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

Emissions

Greenhouse gases

Aerosols

Impacts

on human and natural systems

Socio-economic development

Adaptation

Mitigation

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

Quebec

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

Ecole 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

- Research & Dev.
  - Observed and Historical data
  - Climate simulations
  - Hydro-climatic analysis
  - Climate scenarios

- Impacts and Adaptation
  - Populations, infrastructures and Northern ecosystems
  - Energetic resources (water, wind)
  - Forest resources
  - Maritime environment
  - Water resources and water systems
  - Impacts on Society and Environment
    - Agriculture
    - Health
    - Economy
    - Transportation, infrastructures and society
    - Natural Environment
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

- Ouranos Employees
- Contributed staff
- External Institutional staff

Status of project:
Green: completed
Brown: ongoing

- Energetic Resources (water, wind)
  • Peatlands moisture regime
  • Snow cover analysis
  • Northern hydrological modeling

- Forest Resources
  • Management and fire
  • Productivity
  • Natural disturbances
  • Impacts on insects
  • Fertility
  • Adaptation hardwood forests

- Maritime Environment
  • Coastal erosion
  • Economic assessment of erosion

- Impacts on Society and Environment
  • Health: heat waves (phase 2), air quality (phase 2), water quality, integration and technology transfer
  • Transportation, infrastructures and safety: Urban drainage, phase II, FIMR-2
  • Agriculture: Adaptation, extreme impacts, apple trees, adaptation in the Saguenay, soya
  • Economy: Energy demand, Assessment guide
  • Tourism: sky and golf
  • Ecosystems

- Water Resources and Water Systems
  • Adaptation to water levels modifications
  • Water flows variation
  • Tributaries
  • Floods and low water
  • Ground water levels
  • GLOWA
  • Canadian watersheds and hydroelectricity adaptation
Impacts of climate change on northern environments

Warming Permafrost in Salluit

Increase in snow depth

Below 0°C degree-days vs ice cover

Snow/ice road issues for communities

Degree Days scenarios for Kuujjuaq
Vulnerability maps: land use/infrastructure planning
Approach for CC and coastal zones adaptation issues

Past climate

Future climate

Sea level rise

Protecting ice cover reduction

Freeze-thaw cycle increases

Increased storminess

Modification of coastal processes

submersion

alteration

solifluxion

landsides

Increases in wind intensity and wave height

Increases in frequency intensity of storms

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

Acceleration of coastal erosion

Choices of adaptation scenarios

Zoning

Protection

Infrastructures

Retreat

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

Coordination and integration
Mandate: coordinate and integrate all program and associated project activities

Applied Climatology
Mandate: provide required climate-related information and tools for I&A

Vulnerabilities / Impacts
Mandate: multidisciplinary quantitative/qualitative assessment of risks and opportunities

Adaptation
Mandate: identification and assessment of adaptation options with optimal use of available science

Knowledge transfer

Test on pilot sectors

Framework: Development of knowledge and tools to promote synergies and communication

Regional Climatology and Adaptation to Climate Change

Decision-making and implementation

=The arrows highlight the importance of moving forward in parallel and through linkages
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)
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

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 $T_{21}$

Δ(soil Temperature)
in CRCM2
2050s - 1980s

Change Precipitation (%) Winter

Change Snow Cover (%) Winter

Source: Équipe Simulations climatiques Ouranos
CRCM4

High resolution scenarios for optimal adaptation
Regional scales needed for all

Mitigate
the source of the problem

Adapt
to changes

Permafrost Is Already Thawing

Adapting the Forest

Managing Hydroelectricity

Coastal Erosion in the Maritimes

Southern Quebec Economy

Environment – Urban Health

Water Management

Climate Science is clearly a decision support tool for most users

Regional Climate Model
Towards quantitative information, for decision-makers

Government direction and actions plans

Small scale decisions: case studies

Determining issues: projects

Level of experiences and trials

Scientific reliability: minimum to weak 1997-2000

Scientific reliability: high to very high 2009-2013

Scientific reliability: average to high 2004-2008

Scientific reliability: 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

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...

: Climate science at the continental scale

: I&A involving users/stakeholders at the relevant scales

Thank you for your attention!

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