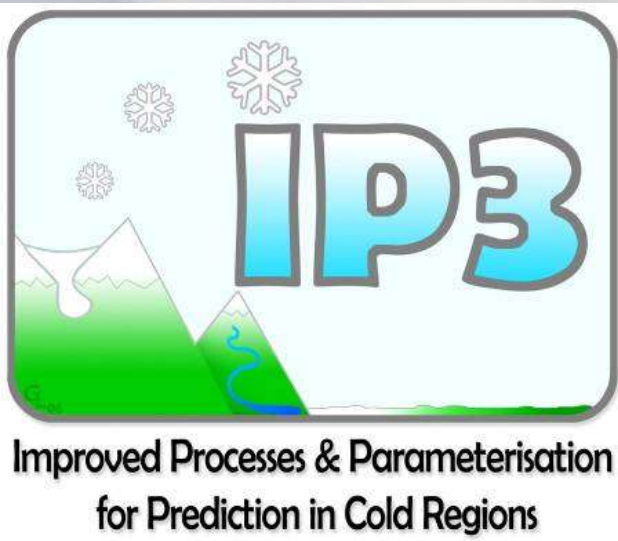


The IP3 Research Network: Enhancing Understanding of Water Resources in Canada's Cold Regions



John Pomeroy & the IP3 Network

www.usask.ca/ip3



Canadian Foundation for Climate
and Atmospheric Sciences (CFCAS)

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

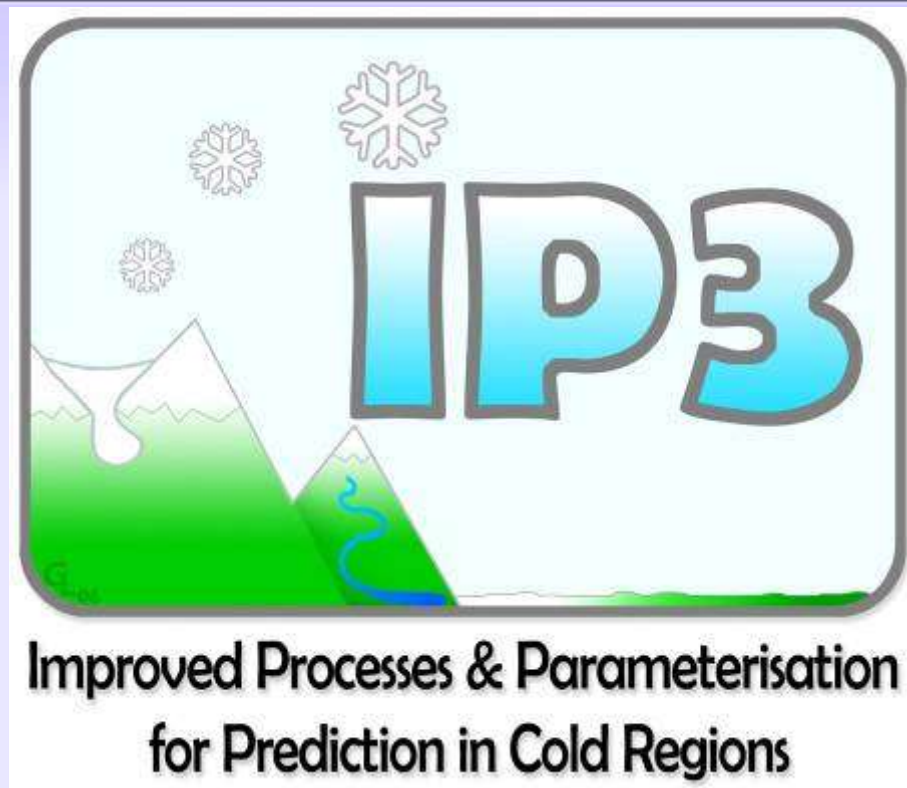
IP3...

- * ...is devoted to understanding **water supply** and **weather systems** in cold Regions at high altitudes and high latitudes (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

- * ...is composed over about 40 investigators and collaborators from Canada, USA, UK, France, Germany

- * ...runs from 2006-2010



Why IP3?

- ★ Need to forecast changing flow regime of streams and rivers in the Western Cordillera and North
- ★ Increasing consumptive use of Rocky Mountain water in Prairie Provinces
- ★ Uncertainty in design for resource (oil & gas, diamond, etc) development and restoration activities in small to medium size, headwater 'ungauged' basins
- ★ Opportunity to improve cold regions snow, ice, frost, soil and water processes in models to reduce predictive uncertainty in:
 - Atmospheric impacts on snow, ice and water resources
 - Simulation of land-cryosphere-atmosphere interaction
 - Cycling and storage of water, snow and ice
 - Prediction of future climate change



IP3 Network Investigators

Sean Carey, Carleton University

Richard Essery, Edinburgh University

Raoul Granger, Environment Canada

Masaki Hayashi, University of Calgary

Rick Janowicz, Yukon Environment

Philip Marsh, University of Saskatchewan

Scott Munro, University of Toronto

Alain Pietroniro, University of Saskatchewan

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

Diana Verseghy, Environment Canada

(people in bold are on Scientific Committee)



IP3 Collaborators

Peter Blanken, University of Colorado

Doug Clark, Centre for Ecology & Hydrology, UK

Bruce Davison, McGill University

Mike Demuth, Natural Resources Canada

Vincent Fortin, MRD - Environment Canada

Ron Goodson, HAL - Environment Canada

Chris Hopkinson, Centre of Geographic Sciences, NS

Tim Link, University of Idaho

Newell Hedstrom, NWRI - Environment Canada

Richard Heck, University of Guelph

Joni Onclin, University of Saskatchewan

Murray Mackay, CRD - Environment Canada

Danny Marks, USDA - Agricultural Research Service

Nick Rutter, University of Sheffield, UK

Frank Seglenieks, University of Waterloo

Mike Solohub, University of Saskatchewan

Brenda Toth, HAL - Environment Canada

Cherie Westbrook, University of Saskatchewan

Jean Emmanuel Sicart, IRD France

Stefan Pohl, Germany



Bob Reid, Indian and Northern Affairs Canada

Rob Schincariol, Univ. of Western Ontario

Kevin Shook, University of Saskatchewan

Uli Strasser, LMU, Munich, Germany

Bryan Tolson, University of Waterloo

Adam Winstral, USDA – ARS

James Craig, University of Waterloo

IP3 Secretariat

Housed at Centre for Hydrology,
Kirk Hall University of Saskatchewan,
Saskatoon, and at UNBC, Prince George

- Terrabyte Server for Data and Model
- Archive
- Website, FTP
- CRHM/MESH repository
- Unix Workstation
- High Speed Link to NHRC HAL Computing Cluster



Julie Friddell, Network Manager, Secretary of SC, Secretary of BOD,
Nadine Kapphahn (UNBC), IP3/WC²N Outreach Coordinator

TBD, IP3/WC²N Information and Data Manager

Edgar Herrera, GEM Modeller

Tom Brown, CRHM Modeller

IP3 Science Focus

- Snow – redistribution, accumulation, sublimation, radiative transfer and melt
- Forests – effect on radiative and turbulent transfer to snow and frozen ground
- Glaciers - interactions with the atmosphere
- Frozen ground – freezing, thaw, water transmission and storage
- Lakes/Ponds – advection, atmospheric fluxes, heat storage, flow in drainage systems

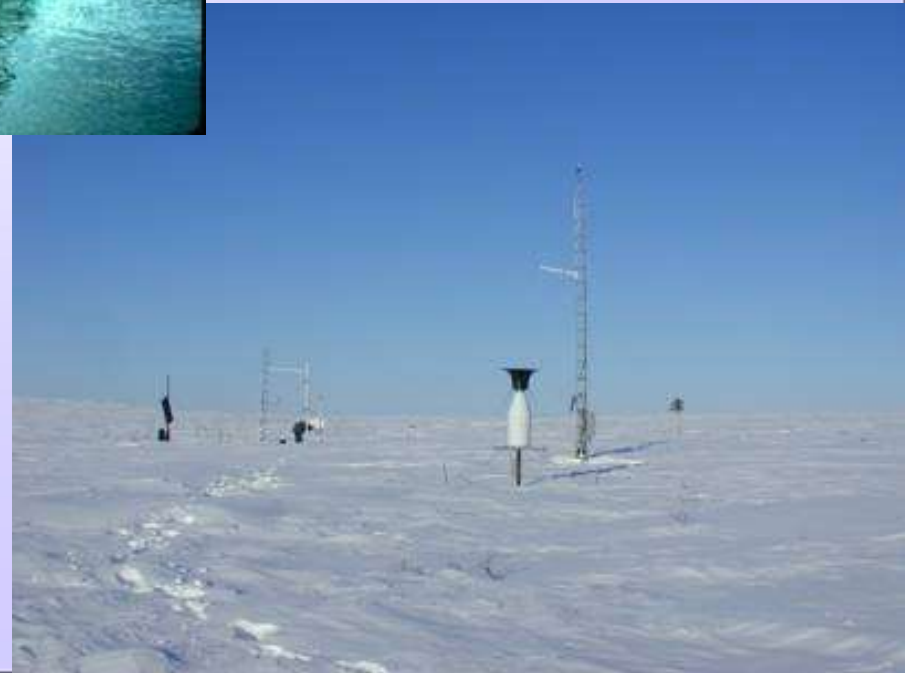


IP3 – Goals and Theme Structure

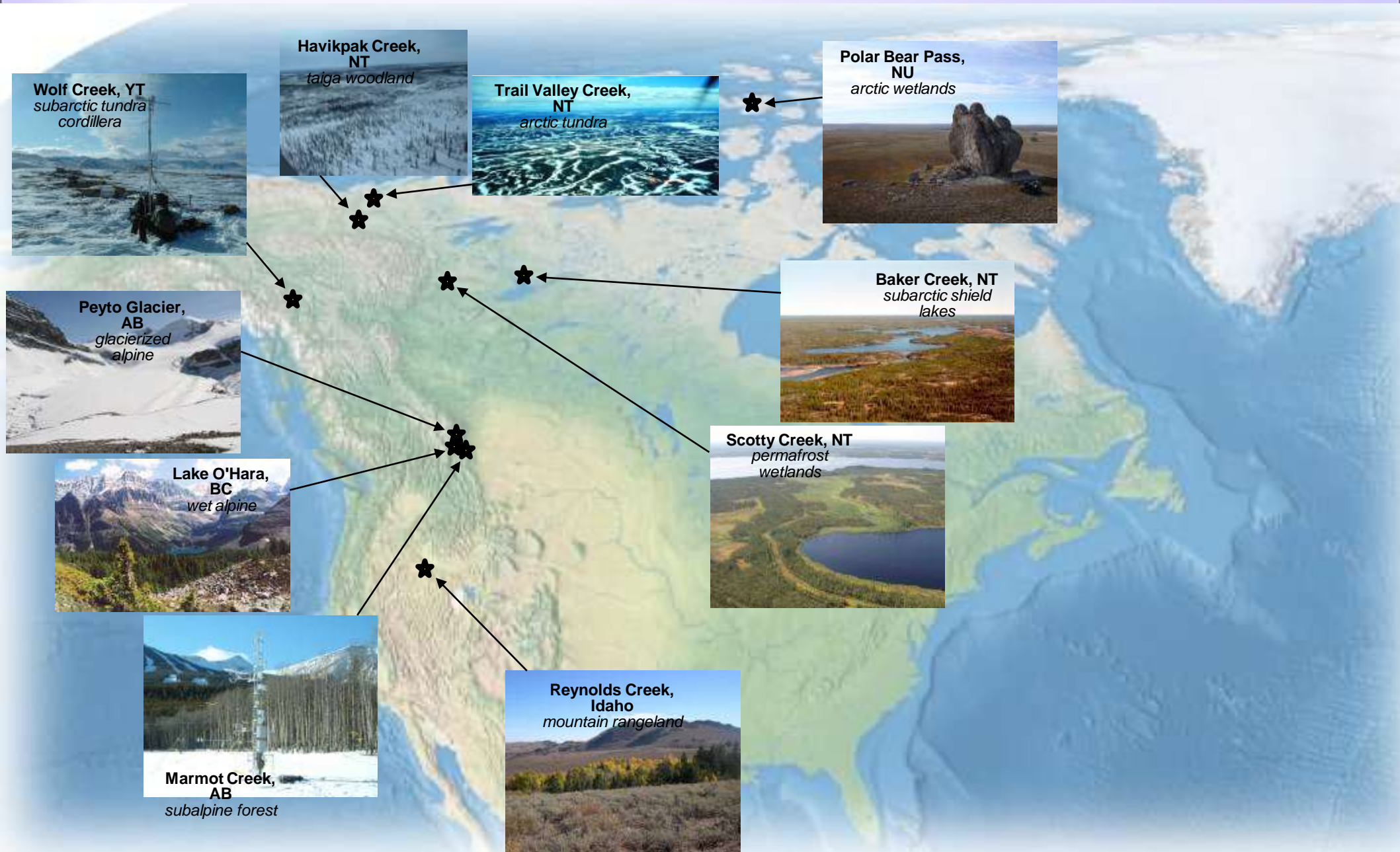
- **Theme 1 Processes: Advance our understanding** of cold regions hydrometeorological processes
- **Theme 2 Parameterisation Develop mathematical parameterisation** of cold regions processes for small to medium scales
- **Theme 3 Prediction Evaluate and demonstrate improved hydrological and atmospheric prediction** at regional and smaller scales in the cold regions of Canada
- *Ultimately* – contribute to **multiscale assessment of coupled climate system, weather and water resources** in cold regions

Processes

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



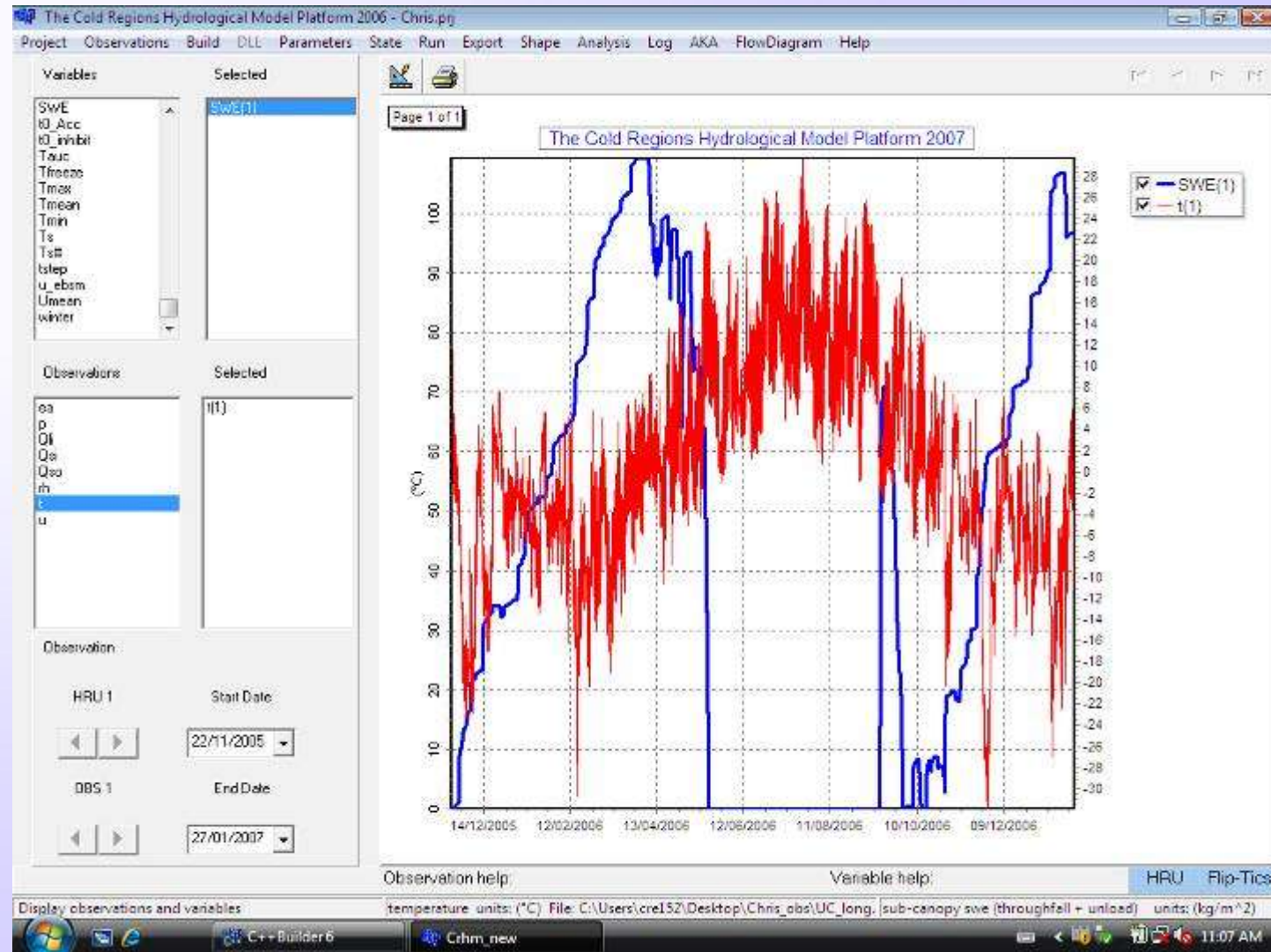
IP3 Research Basins



Parameterisation

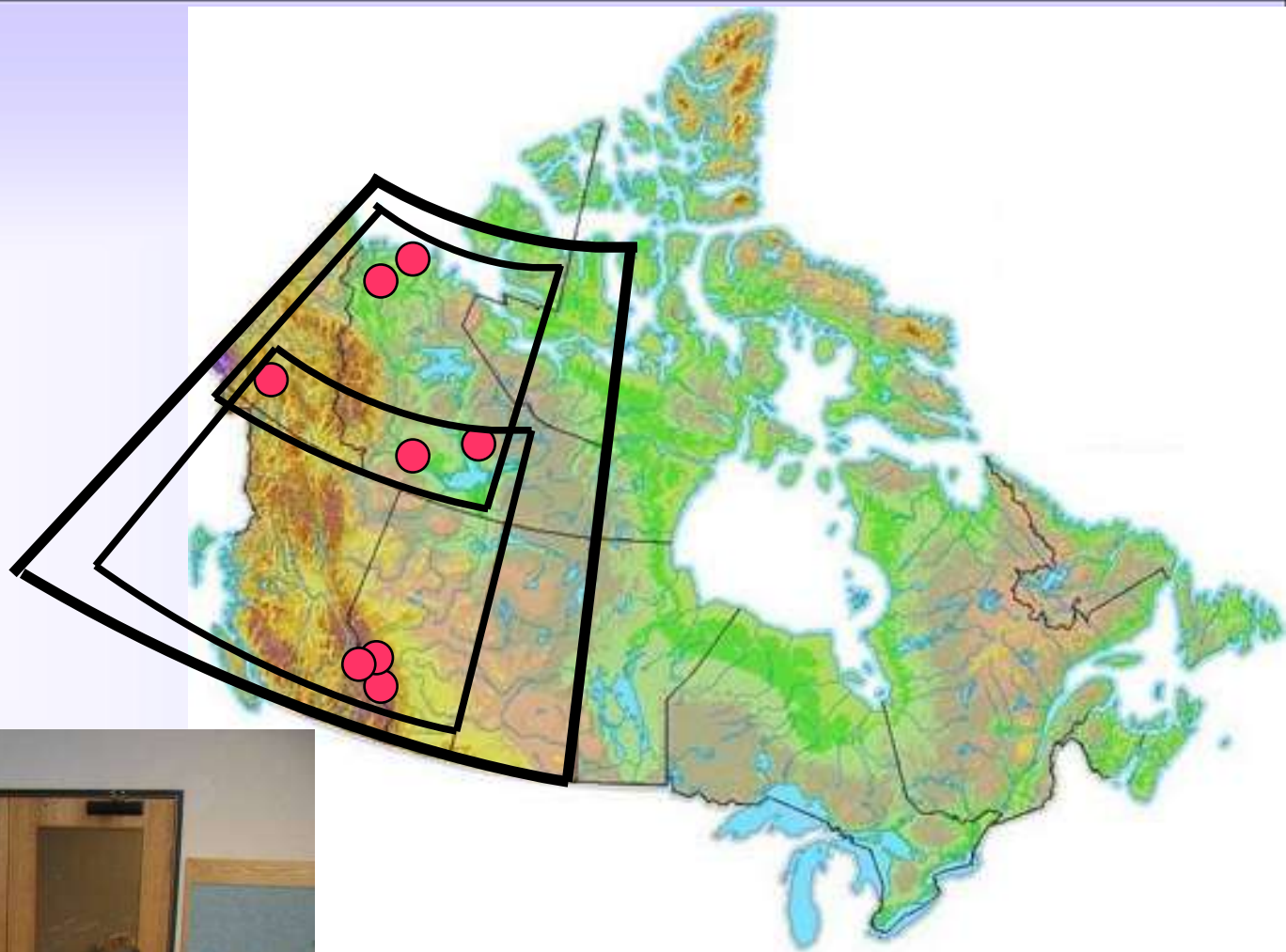
→ Scaling of hydrological processes

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



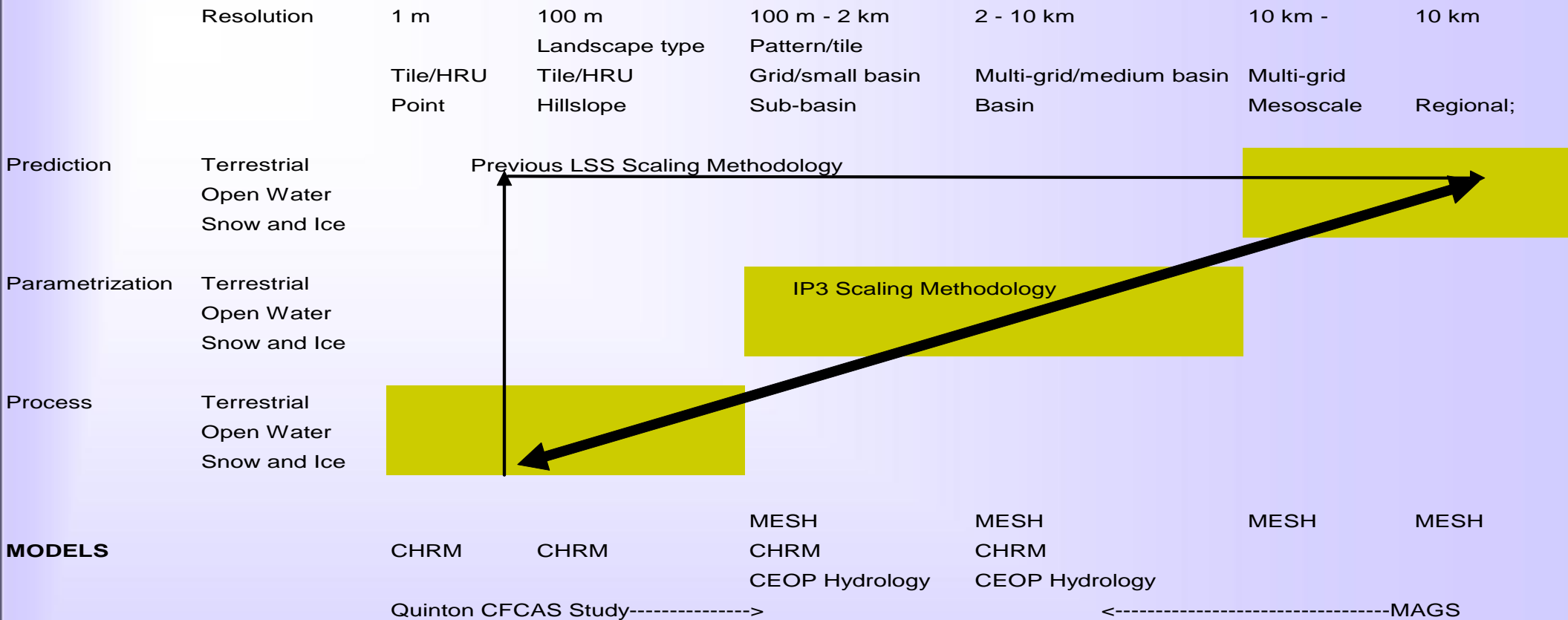
Cold Regions Hydrological Model CRHM

Prediction



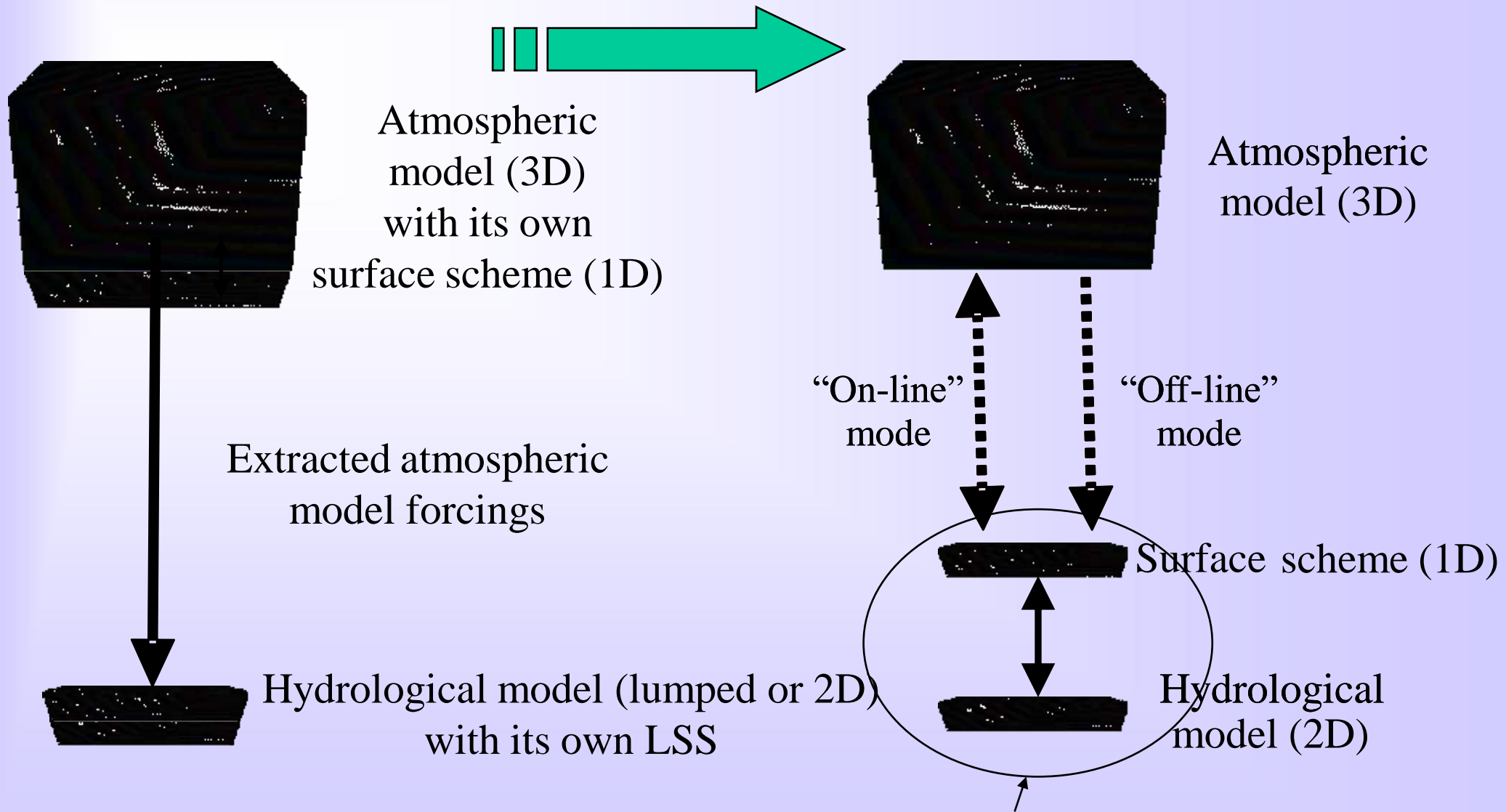
→ Water resources (storage, discharge, snow cover, soil moisture), atmosphere-ground interaction (evaporation), and weather and climate

IP3 Scaling Methodology



Integrating the TOP DOWN and BOTTOM UP approaches

Modélisation Environnementale Communautaire, MEC



MESH – MEC - Surface and Hydrology

MESH

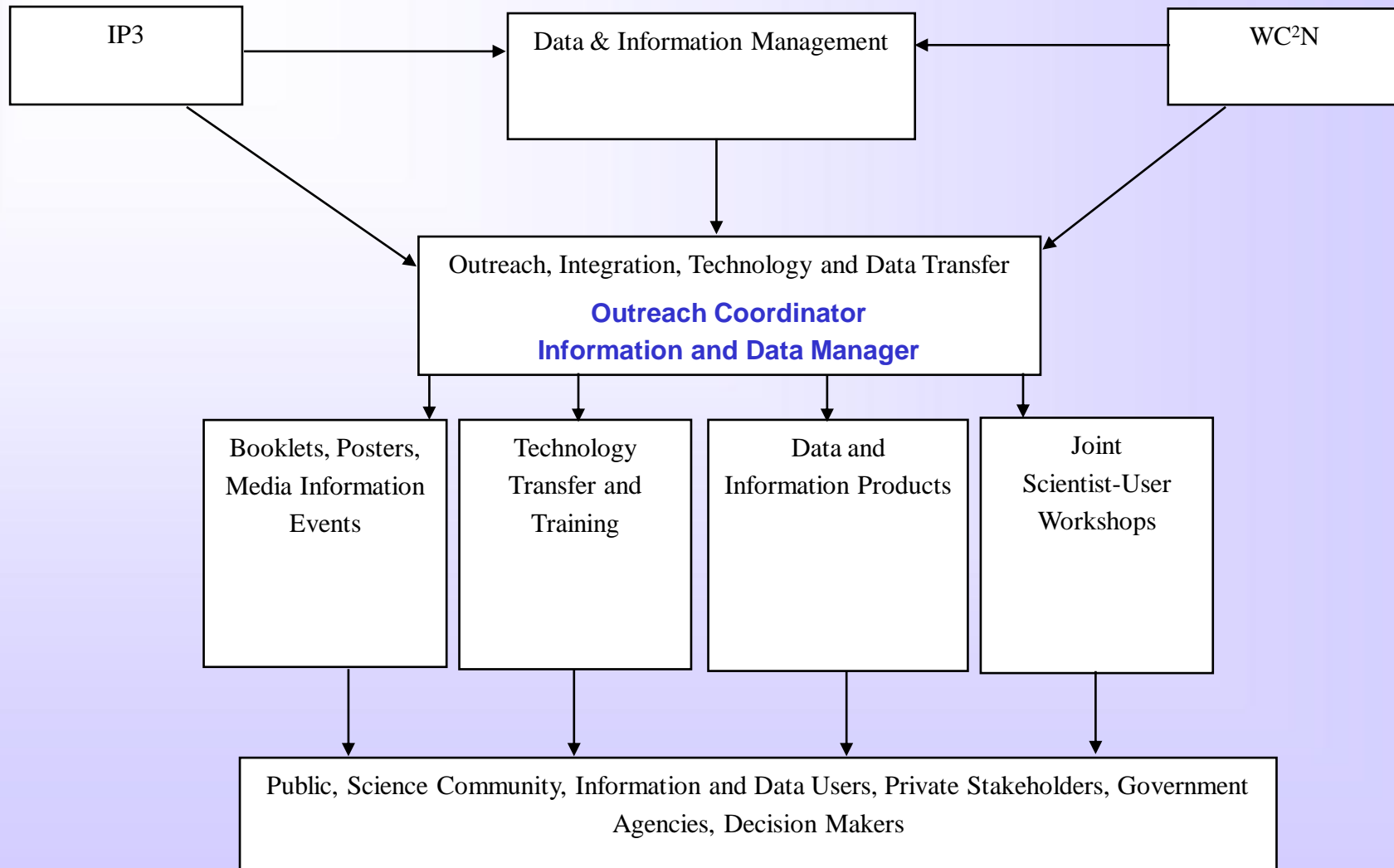
- Environment Canada supported model
- Links land surface scheme to hydrology
- Significant cold regions attributes
- Developing in collaboration with IP3 as major output of Theme 3.
- Also supported by DRI Prediction Strategy

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 and parameterisations into hydrological and meteorological models at regional and smaller scales – CRHM, MESH
- ★ 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



Integration of Data Management and Outreach for Cold Regions Hydrological, Cryospheric and Climate Science in Western and Northern Canada



Network Completion

- IP3 Sessions at CGU/AGU Toronto May 2009
- HESS Special Issue
- Final Workshop at Lake Louise in the Rockies, 14-17 October 2009.
- Final Scientific Session at CGU/CMOS in Ottawa June 2010
- No cost extension of IP3 to end of Dec 2010
 - Science Activities to cease by ~June 2010
- Secretariat, Outreach and Information Management funded to end of Dec 2010 (CFCAS to end of March 2011)

IP4?

- CFCAS to wrap up early in 2011
- Water Resources and Water Security a strategic area for NSERC
- Substantial feedback from users that IP3 should *stay together* and build links to related research in WC²N and DRI amongst other groups.
- Must formulate a plan NOW.
- Discussion Tuesday afternoon