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Dear Colleagues,

This newsletter finds the HIWeather community working in a different world of social distancing, isolation and lockdown. We have all had to come to terms with working from home but the challenge has been different for each one of us: some having child care responsibilities to juggle; some having to share facilities with partners; some having to run departments and projects remotely; some having key worker status in maintaining critical services; some being called on to support vulnerable relatives or neighbours. In many cases, we recognise that HIWeather activity, even any scientific activity, will not be your priority. For the time being this is not important, and we wish you, most of all, to keep yourselves and your loved ones safe and well.

As might be expected, a lot of things that traditionally get reported in these newsletters have not been happening. Most conferences this year are being cancelled or substituted with online gatherings. We have decided that an online gathering will be the best way forward for our HIWeather workshop this year. Planning has only just started, so please look out for updates. We are planning the workshop in two parts: a series of webinars spread over the last two weeks of November followed by three days of discussions in the first week of December. We will focus on the HIWeather core objectives: the citizen science initiative; the end-to-end database initiative; and the perfect warning system book. For the citizen science initiative, the workshop will focus on synthesising key issues from the research gathered for the special issue. For the end-to-end database initiative, the conference will aim to gather end-to-end case studies and to agree how they can best be indexed so as to facilitate analysis. For the book, we hope to have a first review of a complete draft. We expect to use a range of remote participation tools to facilitate a successful meeting across multiple time zones.

Meanwhile, those with less responsibilities to juggle are finding an increase in opportunities to join webinars on relevant topics. Over the last year, I have been working to establish a link between HIWeather and the WCRP/IRDR/Future Earth Risk-Knowledge Action Network. The Risk-KAN has a particular focus on compound risk – defined as multiple risks that combine together to give a total risk greater than the sum of the partial risks. This is a rather new area, though there have been a few studies of some hazard combinations, such as river flood and storm surge. In HIWeather we emphasised compound risks arising in the impact cascade, where damage to critical infrastructure may drive the increased risk. At seasonal timescales there are many agricultural examples of a climate anomaly in one season preconditioning crops to suffer from a different anomaly in a later season – a mild winter followed by heavy spring frost is perhaps the best known. However, the current COVID-19 crisis highlights many aspects of compound risk. This was brought into focus when Cyclone Harold threatened Vanuatu earlier in the month, requiring a relaxation of lockdown restrictions to enable people to evacuate. The compound risks between COVID-19 and weather are many and not all require the weather itself to be hazardous. Indeed, in England, the first fine weekend (dry, sunny, maximum temperature 20oC) of Spring coincided with the first weekend of restrictions. The impact of the weather was seen in widespread ignoring of health guidance, with likely implications for increased deaths, economic losses and length of lockdown, due to the enhanced spread of the virus. By the time of even finer weather on the Easter bank holiday, the Met Office was issuing fine weather warnings to government to inform its messaging, and fortunately a repeat was avoided.

In conclusion, I wish you all well through these challenging times. Please keep in touch and pick up your HIWeather work when you can. And we look forward to better times ahead when we can once more focus on achieving better weather-related warning systems that save lives, property and livelihoods.

Best wishes,

*David Johnston*

HIWeather Co-chair

## CONTENTS

## CALLS AND REQUESTS

**Citizen Science for Understanding and Improving the Warnings Value Chain:** Citizen science is a broad term, which encompasses a variety of different types of projects where the public (citizens) work with agencies and academic researchers to undertake scientific research. A special issue of the Australasian Journal of Disaster and Trauma Studies will bring together accounts of the research, policy and practice initiatives from researchers, practitioners and the wider HIWeather and DRR community. Submission details are available at: http://trauma.massey.ac.nz/

**HIWeather Endorsement:** The Steering Group (SG) of the High Impact Weather (HIWeather) Project provides endorsement for projects, programs and initiatives that plan to contribute to the goals of HIWeather as outlined in the HIWeather Implementation Plan. Projects seeking endorsement through HIWeather may either be funded or in the process of seeking funding. (More http://hiweather.net/news/show/c_id/145/n_id/315.html)

**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_yoLCWSb6KzvDZR_e2wTBqYOsFFYRU5M/edit?usp=sharing

**Request**: Anyone interested in joining the Social Media cross-cutting project, or find out more, is requested to email Sara Harrison at s.harrison@massey.ac.nz

## ACTIVITIES

- On 10-12 March **ECMWF** organised a **workshop focused on warm conveyor belts (WCB)**. Due to COVID-19, all workshop was reorganised to be an online event. This fact did not hinder the workshop from being a success with a lot of interesting talks, break-out working groups and also poster sessions. Several of the talks presented results from the NAWDEX campaign for example. The key questions for the workshop tackled predictability, observations, modeling and impacts of WCB and also the closely related atmospheric rivers.

  In the spring issue of ECMWF Newsletter, an article about the February storms in north-western Europe highlighted new forecast products for extreme weather on various time scales: link

- Due to COVID-19, **AOGS 2020** (Hongcheon Korea), **Disaster Ethnic Conference 2020** (Denmark), **FESSTVal Summer School** (Germany) were cancelled.
- **EGU Online webinar** (4-8 May 2020): *https://meetingorganizer.copernicus.org/EGU2020/displays/35911*
- **30th Conference on Severe Local Storms**: 12-16 October 2020, Santa Fe, NM.

  Abstract Deadline: 12 June, 2020

  Acceptance E-mails Sent Out & Program is Posted: Early-August, 2020

  Extended Abstract Deadline: 13 November, 2020

  Website: https://www.ametsoc.org/30th-conference-on-severe-local-storms1/

## FLAGSHIP ACTIVITIES

### HIWEATHER CITIZEN SCIENCE PROJECT

With many new and ongoing citizen projects planned or underway within the High Impact Weather community, this project is designed to share information and to provide tools to help groups and agencies develop new activities. There are five initial activities in year 1 and the first three have started in Q1 of 2020. See concept note for more overall details. *http://hiweather.net/news/show/c_id/41/n_id/321.html*

**Activity 1: Develop a guidance note for including citizen science in weather, climate and water projects.** This activity will involve the development of a "A guidance note for including citizen science in weather, climate and water projects", outlining the definition, a typology of Citizen Science projects, illustrative case studies, bibliography of both theoretical and practice guidance papers/reports and some "how to develop a Citizen Science project" worksheets. A first draft for consultation is due in early July.

**Activity 2: Citizen Science Demonstration projects.** A range of citizen science activities can serve as demonstration projects. These may include existing or new HIWeather projects or other projects that illustrate citizen science methods. An initial phase of this activity will be the development of the selection criteria for projects. In early-mid May an online survey will be sent out to capture details of existing projects and ideas for new ones.

**Activity 3** is the Special Issue of the Journal (see early details in this newsletter).

## TASK TEAM ACTIVITIES

| | |
|---|---|
| P&P | Review the state of wind hazard forecasting |
| | NAWDEX (North Atlantic Waveguide and Downstream Impacts Experiment) |
| | Multi-scale, multi-leadtime predictability of high-impact weather |
| | RELAMPAGO-CACTI (Remote sensing of Electrification, Lightning, And Meso-scale/micro-scale Processes with Adaptive Ground Observations - Cloud Aerosols and Complex Terrain Interactions) |
| | SCMREX (Southern China Monsoon Rainfall EXperiment) |
| | PRECIP (Prediction of Rainfall Extremes Campaign in the Pacific) |

### *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 2020.

### *NAWDEX (NORTH ATLANTIC WAVEGUIDE AND DOWNSTREAM IMPACTS EXPERIMENT)*

Lead: Andreas Schäfler

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 FESSTVal campaigns were represented. The workshop led to great discussions how to increase the interactions, and how 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-LEADTIME PREDICTABILITY OF HIGH-IMPACT WEATHER*

Leads: Shira Raveh-Rubin, Linus Magnusson, Michael Riemer

Objectives: Assess the predictability of different ingredients to HIW events as a function of leadtime and identify the physical processes that limit predictability (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 Working Group on Nowcasting and Mesoscale Research (WGNMR)

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)*

Lead: Yali Luo

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

The fourth WMO Monsoon Heavy 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*

### *PRECIP*

Lead: 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) in 2021 and conduct a small virtual campaign in 2020. 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.

| | |
|---|---|
| MSF | MOUNTAOM (RDP alongside the 2022 Winter Olympic Games in Beijing) |
| | Review the current state of nowcasting & forecasting high impact weather |
| | Intercomparison of km-scale DA & nowcast/forecast systems |
| | SURF (Study of Urban Rainfall and fog/haze) |
| | ICE-POP2018 (RDP/FDP alongside the Pyeongchang Winter Olympic Games in South Korea) |
| | UK Environmental Prediction (UKEP) project |

### *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 2020.

### *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 a 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 WGNMR 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*. It develops and evaluates the UK's first fully coupled regional prediction system at kilometre scale, encompassing atmosphere, ocean, wave, land surface, and biogeochemistry model components and their interactions. The aim of the initiative is to enable multi-disciplinary research on Earth system processes at high resolution and to improve future operational applications. One of the

exciting aspects of working with coupled systems, illustrated during a workshop held in June 2019, is the need to join together and share different perspectives and expertise from across weather and climate, marine and hydrological science disciplines. For further information on the UK Environmental Prediction collaboration, contact huw.lewis@metoffice.gov.uk or visit https://www.metoffice.gov.uk/research/approach/collaboration/ukenvironmentalprediction

| | |
|---|---|
| HIVR | Formal (statistical) impact model intercomparison |
| | Impact data collection |
| | 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 physically-based impact models

### *IMPACT DATA COLLECTION*

Leads: Joanne Robbins and Rainer Kaltenberger

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

### *REVIEW & CLASSIFICATION OF IMPACT MODELLING*

Leads: Brian Mills & HIVR task team

The scope of the review is being prepared.

| | |
|---|---|
| COMM | Unconventional data sources for impact modelling, evaluation & communication |
| | Review of approaches to communicating high impact weather. |
| | Training Materials |
| | Review of the role of trust, salience and beliefs on people's responses to weather warnings |
| | Communicating uncertainty |
| | Post-event case studies |
| | Communication platform |
| | HIGHWAY (Lake Victoria Basin Nowcasting project) |
| | GCRF African Science for Weather Information and Forecasting Techniques (GCRF African SWIFT) |

### *UNCONVENTIONAL DATA SOURCES FOR IMPACT MODELLING, EVALUATION & COMMUNICATION*

Leads: 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)

- Thomas Kox and colleagues have a have a new little citizen science project in Munich on weather impacts and weather observations with school children. However, this is currently paused due to the COVID situation

### *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: Andrea Taylor, Communication task team

Julie Demuth has circulated UCAR COMET training module on communicating impact-based warnings. https://www.meted.ucar.edu/training_module.php?id=1597#.XqDuVP8za71

We are continuing to collate existing training materials for weather communication. Links can be shared with Andrea Taylor (a.l.taylor@leeds.ac.uk).

### *COMMUNICATING UNCERTAINTY*

Lead: Sally Potter

The aim of this project is to review and publish the implications of uncertainty in weather forecasts and warnings across the whole spectrum of HIWeather.

A publication on communicating model uncertainty, associated with HIWeather, has been published: *https://www.sciencedirect.com/science/article/pii/S2212420918306630?via%3Dihub*

Collated essays on uncertainty from an AMS special session have been shared by Julie Demuth: https://items.ssrc.org/category/chancing-the-storm/

### *POST-EVENT CASE STUDIES*

Lead: Brian Golding

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*

### *COMMUNICATION PLATFORM*

Lead: Emily Campbell, Communication Task Team.

Outputs from HIWeather communication activities will be freely available on the HIWeather Communication Platform, including best practice guidelines and reviews. The Platform is *http://hiweathercomms.net/*. Additionally, the HIWeather twitter is also now available to follow at *https://twitter.com/WMO_HIWeather.* Content on the Communication Platform will mainly be populated through the newsletter and task team meeting minutes.

### *INFLUENCE OF TRUST, SALIENCE AND BELIEFS ON WARNING RESPONSE*

Lead: Amisha Mehta, Communication Task Team

Amisha recently joined the Communication Task Team to lead a review into the influence of trust, salience and beliefs on warning response. She is planning on putting together a project plan by July 2020. Anyone interested in being part of this activity is encouraged to contact Amisha at *a.mehta@qut.edu.au*.

A research study is underway to examine how participants trust weather forecasts and agency warnings in the context of flood events. This work is part of a program funded by the Bushfire and Natural Hazards Cooperative Research Centre and co-designed with Victoria State Emergency Services and the Australian Government Bureau of Meteorology.

### *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*.

### *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. For current news see *https://africanswift.org/*

| | |
|---|---|
| EVAL | Evaluating the effectiveness of impact-based, extreme weather warnings and behavioural recommendations. |
| | Warning response |
| | Global Hazard Map |
| | Weather Information Value Chain |
| | Probabilistic forecasting and evaluation of Tropical Cyclones |
| | Fire weather evaluation |
| | Mesoscale Verification Inter-comparison over Complex Terrain (MesoVICT) |
| | Societal and Economic Research Applications (SERA) Workshop |
| | Value Chain review by WWRP SERA Working Group |
| | Verification Challenge |
| | Method(s) to measure avoided losses due to improved warnings |

### *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*

Leads: Anna Scolobig and Philippe Weyrich

Collecting real-time storm warning and response data from an app from a private company; still waiting for a type3 warning to occur to test the response to impact-based and non-impact-based warnings.

Running serious (simulation) games to understand how social media communication and searching are used in warning. A flood simulation game was run in May 2019 at a training course for professionals in disaster risk reduction held at the University of Geneva.

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

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 2019. (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).

### *FIRE WEATHER EVALUATION*

Lead: 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.

### *MESOSCALE VERIFICATION INTER-COMPARISON OVER COMPLEX TERRAIN (MESOVICT)*

Leads: Manfred Dorninger and Marion Mittermaier

The project encouraged investigation of spatial verification methods in complex terrain, including for ensemble forecasts and uncertain observations. The final workshop was held in July 2019 in Vienna (https://mesovict.univie.ac.at/). A special collection of articles related to MesoVICT is being published in *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*

Leads: 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*

Leads: 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.

## 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).

Associated with Waves to Weather, a new PhD project has started to investigate the impact of the new Aeolus space-born Doppler lidar on tropical waves and precipitation. Through its measurements of winds in cloud free regions Aeolus is closing an important gap in the global observing system and thus it is expected to substantially improve analysis fields and subsequently predictions of synoptic- to planetary-scale wave phenomena in the Tropics. The work will be conducted in close collaboration with the German Weather Service (DWD) and the European Centre for Medium-Range Weather Forecasts (ECMWF), which both are currently running data impact experiments with the new data.

In addition, Waves to Weather scientists are going to participate in an international field campaign on the Cape Verde islands in summer 2020, called ASKOS (*http://askos.space.noa.gr*). This project is built around planned calibration/validation aircraft measurements conducted during the same period. Cape Verde during boreal summer is ideal for a study of tropical wave phenomena. The midlevel African easterly jet allows for the formation of synoptic-scale African easterly waves (AEWs) that typically reach their maximum intensity close to the coast of West Africa. AEWs interact with convection and its mesoscale organization through modifications in humidity, temperature and vertical wind shear, and often serve as initial disturbances for tropical cyclogenesis. In addition, the tropical

atmosphere sustains different types of planetary waves that frequently interact with the monsoon and AEWs. To support our research in this area, we plan frequent radiosonde ascents from Cape Verde to complement the measurements from space and aircraft.

## *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 are conducting a small project on **impact prediction**, currently looking at impacts of wind on infrastructure. Partners include forecasters and State Emergency Services. High resolution ensemble NWP is coupled to a wind damage function to derive probabilistic spatial maps of damage severity, using East Coast Lows as demonstration events.

Future Warning Services (FWS) framework: In February 2018 the Australian Fire and Emergency Services Authority Council (AFAC) Warning Group commissioned social research to build a sound evidence base for a national three-level warning framework for all hazards. The Australian Bureau of Meteorology has embarked on a three-year Public Services Transformation to improve the impact and value of our services. The includes new and enhanced impact-based warning services that provides warnings that are clear, accurate, location specific, relevant and contextual. We are developing a framework to guide the preparation of a product roadmap that systematically priorities the future development of services. People can get a copy of the PST business case by emailing *public-services@bom.gov.au*.

The 'Reducing Illness and Lives Lost from Heatwaves' (RILLH) is a multi-agency collaboration between the Australian Bureau of Meteorology (BOM), Australian Bureau of Statistics (ABS), Department of Health (DOH), and Geoscience Australia (GA). The RILLH is a data-integration partnership project and asks three questions; 'who is most at risk?', 'where are they?', and 'how can services to vulnerable groups be improved through heat-health warnings and targeted interventions?'. This project seeks to answer these questions by mapping vulnerability against Excess Heat Factor (EHF), the scale used to define heatwave intensity by the Bureau of Meteorology and many Australian States and Territories. Through the utilisation and analysis of health and health service data, weather observations, neighbourhood community and environmental characteristics, the project is building a national 'map' of heat health vulnerability which will be underpinned by a Heat Vulnerability Index. It is anticipated that the core methodology of multi-agency collaboration and integration of data used in this project can be applied to other natural hazards as well. The results will support emergency response and planning in the immediate term and will inform and shape spatially target intervention strategies including impact forecast warning systems, social registries and community outreach, social media targeting, and urban planning. For more information contact Shannon Panchuk (*shannon.panchuk@bom.gov.au*)

## *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 mid-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). Due to the end-to-end nature of this project, it's possible it could be a 'demonstration' project for WMO HIWeather.

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/*). This guidance has been used for structuring New Zealand's Emergency Mobile Alert messages during the COVID-19 response.

## 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

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 face-to-face 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). The 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, four 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 project aims to improve 24-hour precipitation scores in the Beijing-Tianjing-Hebei region by developing improved mixed-phase parametrization scheme that incorporate aerosol effects. The parametrizations will be developed on the basis of field campaigns.

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

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

## *RELATED ACTIVITIES*

### *GHHIN (GLOBAL HEAT HEALTH INFORMATION NETWORK).*

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

### *VORTEX-SE (VERIFICATION OF THE ORIGINS OF ROTATION IN TORNADOES EXPERIMENT – SOUTHEAST)*

A research program to understand how environmental factors characteristic of the southeastern United States affect the formation, intensity, structure, and path of tornadoes. It will also determine the best methods for communicating forecast uncertainty related to these events to the public and evaluate public response. See *http://www.nssl.noaa.gov/projects/vortexse/*

### *I-REACT*

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

### *ANYWHERE*

An EU Innovation action designed to bridge the gap between R&D in forecasting and warning high impact weather and climate so as to enhance response by emergency managers and first responders across Europe *http://www.anywhere-h2020.eu/*. Work packages include translating weather forecasts into impact forecasts, developing a platform for communicating information to emergency managers. The project is working on 5 pilot sites: Ligurian Sea, Catalonia, Finland/Norway, Swiss Alps. It is a partnership of operational authorities, R&D institutes and private sector businesses. The project catalogue contains a large collection of forecasting algorithms, many developed in previous EU actions. Mostly they concern prediction of the hazard, but a few also deal with the impact. See *http://anywhere-h2020.eu/catalogue/*

### *ARISTOTLE*

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

### *EUROPEAN DISASTER RISK MANAGEMENT KNOWLEDGE CENTRE*

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

### *S2S (SUB-SEASONAL-TO-SEASONAL PREDICTION)*

*Latest news is available at* *http://www.s2sprediction.net/static/news*

## *PPP (POLAR PREDICTION PROJECT)*

*Latest news is available at http://www.polarprediction.net/news.html.*

## *TIGGE (THORPEX INTERACTIVE GRAND GLOBAL ENSEMBLE) AND TIGGE-LAM (-LIMITED AREA MODEL)*

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

## *CODATA: THE COMMITTEE ON DATA OF ICSU*

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

## *THE YOUNG EARTH SYSTEM SCIENTISTS (YESS) COMMUNITY*

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

## *JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH*

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

## *THE PROJECT*

### *STEERING GROUP AND TASK TEAMS*

***Co-chairs**:*

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*David Johnston, New Zealand,* D.M.Johnston@massey.ac.nz

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

***Processes & Predictability (P&P) theme***

*lead: Michael Riemer, Germany,* mriemer@uni-mainz.de*.*

*Members: John Knox, Peter Knippertz, Andreas Schäfler, Juan Fang, Shira Rabeh-Ruvin, Linus Magnusson, Deanna Hence, Yali Luo, Linda Schlemmer, Robert Rogers*

***Multi-Scale coupled Forecasting (MSF) theme***

*lead: Jenny Sun, USA,* sunj@ucar.edu*.*

*Members: Paul Joe, Peter Steinle, Sharan Majumdar, Jianjie Wang, Jim Dudhia, Krushna Chandra Gouda, Nusrat Yussouf.*

***Human Impacts, Vulnerability & Risk (HIVR) theme***

*lead: Brian Mills, Canada,* bmills@uwaterloo.ca*.*

*Members: Joanne Robbins, Michael Kunz, Isabelle Ruin, Melanie Gall.*

***Communication theme***

*co-leads: Andrea Taylor, UK,* a.l.taylor@leeds.ac.uk *& 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, Amisha Mehta.*

***Evaluation theme***

*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

***Representatives of WGNE:** *WGNE: working group on Numerical Experiment under WCRP*

*Ariane Frassoni, Brazil,* ariane.frassoni@inpe.br

*Ron McTaggart, Canada,* ron.mctaggart-cowan@ec.gc.ca

### *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, Hugo Remaury and Martin Wegmann 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 has recently become live at *http://hiweathercomms.net/*. It is currently being updated. A HIWeather twitter account is also now available to follow at *https://twitter.com/WMO_HIWeather*.

**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

## *RELEVANT PUBLICATIONS*


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