Leveraging Climate Science for Water and Energy Management

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The "Nexus Forum"- 4rd Forum on the Climate-Energy Security Nexus: Water and Energy – Geneva, June 12, 2014

Climate models - virtual worlds

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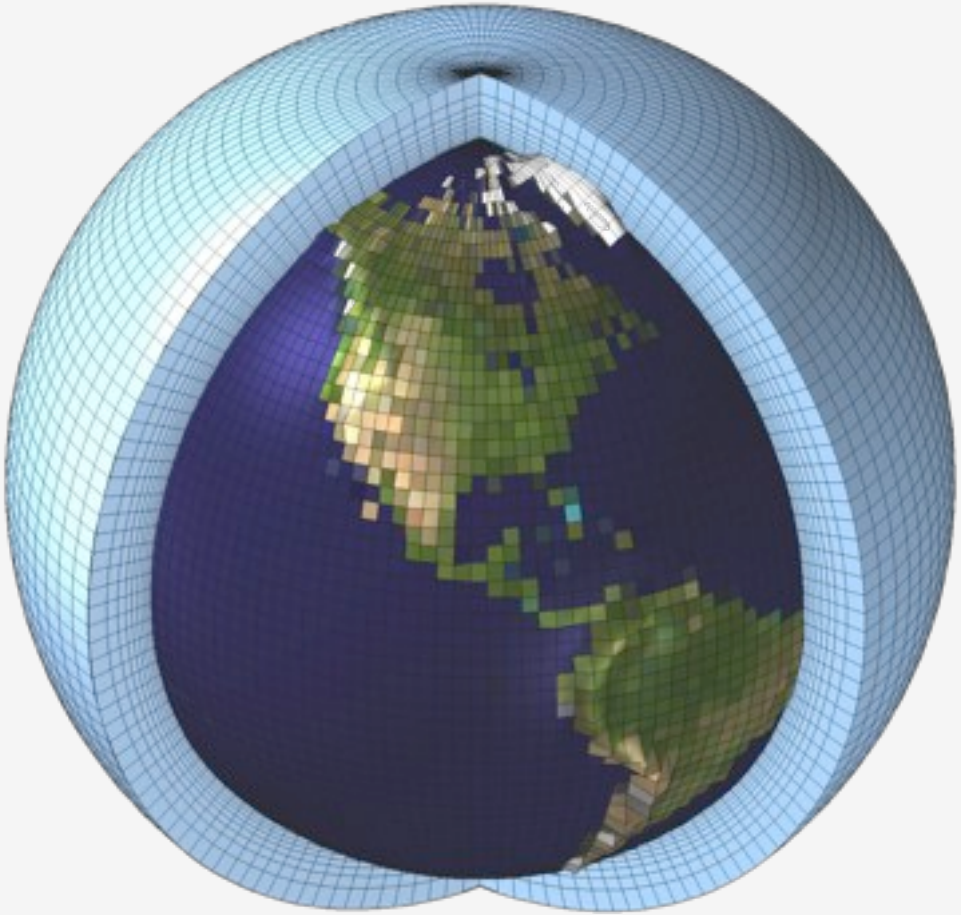
Climate Models vs Real World



2.5° / ~ 300km

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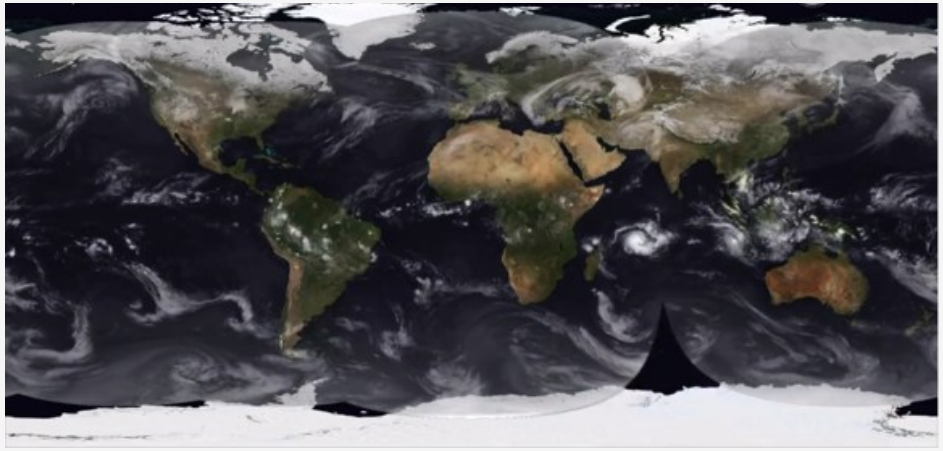
Climate Models vs Real World

animation online: http://www.youtube.com/watch?v=n0mupl4FZsQ&feature=related



animation online: http://www.youtube.com/watch?v=m2Gy8V0Dv78

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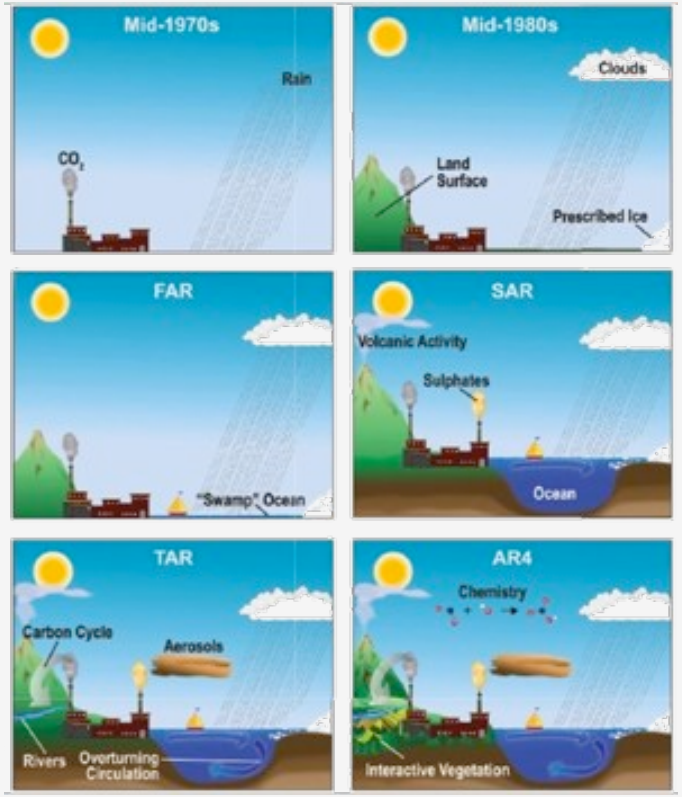
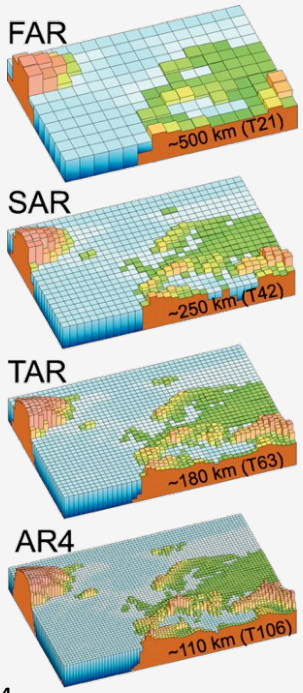
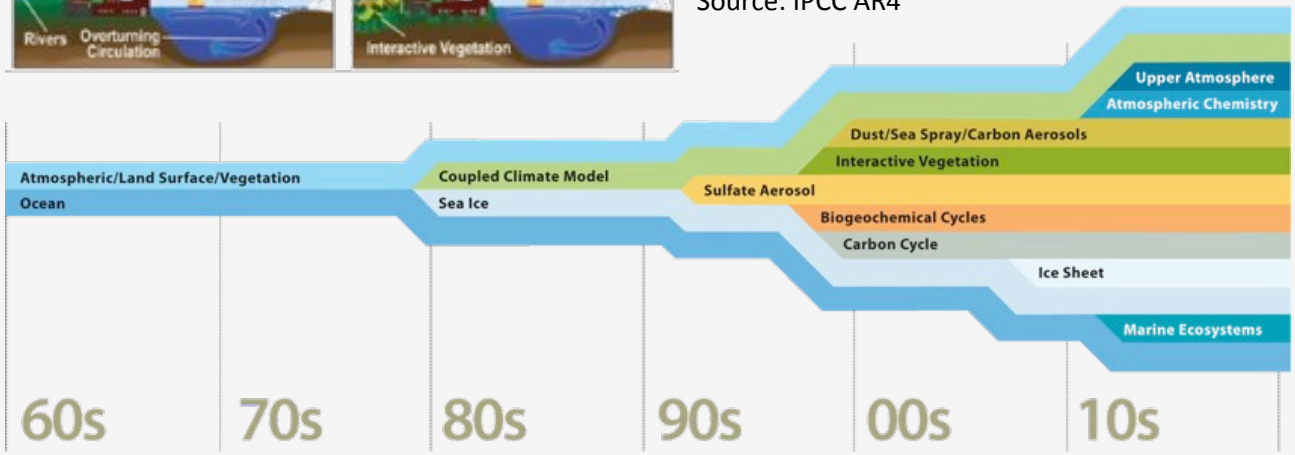
Climate Model Evolution





Source: IPCC AR4



Source: ©UCAR

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Adaptation Example I: Hydro Generation System Expansion - What are the prospects of operation in a future climate?

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Example: Manitoba Hydro

courtesy of Manitoba Hydro

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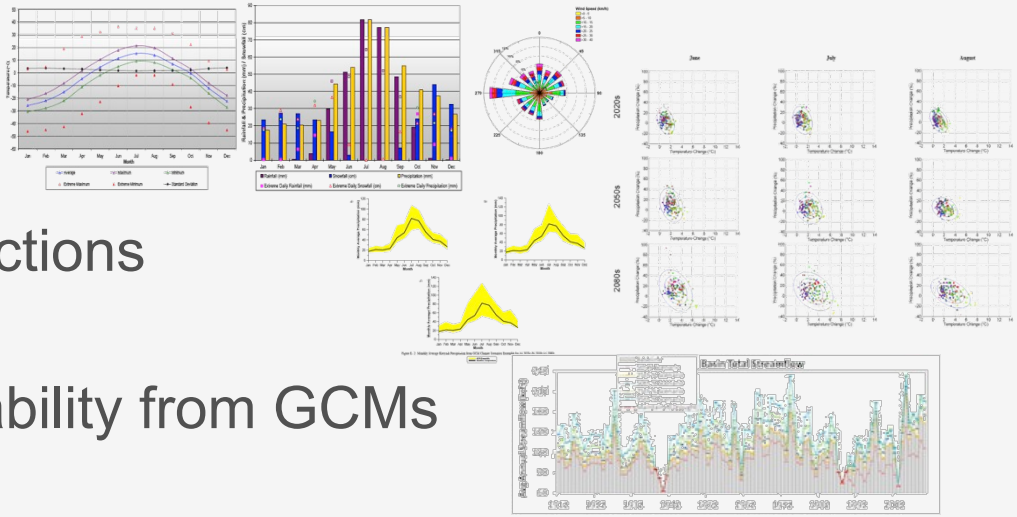
Example: Manitoba Hydro – How?

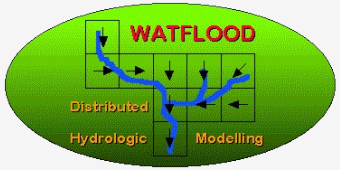
Manitoba Hydro + OURANOS

- get involved with climate experts

- built own hydro climate task force
- study observed climate



- study climate model projections
- assess future water availability from GCMs
- asses options using an impact model (SPLASH)
- set up a complex hydro model



courtesy of Manitoba Hydro

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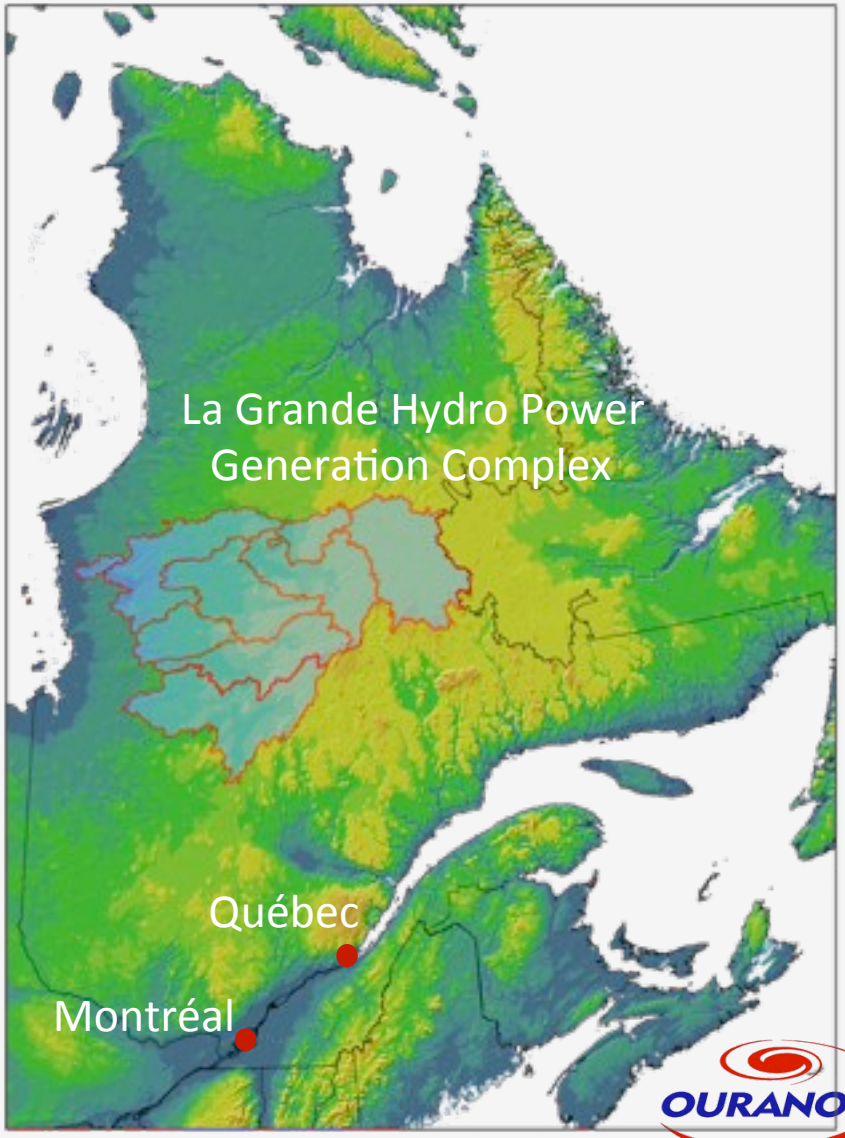
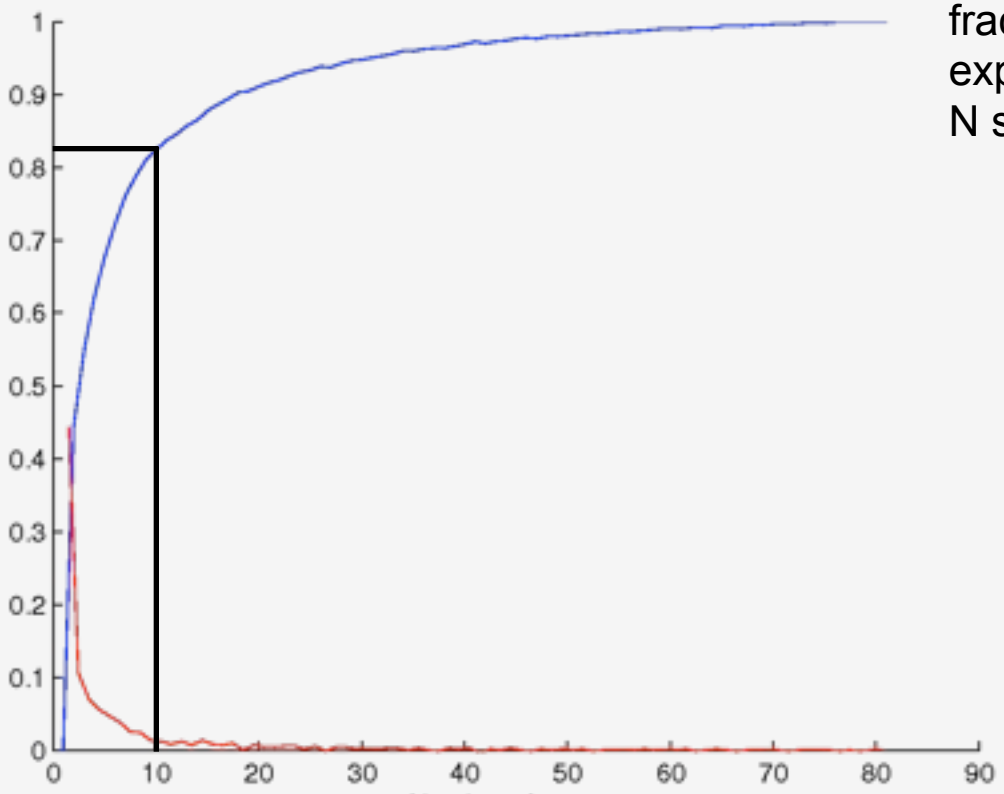
Adaptation Example II: Equipment refurbishment - Are future changes in water availability to be taken into account?

Hydro-Québec: Are CC impacts an issue for renovations?

- Installations will need refurbishment
- Request: « We need your best climate change scenario! »
- Response: Show why there is no single « best CC scenario » and propose alternative.



THE best simulation?
Uncertainty explained by N simulations



fraction of spread explained by N simulations

Δ fraction

number of climate model simulations

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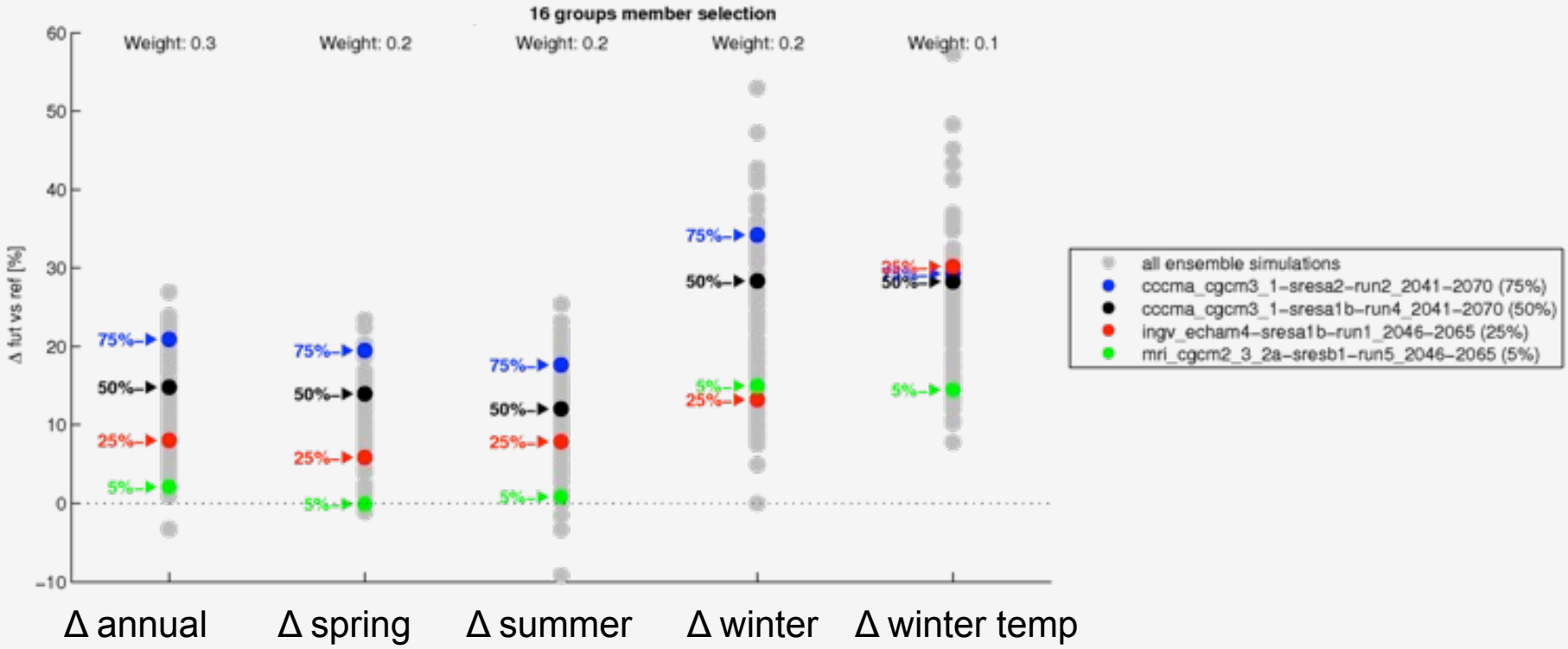
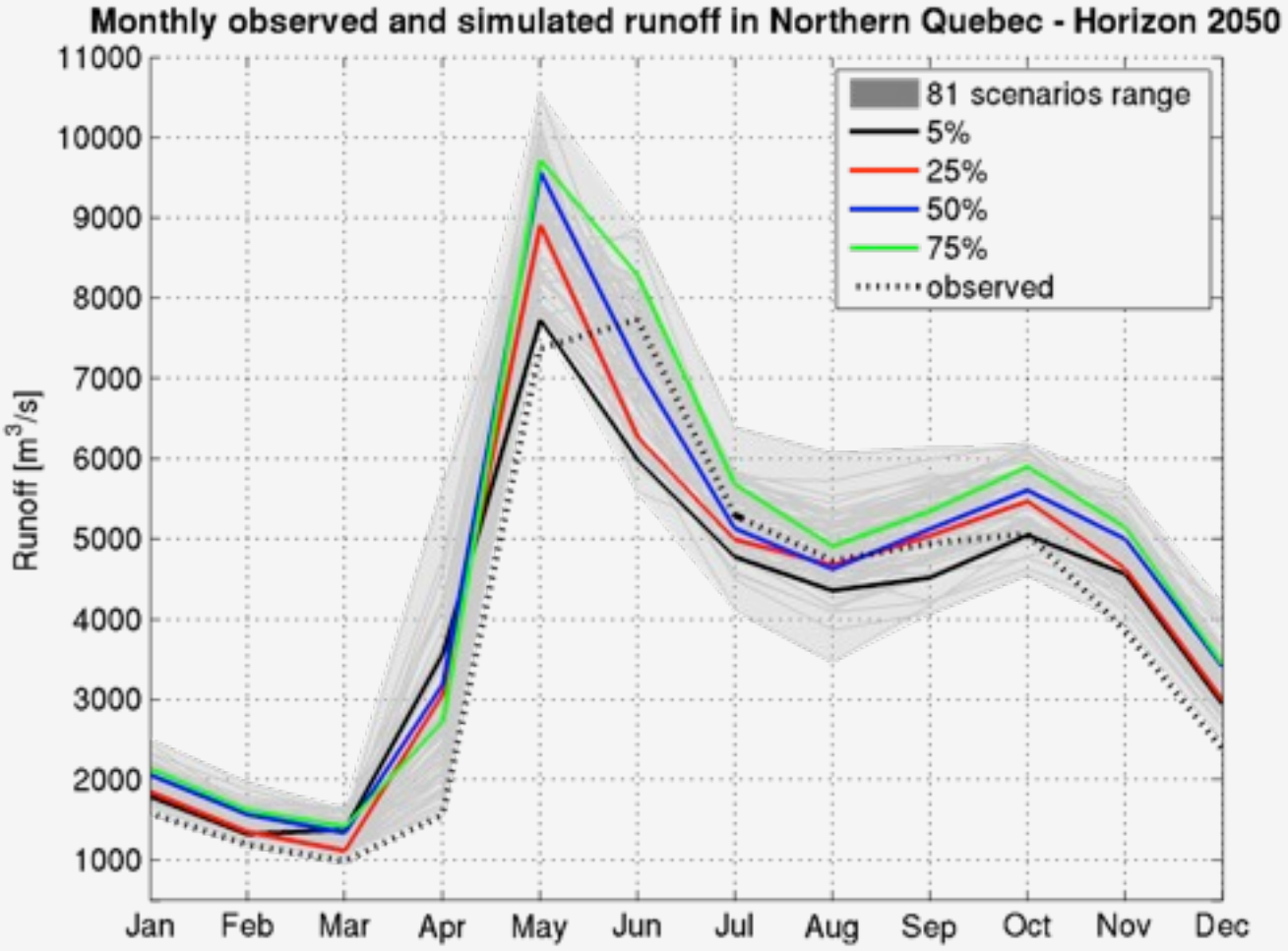
Response: Selection of four scenarios at 5%, 25%, 50% and 75% of change

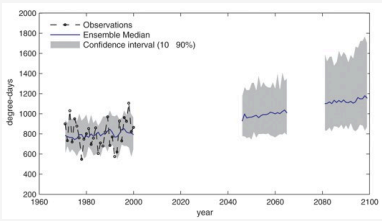
Selcection Criteria: Δ in energy production / temp

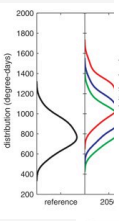


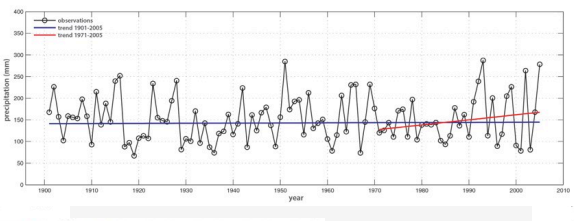
Response: Selection of four scenarios at 5%, 25%, 50% and 75% of change

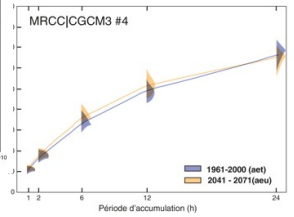


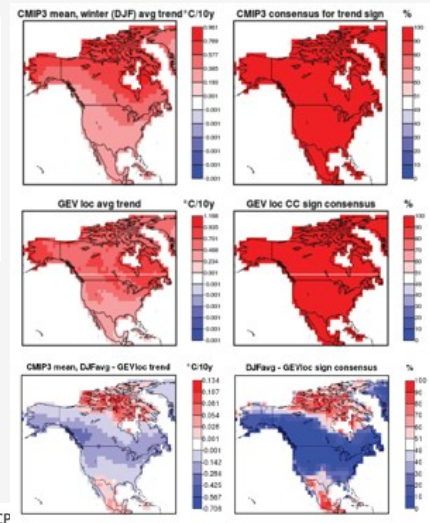
Climate Information Variety



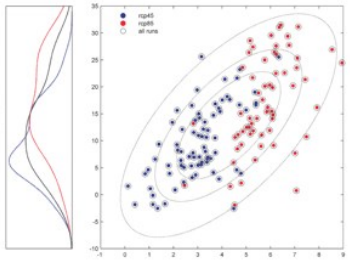


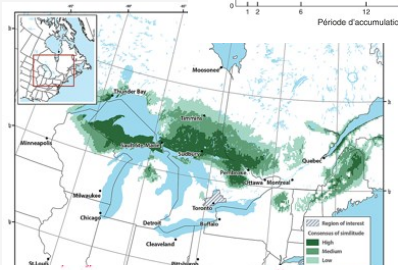


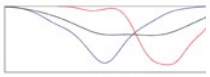


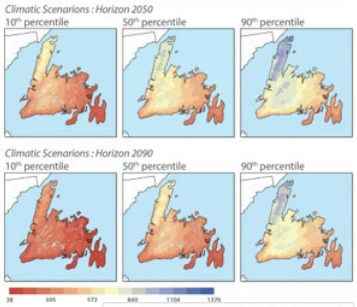


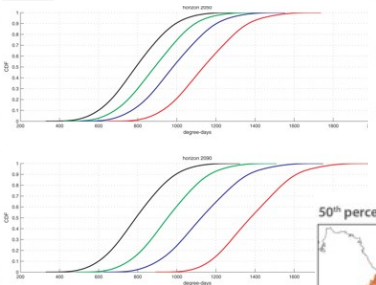
Climate Variable	Season	Projected changes for horizon 2050 (2040-2069)	
		Ensemble Median	Range (10th to 90th percentile)
Mean temperature (°C)	Annual	+1.8 °C	+1.3 °C to 2.7 °C
Precipitation	Annual Summer Winter	+ 6% -1% +8%	+2% to +12% -8% to +6% -2% to +15%
Growing degree days (degree days)	Annual	+ 283 degree days	+179 to +429 degree days
Frost-fee days (days)	Annual	+ 20 days	+12 to +29 days

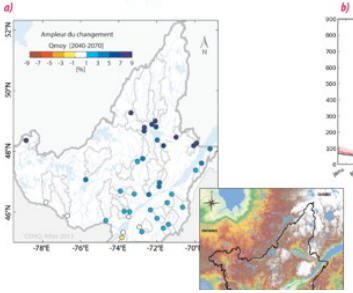


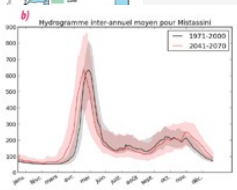


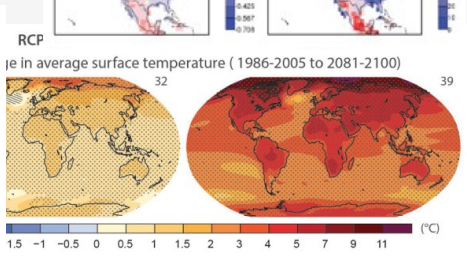


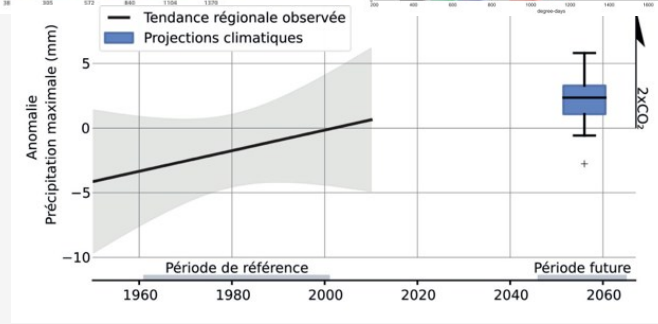


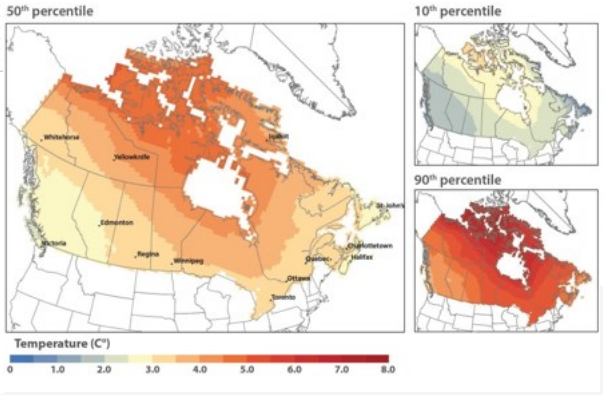


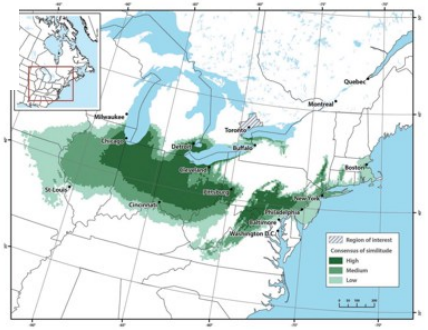








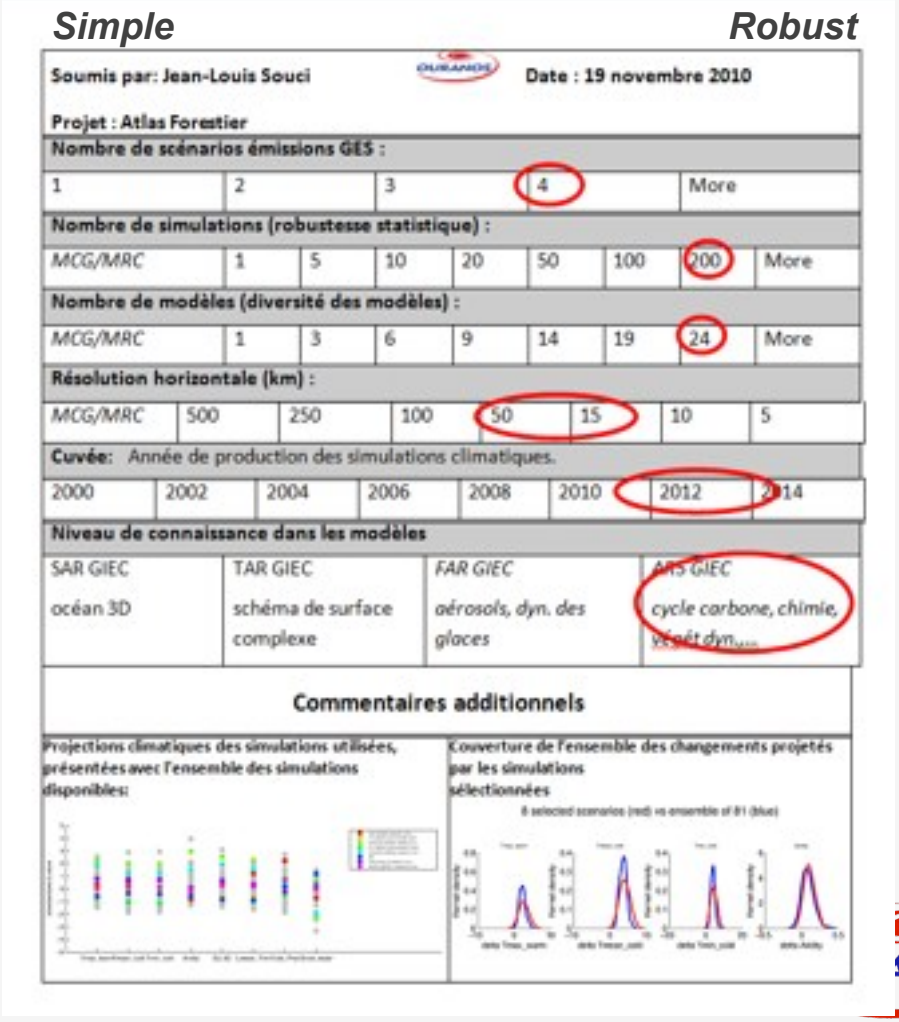




source: Isabelle Charron, A Guidbook on Climate Scenarios, 2014, Ouranos

Climate Services

- a bidirectional learning and communication process that should maintain
  - a critical spirit
  - transparency
  - credibility
  - responsibility
  - traceability



Simple ***Robust***

Soumis par: Jean-Louis Souci **Date : 19 novembre 2010**

Projet : Atlas Forestier

Nombre de scénarios émissions GES :							
1	2	3	4	More			
Nombre de simulations (robustesse statistique) :							
MCG/MRC	1	5	10	20	50	100	200	More
Nombre de modèles (diversité des modèles) :							
MCG/MRC	1	3	6	9	14	19	24	More
Résolution horizontale (km) :							
MCG/MRC	500	250	100	50	15	10	5
Cuvée: Année de production des simulations climatiques.							
2000	2002	2004	2006	2008	2010	2012	2014

Niveau de connaissance dans les modèles			
SAR GIEC	TAR GIEC	*FAR GIEC*	*AR5 GIEC*
océan 3D	schéma de surface complexe	*aérosols, dyn. des glaces*	*cycle carbone, chimie, végét dyn....*

Commentaires additionnels

Projections climatiques des simulations utilisées, présentées avec l'ensemble des simulations disponibles:

Couverture de l'ensemble des changements projetés par les simulations sélectionnées

Climate Services

- a bidirectional learning and communication process that should maintain
  - a critical spirit
  - transparency
  - credibility
  - responsibility
  - traceability
- can range from basic information and support to detailed, custom tailored analysis including R&D
- climate change information needs to include variability and uncertainties

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Conclusions

- Climate simulators (=models) provide climate information in abundance at different scales. The complexity of these data must be understood.
- Downscaling can be employed to meet scales and correct biases.
- Climate impact models can be driven with climate data (hydro models, management models, etc.)
- Appropriate assessment and documentation of uncertainties is required for all levels of scenario production and use (emission scenarios, models, natural variability, impact models, …)
- Climate experts can help in interpreting and processing these data into value added products (connect users + Climate Services)
- Despite all remaining climate projection caveats and uncertainties the information we have is sufficiently mature to show anticipated changes and the underlying level of confidence

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Thank You For Your Attention!

Questions?
Comments?

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