Annual Meeting, 12-20 January 2020, Boston, USA***https://annual.ametsoc.org/index.cfm/2020/***

04 **EGU**, General Assembly, 3-8 May 2020, Vienna, Austria***https://egu2020.eu/. Abstract deadline 15th January 2020.***

05 **34th Conference on Hurricanes and Tropical Meteorology,** 10-15 May 2020, New Orleans LA

Abstract Deadline: 15 November 2019.***https://annual.ametsoc.org/index.cfm/2020/***

06 **AOGS** 2020, 28 June to 4 July, Hongcheon Korea. Author registration deadline: 21 Apr 2020.Website: ***http://www.asiaoceania.org/aogs2020/public.asp?page=home.html***

07 **FESSTVal Summer School: 13-24 July 2020, Meteorological Observatory Lindenberg MOL_RAO, Germany**

- **Topic: Observing and understanding sub-mesoscale atmospheric dynamics.**
- **For whom: MSc and PhD students, and Postdocs in meteorology, physics and related research ares.**
- **Deadline for application: 30 Nov 2019**
- **More information: *http://fesstval.de/fileadmin/user_upload/fesstval/Files/Flyer.pdf***

PART 6

RELEVANT PUBLICATIONS

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Co-chairs

Brian Golding, UK,

brian.golding@metoffice.gov.uk

David Johnston, New Zealand,

D.M.Johnston@massey.ac.nz

ICO

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

Processes & Predictability (P&P)

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)

lead:

Jenny Sun, USA,
sunj@ucar.edu.

Members:

Paul Joe, Peter Steinle,

Sharan Majumdar,

Jianjie Wang, Jim Dudhia,

Krushna Chandra Gouda,

Nusrat Yussout.

PART 7

PEOPLE AND CONTACTS

STEERING GROUP AND TASK TEAMS

Human Impacts, Vulnerability & Risk (HIVR)

lead:

Brian Mills, Canada, bmills@uwaterloo.ca.

Members:

Joanne Robbins, Michael Kunz, Isabelle Ruin, Melanie Gall.

Communication

co-leads:

Andrea Taylor, UK, a.l.taylor@leeds.ac.uk & Sally Potter, New Zealand s.potter@gns.cri.nz

Members:

Sara Harrison, Brenda Mackie, Shannon Panchuk, Julie Demuth, Amber Silver, Thomas Kox, Linda Anderson-Berry, Bob Goldhammer, Philippe Weyrich, Emily Campbell, Lisa McLaren.

Evaluation

lead:

Beth Ebert, Australia, beth.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

Link to SURF project

Xudong Liang

liangxd@cma.gov.cn

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 is hosted by Chinese Academy of Meteorological Sciences, and responsible for the organisation of Steering Group, Advisory Board and Task Team teleconferences and maintenance of HIWeather web site: http://hiweather.net/Index.

Secretariat

Paolo Ruti and Hugo Remaury provide the link to the World Weather Research Programme.

Communication

The HIWeather web site can be reached at http://hiweather.net/Index. 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.

Meetings

The Steering Group meets quarterly, usually by teleconference. The latest physical annual SG meeting has been held on 14-16 October in Geneva, with attendance of WWRD, Co-chairs, Task team leaders, and ICO. Task teams meet by teleconference at intervals to suit their work. The Advisory Board aims to meet at least once a year by teleconference.

CONTACT OF ICO

Address: 46, Zhongguancun South Avenue, Haidian District, Beijing 100081, China

Tel: +010 5899 4280

Email Address: hiwico@cma.gov.cn

INTERNATIONAL COORDINATION OFFICE OF HIWEATHER46,
ZHONGGUANCUN SOUTHAVENUE, HAIDIAN DISTRICT,
BEIJING 100081,CHINA
TEL: +010 5899 4280
EMAIL: HIWICO@CMA.GOV.CN