

## **H01: Hydro-climatic Impacts and Adaptation**

**Conveners:** Rajesh Shrestha<sup>1</sup>, Yonas Dibike<sup>1</sup>, Daniel Peters<sup>1</sup>

**Co-chairs:** Rajesh Shrestha<sup>1</sup>, Yonas Dibike<sup>1</sup>, Daniel Peters<sup>1</sup>

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### **Session Description**

Climate change has the potential to affect the mean hydrologic state and its variability, such as the volume and extent of snowpack, the magnitude and timing of snowmelt driven spring freshet and rainfall driven stormflow, and the seasonality and extreme states of water fluxes. Coping with these likely impacts requires adaptation strategies, such as modification of current water management strategies, as well as mitigation measure, such as updating/upgrading existing water resource infrastructure.

This session aims to provide a platform for presenting research that assess the implications of climate variability/change on planning, allocation and operations of water resources, and adaptation/mitigation measures that address the potential negative/positive impacts. We seek presentations on hydro-climate impacts studies on water demand and supply, such as municipal, agriculture, hydroelectric power generation, floods and drought. Of particular interest are studies that examined adaptation/mitigation measures ranging from the local to regional scales. We also encourage contributions that address emerging implications of climate change, such as dry and wet regime changes, regional and seasonal shifts in water fluxes, change in the frequency of extreme events, effects on hydro-ecological connectivity, and new methods and tools for assessing impacts and evaluating adaptation/mitigation measures.

**Primary Affiliation:** Hydrology

## **H02: Recent advances in peatland hydrology, Part 1: Peatland restoration and ecohydrological processes**

**Conveners:** Sarah Howie<sup>1</sup> and Pete Whittington<sup>2</sup>

**Co-chairs:** Sarah Howie<sup>1</sup>, Pete Whittington<sup>2</sup>, Maria Strack<sup>3</sup>, and Jonathan Hughes<sup>4</sup>

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### **Session Description**

Peatlands cover about 15% of Canada's land surface. Since peatlands act as CO<sub>2</sub> sinks, it has been suggested that conservation of undisturbed peatlands may be valuable in limiting CO<sub>2</sub> emissions globally. However, peatland disturbance has increased in recent years, particularly relating to ore and petrol extraction, agriculture, and forestry. Thus, a greater understanding of peatland ecohydrological processes and an improvement in peatland restoration techniques is critical to limiting greenhouse gas emissions from these disturbed sites and restarting the process of soil carbon accumulation. Peatland restoration began in *Sphagnum*-dominated bogs about 25 years ago, but has expanded in recent years to include fens and swamps as disturbance has been increasing in these wetland types. The goal of the session is to bring together peatland scientists to share lessons learned with the goal of improving current studies and restoration projects throughout the country. The session will also provide an opportunity to address key research gaps in this field. In particular, contributions will be welcomed that focus on the latest methodology and findings in ecohydrological studies of both undisturbed and anthropogenically disturbed peatlands (e.g. drainage, resource extraction, climate change), as well as novel peatland restoration techniques.

**Primary Affiliation:** Biogeosciences / Hydrology

### **H03: Recent Advances in Isotopes as Tracers of Hydrology and Earth-System-Science**

**Conveners:** Tricia Stadnyk<sup>1</sup> and John Gibson<sup>2</sup>

The name of the corresponding convener should be underlined.

**Co-chairs:** Tricia Stadnyk<sup>1</sup>, and John Gibson<sup>2</sup>

Please list at least two co-chairs who will be attending the conference and will be available to chair the oral session(s)

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#### **Session Description**

At a World Summit on Sustainable Development, a partnership between the International Atomic Energy Agency (IAEA) and United Nations Educational, Scientific and Cultural Organization (UNESCO) was formed to focus on enhancing technology applications for water resources management. The IAEA announced a need to “*develop a methodology and monitoring network for isotopes*” with the fundamental goal of improving our understanding of hydrology in river basins. Since then, many studies have incorporated isotope tracers to elicit understanding of the connectivity between meteorology, hydrology and geology, or earth system science. Canadian researchers are leaders in using isotope tracers in global and catchment-scale studies to examine change related to climate and land-use factors. Establishment of national and regional-scale tracer networks have progressively advanced research initiatives, and have enabled the coupling of isotope measurements to hydrometric observation. The goal of this session is to provide a forum for multi-disciplinary discussion on the recent applications of isotope tracers in hydrology and earth-system-science, with the specific goal of fostering new and unique collaborations. We encourage contributions relating to the use of isotopes as tracers of earth-system-science including hydrometeorological, hydrogeological, and hydrological applications. Submissions focusing on all spatial and temporal scales, field or laboratory studies, coupled modelling approaches, and various temporal scales are invited.

**Primary Affiliation:** Joint / CSAFM / Biogeosciences / Earth Surface Processes / Geodesy / **Hydrology(CGU)** / Solid Earth

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## **H04: Recent advances in peatland hydrology, Part 2: Flow and transport of water, solute, and energy in organic soils**

**Conveners:** Colin McCarter<sup>1</sup>, Tobias Weber<sup>2</sup>, and Jonathan Price<sup>3</sup>

**Co-chairs:** Colin McCarter<sup>1</sup>, Tobias Weber<sup>2</sup>, and Jonathan Price<sup>3</sup>

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### **Session Description**

With increasing northern developmental pressure, the need to understand the processes governing the flow of water, solutes, and energy in organic soils, which are prevalent in northern Canada, is increasing. Unlocking the underlying processes is a major scientific challenge to improve our understanding and our ability to predict water fluxes, nutrient and contaminant transport, peatland development, and ecosystem services under a changing climate and developmental pressures. The physical structure of organic soils controls the movement of water, solutes and energy and results in non-linear unsaturated hydrology, an abundance of macropores and inactive porosity, and are subject to shrinkage and swelling. Thus, describing water, solute, and energy transport in organic soils is complicated due to these complex physical soil properties, in addition to the relatively unknown transport processes (i.e., dispersion, diffusion, sorption, and local non-equilibrium), high moisture and organic content, and abrupt temporal/spatial changes in geochemical conditions (e.g., anoxia). Recently, there has been a push to understand how advection, dispersion, diffusion, sorption, and biogeochemical processes govern the flow and transport of water, solutes, and energy in organic soils from the pore to regional scale. Thus, the goal of this session aims at providing a platform for hydrologists, hydrochemists, wetland scientists, and soil physicists to discuss the recent advances in our understanding of the processes governing the transport of water, nutrients, contaminants, and energy in organic soils. Our scale of interest ranges from the laboratory to the regional scale. In particular, contributions will be welcome that cover hydrological fluxes, soil physics, sorption and desorption processes, contaminant and nutrient fluxes, thermal transport and hydrological models that illuminate these processes in organic soils and organic horticultural substrates. Additionally, we welcome the presentation of new, developing, or novel methodologies and experiments that highlight these complex processes.

**Primary Affiliation:** Hydrology & Biogeosciences

## **H05: Insights into Environmental/Hydrological Models Using Sensitivity and Uncertainty Analysis and Information Theory**

**Conveners:** Amin Haghnegahdar<sup>1</sup>, Saman Razavi<sup>2</sup>, Steven Weijs<sup>3</sup>

**Co-chairs:** Amin Haghnegahdar<sup>1</sup> Saman Razavi<sup>2</sup>, Steven Weijs<sup>3</sup>

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### **Session Description**

Proper characterization of uncertainty and information remains a major challenge, and is inherent to many aspects of modelling such as structural development, hypothesis testing and parameter estimation, and the adequate characterization of forcing data and initial and boundary conditions. To address this challenge, methods for a) uncertainty analysis (UA) that seek to quantify uncertainty (and how it propagates through a system/model), and b) the closely-related methods for sensitivity analysis (SA) that evaluate the role and significance of uncertain factors (in the functioning of systems/models), have proved to be very helpful.

This session invites contributions on both theory and/or application of SA/UA methods applicable to all Earth and Environmental models (e.g. climatological or hydrological models). Contributions addressing any or all aspects of sensitivity/uncertainty, including those related to structural development, hypothesis testing, parameter estimation and model calibration, forcing data, and initial and boundary conditions are invited. Particular topics of interest include (but are not limited to):

- 1) Novel methods for effective characterization of sensitivity and uncertainty
- 2) Implications of SA/UA for model calibration and validation
- 3) Impact of input data uncertainty on model learning and performance
- 4) Single- versus Multi-criteria SA/UA
- 5) Metric specification for model evaluation
- 6) Improving the computational efficiency of SA/UA (efficient sampling, surrogate modelling, parallel computing, model pre-emption, etc.)

- 7) Information-theoretical analysis of uncertainty in (the interface between) models and data

**Note:** The proposed session is mainly intended for Hydrology and Glaciology, but due to its general scope it can be open to submission for both CGU and CSAFM members.

## **H06: Advances in Cold Regions Hydrology**

**Conveners:** John Pomeroy<sup>1</sup>, Howard Wheeler<sup>2</sup>, Sean Carey<sup>3</sup>, and Chris DeBeer<sup>2</sup>

**Co-chairs:** John Pomeroy<sup>1</sup>, Howard Wheeler<sup>2</sup>, Sean Carey<sup>3</sup>, and Chris DeBeer<sup>2</sup>

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### **Session Description**

Roughly half the world's population and all of Canada are dependent on water from cold regions, which are at the forefront of global warming and undergoing rapid change. The major hydrological events in cold regions are related to storage and melt of snow and ice and the related energetics of phase change, along with other cryospheric processes, resulting in a unique assemblage of hydrological processes and parameters that produce a very distinctive hydrological response. Because these regions will be strongly affected by climatic warming in the near future, we must advance our understanding of cold regions hydrological systems and their representation in numerical models to better manage uncertain water futures in the face of dramatically increasing risk. This session invites papers that describe recent advances in observations, process understanding, model development or model application in cold region environments. We particularly welcome papers that deal with the diagnosis of past hydrological change, shedding insight on the complexities of interacting cold region processes, or that focus on the application of models toward predicting future change in response to climate warming.

**Primary Affiliation:** Hydrology

## **H07: Surface Water and Groundwater in Coastal Environments: Research Innovations and Future Challenges**

**Conveners:** Barret L. Kurylyk<sup>1</sup>, and Jeffrey M. McKenzie<sup>2</sup>

**Co-chairs:** Barret L. Kurylyk<sup>1</sup>, and Jeffrey M. McKenzie<sup>2</sup>

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### **Session Description**

Canada borders three oceans and has the longest coastline of any country in the world, yet most of Canadian hydrology research has focused on environments far inland. Coastal environments are subject to many of the same hydrologic perturbations as inland environments (e.g. urbanization, over extraction, and changing climatic conditions), but they also face distinct challenges due to their proximity to the ocean. Examples include sea water intrusion into coastal aquifers, inundation and salinization from storm surges, and increasing population density resulting in intensified water demand in coastal communities. The hydraulic, chemical, and thermal regimes of coastal rivers are also influenced by tidal activity, and this high frequency forcing must be superimposed on low frequency alterations arising from climate change and sea level rise. This session welcomes all abstracts with a focus on the hydrology, hydrogeology, or river geomorphology of coastal aquatic environments and encourages submissions with field and/or modeling components that address future scientific challenges.

**Primary Affiliation:** CGU / Hydrology / Biogeoscience



## **H08: Snow Level and Precipitation: Trends, Extremes and Impacts**

**Conveners:** Mindy Brugman<sup>1</sup>, and Ron Stewart <sup>2</sup>

**Co-chairs:** Mindy Brugman<sup>1</sup>, and Ron Stewart <sup>2</sup>

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### **Session Description**

Snow Level is closely tied to Precipitation Intensity, and both factors change dramatically with individual weather systems and climate change. Modeling of the melting snow transition layer, through which precipitation melts from snow into rain is critical for accurate snow level forecasting. Also, the heavier the precipitation rate, the greater the cooling required in the atmosphere to melt the snow, and the lower the snow level. A series of interrelated processes occur in the melting snow transition layer that can be observed with a variety of instruments, and can be tracked with time. The intensity of precipitation is expected to increase with global warming, and there already is some suggestion that convective precipitation is increasing on earth. In recent years we have been experiencing repeated record breaking precipitation events, and impactful snow level changes. How more frequent will extreme events now occur? The impacts caused by more intense precipitation with or without rapidly varying snow levels, can be extreme. The current trends are for the snow level to rise, however with more intense precipitation it is possible deep snow will still accumulate at the highest elevations. All papers related to snow level and precipitation, from observations to modeling, past present and future are invited. Studies that provide new insight into remote sensing of melting snow layer properties and the physics controlling precipitation and snow level variations are invited. Innovative new methods are welcome, including isotopic applications. Studies that focus on precipitation intensity and detection of shifts and extremes are also welcome. Investigations on the impacts of past snow level and precipitation intensity changes are needed, to improve our understanding of current trends and extremes, so we can accurately warn and effectively prepare for change. In addition, related regional impact studies such as flooding, avalanche and water supply changes are welcome.

**Primary Affiliation:** Joint cgu/CSAFM/ Meteorology/ Hydrology/ Earth Surface Processes / Glaciology

## **H09: Measuring and modelling glacier change**

**Conveners:** [Alexandra Pulwicki](#)<sup>1</sup>, Laura Thomson<sup>2</sup>, Valentina Radic<sup>3</sup>, Brian Menounos<sup>4</sup>

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### **Session Description**

Measuring and modelling glacier change is central to understanding the current health of glaciers and for predicting future glacier change. Ice conditions and surface processes affect both the mass balance and flow characteristics of glaciers. While measurements of ice velocity and deformation, mass balance, and glacier hydrology have a long history, there are a number of opportunities and challenges that persist. Field and remote sensing techniques continue to provide new data about environmental and ice conditions, such as energy balance and ice velocity. This allows for finer resolution of variables that affect glaciers, including ice formation and melt as well as hydrological conditions. Replicating these observations with physically-based and statistical models and interpreting the results often provides a new understanding of factors that control glacier change but the spatial and temporal variability can make it difficult to generalize interpretations. This session will focus on research that aims to increase our knowledge about glacier change through novel field observations, physically-based and statistical models, as well as remote sensing. We welcome submissions that address questions of how to better understand and represent spatial and temporal changes of mass balance and ice change.

**Primary Affiliation:** Hydrology and Glaciology

## **H10: Catchment hydrological and biogeochemical behaviour in human-dominated landscapes**

**Conveners:** Claire Oswald<sup>1</sup>, Merrin Macrae<sup>2</sup> and Christopher Wellen<sup>3</sup>  
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### **Session Description**

Urban, urbanizing and agricultural landscapes (i.e. where we live and where we get our food from) are ubiquitous across Canada. Alterations to drainage networks and elevated inputs of materials such as nutrients, salts, metals, and organic compounds have fundamentally changed the hydrological and biogeochemical functioning of these areas. The goal of this session is to bring together a broad range of research that examines the impacts of human alterations to the landscape to coupled hydrological and biogeochemical processes. Some themes of interest include, but are not limited to, impacts of extreme weather events on hydro-biogeochemical fluxes, agricultural intensification and the functioning of mixed urban and agricultural basins. Studies that address scaling effects and/or use novel field- and modelling-based approaches to explicitly link water sources and flow pathways to biogeochemical patterns are especially encouraged.

**Primary Affiliation:** CGU / Hydrology / Biogeoscience

## **H11: Hydro-ecological and hydrogeomorphic impacts of forest disturbance and management**

**Conveners:** Jim Buttle<sup>1</sup>, Irena Creed<sup>2</sup> and Brett Eaton<sup>3</sup> and Dan Moore<sup>4</sup>  
**Co-chairs:** Jim Buttle<sup>1</sup>, Irena Creed<sup>2</sup> and Brett Eaton<sup>3</sup> and Dan Moore<sup>4</sup>

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### **Session Description**

Changes in forest cover associated with forest management and natural disturbance can have profound influences on hydrologic processes, nutrient cycling, sediment transport, channel morphology, water quality and aquatic habitat. It is important for managers and decision-makers to understand the nature of these changes in order to anticipate how they will influence ecosystem services. However, it is difficult to isolate the effects of forest cover change from background climatic variability, especially in the context of ongoing climate change and legacy effects of historic harvesting practices and past disturbances. This session aims to provide a platform for presenting research that provides new insights into the hydrologic, hydro-ecological and hydrogeomorphic consequences of forest cover changes at all spatial scales, from small plots to large regions, based on field research, empirical analysis of hydroclimatic data sets and simulation modelling. In addition to fundamental research on topics such as the effects of forest succession on water and nutrient budgets, we welcome presentations based on applied research, such as experimental studies of alternative riparian management impacts on water quality and aquatic habitat, or the effects of roads on runoff generation or sediment budgets.

**Primary Affiliation:** Hydrology, Biogeosciences, Earth Surface Processes

## **H12: Glacier Hydrology: On, In and Under the Ice**

**Conveners:** Anna Grau Galofre<sup>1</sup>, Leonora King<sup>2</sup>, and Gwenn Flowers<sup>3</sup>

**Co-chairs:** Anna Grau Galofre<sup>1</sup>, and Leonora King<sup>2</sup>, and Gwenn Flowers<sup>3</sup>

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### **Session Description**

Rising temperatures are extending glacier and ice-sheet ablation zones, increasing surface melt and inducing higher diurnal and seasonal variability in meltwater supply. This meltwater can be stored at the surface of the ice in supraglacial lakes or transported in channels, and can be delivered down to the ice-bedrock interface, opening en- and sub-glacial waterways. Drainage pathways developed by meltwater at the ice-bed interface influence ice flow mechanisms. Meltwater input and variability can result in an increase or decrease in ice velocities, including the development or termination of glacier surges, and the onset of catastrophic floods. Advances in remote sensing techniques, modelling, and field studies are key to characterizing the spatial and temporal dynamics of these supra-, en-, and sub-glacial drainage structures as well as their formative mechanisms. The morphology of these waterways reflects the cumulative effects of their discharge rates and meltwater supply, the dynamics and characteristics of their glacial substrates, and the role of mechanical and thermal erosion. The goal of this session is to bring together insights from glacier hydrology modelling, field observations and remote sensing to improve our understanding of the role of meltwater in ice dynamics, the formation and morphological characteristics of drainage systems, and the onset of catastrophic floods. In particular, we welcome contributions addressing the formative mechanisms of subglacial and englacial channels, the role of thermal and mechanical erosion, and the morphologic characteristics of the drainage pathways. Advancing our understanding of the role of meltwater in ice-flow dynamics is key to improving predictions regarding the rate of ice loss and rise of eustatic sea level, as well as assessing the risk of glacier outburst floods.

**Primary Affiliation:** Specific / CGU / Glaciology / Hydrology / Earth Surface Processes/ Quaternary Sciences.

### **H13: Advances in Hydroecology in Canada**

**Convenors:** Daniel Peters<sup>1</sup>, Wendy Monk<sup>2</sup>

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#### **Session Description:**

The objective of the Hydroecology Committee is to promote and advance the understanding of the linkages between hydrology and ecology in wetland, lake, and river systems across Canada. The goal of this session organized by the Chairs of the Hydroecology Committee is to convene scientists who are investigating the role of hydrology in influencing ecological processes and integrity in ecosystems across Canada. Topics of interest include, but not limited to: anthropogenic effects (e.g. climate change, flow regulation and resource development) on runoff generation and storage, such as on low flow and flood events, with implications for riverine and riparian/delta floodplain environments; development of hydroecological models and remote sensing monitoring approaches; environmental flows; hydrological connectivity and ecological integrity; hydroecological indicators.

## **H14: General Hydrology**

**Conveners:** Claire Oswald<sup>1</sup>, and Daniel Peters<sup>2</sup>  
**Co-chairs:** Claire Oswald<sup>1</sup>, and Daniel Peters<sup>2</sup>

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### **Session Description**

This session invites contributions from all aspects of hydrology, in particular those not covered by a special session.

**Primary Affiliation:** CGU / Hydrology