Precipitation-Related Extremes: Background

Meeting Objective

To formally ‘kick off’ our project by reviewing our objectives and plans, updating our strategy, and developing specific actions

Background

1. Objective
2. Participants
3. Partners/Users
4. Secretariat
5. Strategy
6. Links with GWF Core and other GWF projects
7. Status

Objective

The objective of this Project is:

To support our users in planning for, preparing for, and adapting to the environmental, health and economic impacts of their identified critical climate-related precipitation extremes.

The ‘Original’ Research Team

Name of PI and contact information:
Ronald Stewart (RS) - University of Manitoba
Francis Zwiers (FZ) – Pacific Climate Impacts Consortium, University of Victoria (PCIC/UVIC)

Names of Eligible Co-Is and their affiliations:
John Hanesiak (JH) - University of Manitoba
Mary Kelly (MK) – Wilfrid Laurier University
Yanping Li (YL) - University of Saskatchewan
Julie Theriault (JT) - University of Quebec at Montreal

Names of Collaborators and their affiliations:
Ahmed Attir (AA) – NRC Ottawa
Peter Berry (PB) Health Canada, Ottawa and University of Waterloo
Barrie Bonsal (BB) - ECCC Saskatoon (WHERD)
Julian Brimelow (JB) - ECCC Edmonton (PSOW)
Bob Kochtubajda (BK) - ECCC Edmonton (PSOW)
Lawrence Mudryk (LM) - ECCC Toronto (CRD/CPS)
Budong Qian (BQ) - AAFC Ottawa
Roy Rasmussen (RR) - National Center for Atmospheric Research Boulder
Elaine Wheaton (EW) - University of Saskatchewan
Xuebin Zhang (XZ) – ECCC Toronto (CRD/CDAS)

Partner/User Sectors - Original

Agriculture

Electrical Utilities

Engineering Design

Health

Insurance

Partners/Users - original/new

Agriculture and Agri-Food Canada

Manitoba Hydro and NB Power

Health Canada

National Research Council

Canadian Institute of Actuaries, Institute for Catastrophic Loss Reduction
Insurance Bureau of Canada

PricewaterhouseCoopers

Environment and Climate Change Canada
BC government

Canadian Council for Ministers of the Environment
CatIQ

	Extreme phenomenon of concern						
	Drought	Excess Wet	Extreme Precip.	Hail	Precipitation Timing	Freezing rain	Snow
Agriculture	✓	✓	✓ subdaily daily	✓	✓ event sequence		
Electrical	✓	✓	✓ prob. Max.		✓ low freq. variation	✓	✓ wet snow + wind
Engineering Design			✓ subdaily daily			✓	✓ extreme snow
Health	✓	✓	✓ daily 5-day		✓ event sequence	✓	✓ snow
Insurance	✓		✓ subdaily	✓		✓	✓ extreme snow
Researchers	BB, JB, PB, JH, BQ, RS, EW		JB, PB, JH, BK, MK, YL, RR, EW, FZ, XZ			PB, BK, MK, LM, RR, RS, JT, XZ	

PKM Manager

The Project and Knowledge Mobilization (PKM) manager will facilitate knowledge mobilization by actively coordinating with users and creating the conditions required to enable KM.

This includes, as appropriate and required:

- logistical support, the structuring of documentation, facilitation of training and/or reporting to users, etc.
- the PKM manager will be aided and guided by the co-PI's and the KM Committee
- PKM manager will devote 50% of time to enabling KM and 50% to ensuring the smooth functioning of the project from an administrative and project management perspective
- overall management of the project will include bi-monthly project-wide conference calls that alternate with bi-monthly Project Steering Committee conference calls. These calls will ensure that all participants are continually aware of project activities and developments; that timelines and deliverables are being met; and that KM (to be an agenda item of every meeting) is operating smoothly.

Information Manager

Data management support is essential to facilitate access to data of interest to Project researchers and users. This is equivalent to a half-time position.

Numerous responsibilities are associated with this activity.

- maintain a catalogue of data utilized by researchers
- assist with the acquisition of data for use by researchers and users as required.
- as necessary, maintain easily accessible copies of data via a web portal, ensuring open access to users and the general public provided this is consistent with the terms of usage under which the data are obtained.
- maintain a Project web page to keep researchers and the general public informed of Project activities
- assist with KM, for example, by supporting the creation of open source versions of software developed by the Project.

Two-Pronged Strategy

1. address **sector-based user issues**. The needs of the five sectors include a need for information and guidance on changing:

magnitudes
return periods
spatial coverage
seasonal variations of extreme precipitation-related events.

Addressing these is foremost and this in turn affects our research methodology, which is based on a strong basis of observational data and the three modelling pillars.

2. **provide the needed appropriate information** to users in ways that meet their needs and applications. Through our Knowledge Mobilization activities, the transfer of information and insight between the researchers and users will occur through several means including sector based collaboration, and will be assisted and fostered by the Knowledge Mobilization Committee which includes advisors from each of the sectors.

Methodology

Our research is accomplished through:

- innovative **analysis techniques**
- state-of-the art **observational data**
  station/gridded precipitation, remote sensing
- climate simulations from **three modelling pillars**
  spatial resolutions of global climate models (~200-100km)
  conventional regional climate models (50-10km)
  convection permitting WRF model (4km).

Indicators

Indicators: Hand-in-hand with these tools, we will engage our sector communities.

Early on, we will bring together the sectors and researchers to:

- more precisely identify the detailed aspects of the phenomena with the intent of summarizing the most critical thresholds or sequencing.
- possibly develop new indicators.

in parallel, we will assess our capabilities to produce those indicators

While it is evident that there is considerable commonality, some rationalization may still be needed to jointly identify indicators that best address as many sector concerns as possible within our constraints.

Outlook to 7 Years

The strategy also recognizes that, while we will have tackled some of the pressing issues faced by our sectors in years 1-3, much more will need to be done in years 4-7.

- Our assessment of these requirements and ability to meet them will be based on our experience in years 1-3, including the experience gained in Knowledge Mobilization, user reactions, suggestions and further requirements, and technological developments such as data and model improvements.
- These developments include widely available CMIP6 information from numerous models and their regional counterparts.
- Although it is possible, we are not counting on new century-long climate model forced WRF simulations being available before year 3.
- In addition to expanding the depth and complexity of sector based issues to be addressed in years 4-7, we will be better positioned to provide advice on levels of confidence

Year 1

- Initial workshop(s) to fully engage our users, further refine the areas of concern identified in this proposal, identify time periods/locations of past events that illustrate concerns, develop indicators of impacts seeking as much commonality as possible across sectors, and jointly scope tractable scientific approaches to obtain the information needed by users for adaptation and risk mitigation. The determination of "tractability" will include relevance to user concerns, scientific feasibility within the time and expertise constraints of the project, and availability of data and model output of sufficient quality, resolution, and spatial/temporal extent.
- In consultation with the Knowledge Mobilization (KM) committee, develop a detailed scientific work plan, focussing initially on scientifically tractable issues common to multiple sectors with high potential for early knowledge mobilization.
- In parallel, recruit HQPs and the Network and Knowledge Mobilization manager
- Gather relevant observational and user-derived data for each sector
- Acquire relevant model output from available GCMs, RCMs and convection permitting models (notably WRF).
- Initiate analyses and other research activities specified in the work plan. It is anticipated that the work plan will include the analysis of precipitation extremes for events of different durations, the frequency, location and intensity of hail and freezing rain, and the occurrence, location, spatial extent and intensity of drought. If feasible and resources permit, studies could also be undertaken on events with critical precipitation and wind aspects.
- Establish collaborative research activities with appropriate components of sector organizations
- Initiate alternating monthly conference calls for the entire project and Project Steering Committee

Year 2

- In collaboration with users, continue to develop and analyze indicators relevant to sector needs with a view to early KM. This includes the possibility of incorporating analysis procedures in open source packages for others to use and further adapt to their specific requirements. Indicators are likely to include measures of extreme precipitation and other key elements that are based on advanced statistical extreme value analysis techniques.
- Undertake statistical analyses of historic events within each sector as feasible (e.g. develop intensity/return period information based on advanced statistical approaches)
- Evaluate the ability of different types of climate models to replicate extremes, assess degree of variability and uncertainties. The evaluation of WRF simulations will initially be limited to relatively short, single, 10 to 15-year PGW simulations whereas ensembles of longer simulations will often be available for lower resolution models.
- If available, begin to examine a century-long WRF simulation forced by a global climate model.
- Produce initial tailored historical (and, as possible, future) products for each sector; consultations ongoing with users to ensure products are usable. An example of such a product might be maps of Probable Maximum Precipitation (PMP) projections and associated uncertainties for the hydroelectric sector using an advanced, probabilistic PMP estimation approach.
- Continued alternating bimonthly network wide and project steering committee calls to ensure coordination and the continued effective management of the project.
- One or more mid-project workshops with users, the scientific steering committee and knowledge mobilization committee to ensure the Project is on track.

Year 3

- Complete statistical analyses of historic and future extremes for each sector.
- Provide information as to model limitations, uncertainties, range of variability and potential errors for each extreme and sector.
- Finalize tailored historical and future projection products that are based on the relevant indicators for each sector through continued consultations with users.
- Ensure all data/model/analysis activities and progress have been documented and/or evaluated.
- Complete analysis of historic/future precipitation extremes across the country and ensure that the information, including uncertainties, is actionable by users.
- Continued alternating bimonthly network wide and project steering committee calls to ensure coordination and the continued effective management of the project.
- Final workshop to ensure that user needs have been realized and to receive user feedback on ‘what next’ for years 4-7.
- Ensure that outreach material has been produced and is utilized by our users. One example is appropriate input for inclusion in the 2020/2021 national assessments on health.

Years 4-7

- Engage additional sectors, working with these sectors refine problem definitions and further improve KM. This could include an expanded scope of problems, such as understanding the role of low-frequency modes of variability associated with longer duration droughts and the redistribution of precipitation, such as the El-Nino/Southern Oscillation, Pacific Decadal Oscillation and the North Atlantic Oscillation, and how their behaviour and/or impact might change in the future. Depending upon user input, other possibilities include analysis of other extremes such as extensive wet periods, heavy snow, freezing precipitation with wind loading, sub-daily extreme analysis.
- In all cases, incorporate information from improved models, including CMIP6 and WRF at sub-4km resolutions, and from improved observational and user-provided datasets.
- To this end, contribute to the production, analysis and application of a broader suite of climate change scenarios produced with improved versions of WRF at sub-4 km resolutions, focusing specific attention on sub-daily precipitation extremes, spatial/temporal scaling issues, and drought/excessive wetness structure and variability.
- Expand on linkages within GWF to collectively address key issues; for example, work together with hydrologists to address major groundwater and overland flooding factors that cause damaging events for insurance industry and other sectors.

Project Organization

Project Steering Committee: co-chaired by the Project co-PIs with membership being the Co-Is, government collaborators, and sector based knowledge mobilisation advisors. It will also include the Project and Knowledge Mobilization (PKM) manager who will act as the secretary.

The project steering committee (PSC) will have two subcommittees, the Scientific Steering Committee (SSC) and Knowledge Mobilization Committee (KMC).

Scientific Steering Committee: The SSC develops the scientific strategy and the associated scientific work plans, and provides an annual review of the scientific progress of the project. It consists of the Project co-PIs, the Co-Is, government collaborators, two KMC representatives, and the PKM manager, who will act as secretary.

Knowledge Mobilization Committee: The KMC provides ongoing advice to the PSC and SSC regarding users' needs and contributions, with a focus on KM opportunities and facilitation. It will provide an annual update on KM progress and prospects, will serve as a link between the Project and the public, and will develop the project's KM strategy. It consists of the KM advisors and co-PIs, and is assisted by the PKM manager, who will act as secretary. The number of KM advisors will be increased in Year 1.

GWF Core - Linkages

Knowledge Mobilization Core Team. We will work with the Core Team to ensure that interactions between our users and the Project researchers are as efficient as possible.

Modelling Core Team. Much of this linkage will be connected with output from the WRF model. One dataset is an existing one completed for CCRN working collaboratively with the NCAR. The other dataset will have a much larger domain (up to 70 degrees) and it will forced from one GCM (possibly CanESM2) and be a continuous simulation for 100 years using RCP8.5 or updated CMIP6 scenarios. We are not expecting to use its products during years 1-3.

GWF Modelling Core - Drought. This aspect is expected to mainly focus on seasonal drought prediction although the details are still being developed. In contrast, our focus will mainly examine its longer-term projection with specific indicators tailored to specific sectors. We will also consider drought across Canada, not just western Canada.

Data Management Core Team. Work together to make available observational data and model output. With our users, we will determine the essential variables (and combinations); the Data Management Core Team will be needed to efficiently extract, synthesize and analyze this. We will need data support personnel who are familiar with meteorological and associated data and are able to conduct appropriate analyses including data extraction and data format conversion. We will make use of pre-existing capabilities, such as PCIC-developed and supported downscaling and indices packages.

Computer Science Core Team. This interaction will focus on several key issues including the creation of visualization software for end-users and packaging modelling products. We intend on working with this Team to develop the most efficient manners to exploit the enormous model and observational datasets to address user-defined needs.

GWF Other Projects - Linkages

Other GWF projects would be natural links including:

To be filled in...

Other non-GWF projects - Linkages

Most of us are involved one way or another in other projects.

Some of these linkages could contribute to our success.

Status - Nov 29, 2017

Funds in place for year 1
Information Manager onboard
PKM Manager …
Web site
Several researcher conference calls with specific ones on drought/winter hazards
Additional partners/users
More specific information from several partners/users
WRF new simulations being planned
Inception report requirements now available
...
Inception meeting (Now)