



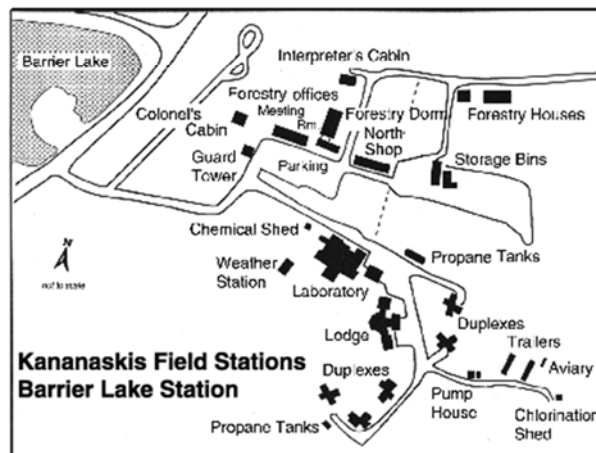
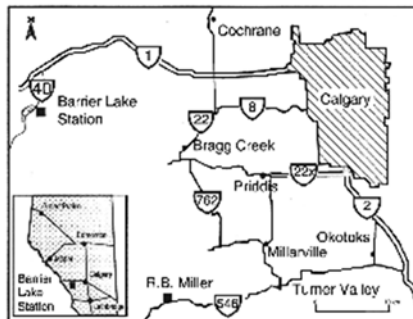
International Network for Alpine Research Catchment Hydrology *Inaugural Workshop*

22-24 October, 2015

Barrier Lake Field Station

Kananaskis Country, Alberta, Canada

Thursday, 22 October 2015		
Day 1:	Breakfast 8:00 am	
9:30am	Tour of Canadian Rockies Hydrological Observatory – Fortress Mountain Meet at Barrier Lake Field Station	John Pomeroy, May Guan
<i>Brown bag lunch in field</i>		
4pm	Tour of Coldwater Laboratory, Barrier Lake Field Station	John Pomeroy, Angus Duncan
6:00pm	<i>Dinner at Barrier Lake Field Station Lodge</i>	



Friday, 23 October 2015		All Sessions in Barrier Lake Field Station, Main Laboratory Meeting Room	
Day 2:		Breakfast 8:00 am Barrier Lake Field Station Lodge	
Session 1: Introduction, Opening		Chair: Georg Kaser	
8:30am	Welcome, objectives and introduction of attendees	John Pomeroy	
9:00am	Importance of mountain headwaters to Alberta	John Diiwu	
9:20am	Context of mountain observations and modelling in GEWEX's CCRN and large scale hydroclimatic change	Howard Wheeler	
9:40am	Mountain water resources, climate change – UNESCO's interest	Anil Mishra (remote presentation)	
10:00am	<i>Coffee</i>		
Session 2: Mountain Measurements and Observations I		Chair: Howard Wheeler	
10:20am	Austria and Tropical Glaciers	Georg Kaser	
10:40am	United States – NASA JPL	McKenzie Skiles	
10:55am	United States - NCAR	Ethan Gutmann	
11:10am	Switzerland	Tobias Jonas	
11:30am	Germany	Matthias Bernhardt	
11:50pm	China	Junfeng Liu	
12:10pm	Spain	Ignacio Lopez Moreno	
12:30pm	<i>Lunch</i> Barrier Lake Field Station Lodge		
Session 2: Mountain Measurements and Observations II		Chair: John Diiwu	
1:20pm	France	Isabella Zin	
1:40pm	Chile	James McPhee	
2:00pm	Canadian Rockies Hydrological Observatory	John Pomeroy	
2:15pm	Lake O'Hara, BC and related studies	Masaki Hayashi	
2:30pm	Haig Glacier, AB and related studies	Shawn Marshall	
2:45pm	Cariboo Mountains, BC and related studies	Stephen Dery	
3:00pm	<i>Coffee</i>		
3:20pm	<i>Discussion</i> - recommendations for common measurement strategies, collaboration, and archiving and accessing datasets	Lead: Matthias Bernhardt Rapporteur: James McPhee	
Session 3: Groundwater, Snow, Glaciers and Hydrology		Chair: Ethan Gutmann	
4:00pm	The role of groundwater in alpine hydrology	Masaki Hayashi	
4:20pm	The role of glaciers in alpine hydrology	Georg Kaser	
4:40pm	The role of snow in alpine hydrology	Matthias Bernhardt	
5:00pm	Integrating alpine hydrology into river basin hydrology	James McPhee	
5:20pm	<i>Discussion</i> –persistent scientific uncertainties, recommendations to address improvements	Lead: Ignacio Lopez Moreno Rapporteur: McKenzie Skiles	
6:30pm	<i>Dinner at Barrier Lake Field Station Lodge</i> Speaker: Robert Sandford, United Nations University "Transforming Our World: Hydro-Climatic Change & It's Consequences"		

Saturday, 24 October 2015			All Sessions in Barrier Lake Field Station, Main Laboratory Meeting Room		
Day 3:			Breakfast 8:00 am Barrier Lake Field Station Lodge		
Session 4:		Developing, Intercomparing and Downscaling Models		Chair: Ignacio Lopez Moreno	
8:40am	Advances in snow modelling in Switzerland	Tobias Jonas			
9:00am	Snow model intercomparisons	Richard Essery (remote presentation)			
9:20am	Downscaling atmospheric models	Ethan Gutmann			
9:40am	Validating the Airborne Snow Observatory	McKenzie Skiles			
10:00am	<i>Coffee</i>				
10:20am	<i>Discussion</i> – testing and improving model physics, downscaling, and parameterisations	Lead: Ethan Gutmann Rapporteur: Tobias Jonas			
Session 5:		Modelling Changing Mountain Hydrology and Climate I		Chair: Matthias Bernhardt	
11:00am	Cold Regions Hydrological Model – background and modelled alpine snow and hydrological change in North America	John Pomeroy, Xing Fang, Kabir Rasouli, Danny Marks			
11:20am	Snow and glacier change modelling in the French Alps	Isabella Zin			
11:40am	Snow change modelling by the Spanish National Research Council (CSIC)	Ignacio Lopez Moreno			
12:00am	Glacier change modelling in Canada	Shawn Marshall			
12:20am	Mountain snow and hydrological change modelling	Stephen Dery			
12:40pm	<i>Lunch</i> Barrier Lake Field Station Lodge				
Session 6:		Modelling Changing Mountain Hydrology and Climate II		Chair: Tobias Jonas	
1:30pm	Snow and glacier change modelling in the Chilean Andes	James McPhee			
1:50pm	Glacier change modelling in the tropics	Georg Kaser			
2:10pm	<i>Discussion</i> - common numerical experiments to assess the climate sensitivity of alpine snow and ice hydrology regimes around the world – synthesis project and paper	Lead: John Pomeroy Rapporteur: Ignacio Lopez Moreno			
3:10pm	<i>Coffee</i>				
Session 7:		Synthesis		Chair: James McPhee	
3:30pm	<i>Discussion</i> - network structure, function and future activities	Lead: John Pomeroy Rapporteur: Isabella Zin			
4:10pm	Wrap-up – concluding comments, workshop “statement” and roundtable	Lead: John Diiwu Rapporteur: Paul Whitfield			
5:00pm	<i>Dinner</i> Barrier Lake Field Station Lodge				
7:30pm	<i>Bonfire: Pomeroy's House: 197 Carey, Canmore</i>				
Sunday, 25 October 2015			Breakfast 8:00 am Barrier Lake Field Station Lodge		

INARCH

A cross-cut project of the Global Energy and Water Exchanges Project (GEWEX), World Climate Research Programme that also delivers scientific input to UNESCO's International Hydrological Programme. INARCH focusses on improving understanding and prediction of mountain hydrology through alpine research catchments so as to evaluate mountain water resources under global change. www.usask.ca/inarch

INARCH Science Steering Group

John Pomeroy (Canada), Chair

Yaoming Ma (China)

Xin Li, (China)

Tobias Jonas (Switzerland)

James McPhee (Chile)

Ignacio Lopez Moreno (Spain)

Matthias Bernhardt (Germany)

Ulli Strasser (Austria)

Danny Marks (USA)

Vincent Vionnet (France)

INARCH Objectives

The overall objective is to better understand alpine cold regions hydrological processes, improve their prediction and find consistent measurement strategies.

To achieve this objective it is necessary to develop transferable and validated model schemes of different complexity that can support research in data sparse mountain areas.

This leads to the following research questions relating to alpine hydrology and related snow and glacier studies and hydrometeorology:

- i) How different are the measurement standards and the standards for field sampling and do we expect distinctive differences in model results and hydrological predictability because of the sampling schemes, data quality and data quantity?
- ii) How do the predictability, uncertainty and sensitivity of catchment energy and water exchange vary with changing atmospheric dynamics in various high mountain regions of the Earth?
- iii) What improvements to high mountain energy and water exchange predictability are possible through improved physics in land surface hydrological models, improved downscaling of atmospheric models in complex terrain, and improved approaches to data collection and assimilation of both in-situ and remotely sensed data?
- iv) Do the existent model routines have a global validity, are they transferable and are they meaningful in different mountain environments?
- v) How do transient changes in perennial snowpacks, glaciers, ground frost, soil stability, and vegetation impact models of water and energy cycling in high mountain catchments?

This workshop was made possible with support from the Global Institute for Water Security and the Centre for Hydrology, University of Saskatchewan, the Biogeoscience Institute, University of Calgary, the Alberta Dept. of Agriculture and Forestry and the World Climate Research Programme through the World Meteorological Organisation.

Attendees – INARCH Inaugural Workshop

Anil Mishra – UNESCO, Paris, France (remote)
Ethan Gutmann – NCAR, Boulder, USA
Georg Kaser – Univ. Innsbruck, Austria
Howard Wheeler – Univ. Saskatchewan, Saskatoon, Canada
Ignacio Lopez-Moreno – Inst Pyrenean Ecology, Zaragoza, Spain
Isabella Zin – Univ. Grenoble Alps, France
James McPhee – Univ. Chile, Santiago, Chile
John Diiwu – Alberta Agriculture and Forest, Edmonton, Canada
Junfeng Liu – Chinese Academy of Sciences, Lanzhou, China
Matthias Bernhardt – BOKU, Vienna, Austria
Richard Essery, Univ. Edinburgh, UK (remote)
Robert Sandford, UN University, Hamilton, Canada
Masaki Hayashi – Univ. Calgary, Canada
Andrius Paznekas – Univ. Calgary, Canada
Barret Kurylyk – Univ. Calgary, Canada
Jordan Harrington – Univ. Calgary, Canada
Craig Christensen – Univ. Calgary, Canada
Laura Beamish – Univ. Calgary, Canada
McKenzie Skiles – NASA, JPL, USA
Shawn Marshall – Univ. Calgary, Canada
Wendy Wood – Univ. Calgary, Canada
Samira Samimi – Univ. Calgary, Canada
Samaneh Ebrahimi – Univ. Calgary, Canada
Ritu Nath – Univ. Calgary, Canada
Stephen Dery – UNBC, Prince George, Canada
Michael Allchin – UNBC, Prince George, Canada
Tobias Jonas – SLF, Davos, Switzerland
John Pomeroy – Univ. Saskatchewan, Saskatoon, Canada
Kabir Rasouli – Univ. Saskatchewan, Kananaskis, Canada
Xing Fang – Univ. Saskatchewan, Kananaskis, Canada
Michael Schirmer – Univ. Saskatchewan, Kananaskis, Canada
Jono Conway – Univ. Saskatchewan, Kananaskis, Canada
Paul Whitfield – Environment Canada, Kananaskis, Canada
May Guan – Univ. Saskatchewan, Kananaskis, Canada
Angus Duncan – Univ. Saskatchewan, Kananaskis, Canada
Nicolas Leroux – Univ. Saskatchewan, Kananaskis, Canada
Nikolas Aksamit – Univ. Saskatchewan, Kananaskis, Canada
Dhiraj Pradhananga – Univ. Saskatchewan, Kananaskis, Canada
& Tribhuvan Univ., Kathmandu, Nepal