Communicating with the VIA community:
A guidebook on climate scenarios

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Montevideo, Uruguay

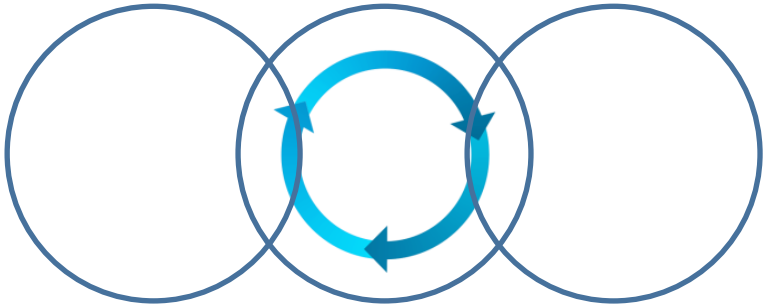
Natural Resources Canada | Ressources naturelles Canada

Canada

OURANOS

Ouranos: Consortium on Regional Climatology and Adaptation to Climate Change

Climate Scenarios and Services



Climate Simulations

Vulnerability, Impacts and Adaptation

CLIMATE SCIENCES		VULNERABILITY, IMPACTS AND ADAPTATION	
CLIMATE SIMULATIONS and ANALYSIS	CLIMATE SCENARIOS and SERVICES	NORTHERN ENVIRONMENT	AGRICULTURE
		ENGERGY RESOURCES	ECOSYSTEMS AND BIODIVERSITY
		MARITIME ENVIRONMENT	HEALTH
		FOREST RESSOURCES	BUILT ENVIRONMENT
		WATER RESOURCES	TOURISM

The motivation

- Knowledge transfer from producers of climate information to users of that information

- Increase the capacity of decision-makers to include climate information in an adaptation framework

  - All levels of climate information can be equally valuable
  - There is no such thing as the «best» scenario
  - The same climate information can be tailored and presented differently depending on user preference and expertise

The motivation

Identifying climate information:

one of the steps in an adaptation framework

Step 1: Get prepared	• Build a team • Begin a discussion on the issues or activity sector to prioritize
Step 2: Evaluate current vulnerability	• Describe the current system conditions • Describe the current stresses (climatic and others) • Describe the adaptation capacity of the system
Step 3: Understand climate change	• Understand the observations • Understand climate simulations and futures projections • Understand the uncertainties
Step 4: Evaluate future vulnerabilities and opportunities	• Identify the impacts and opportunities linked to climate change • Identify the importance of non-climatic factors • Evaluate the vulnerability of the system
Step 5: Develop and prioritize adaptation measures	• Identify potential adaptation measures • Prioritize adaptation measures
Step 6: Establish a plan and put it into action	• Identify actions to undertake in order to adopt adaptation measures • Follow-up on impact of adaptation measures • Adjust the plan as need be

The target audience

Decision-makers

- All those involved in climate change adaptation- from awareness to adaptation measures
- All sectors of activity
- Make better use of available climate information

Climate service providers

- Involved in providing information to users
- Novel way of identifying and categorizing user needs

A need to structure climate information

Information category	Examples of goals and purposes	Example of common formats
BASIC	•raise awareness •risk scanning	•Synthesis tables •Climate normals •Historical trends •Maps of projected global and regional changes
INTERMEDIATE	•vulnerability assessment •impact study	•Spatial analogues •Scatter plots •Evolution and maps of future values •Cumulative distribution functions
DETAILED	•evaluate adaptation measures •research and development	•Temporal series •Analysis of extremes •Analysis of lower-confidence variables (synthetic scenarios/ climate models)

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Increasing complexity in type of climate variable

Increasing resolution, scale of information, or amount of data

Climate information formats

Tailoring

3.2.4 – Evolution of future values

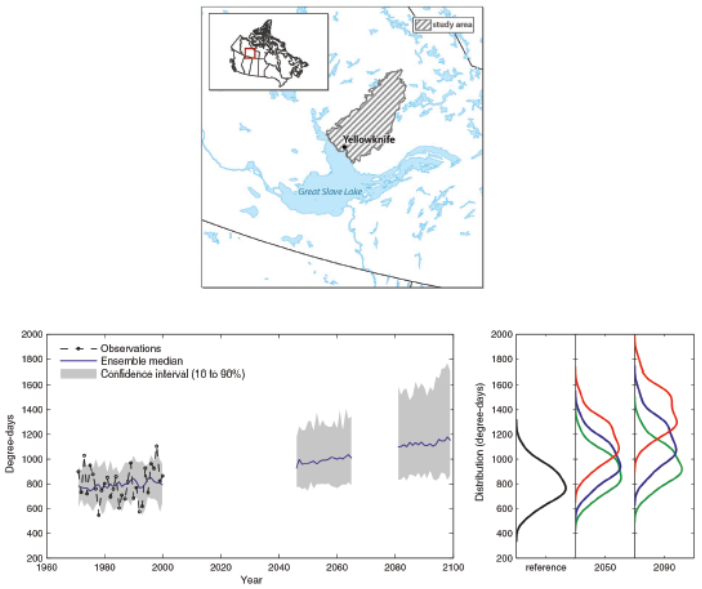


Figure 11: Left: Evolution of the mean annual number of growing-degree days for the years 1971-2100 for the Greater Slave Lake region. The values are calculated using an ensemble of 79 simulations, while the observations come from an NRCan dataset[10]. Right: The distributions values of the regional mean for observed values (black curve) and projected values are shown as the 10th, 50th, and 90th percentiles of the ensemble of climate scenarios (green, blue, and red curves respectively.

Source: T. Logan, Ouranos

What climate information is presented in the figure?

The figure presents the evolution of the number of annual growing degree-days from 1971 to 2100 for a region surrounding Yellowknife in the North West Territories.

Growing-degree days correspond to the absolute difference in mean daily temperature above a threshold of 5°C. For example, if the daily mean temperature is equal to 10°C, the number of growing-degree days for that day is equal to 5. If the temperature is below 5°C, the growing-degree days are equal to zero. Annual values are obtained by adding up the growing-degree day values of all days for the year.

How is the figure constructed?

This type of figure presents the evolution of the projected values of a specific climatic variable for a particular region of interest. Hence, it not only shows the median values for specific time horizon but also how the values evolve over three time periods. A total of 79 simulations (75 from the CMIP3 global ensemble and 4 from the regional CRCM 4.2.3 model[9]) were used to construct this figure (following post-processing).

The left panel presents the average growing-degree days for all grid points for the region of interest shown in the hatched area. The black line shows observed values (notice the observed natural variability of the climate over that time period), the blue line represents the median of the CMIP3 ensemble simulations and the grey envelope represents the confidence interval around the median. This panel uses a bias correction post-processing method.

The panel on the right shows the distribution of the 30 observed annual values of growing-degree days for the reference period (black line), as well as the distributions of the 30 projected years of three individual climate scenarios for both the 2050 (2046-2065) and 2090 (2081-2100) horizons. Three plotted scenarios are selected from the total of 79 by first calculating the average delta values for all scenarios for the two time horizons. The three individual scenarios for each horizon are then chosen as those having (1) the median (blue curve), (2) the 10th (green curve) and (3) the 90th (red curve) percentile values of the average projected change out of the 79 simulations for the horizon in question. Note that the three scenarios are not necessarily the same for each horizon of interest (i.e. the scenario showing the median change in 2050 is probably not the 'median' scenario in 2090). This panel uses a scaling post-processing method which allows a direct comparison of future scenarios with the observed distribution.

How is the figure be interpreted?

The left panel shows a projected increase in the number of growing-degree days from 1971 to 2100. The right panel shows an upward shift in the distributions of the simulations for 2050 and 2090, particularly for the median and 90th percentile distributions indicating a change in mean climate conditions. The shapes of the distributions do not change drastically (compared to the observed) indicating that the inter-annual variability is relatively similar between the observed and future horizons.

What are the limitations/pitfalls/possible ways to misinterpret the figure?

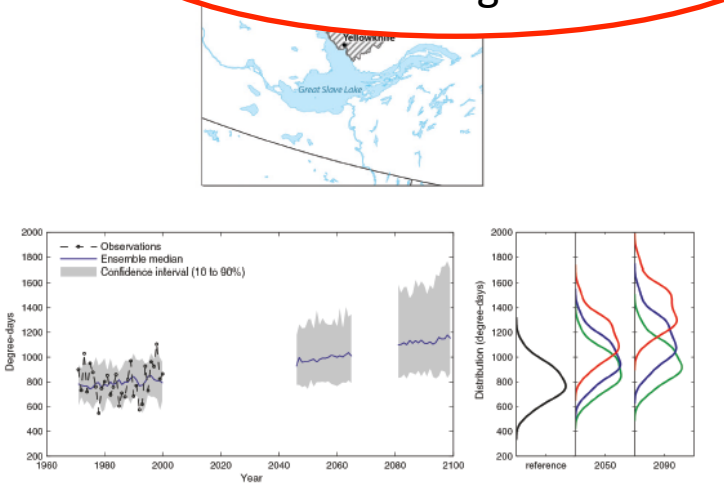
Investigating the left panel in isolation reveals that while there is definitely a projected increase in growing-degree days, there is also a widening of the grey envelope (uncertainty) into the future. An important point is that the grey envelope contains all sources of uncertainty, not just the inter-annual variability. For example, the widening of the envelope could easily lead a user to mistakenly conclude that in the future, the simulations project both warmer average conditions (centered approximately in the middle of the envelope) and an increased amount of variability between individual years (inter-annual variability). However, this is not how the figure should be interpreted. The width of the grey envelope for the future horizons is in fact the result of multiple sources of uncertainty, not only inter-annual variability as for the reference period, but also uncertainty between the different SRES families (i.e. more or less GHGs in the atmosphere), as well as uncertainties in climate model sensitivity (i.e. how sensitive different climate models are to a given increase in GHG concentrations). It is therefore false to assume that the wider grey envelope for future horizons solely represents greater inter-annual variability, as represented by the grey envelope for the reference period.

In order to better understand whether there is indeed an increase in the inter-annual variability (increased fluctuations between years) we need to investigate the panel on the right. Comparing the coloured future distributions with the observed distribution highlights the fact that the distribution shape does not actually change very much in the future (similar widths, tails, etc.), and what is projected is more of a simple upward shift of the distribution in the future, with an increased separation between the green, blue and red curves between 2050 to 2090. Going back to the left panel we can now much more easily conclude that, in this case, the change in width of the grey envelope is due to this increasing separation between the individual climate scenarios (due to differences in emissions and climate model sensitivity) and not because of an increase in inter-annual variability.

Climate information formats

3.2.4 – Evolution of future values

Understanding the information presented in the figures



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Climate information formats

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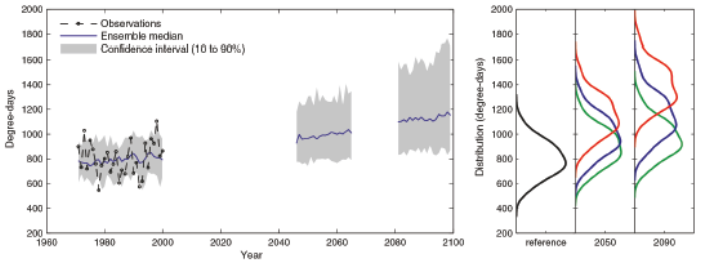
Key climate modeling concepts



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Lessons learned

- Structuring the way we provide data (what is most important in deciding what information to give)
- Difficulties in separating and characterizing the categories
- Finding the correct level of language used (some jargon is necessary but it needs to remain fairly simple)
- From a Climate science specialist view point, explanations regarding reference climate data are missing
- Lessons will come with the use of the guide and feedback from users

Thank you!

Note that the guidebook is available online:

English: http://www.ouranos.ca/media/publication/352_GuideCharron_ENG.pdf

French: http://www.ouranos.ca/media/publication/351_GuideCharron_FR.pdf