The IP3 Network: Improved Processes and Parameterisation for Prediction in Cold Regions

Julie Friddell[1], John Pomeroy[1], Sean Carey[2], Al Pietroniro[3], William Quinton[4]

IP3 Users' Workshop
19 March 2008

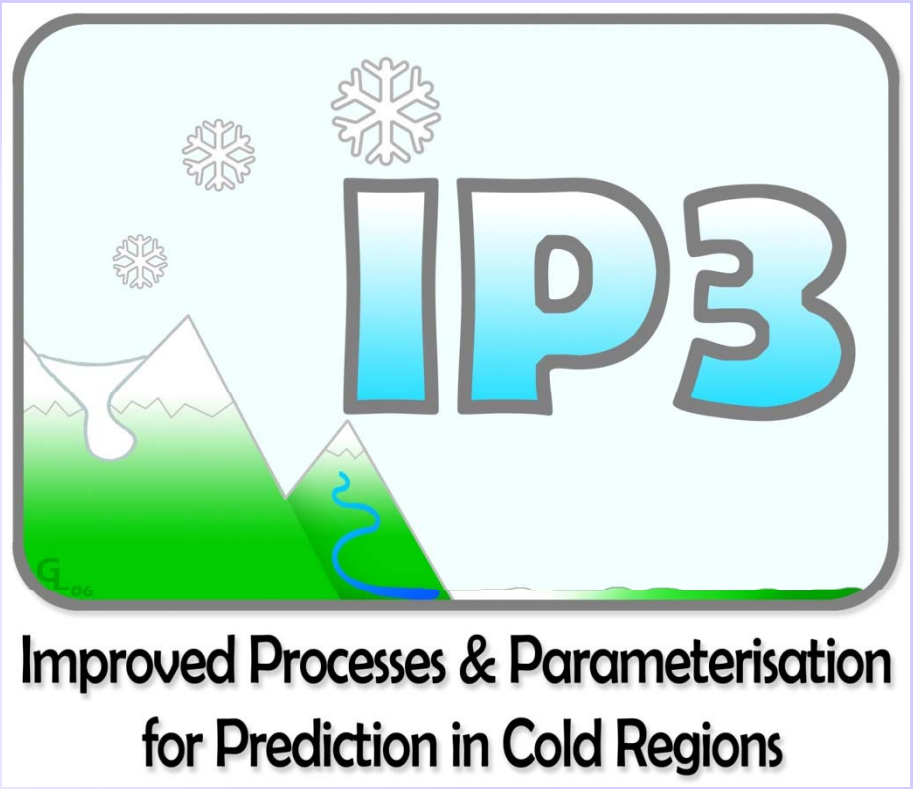
[1]University of Saskatchewan; [2]Carleton University; [3]NHRC, Environment Canada; [4]Wilfrid Laurier University

IP3...

...is devoted to understanding **water supply** and **weather systems** in cold regions (Rockies and western Arctic)

...will contribute to better prediction of regional and local **weather, climate, and water resources** in cold regions, including ungauged basin **streamflow,** changes in **snow and water supplies,** and calculation of **freshwater inputs** to the Arctic Ocean

...has organized a **Users' Advisory Committee** to guide development of relevant **data and model outputs**



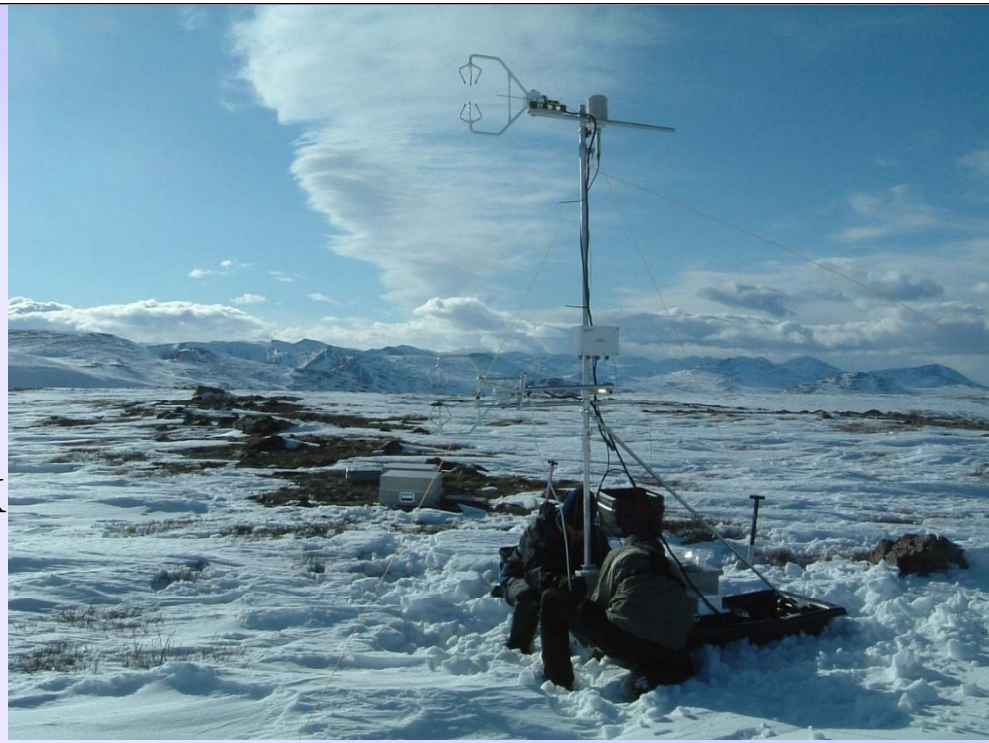
Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)

Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

Network Investigators

Sean Carey, Carleton University
Richard Essery, University of Wales, Aberystwyth
Raoul Granger, National Hydrological Research Centre, Environment Canada
Masaki Hayashi, University of Calgary
Rick Janowicz, Yukon Department of Environment
Philip Marsh, University of Saskatchewan/NHRC, Environment Canada
Scott Munro, University of Toronto
Alain Pietroniro, Univ. of Sask./NHRC, Env. Canada
John Pomeroy (PI), University of Saskatchewan
William Quinton, Wilfrid Laurier University
Ken Snelgrove, Memorial University of Newfoundland
Ric Soulis, University of Waterloo
Chris Spence, University of Saskatchewan/NHRC, Environment Canada
Diana Verseghy, University of Waterloo/MSC, Environment Canada
(people in bold are on Scientific Committee)

Collaborators



Peter Blanken, University of Colorado
Tom Brown, University of Saskatchewan
Doug Clark, Centre for Ecology & Hydrology, UK
James Craig, University of Waterloo
Bruce Davison, HAL - Environment Canada
Mike Demuth, Natural Resources Canada
Vincent Fortin, MRD - Environment Canada
Ron Goodson, HAL - Environment Canada
Richard Heck, University of Guelph
Newell Hedstrom, NHRC - Environment Canada
Chris Hopkinson, Applied Geomatics Research Group
Tim Link, University of Idaho
Murray Mackay, CRD - Environment Canada
Danny Marks, USDA - Agricultural Research Service
Joni Onclin, University of Saskatchewan
Bob Reid, INAC- Water Resources
Nick Rutter, University of Sheffield, UK
Rob Schincariol, Univ. of Western Ontario
Frank Seglenieks, University of Waterloo
Kevin Shook, University of Saskatchewan
Mike Solohub, University of Saskatchewan
Uli Strasser, LMU, Munich, Germany
Bryan Tolson, University of Waterloo
Brenda Toth, HAL - Environment Canada
Cherie Westbrook, Univ. of Saskatchewan
Adam Winstral, USDA - ARS

Partners

Alberta Environment
Cold Regions Research Centre, Wilfrid Laurier Univ.
Diavik Diamond Mines, Inc.
Environment Canada
- Climate Research Division (CRD)
- Hydrometeorology & Arctic Laboratory (HAL)
- Meteorological Research Branch (MRB)
- National Water Research Institute (NWRI)
- Water Survey of Canada

GEWEX/GLASS
Climate and Cryosphere Project (CliC) of the WCRP
Indian and Northern Affairs Canada - Water Resources
International Polar Year (IPY) - Arctic Hydra
International Polar Year (IPY) - Cold Land Processes
Natural Resources Canada
Northwest Territories Power Corporation
Predictions in Ungauged Basins (PUB)
USDA Agricultural Research Service
Parks Canada
Saskatchewan Watershed Authority
Yukon Environment

Board of Directors

Ming-Ko Woo (Chair) – McMaster University

Tim Aston – CFCAS

Dan Moore – University of British Columbia

John Pomeroy (PI)

Bob Reid – Indian and Northern Affairs Canada, Yellowknife

Vincent Fortin – Environment Canada, Montreal

Julie Friddell (Secretary)

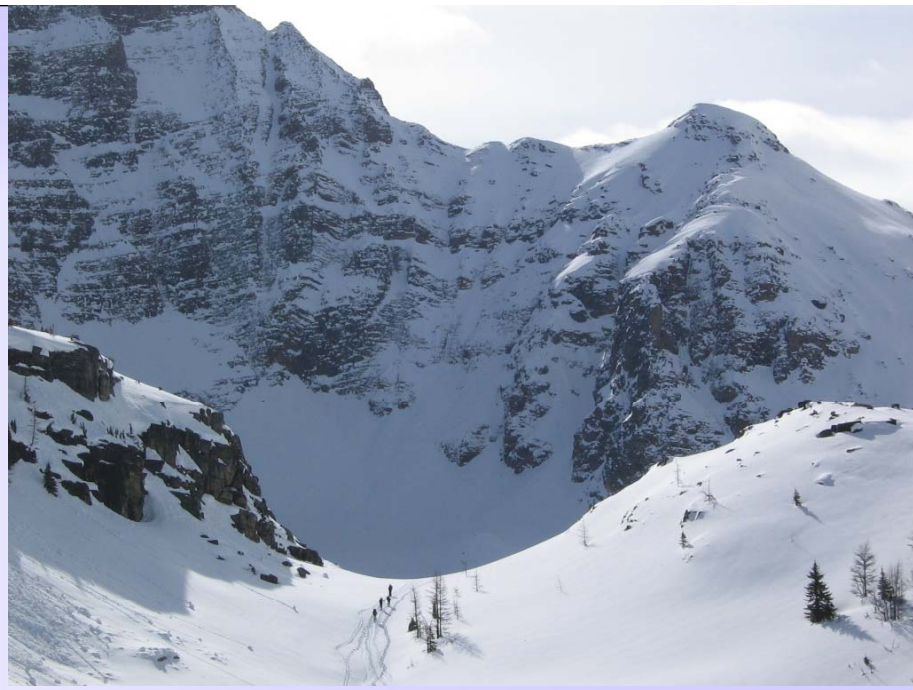
Users' Advisory Committee

- Public and private – community, government, industry,…
- Goal is to provide information that can be used in regional planning/policy making, streamflow forecasting, water management, environmental conservation, and northern development
- Interactive workshops for outreach to practitioners and feedback on applicability of research

Users' Advisory Committee

Bob Reid (Chair), INAC – Water Resources
Mark Bennett, Bow River Basin Council
Ian Church, Canadian IPY/Yukon Gov't
Ken Dies, Northwest Territories Power Corporation
John Diiwu, AB Sustainable Resource Dev.
Steve Donelon, Kananaskis Country Park
Derek Faria, INAC – Water Resources
Anil Gupta, AB Environment
Shelley Humphries, Parks Canada
Ed Johnson, Biogeoscience Institute (UofC)
Kristina Koenig, Manitoba Hydro
David Morrison, Yukon Energy Corporation
Edward Reeves, Deline Renewable Resources Council
Robert Sandford, Western Watersheds Climate Research Collaborative
Wanli Wu, Parks Canada
John Pomeroy (U. Sask.) and Chris Spence (Env. Canada/NHRC), Ex officio
Julie Friddell, IP3 Network Manager

Why IP3?



- Need to forecast changing annual flow/ peak discharge in streams and rivers in the Rockies and North
- Increasing consumptive use of Rocky Mountain water in Prairie Provinces
- Uncertainty in engineering design for resource (oil & gas, diamond and other mines) development and restoration activities in small to medium size ‘ungauged’ basins
- Opportunity to include cold regions processes in coupled atmospheric-hydrological models to reduce uncertainty in:

  Atmospheric impacts on water resources

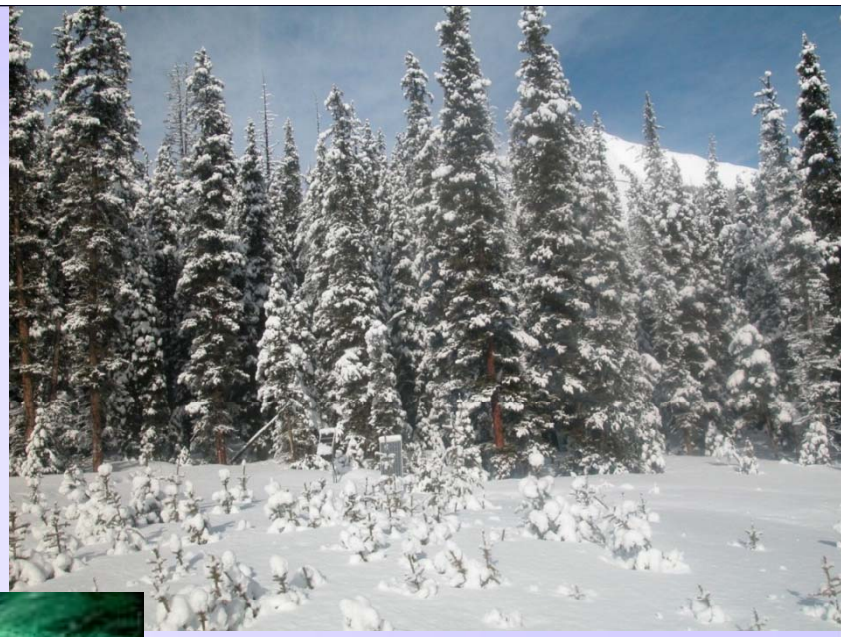
  Simulation of land-atmosphere interaction

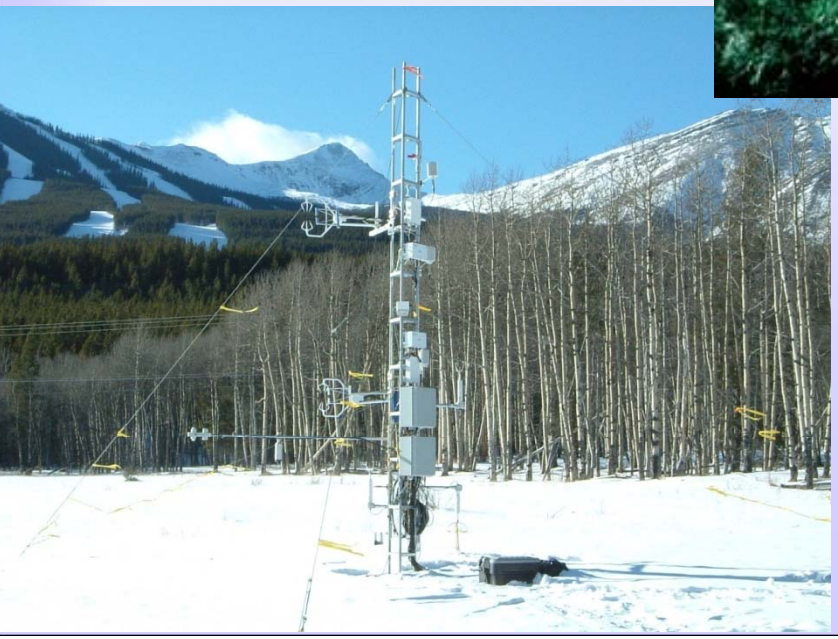
  Cycling and storage of water

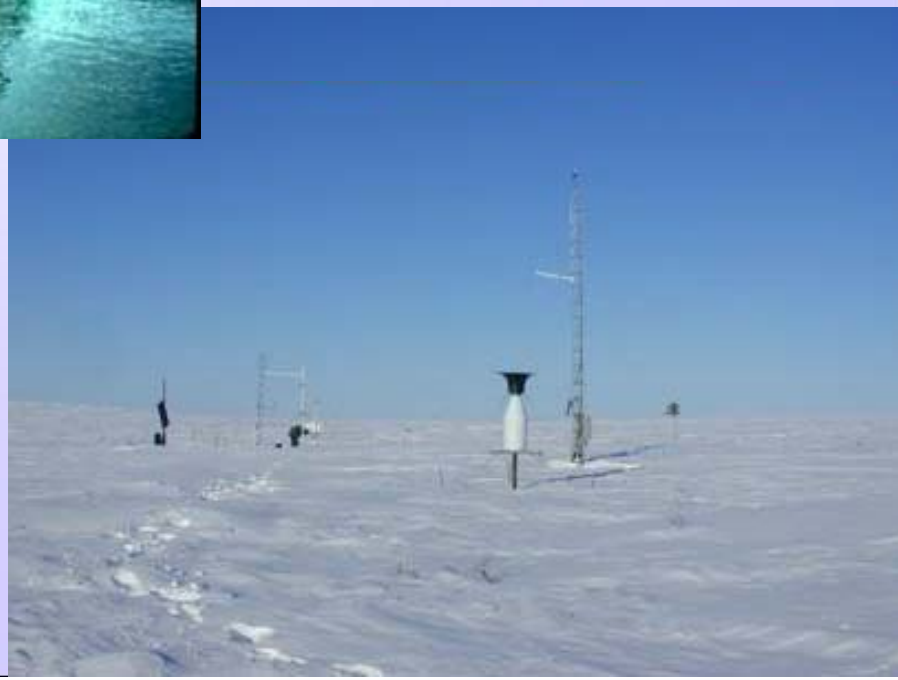
  Prediction of future climate change

Processes

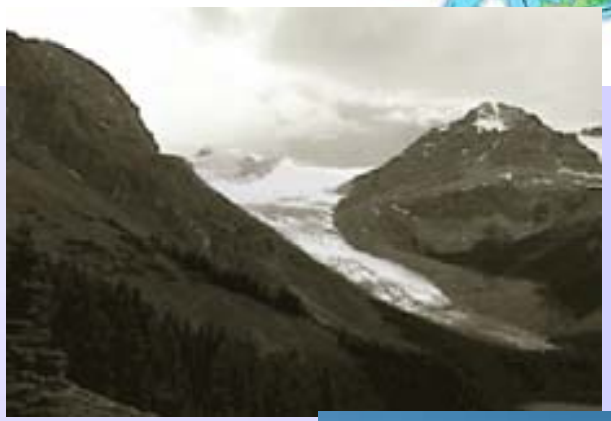
→ Multi-scale observations of effect of radiation, wind, vegetation, and topography on the interaction between snow, water, soil, and air







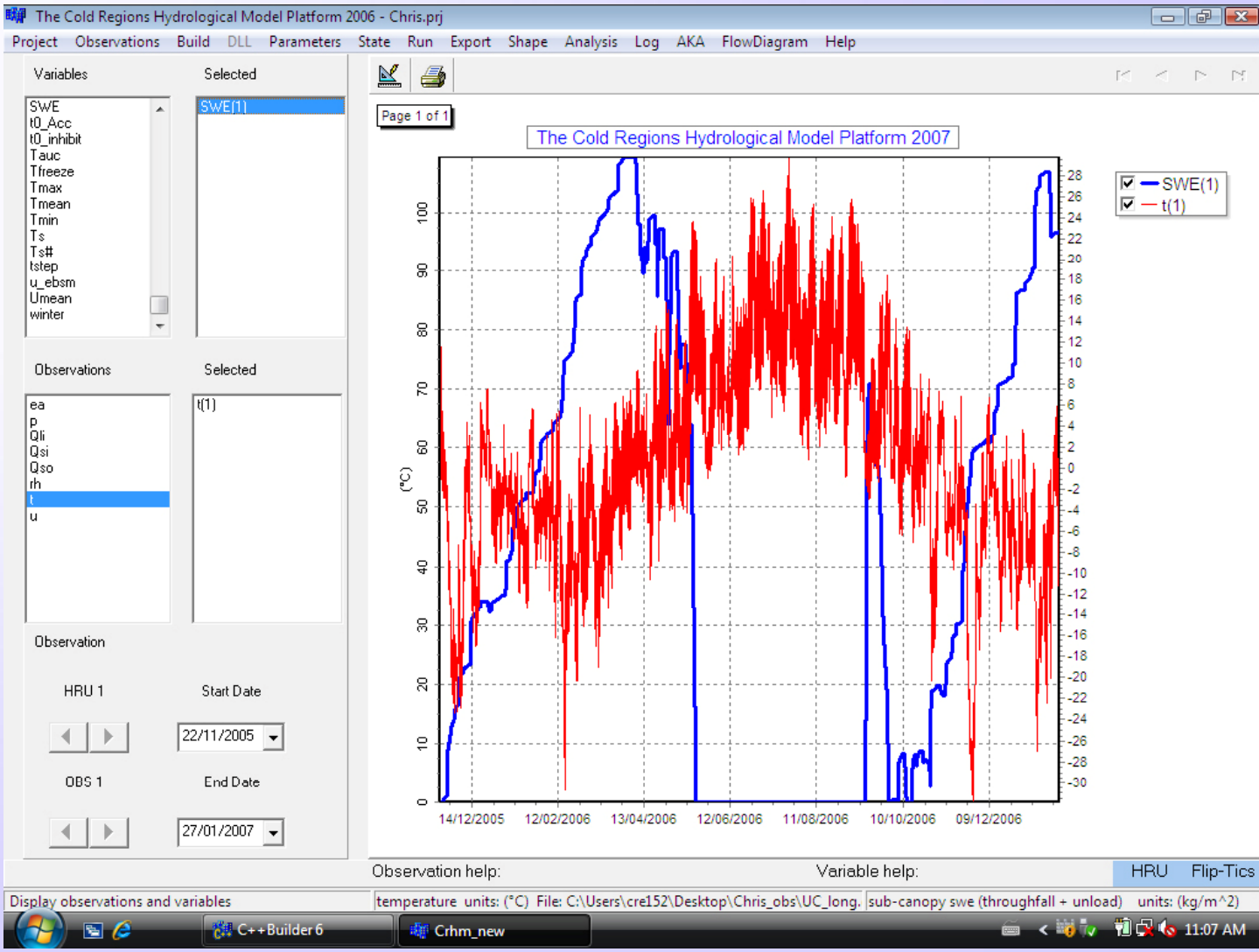
IP3 Research Basins



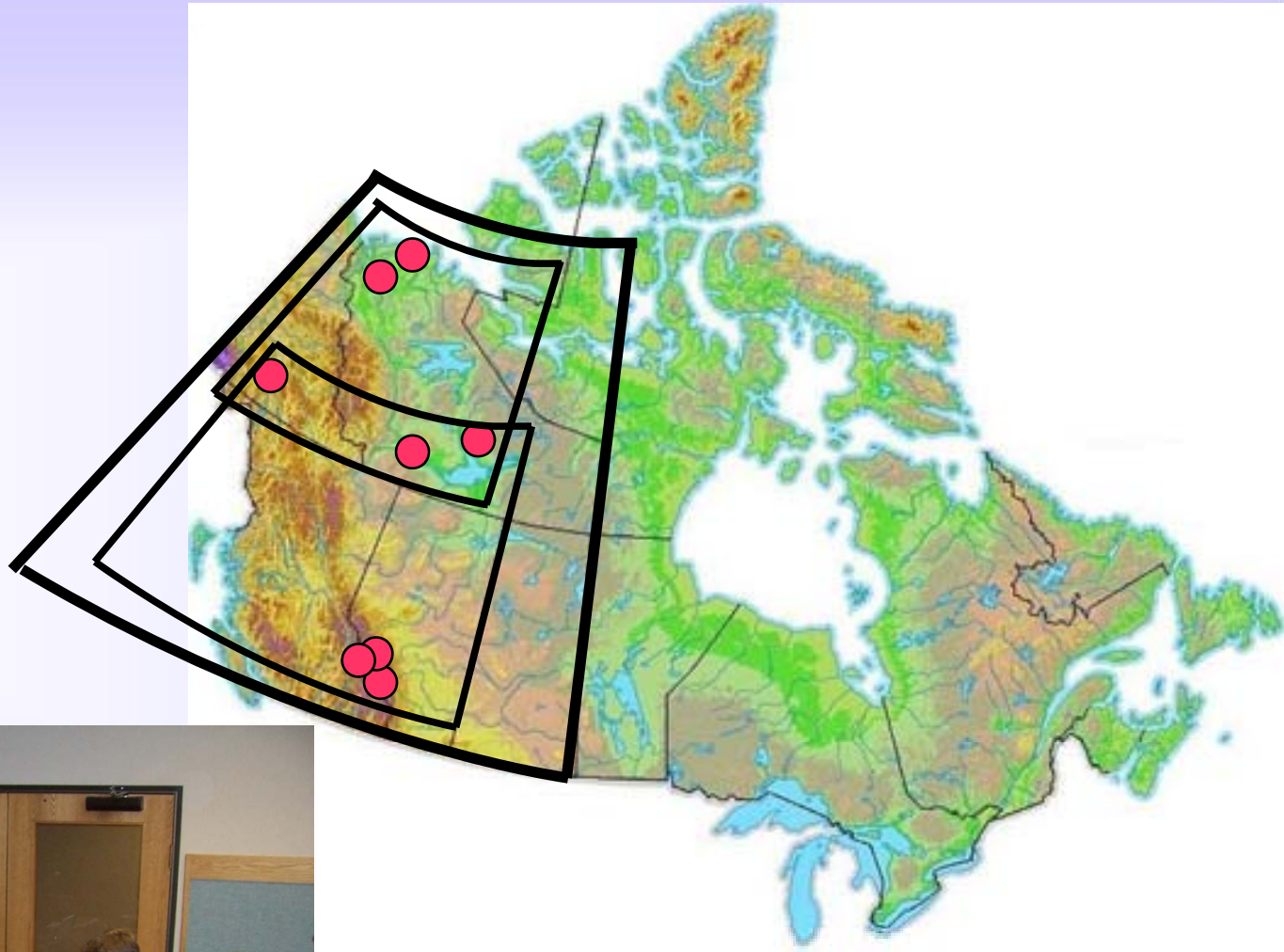
Parameterisation

→ Scaling of hydrological processes

→ Minimize model complexity while reproducing the essential behaviour of the system



Prediction



→ Water resources (storage, discharge, snow cover, soil moisture), atmosphere-ground interaction (evaporation), and weather and climate

IP3 Final Outputs

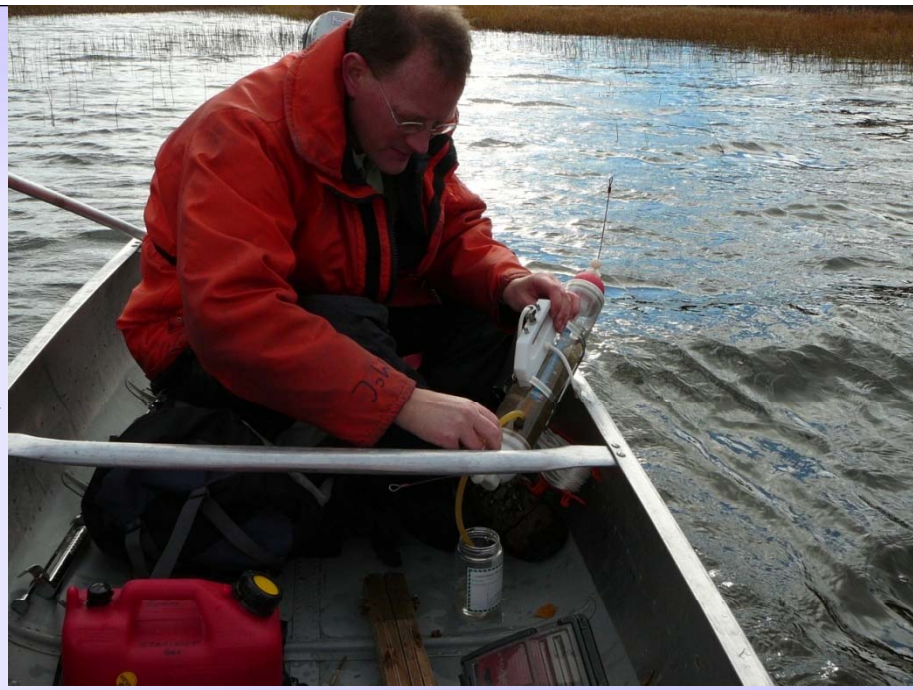
- Improved understanding of cold regions hydrological processes at multiple scales
- Unique observational archive of research basin data
- More effective incorporation of cold regions processes into hydrological and meteorological models (CRHM, MEC/MESH, GEM, etc.)
- Improved environmental predictive capability in cold regions in response to greater water resource demands:

  → Enhanced hydrological and atmospheric model performance at multiple spatial scales *and at scales requested by users*

  → Improved streamflow prediction in ungauged basins with less calibration of model parameters from gauged flows

  → Improved weather and climate prediction due to rigorous model development and testing

Recent Activities



- All 8 research basins fully instrumented and field campaigns on-going (spring)
- CLASS 3.3 finalized
- CRHM – initialized for most basins, participated in SnowMIP2, many new parameterisations added
- MEC/MESH – initialized for several basins, recent training workshop
- Supplementary proposal submitted to CFCAS for new outreach and data management support

Thank you!

Please visit us at www.usask.ca/ip3

Thank you to IP3 participants for providing photos!