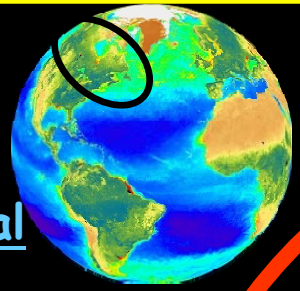

OURANOS
A MULTIDISCIPLINARY APPROACH TO FACILITATE ADAPTATION TO CLIMATE CHANGE

A Balanced, Integrated Strategy to Deal with Climate Change



Our international commitment:

Mitigate

Our domestic need:

Adapt

Avoid 3-4XCO2

Adapt to 2XCO2

Climate Change

Impacts
on human and natural systems

Adaptation

Socio-economic development

Emissions
Greenhouse gases
Aerosols

Mitigation

OURANOS

Adapted from IPCC 2001

Making Climate Change Science Support Relevant for Adaptation

Ouranos
550 Sherbrooke West
Montreal, Canada
www.ouranos.ca

- **Development and coordination of interdisciplinary, applied and user driven research**
- **100+ scientists and professionals working at same location**
  Network of over 250 involved
- **Access to an extensive network of experts/users/stakeholders to answer specific questions**
- **Dedicated supercomputers for climate simulations:**
  - **SGI - 32 CPU & 3 CRAY SX-6**
- **5 M$ annual base budget**
  (12 M$ with leverage: 2006)
- **Important dates:**
  2001-02: Announcements, priorities
  2003-04: Projects, 1st symposium
  2005-06: Initial results, 2nd symposium
  2007+: First phase results, projects renewal

Mission:
To provide decision makers with:

- **Regional Scale Climate Scenarios**
- **Evaluate Impacts of CC**
- **Support to Adaptation Decisions**

Consortium on Regional Climatology and Adaptation to CC

MEMBERS

Québec

Hydro Québec

Environnement Canada
Environment Canada

UQÀM
Université du Québec à Montréal

McGill

UNIVERSITÉ LAVAL

Université du Québec
Institut national
de la recherche
scientifique

Ministries:

1. Sécurité publique
2. Développement durable, Environnement et Parcs
3. Ressources naturelles et Faune
4. Affaires municipales et Régions
5. Transports
6. Agriculture, Pêcheries et Alimentation
7. Développement économique, Innovation et Exportation
8. Santé et Services sociaux

MEMBERS (affiliated) (2007 →)

Manitoba Hydro

Manitoba Hydro

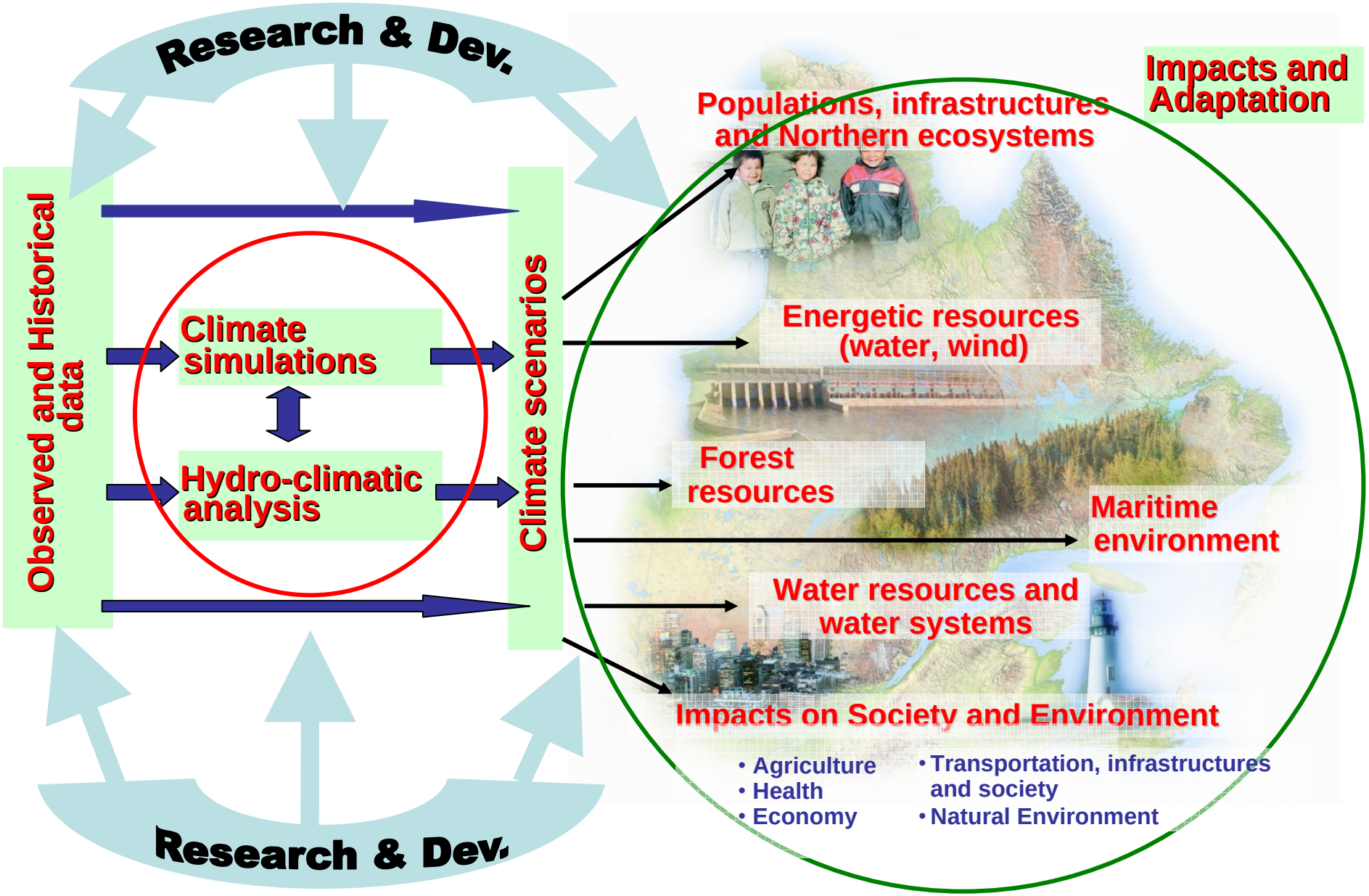
Ecole de Technologie Supérieure

Université du Québec
École de technologie supérieure

OTHER KEY SCIENTIFIC PARTNERSHIPS

- Université de Montréal
- Université du Québec à Rimouski
- Université Sherbrooke
- University of Manitoba, Winnipeg
- Centre de ressources en impacts et adaptation au climat et à ses changements (CRIACC)

Scientific Program



Building the capacity to understand, measure, analyse, apply and respond to a complex multi-disciplinary and highly scientific issue

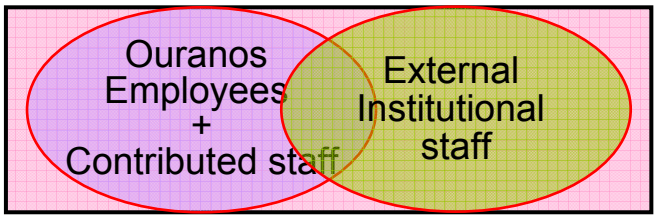
Programs:

North: M. Allard (ULaval)
Hydro: R. Roy (HQ)
Forest: D. Houle (MRNF)
Coasts: F. Morneau (MSP)
Water: A. Bourque (Ouranos)
Health: P. Gosselin (INSPQ)
Economy: C. Desjarlais (MRNF)
Agriculture: N. Lease (MAPAQ)
Ecosystems: L. Vescovi (Ouranos)

Working on many fronts to facilitate adaptation:

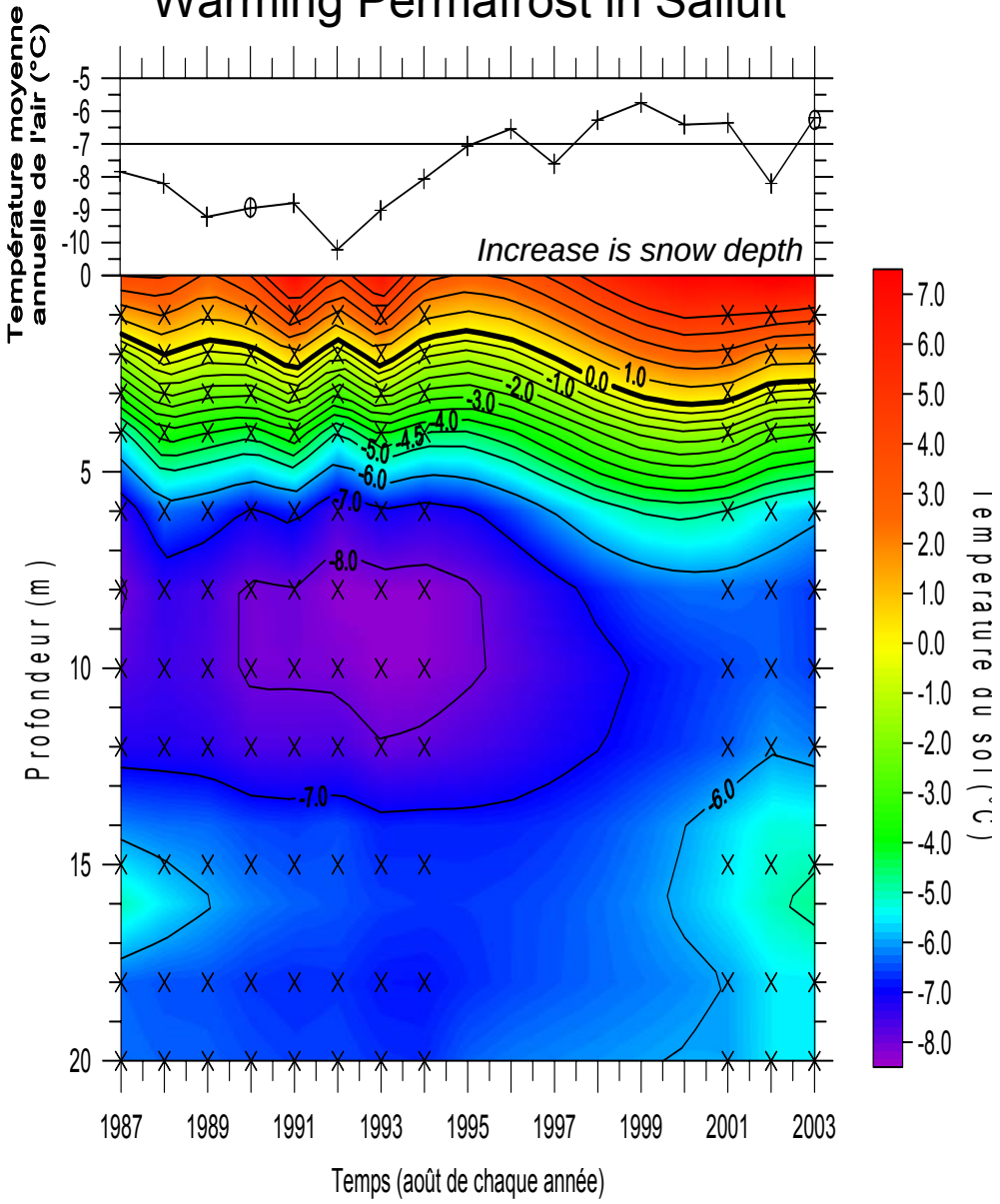
- Producing climate scenarios AND impacts/vulnerability assessments
- Working with the actors of adaptation to facilitate good decision making and relevant R&D

Project management model

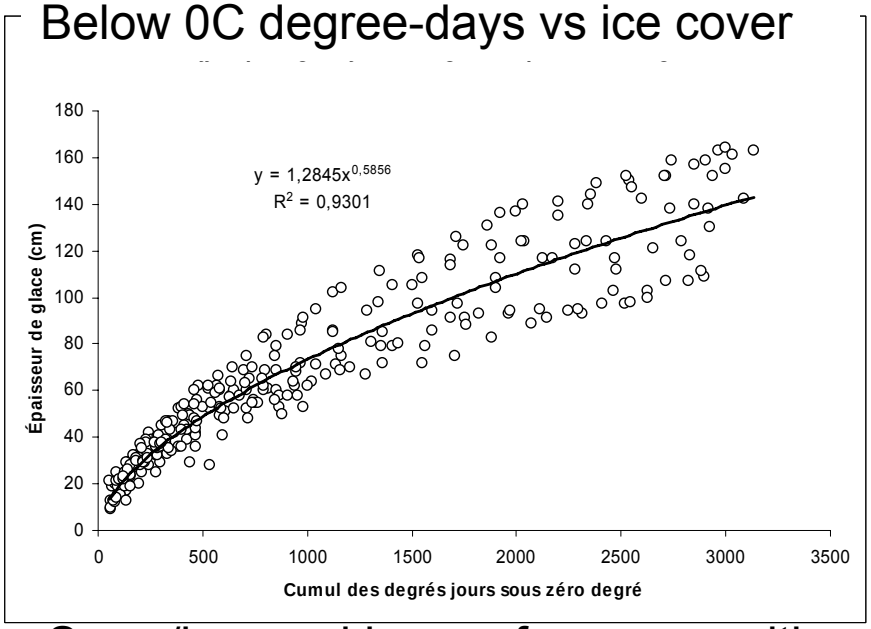


Impacts of climate change on northern environments

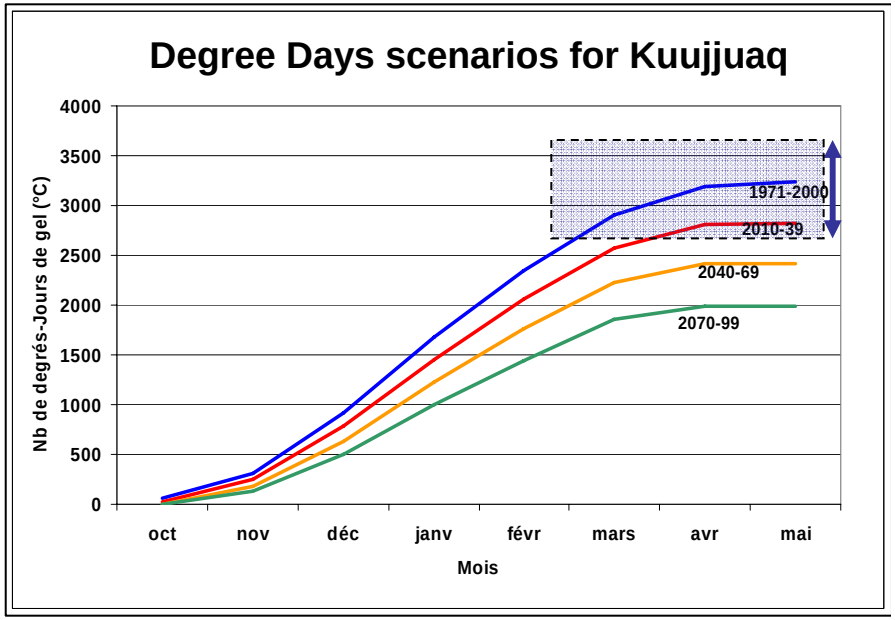
Warming Permafrost in Salluit



Below 0C degree-days vs ice cover

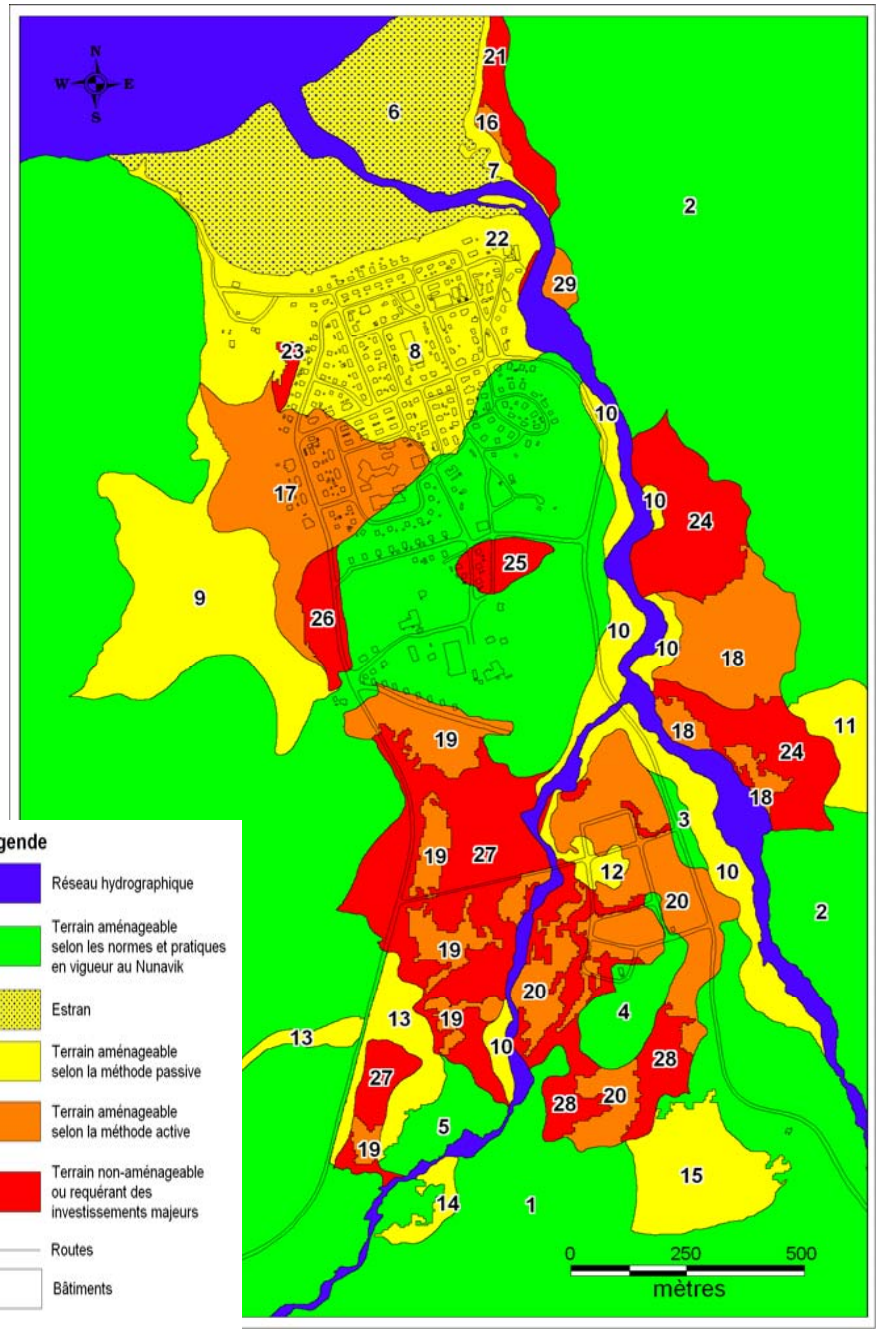


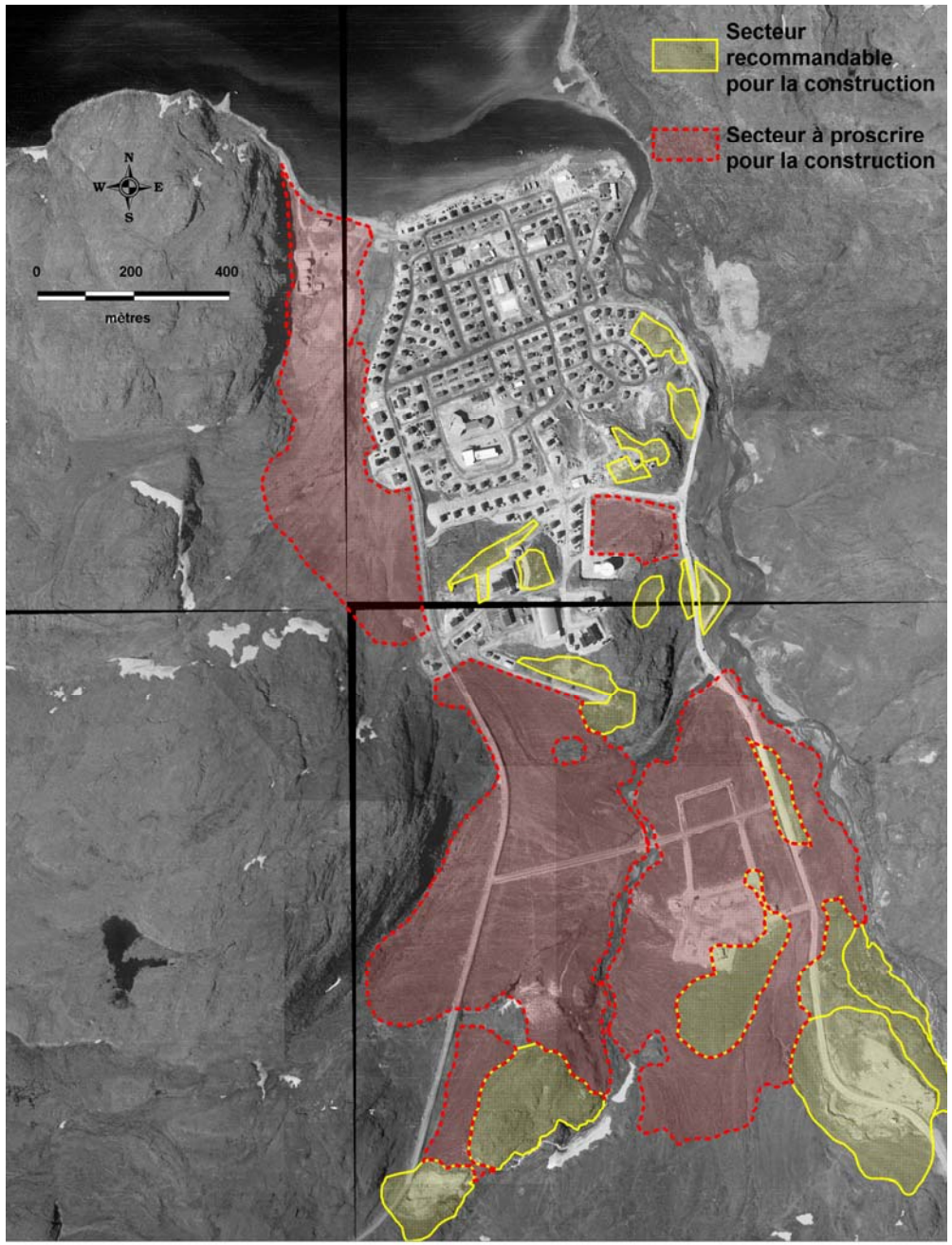
Snow/ice road issues for communities



ULaval *et al.*

Vulnerability maps: land use/infrastructure planning





Approach for CC and coastal zones adaptation issues

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Past climate

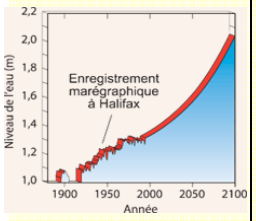
Future climate

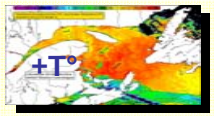
Sea level rise

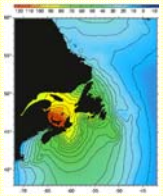
Protecting ice cover reduction

Freeze-thaw cycle increases

Increased storminess







Modification of coastal processes

submersion

alteration solifluxion landslides

Increases in wind intensity and wave height

Increases in frequency intensity of storms

Acceleration of coastal erosion

Choices of adaptation scenarios

zoning

protection

retreat

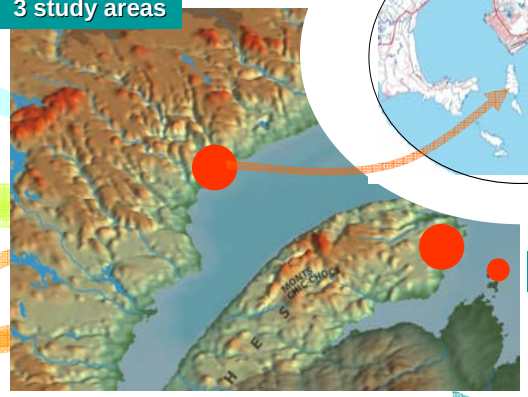
3 research groups

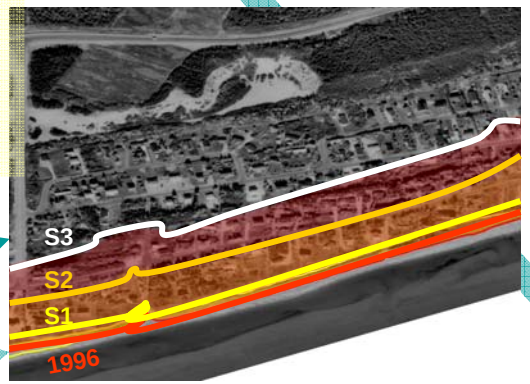
« Climate group »
Documentation of past and future climate

« Coastal dynamic group »
Evaluate impacts on different coastal processes and usage

« Users group »
Estimate impacts and adaptation solutions

3 study areas





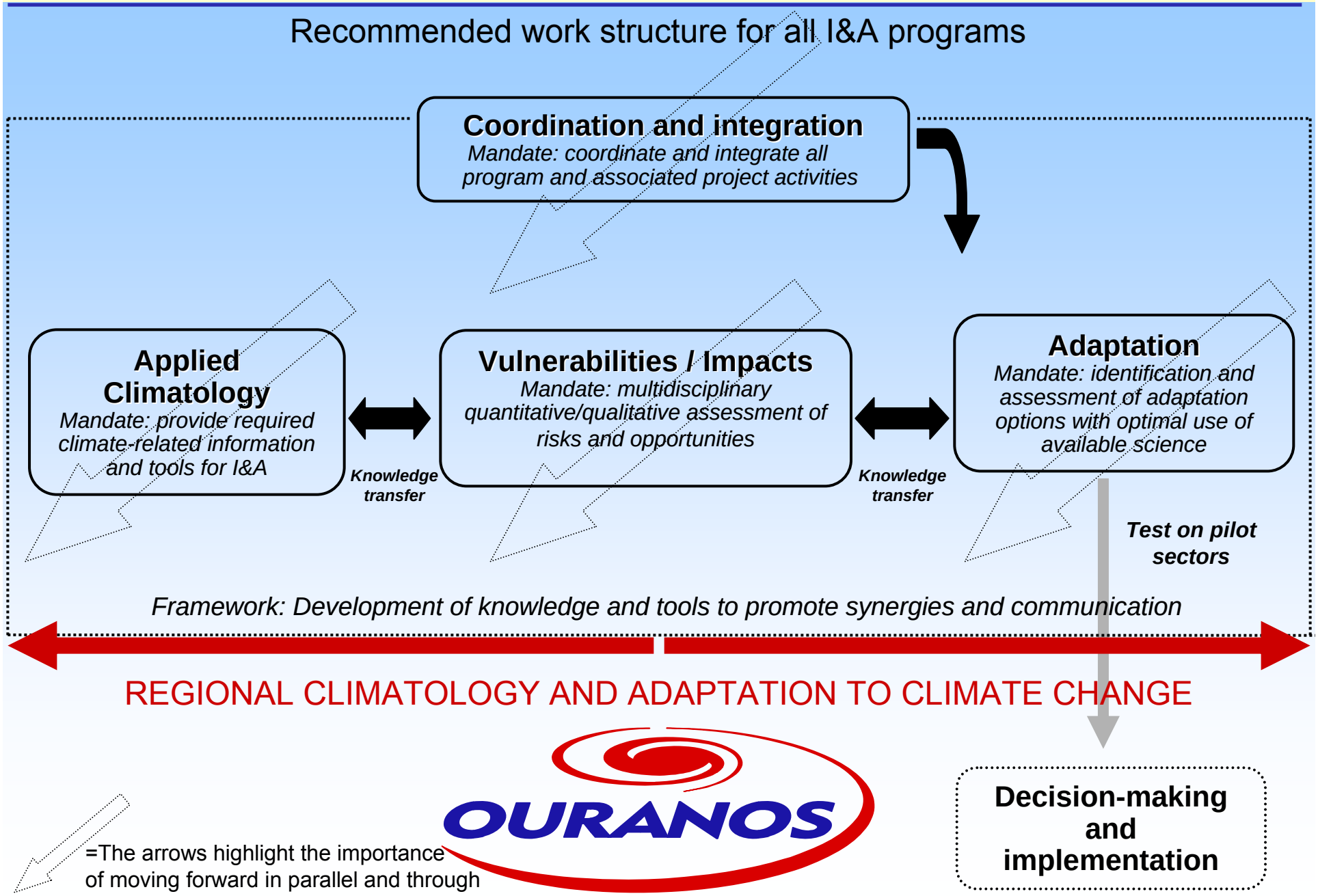
projection in 2030 of scenarios for areas at risk

S1	Optimistic scenario	Mean rate in last 30 years
S2	Moderate scenario	Max decadal rate since 1930
S3	Pessimistic scenario	S3 = 2 S2 – S1

Cost/benefit analysis for adaptation, scenarios

The importance of « What to do? »… and « How to do it? »

Recommended work structure for all I&A programs



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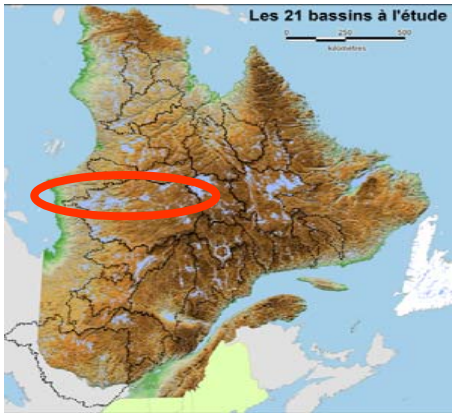
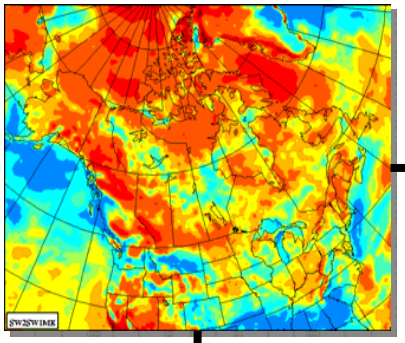
Hydrological scenarios and impacts on water resources and extreme precipitation

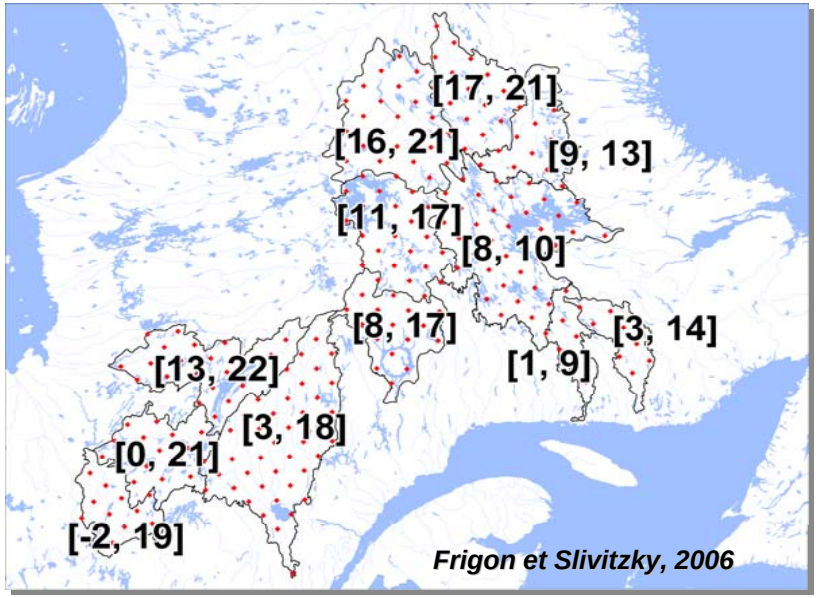


Climate projections



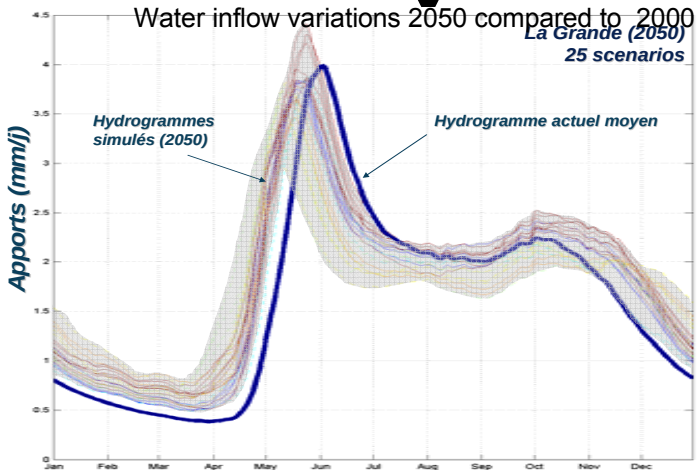
Hydrological models

CRCM flows



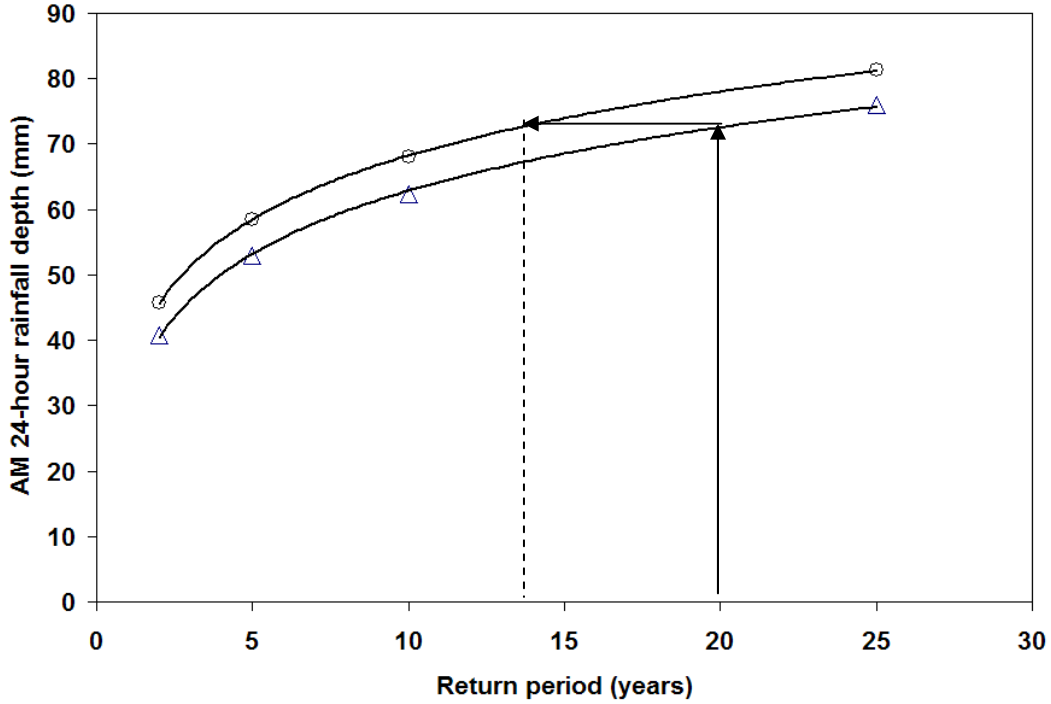
Runoff : range of average change in % between future (2041@2070) and current (1961@1990) from many CRCM climate projections

Water inflow variations 2050 compared to 2000



Extreme precipitation events: Flooding and safety

Future maximum 24-hour summer intensities using CRCM

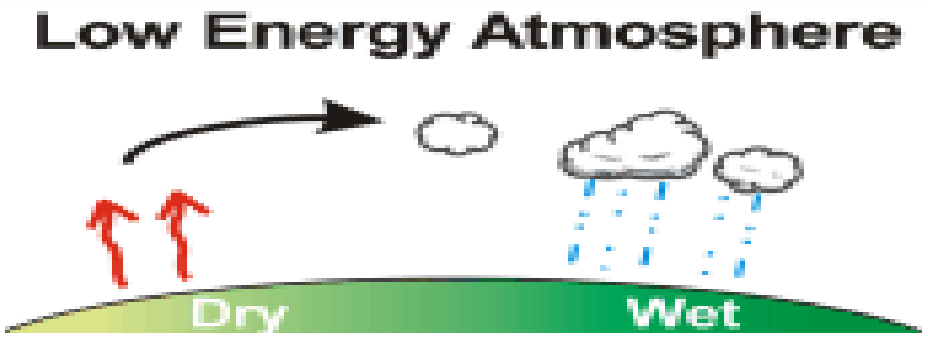


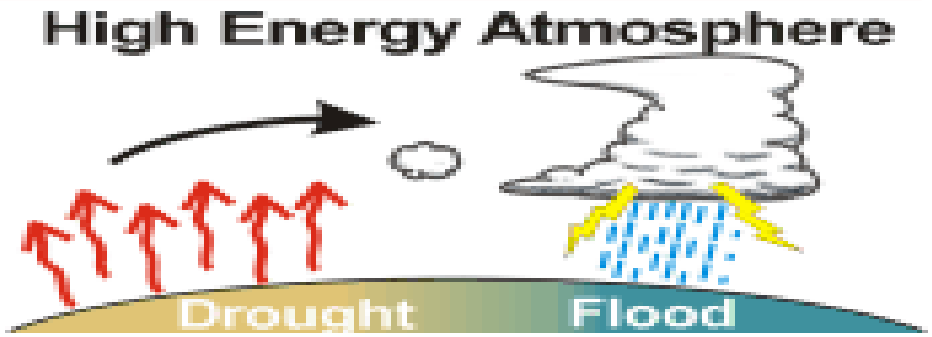
1961-90 (triangles)
vs
2041-2070 (circles)

Numerous impacts:
Flooding
Landslide and erosion
water quality…

Return Period [2041-2070] = 0.67 * Return Period [1961-1990]

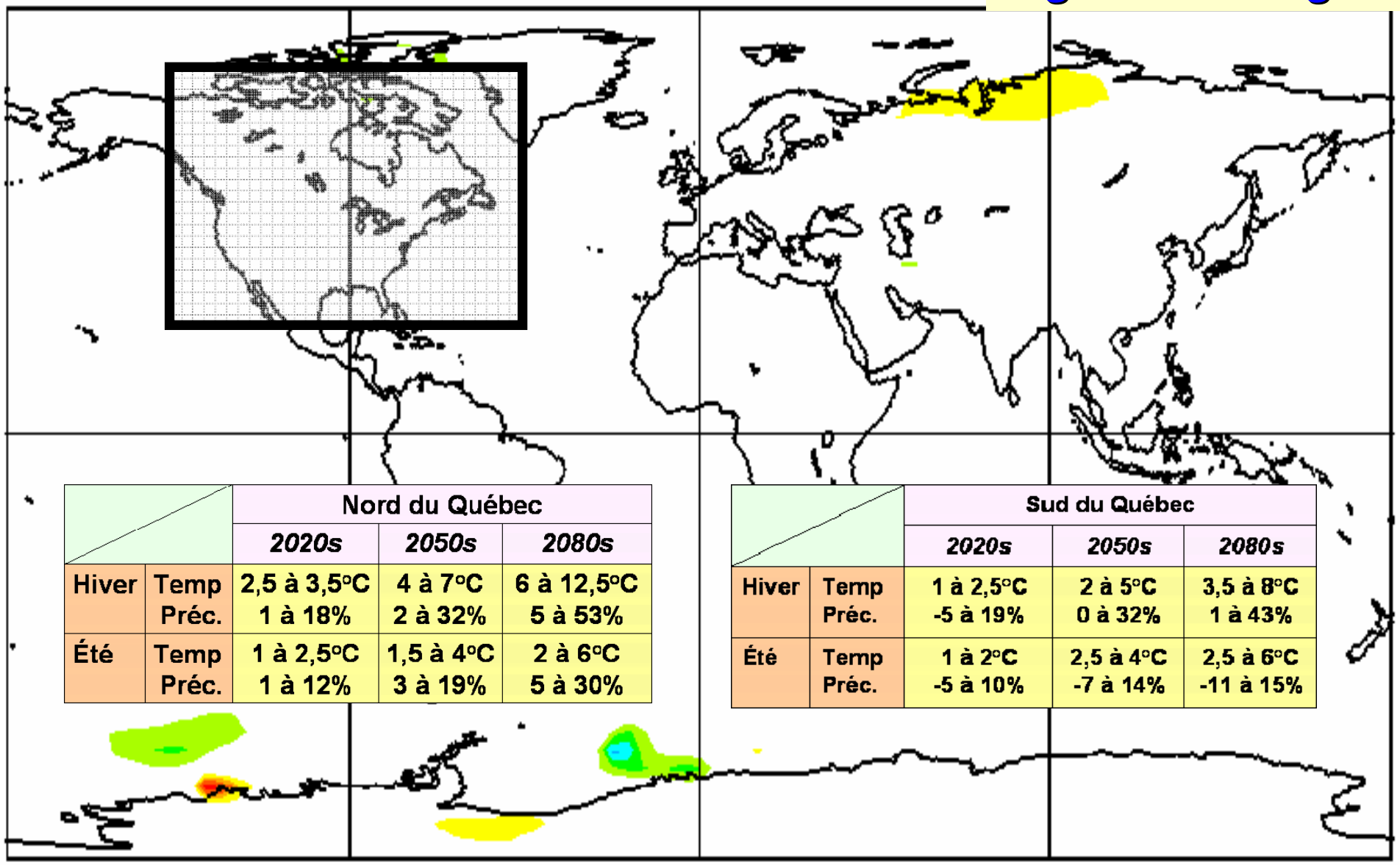
Activation of the water cycle is a behavior confirmed in climate models





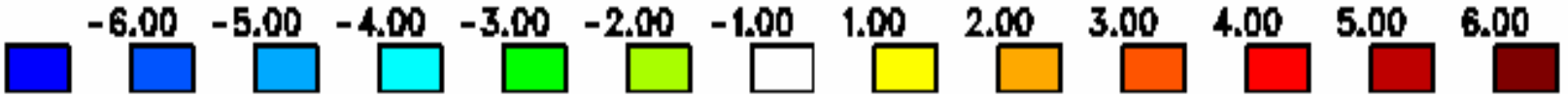
Tools to estimate regional changes

CCCma Surface Temperature Change Projection for 1990
Simulated by CGCM1 (http://www.cccma.bc.ec.gc.ca)



		Nord du Québec		
		2020s	*2050s*	*2080s*
Hiver	Temp	2,5 à 3,5°C	4 à 7°C	6 à 12,5°C
	Préc.	1 à 18%	2 à 32%	5 à 53%
Été	Temp	1 à 2,5°C	1,5 à 4°C	2 à 6°C
	Préc.	1 à 12%	3 à 19%	5 à 30%

		Sud du Québec		
		2020s	*2050s*	*2080s*
Hiver	Temp	1 à 2,5°C	2 à 5°C	3,5 à 8°C
	Préc.	-5 à 19%	0 à 32%	1 à 43%
Été	Temp	1 à 2°C	2,5 à 4°C	2,5 à 6°C
	Préc.	-5 à 10%	-7 à 14%	-11 à 15%



Climate Modeling Required for Regional Adaptation

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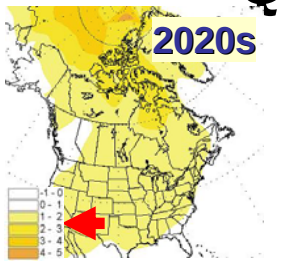
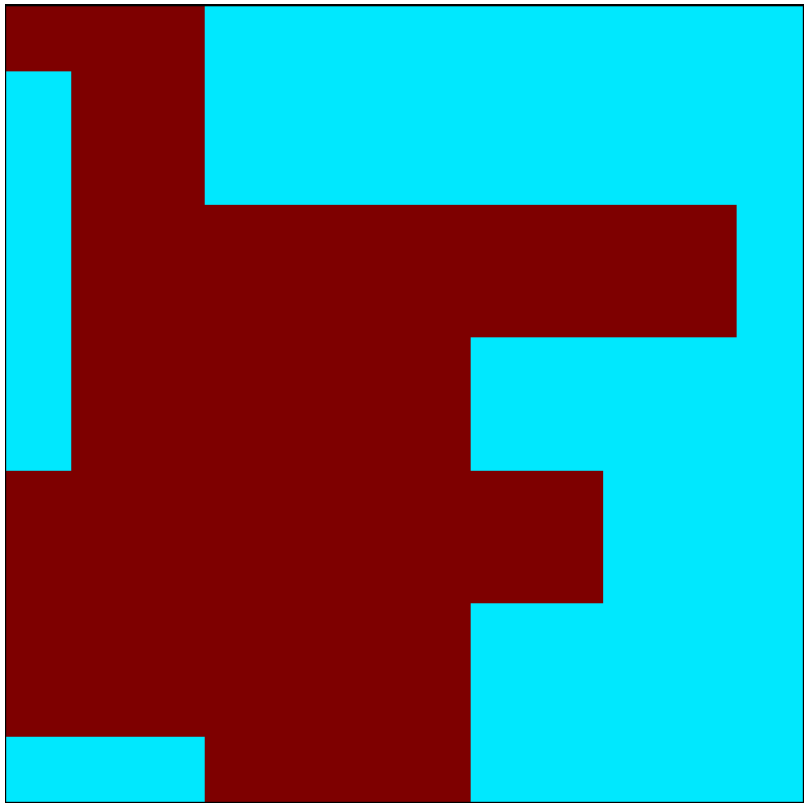
Quebec according to a General Circulation Model

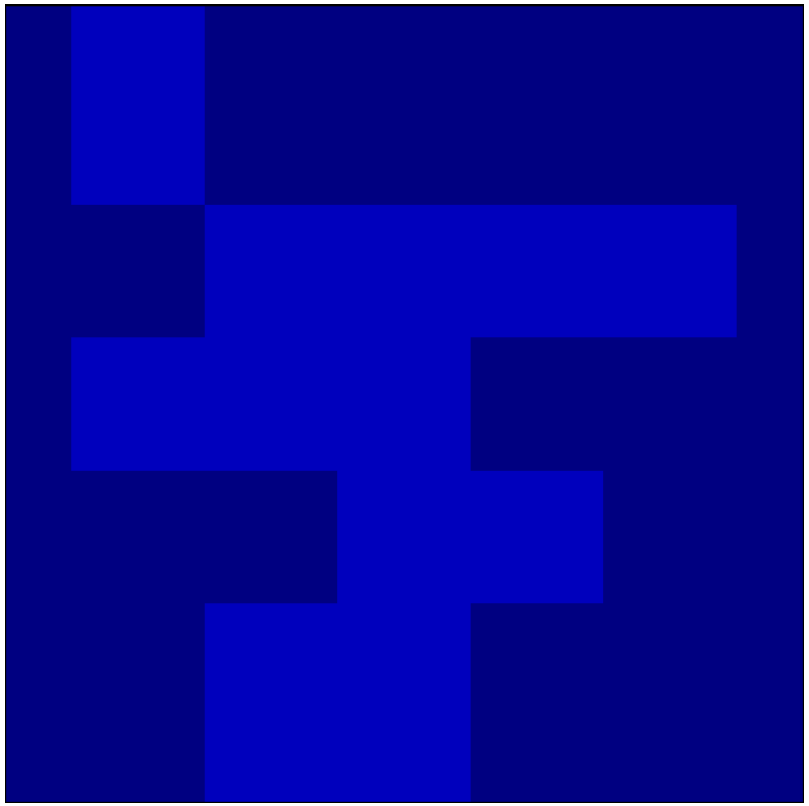
(available from Environment Canada and a few others)



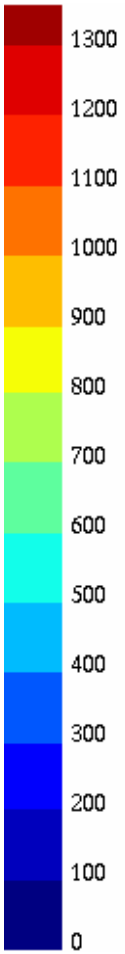
Spatial resolution: 400 km



Land-Water Contour



Elevation

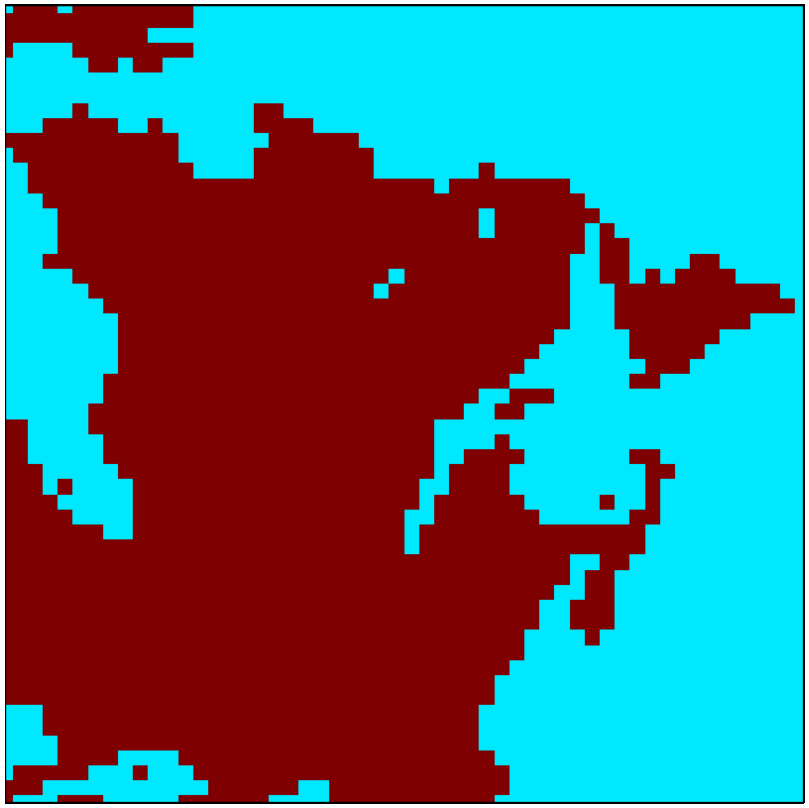


Climate Modeling Required for Regional Adaptation

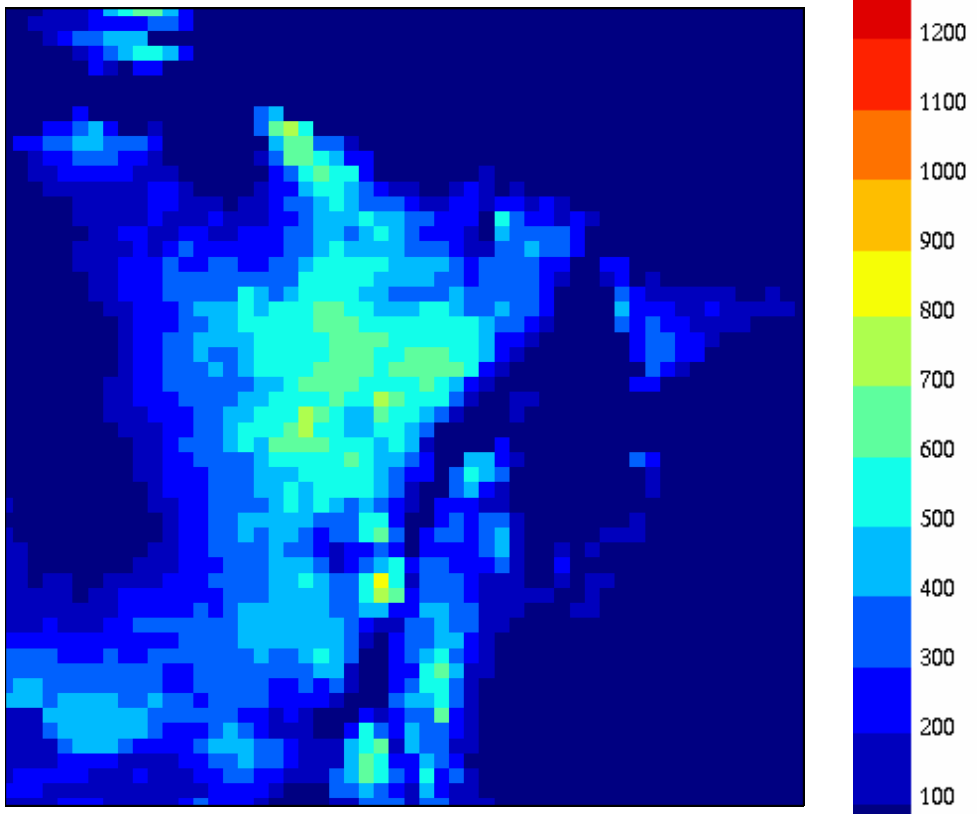
OURANOS

Quebec according to a Regional Climate Model
in the future: Ensemble of RCMs
(CRMC, Arpège, NARCCAP…)

Spatial resolution: 45 km



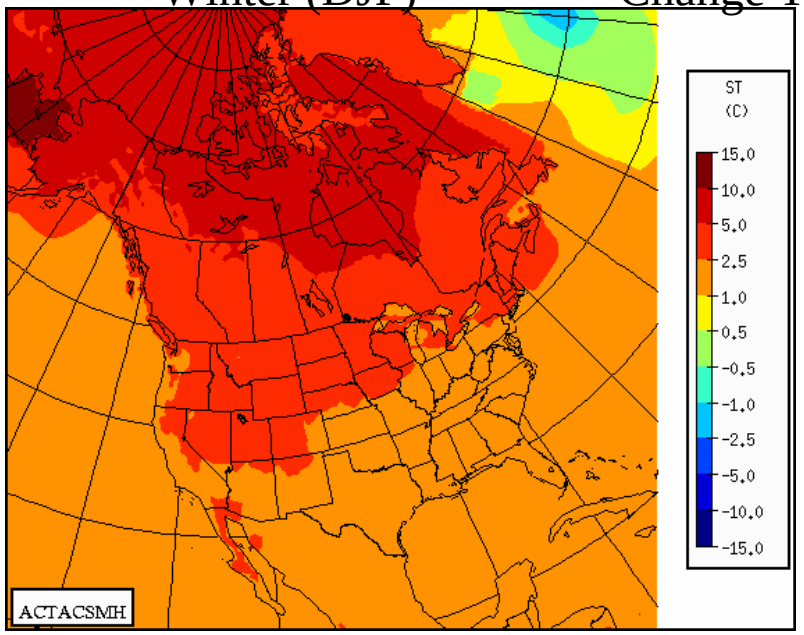
Land-Water Contour

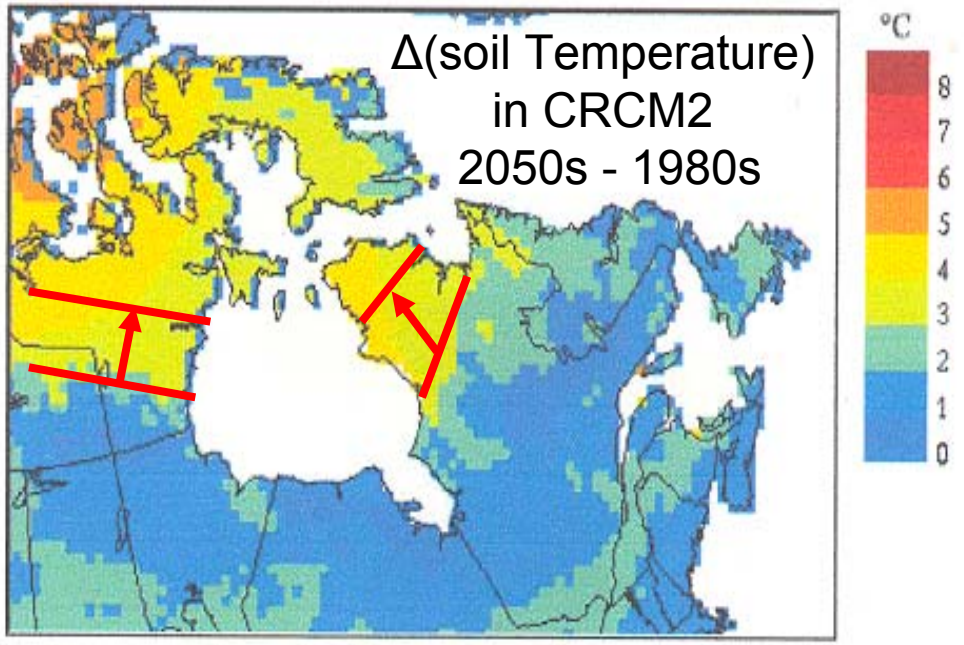


Elevation

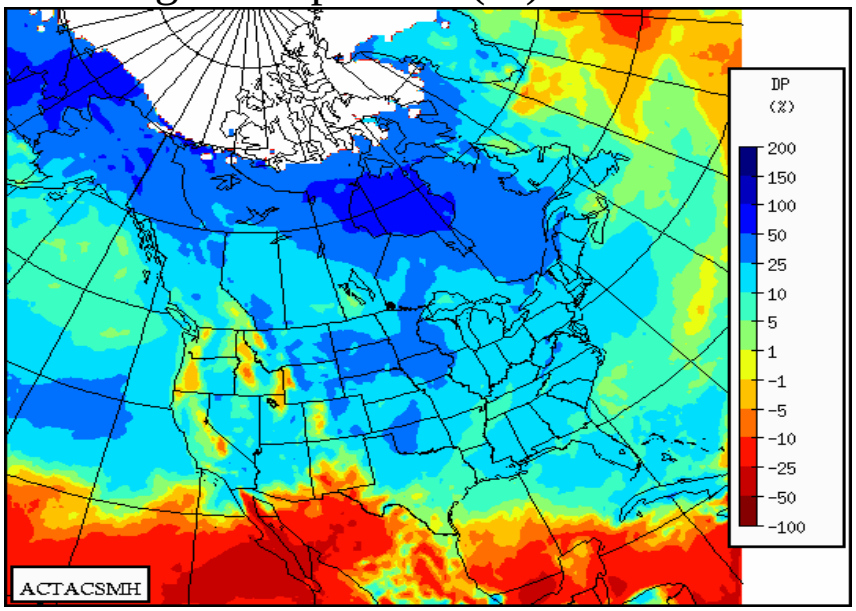
High resolution scenarios for optimal adaptation

Winter (DJF) Change T_{2m}

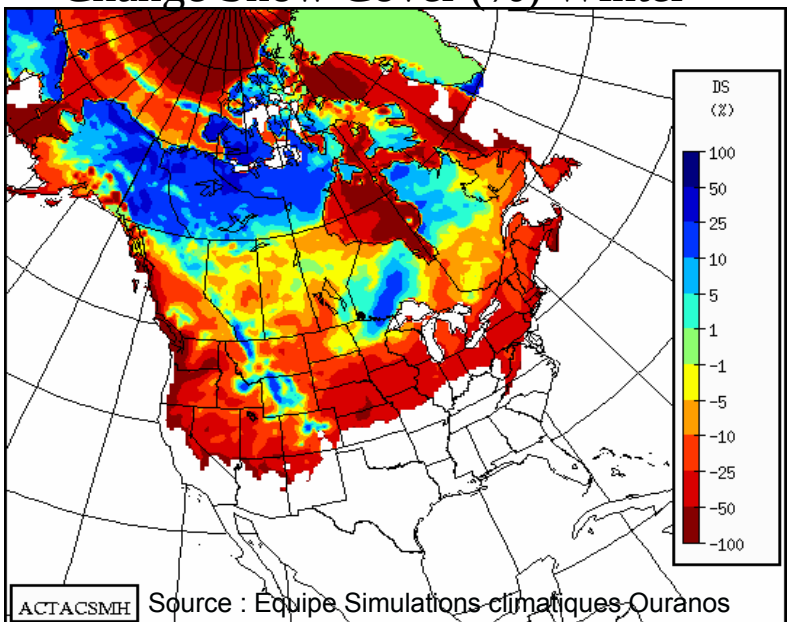




Change Precipitation (%) Winter



Change Snow Cover (%) Winter



Source : Équipe Simulations climatiques Ouranos

Regional scales needed for all

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Mitigate
the source of the problem

Adapt
to changes

Regulation and Incitatives

The Carbon Market

The Forest as a Carbon Sink

Hydroelectricity to Mitigate GHG

Energy Demand in Québec

CO_2 Emissions (1996)

Validate Wind Power Production Potential

Permafrost Is Already Thawing

Adapting the Forest

Managing Hydroelectricity

•32 GW (96%)

•185

•650

New equipments ?

Production

Coastal Erosion in the Maritimes

Southern Quebec Economy

Environment – Urban Health

UN PIC INEDIT DANS LA PERIODE CONTEMPORAINE

Nombre de décès au mois d'août depuis 1946

Août 2003

température

36 °C

Water Management

1994: "average", for the last 30 years

1999: "extreme", lower by 1 meter

... and if 1999 was the "average" ... to which "extremes" are added??

- Water management
- Link w/ Great Lakes
- Commercial Shipping
- Energy production
- Fisheries
- Ecosystems, habitats
- Tourism and leisure
- Infrastructures
- Insurance
- Flood control

- Fresh water supply
- Used water treatment
- Urban drainage
- Underground water
- Agriculture
- Water quality

Through evaporation → → Lower level (-1,3m) and flow reduction (-40%) to the St-Lawrence River

??

Regional Climate Model

Climate Science is clearly a decision support tool for most users

Towards quantitative information, for decision-makers

Government direction and actions plans

Scientific reliability high to very high 2009-2013

Small scale decisions: case studies

Scientific reliability average to high 2004-2008

Determining issues : projects

Fiabilité scientifique weak to average 2001-2003

1. Energy profitability: hydro-wind power potential, domestic and external markets

2. Regional prosperity and development: winter tourism, forestry and waterways

3. Health, security and risk management: new vectors, heat waves, inter-regional insurability, catastrophes,dam security, coastal erosion

4. Knowledge and identity: development of a francophone scientific pole of international caliber and new researchers support for Québec government

Level of experiences and trials

Gvt depts. & universities

Scientific reliability: minimum to weak

1997-2000

University Research

Air-land-sea Processes-Observations

Theoretical and fundamental comprehension at the basis of our climate knowledge


Sharing tools and addressing impacts at the right scale…
OURANOS
OURANOS
: Climate science at the continental scale
: I&A involving users/stakeholders
at the relevant scales
www.ouranos.ca
bourque.alain@ouranos.ca
Thank you for your attention!