Perspectives on Climate Data and Information in Ontario

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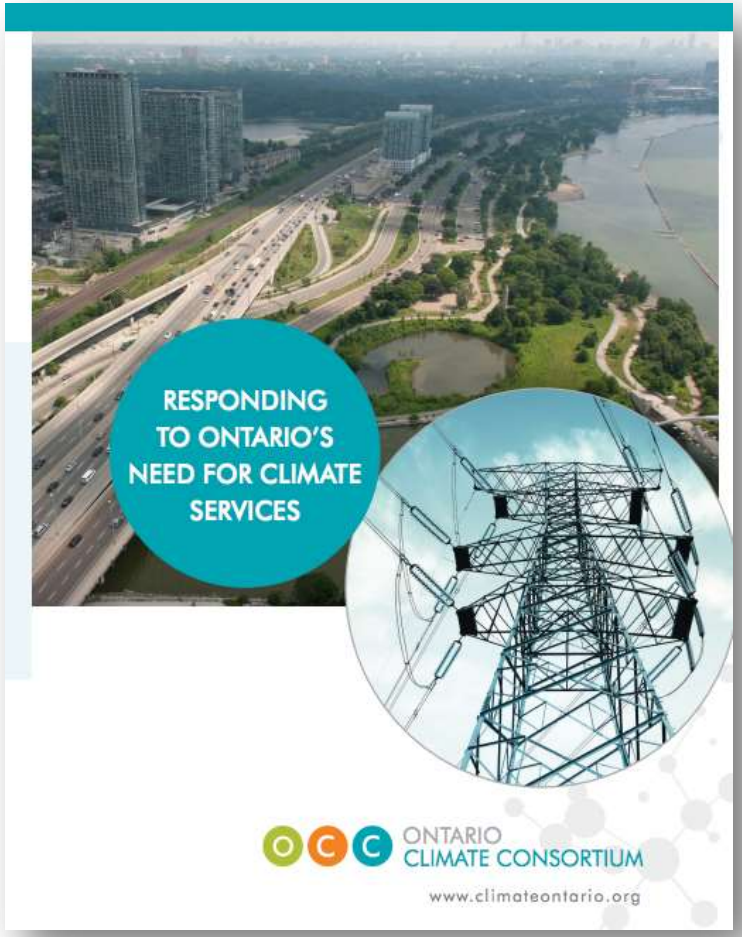
Toronto and Region Conservation

With Support From:

Ontario Climate Consortium



- Collaborative of Ontario researchers and end-users in the public and private sector
- 3 Program Streams:
  - Climate Information
  - Impacts and Adaptation
  - Research Mobilization

Founding Members: York University redefine THE POSSIBLE. Toronto and Region Conservation for The Living City

Ontario Climate Consortium

YORK UNIVERSITÉ UNIVERSITY

Region of Peel
Working for you

UNIVERSITY of GUELPH

McMaster University

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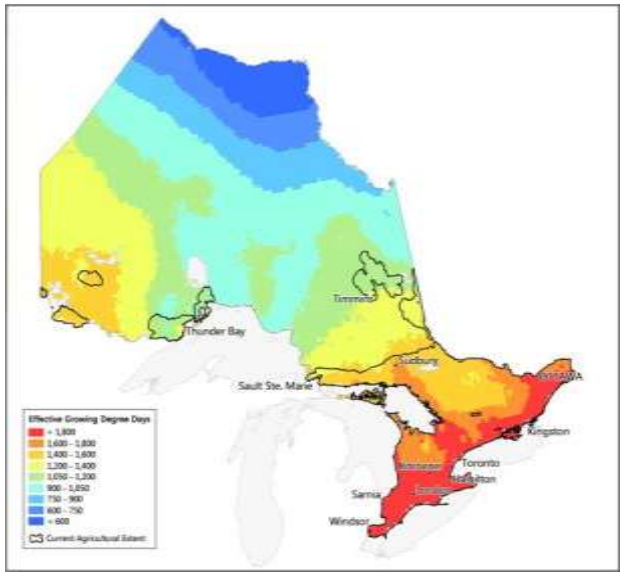
State of Climate Change Science in the Great Lakes Basin: A Focus on Climatological, Hydrologic and Ecological Effects

Climate Change Vulnerabilities of Community Services and Assets in the Region of Peel

Discussion Points

1. Climate information and why we need it
2. Climate data and information in Ontario
3. Challenges and moving forward



Part 1

WHAT IS CLIMATE INFORMATION AND WHY DO WE NEED IT?

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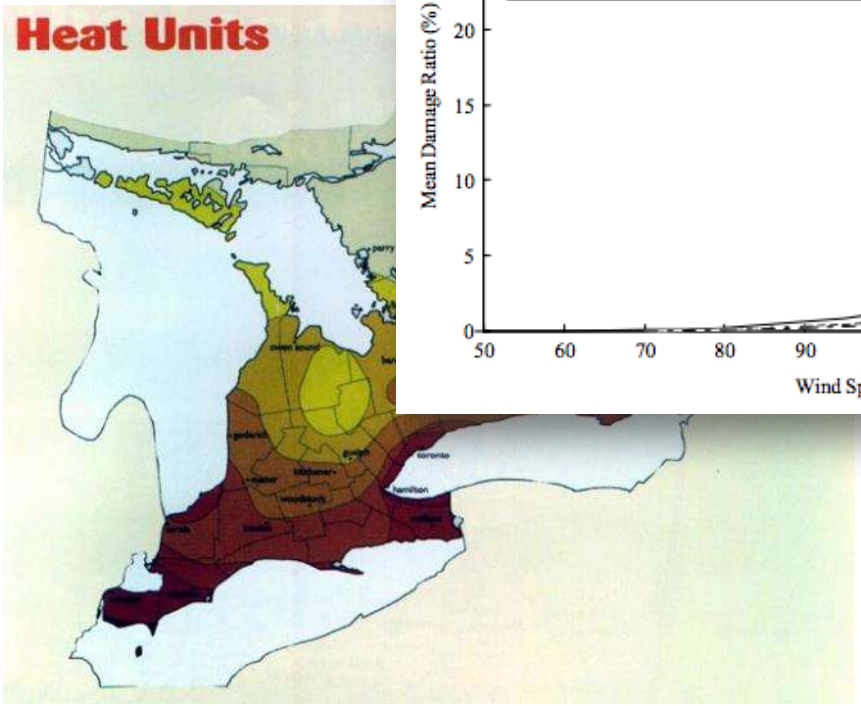
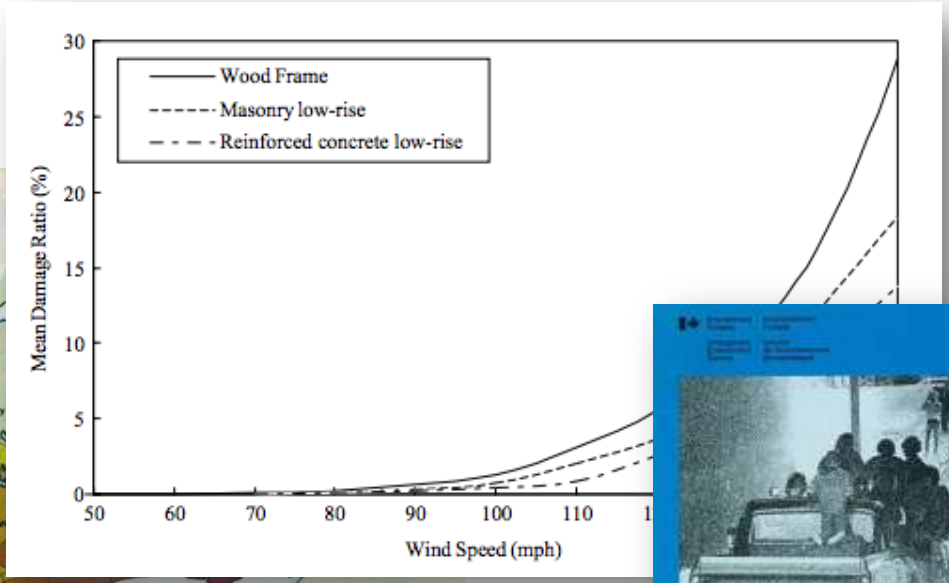
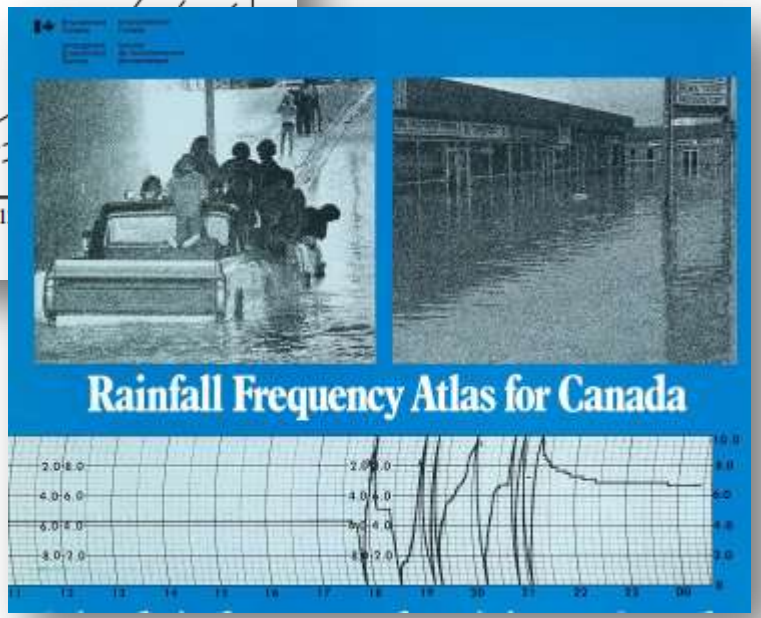
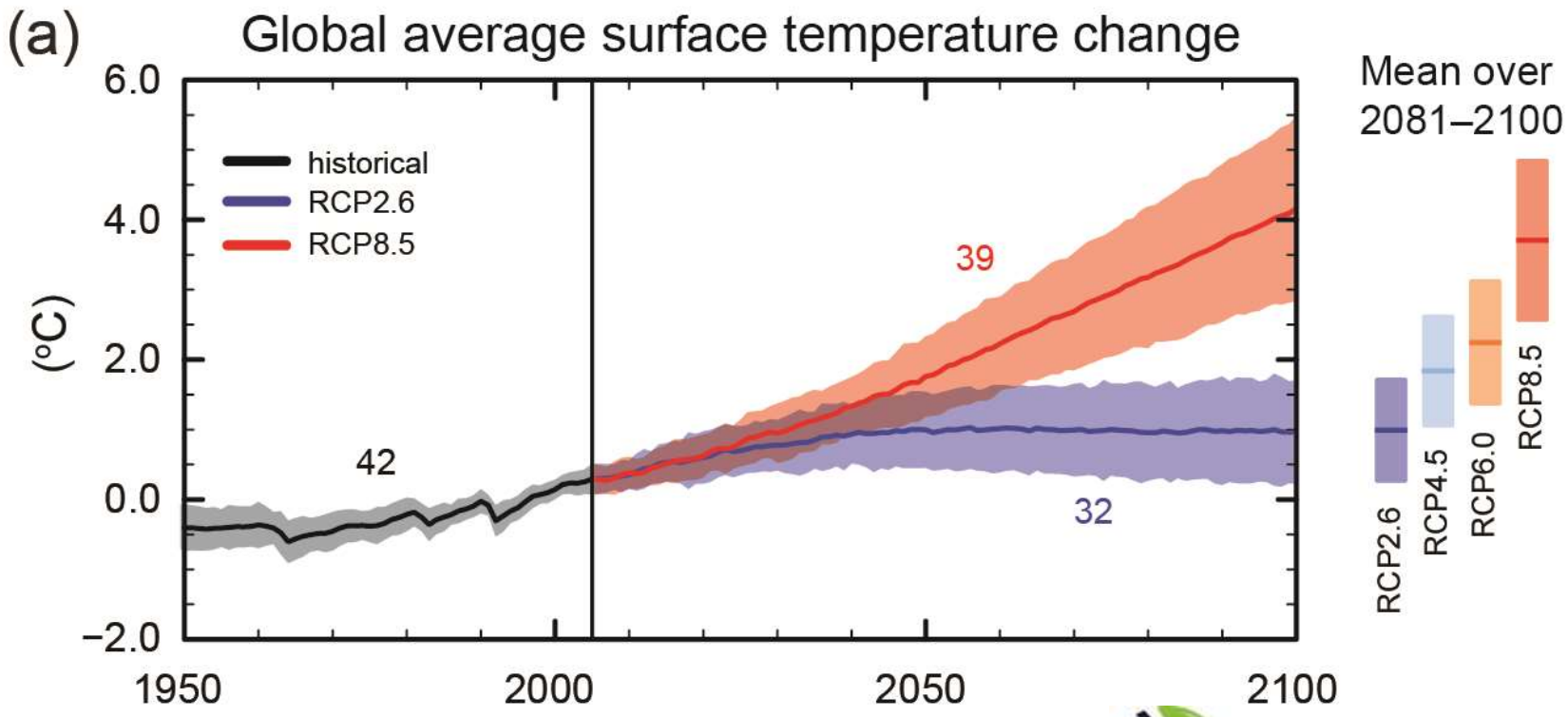
Why do we need climate information?







Why do we need climate **change** information?



Credit: IPCC(2013)

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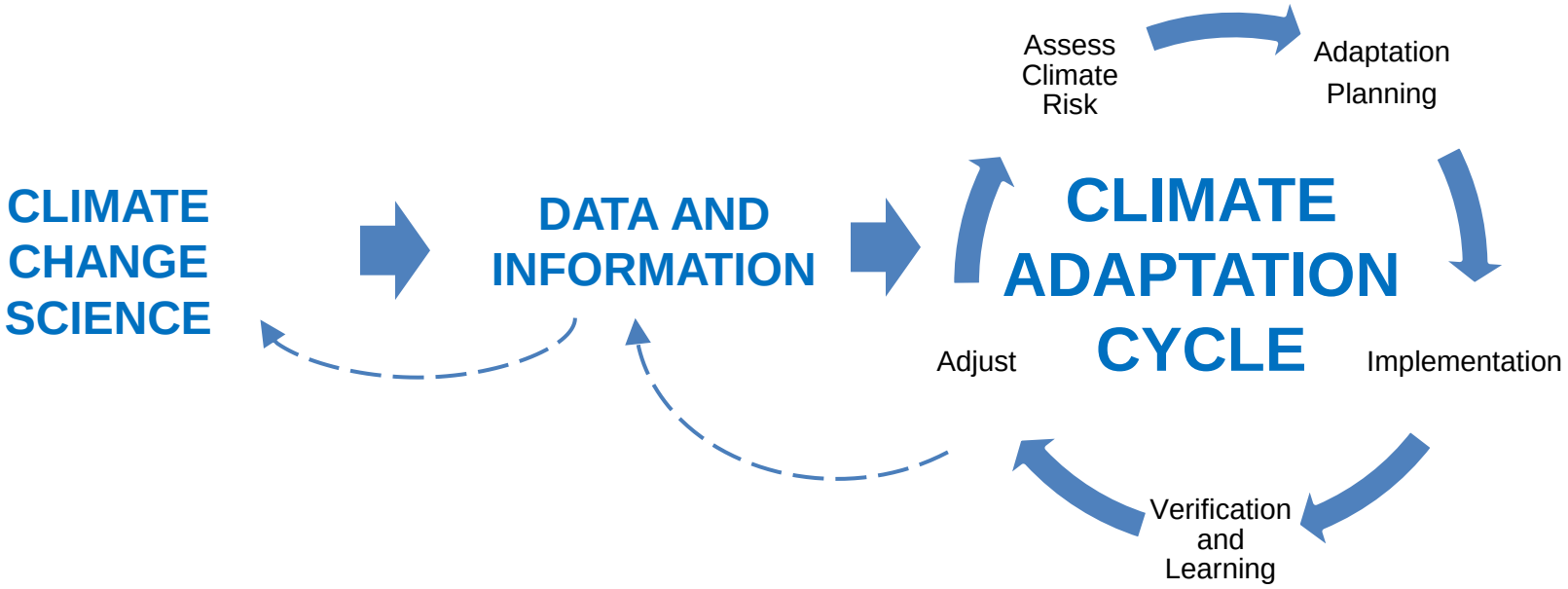
Why do we need climate **change** information?



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Climate Information: a Definition

- Observed, modeled or synthetically created data records (time series) at stations or as gridded products
- Trends, variability, and higher-order statistics, extremes, inter-annual variability, and inter-decadal variability, for both the past and projected future
- Metadata and contextual information required to interpret and use these climate datasets

Adapted from: UNEP (2009) Climate information and capacity needs for Ecosystem Management under a Changing Climate.

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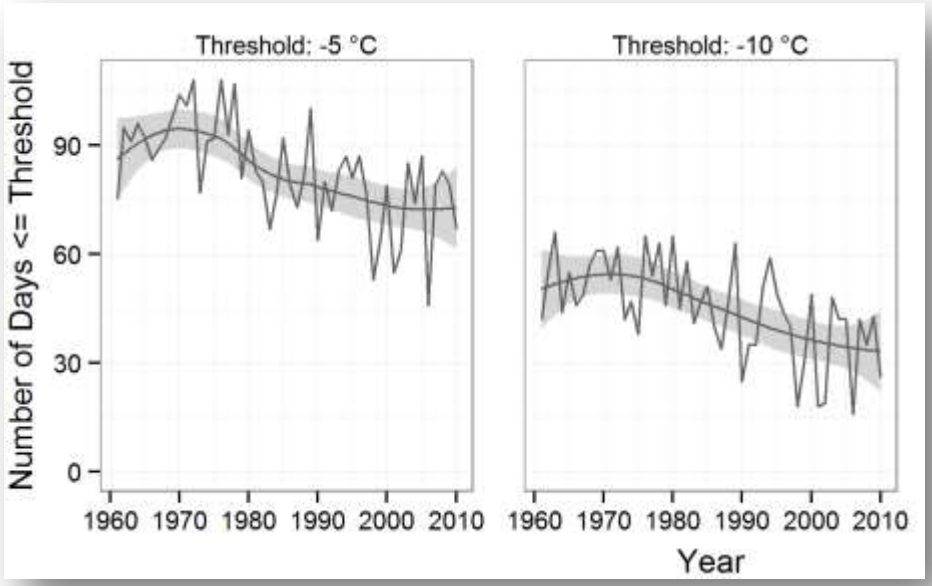
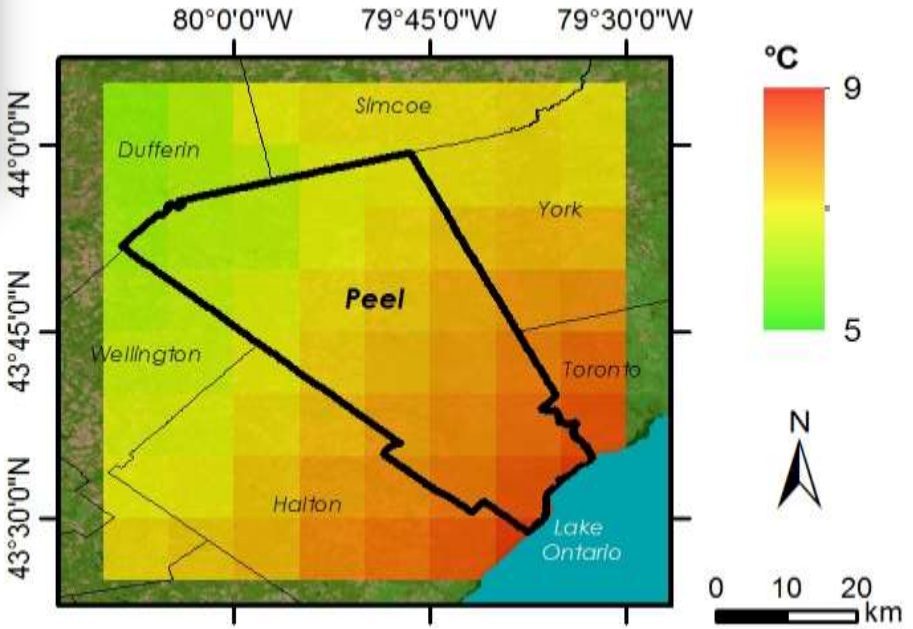
Sources of climate information for adaptation planning

1. Historical information
2. Future climate projections

Historical Data



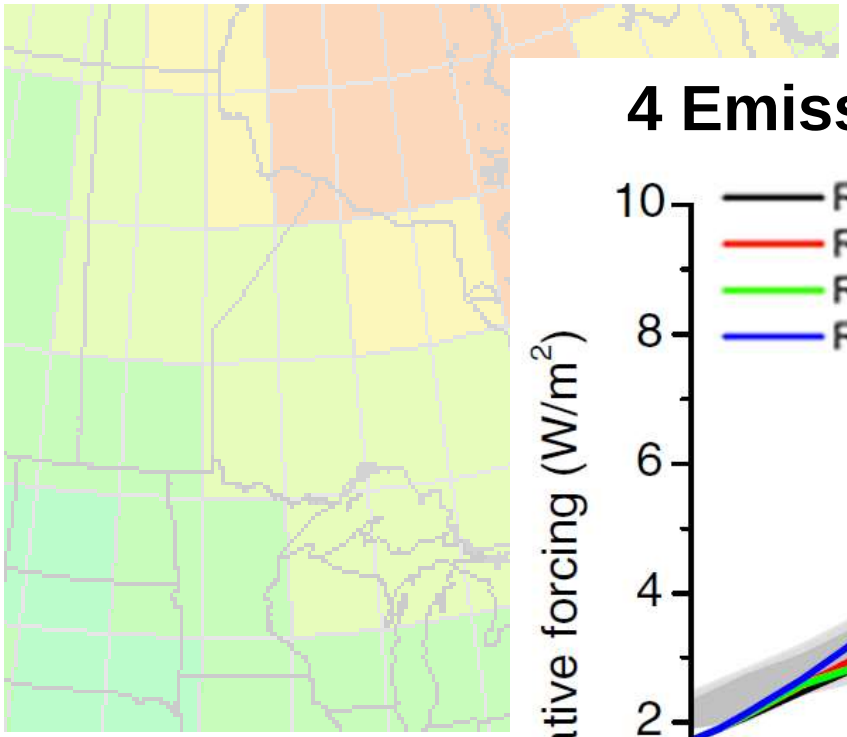
Trends in the number of days below low temperature thresholds (T_{min} <= threshold) for the Pearson Airport Station.



Annual mean temperature for the baseline period (1981-2010).

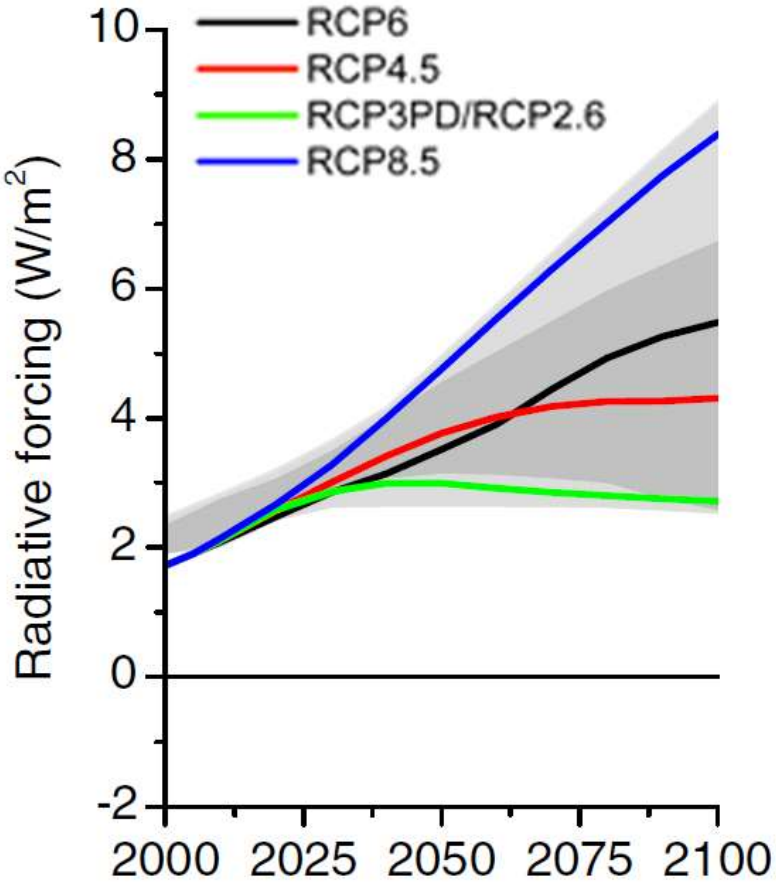
Climate Model Projections

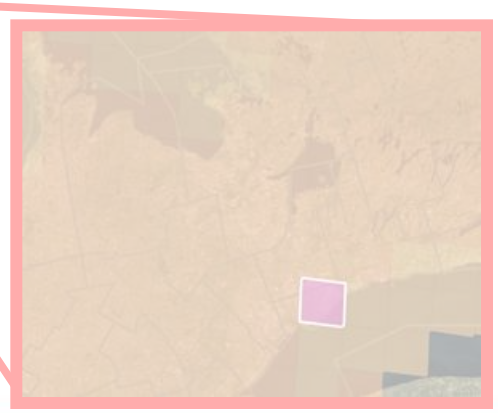
20 Climate Modelling Centres



GCM

4 Emission Scenarios





Downscaling

- **Dynamical downscaling** relies on the use of a regional climate model (RCM), similar to a GCM in its principles but with high resolution. Bounded by the GCM but it can reflect effects of mountains, coastlines, vegetation at a more local scale.

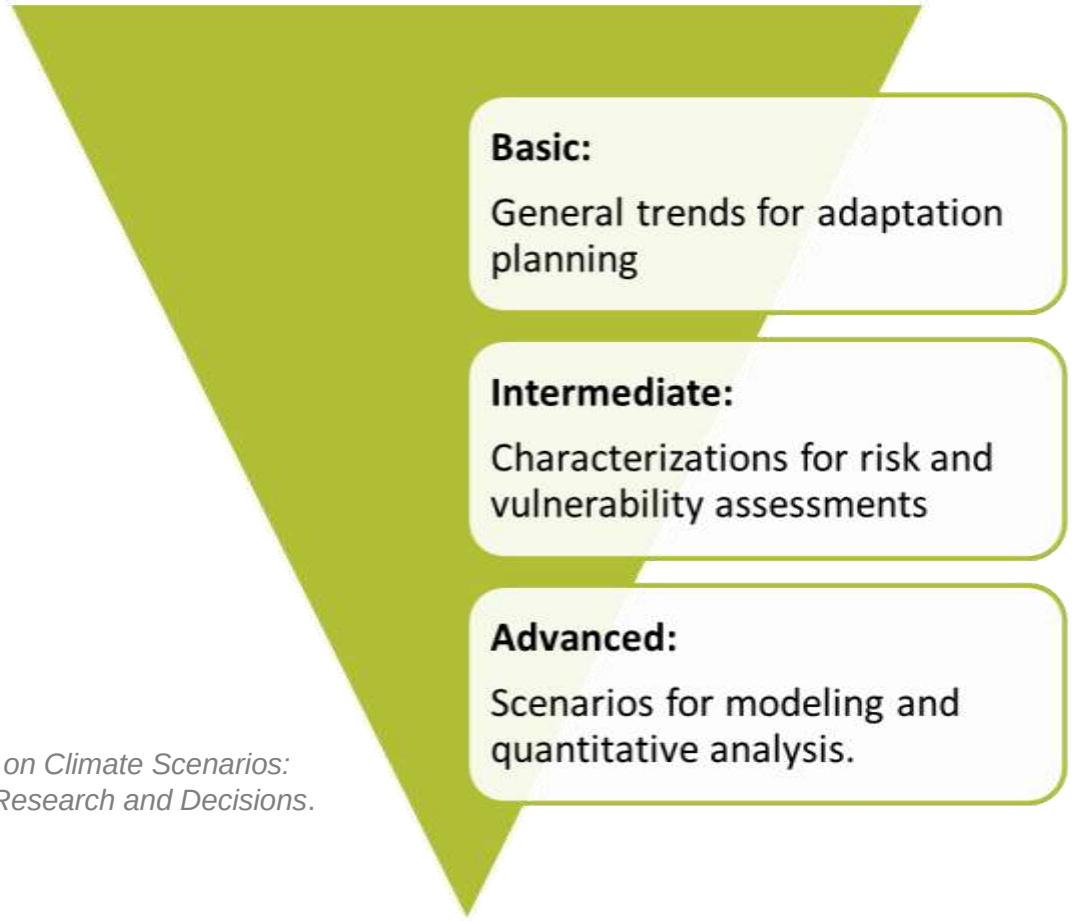
- **Statistical downscaling** involves the establishment of empirical relationships between historical and/or current large-scale atmospheric and local climate variables.

(USAID 2014)

Climate change information in adaptation planning

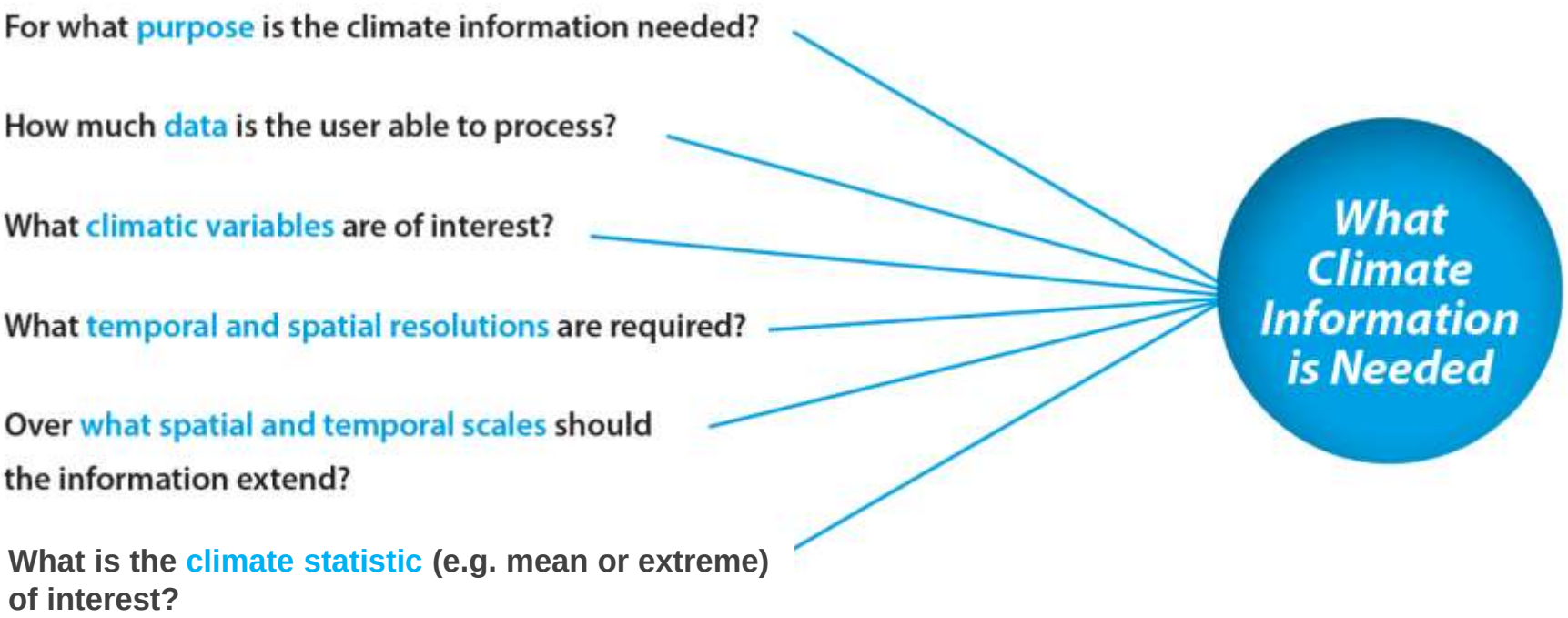
Increasing:

- Parameter complexity
- Resolution
- Specificity
- Level of effort
- Uncertainty



Adapted From: Charron, I. (2014). *A Guidebook on Climate Scenarios: Using Climate Information to Guide Adaptation Research and Decisions*. Ouranos, p. 86

What climate information is needed for adaptation?



From: Charron (2014), p.6

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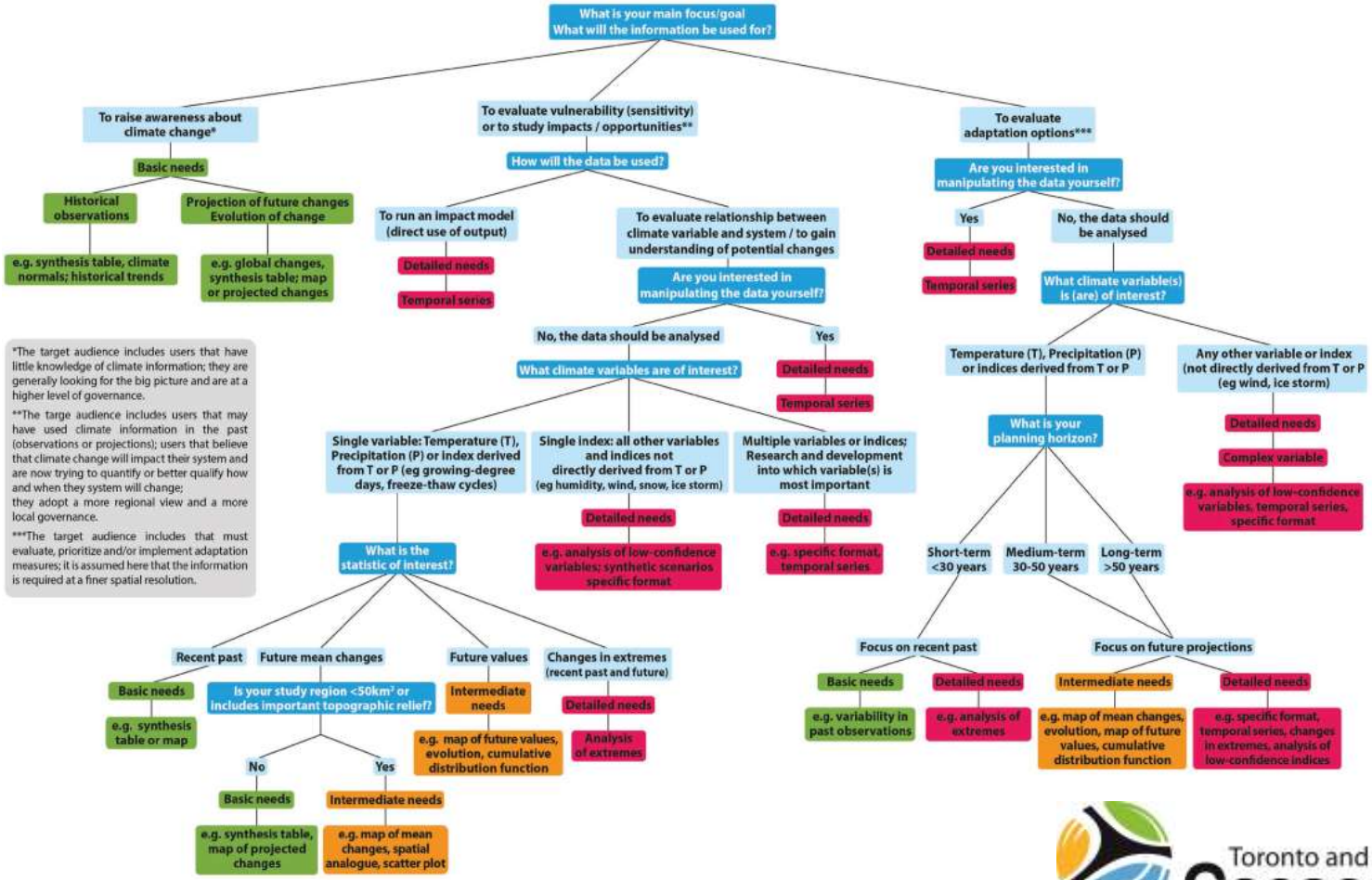

From: Charron (2014) p. 8

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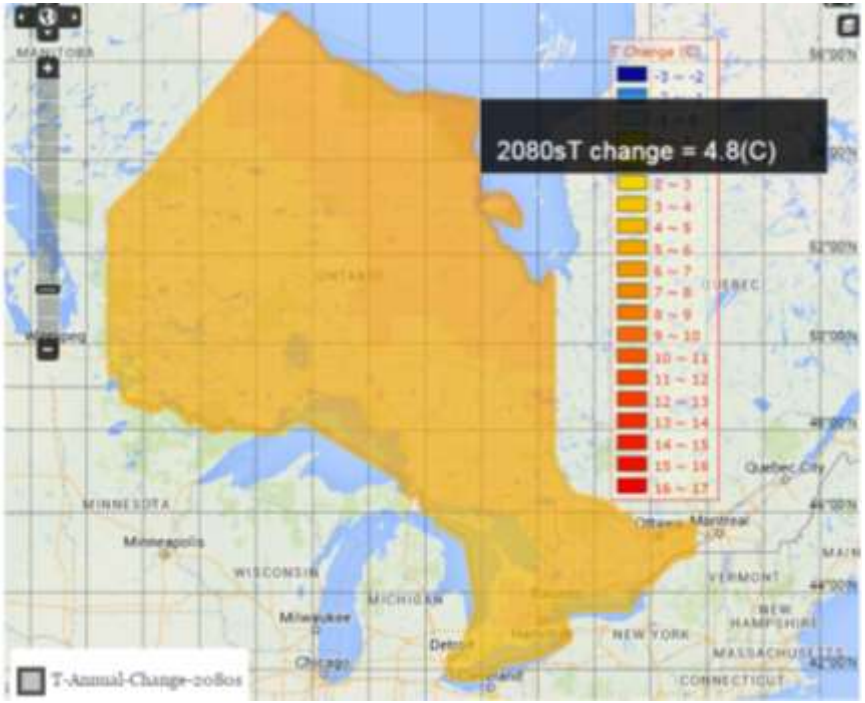

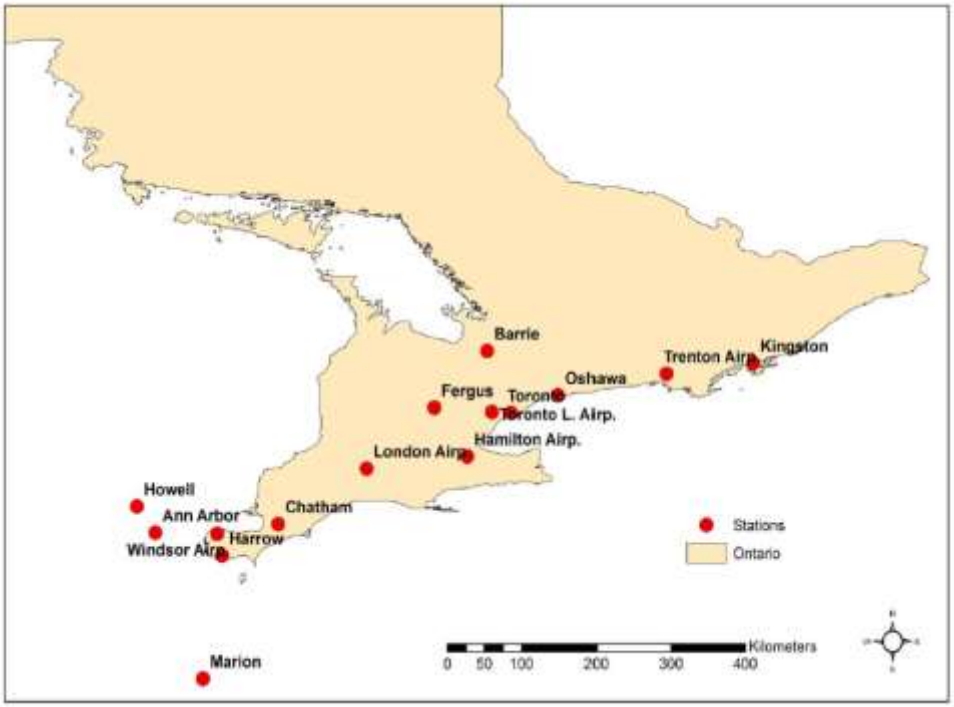

Part 2

CLIMATE INFORMATION IN ONTARIO

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Where can Ontario Users get climate information?

Historical Data:

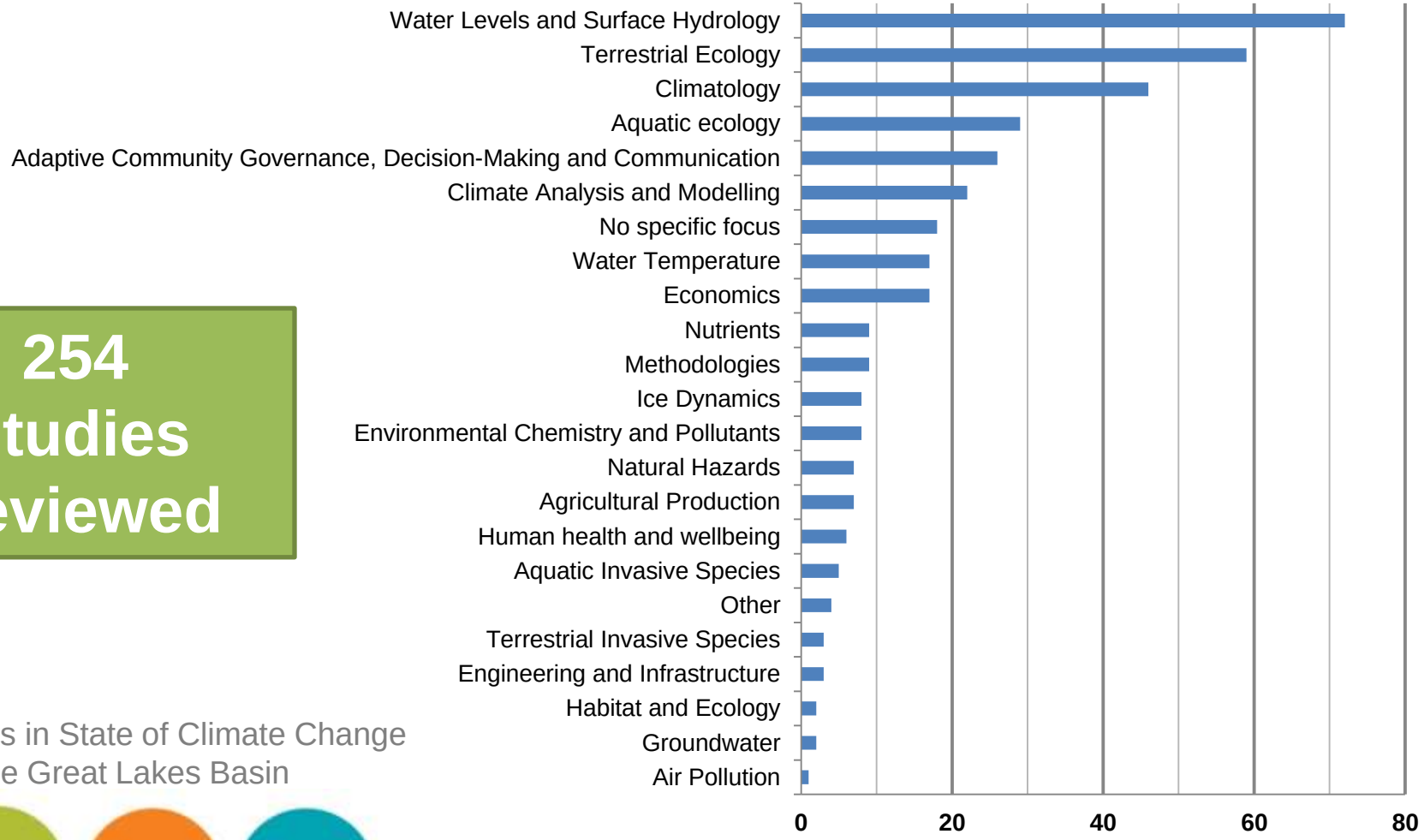
- Environment Canada data archives
- Other public and private monitoring networks
- At least 14 different gridded or infilled station historical data products

Where can users in Ontario get future climate projections?

Climate Projections:

- At least 21 different publicly available future climate datasets, many with multiple subsets
  - Include various combinations of global climate and regional climate model output and statistically downscaled data
- Custom analyses by intermediary agencies, universities, and consultants

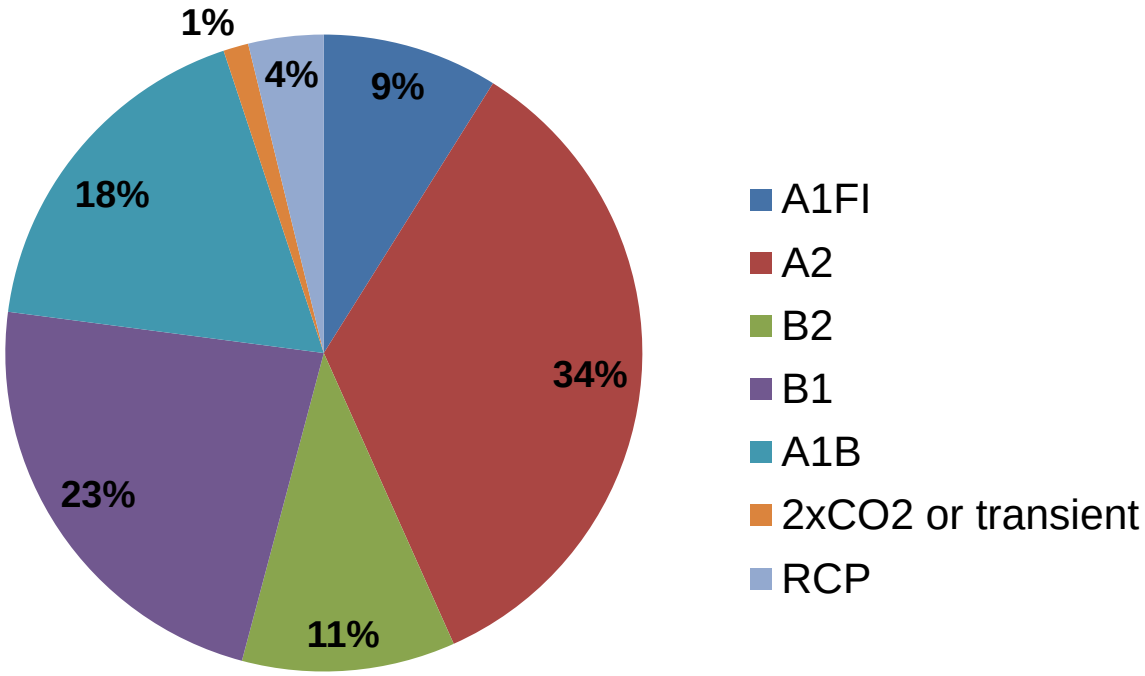
What kinds of work is climate information being used for?



254 Studies Reviewed

From analysis in State of Climate Change Science in the Great Lakes Basin

What climate information are Ontario users using?



- Most scenarios are from AR4, using the "business as usual" A2 scenario
- New RCPs are slow to be used in applications

Percent use of each scenario (N=157)

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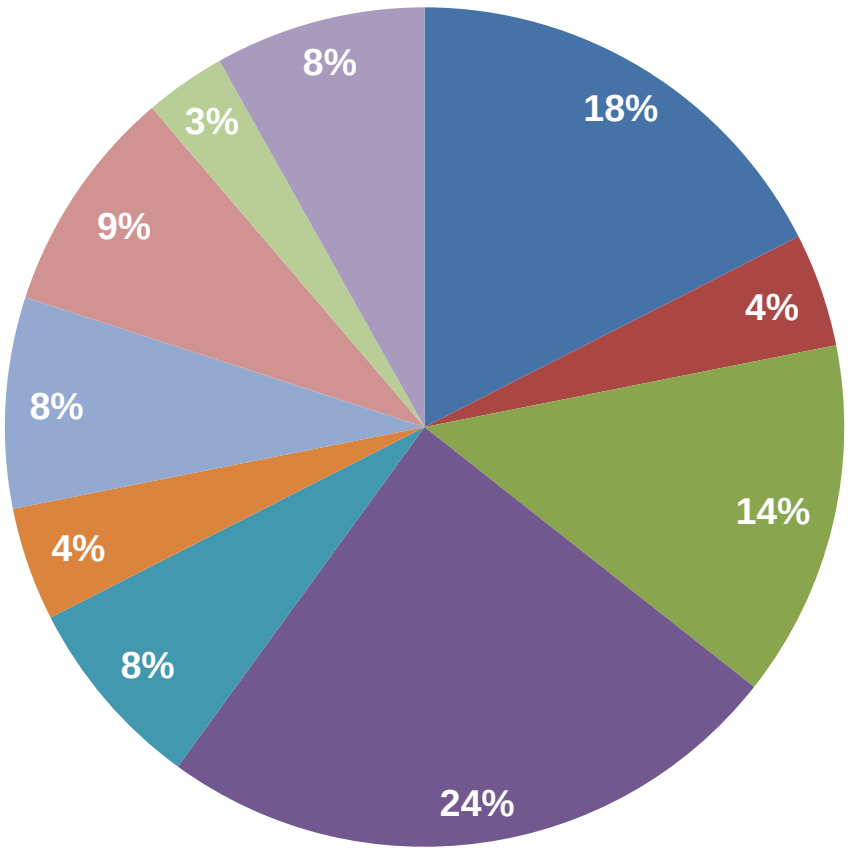
What climate information are Ontario users using?

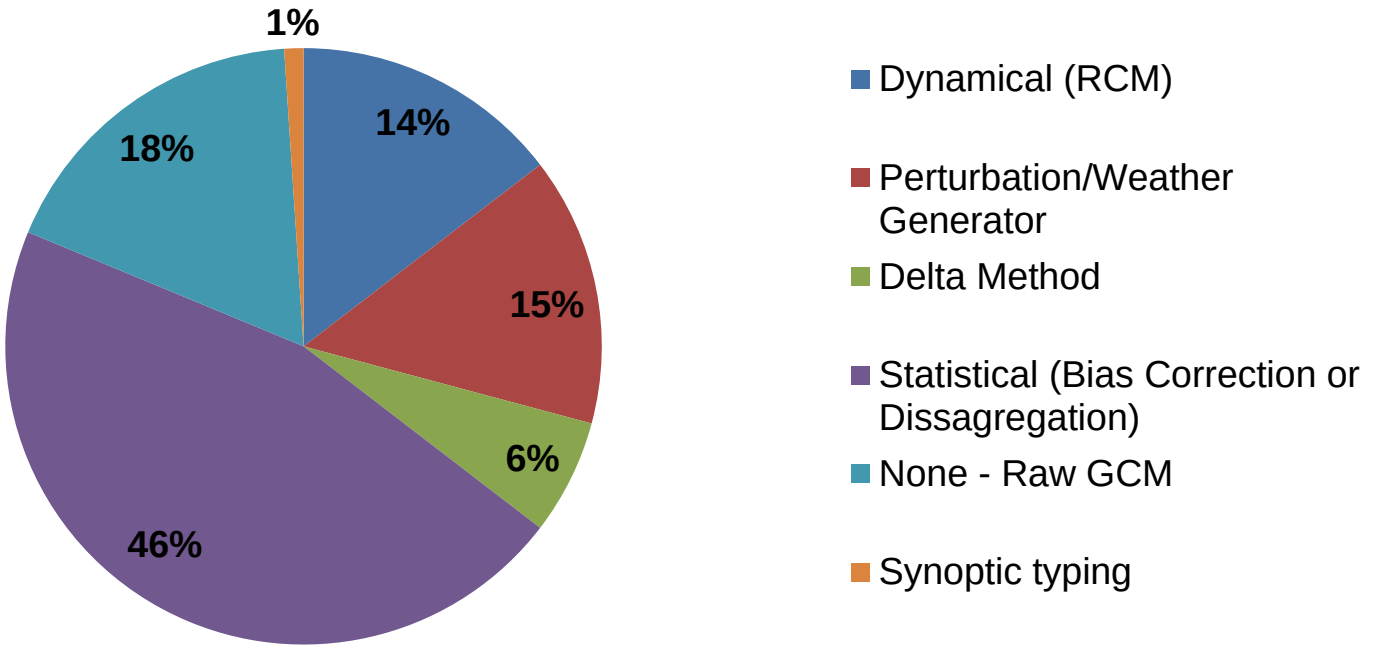


- Certain models are more "popular" than others
- Use of large ensembles is more rare
- Small ensembles are more common (< 5 models)

Percent use of climate models (N=180)

What climate information are Ontario users using?

Downscaling Methods



- 26 % Percent using GCMs only, no downscaling
- Statistical downscaling is often relatively unsophisticated
- Dynamical downscaling includes use of “stock” regional climate models

How do Ontario users decide what climate information to get and how to use it?

- Word of mouth
- Informal networks and communities of practice
- Convenience and familiarity with sources
- Guidance and information from expert organizations

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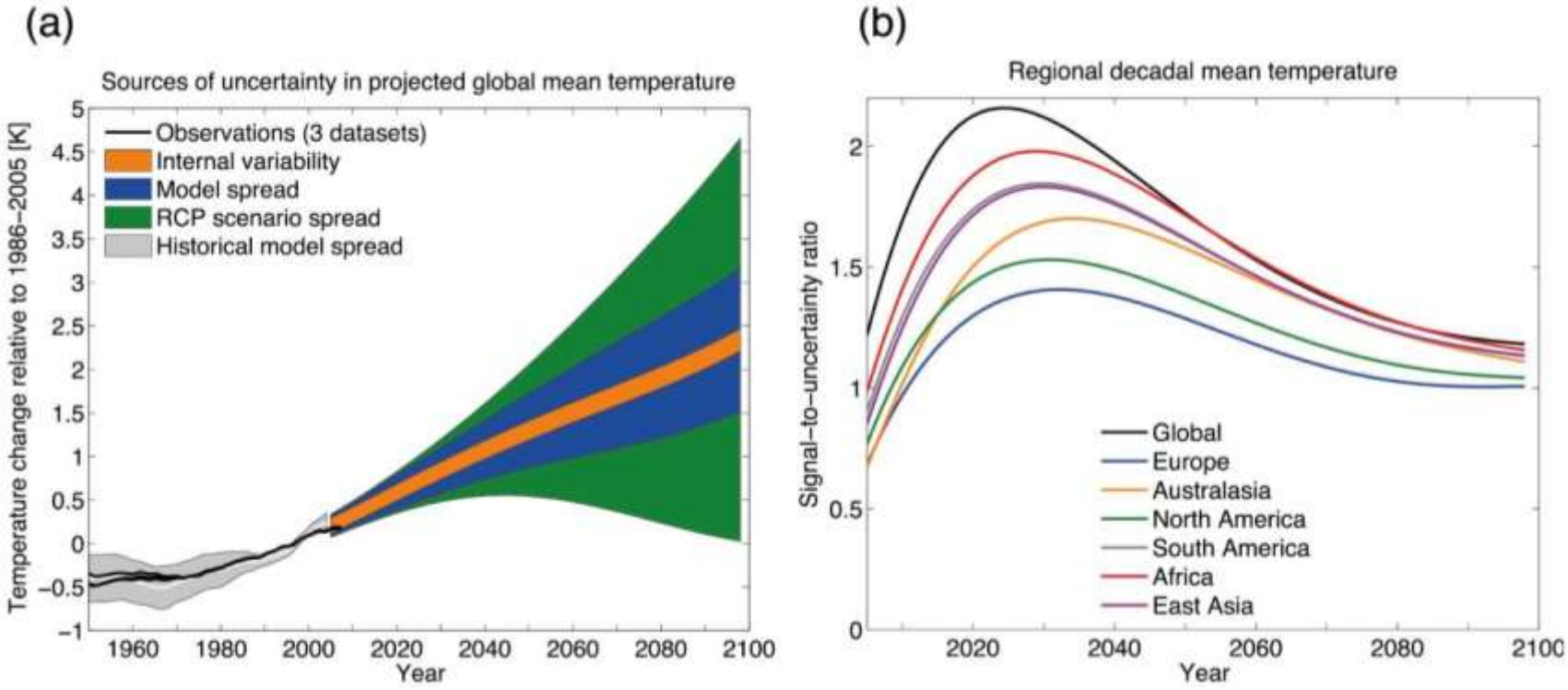
Part 3

CHALLENGES AND MOVING FORWARD

Not Dealing with Uncertainty



From: IPCC (2013)

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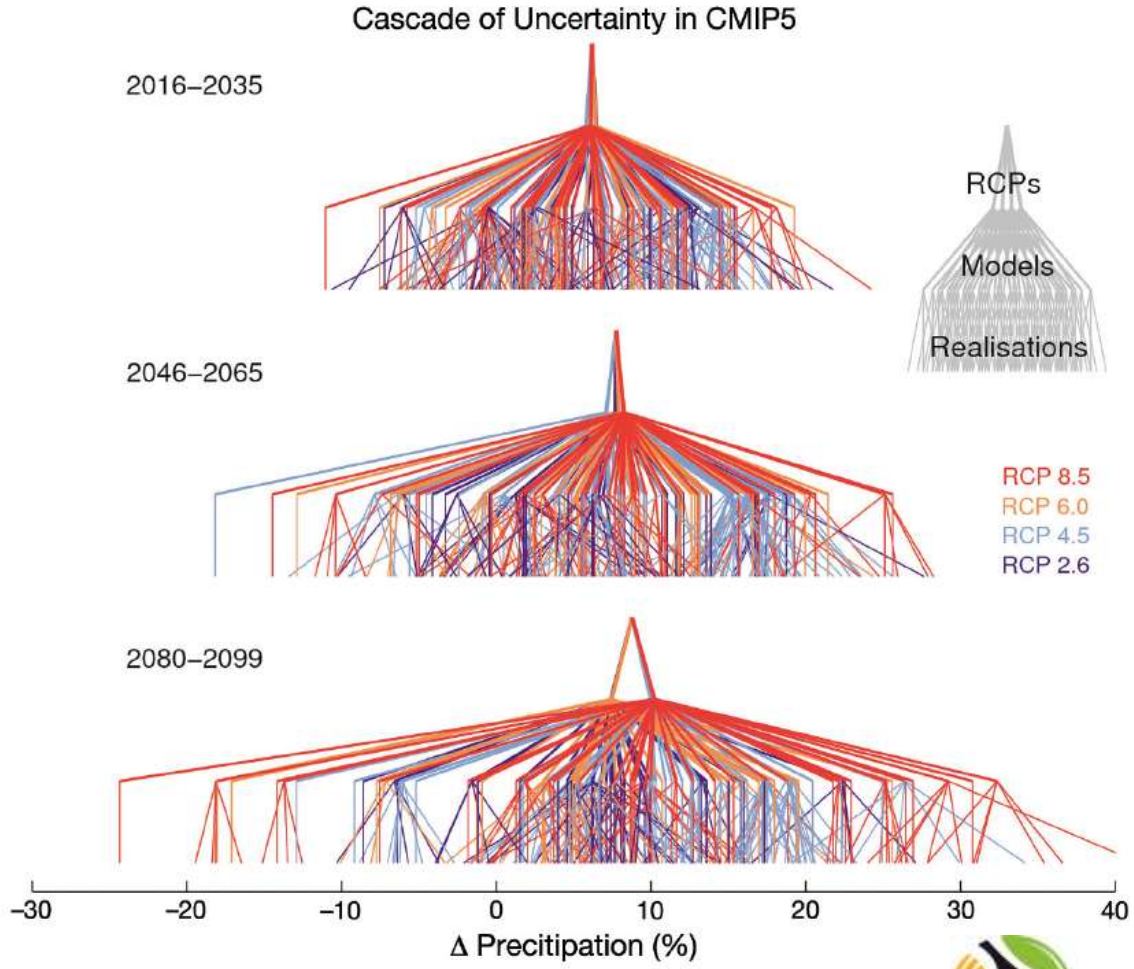
Not Dealing with Uncertainty



From: Wilby et al. (2014)

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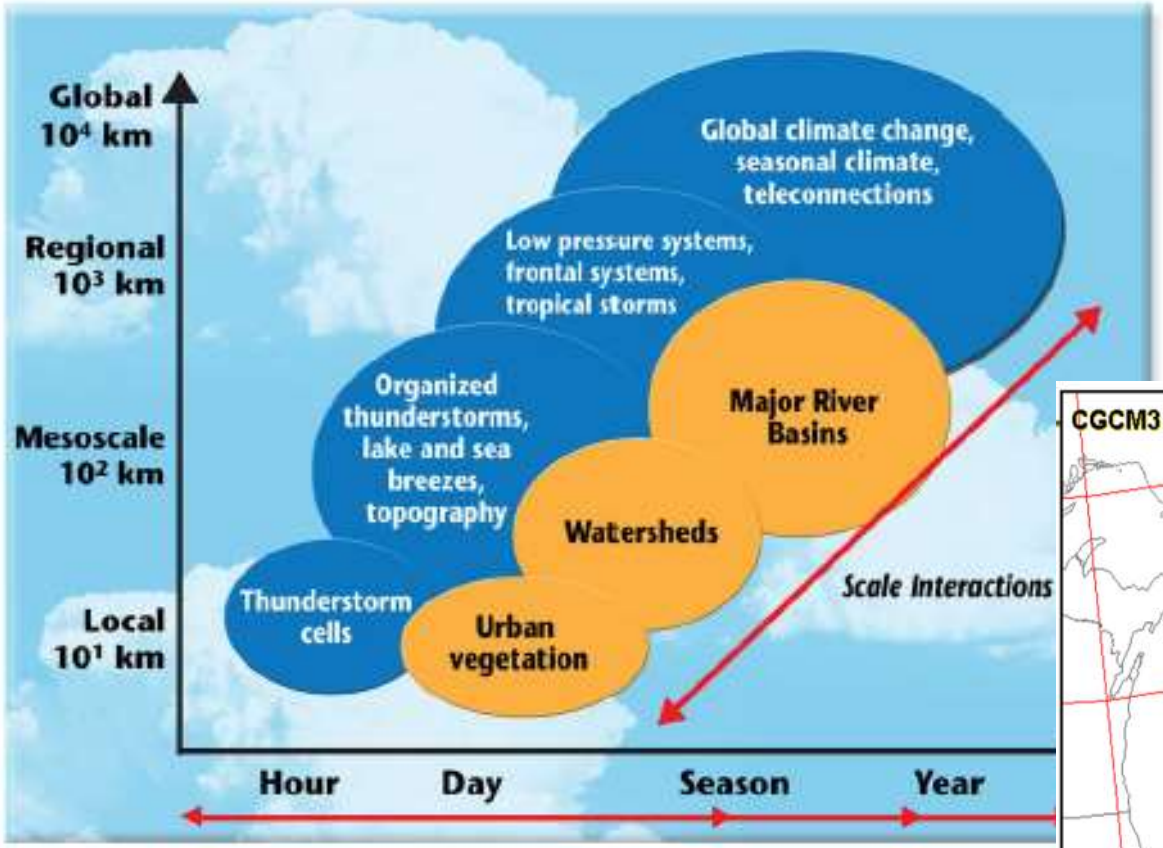
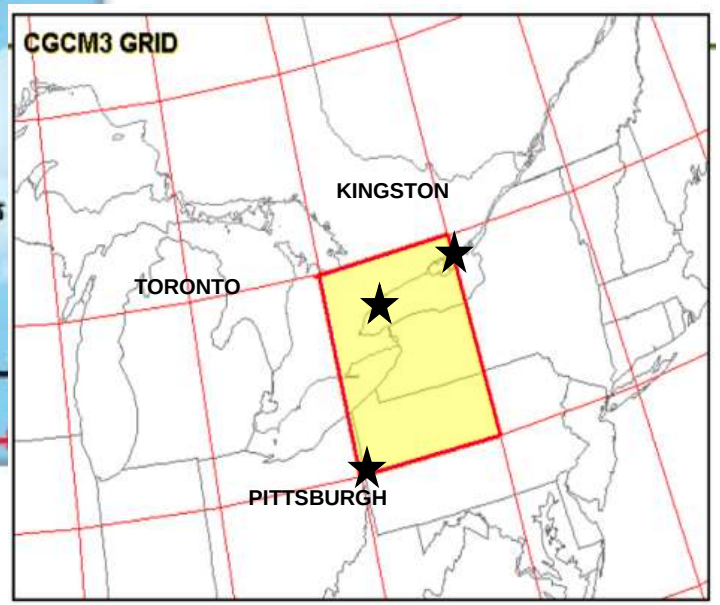
Scale Mismatches





Case Study: Climate Change and IDF

McMaster University

UNIVERSITY OF WATERLOO

Essex Region Conservation Authority

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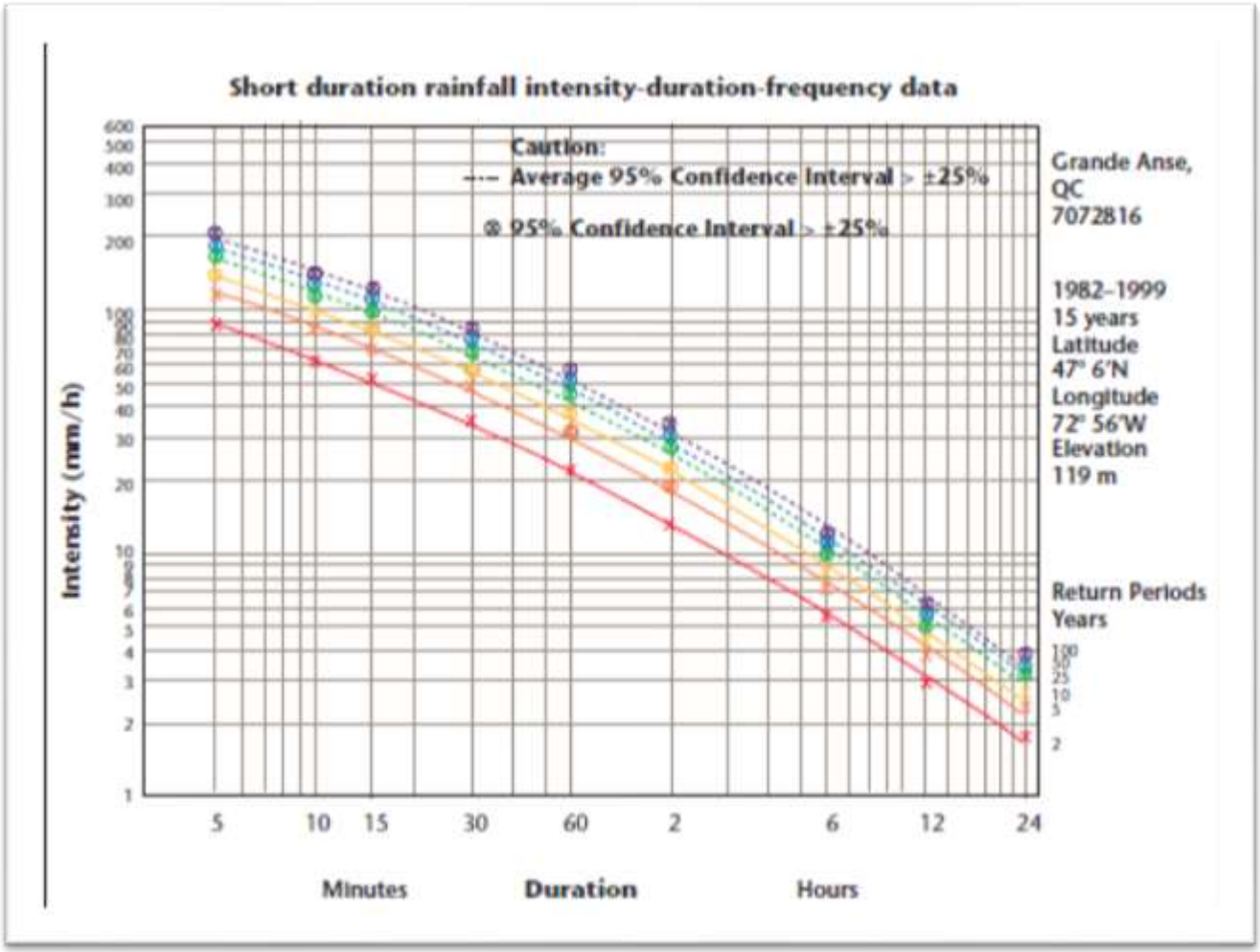
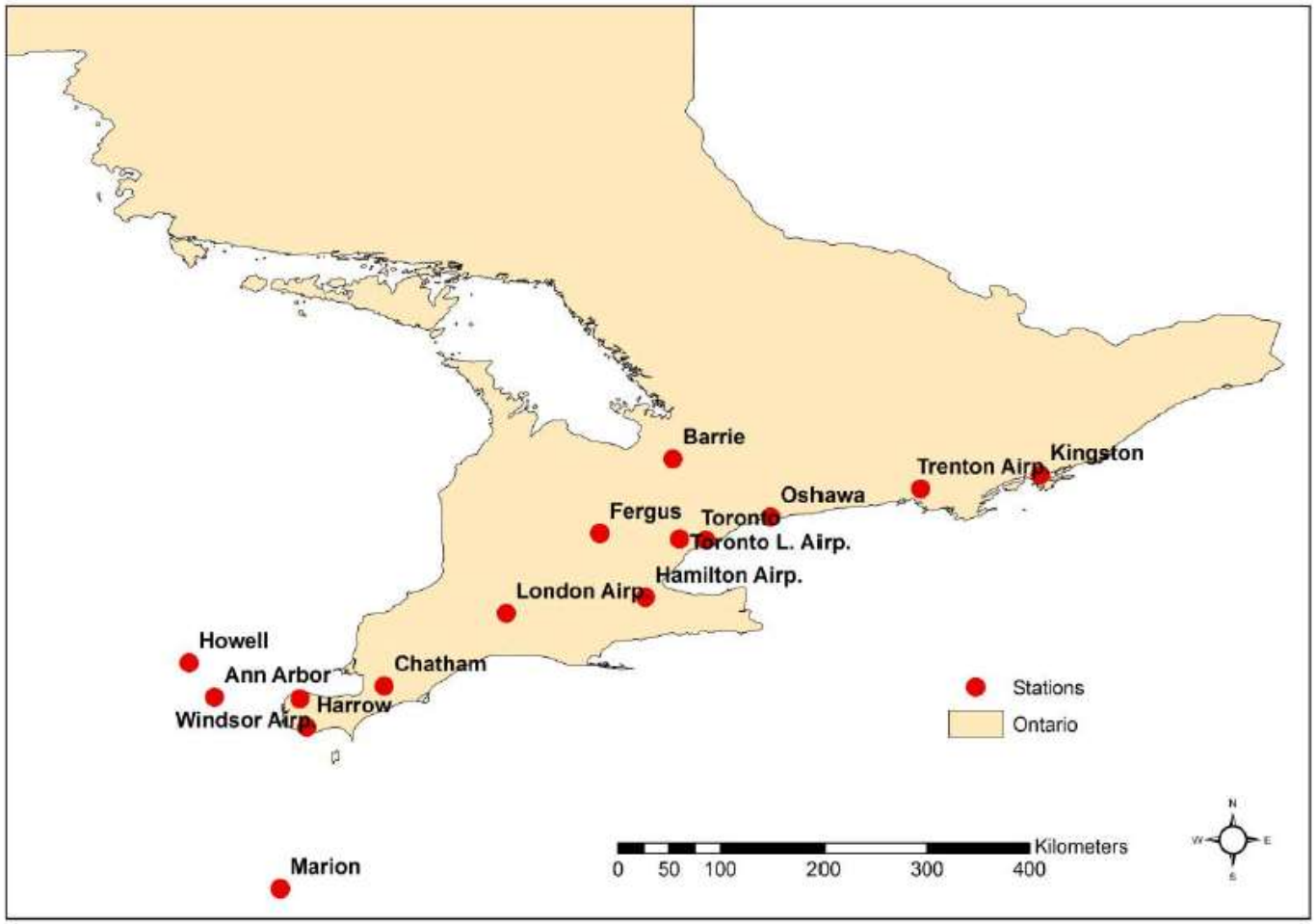


Objectives

- To understand the implications of using different methods for incorporating climate change into IDF curves
- To develop an approach to compare outcomes of different permutations of climate model outputs and IDF derivation methods
- To apply this approach to examine outcomes of alternate methods in Essex and Toronto regions

Study Sites



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Climate Projections and IDF

5
Climate Models

2 GCMs
3 RCMs

1-2
Emissions Scenarios

From moderate to “Business as Usual”

2
Downscaling Methods

16
Permutations

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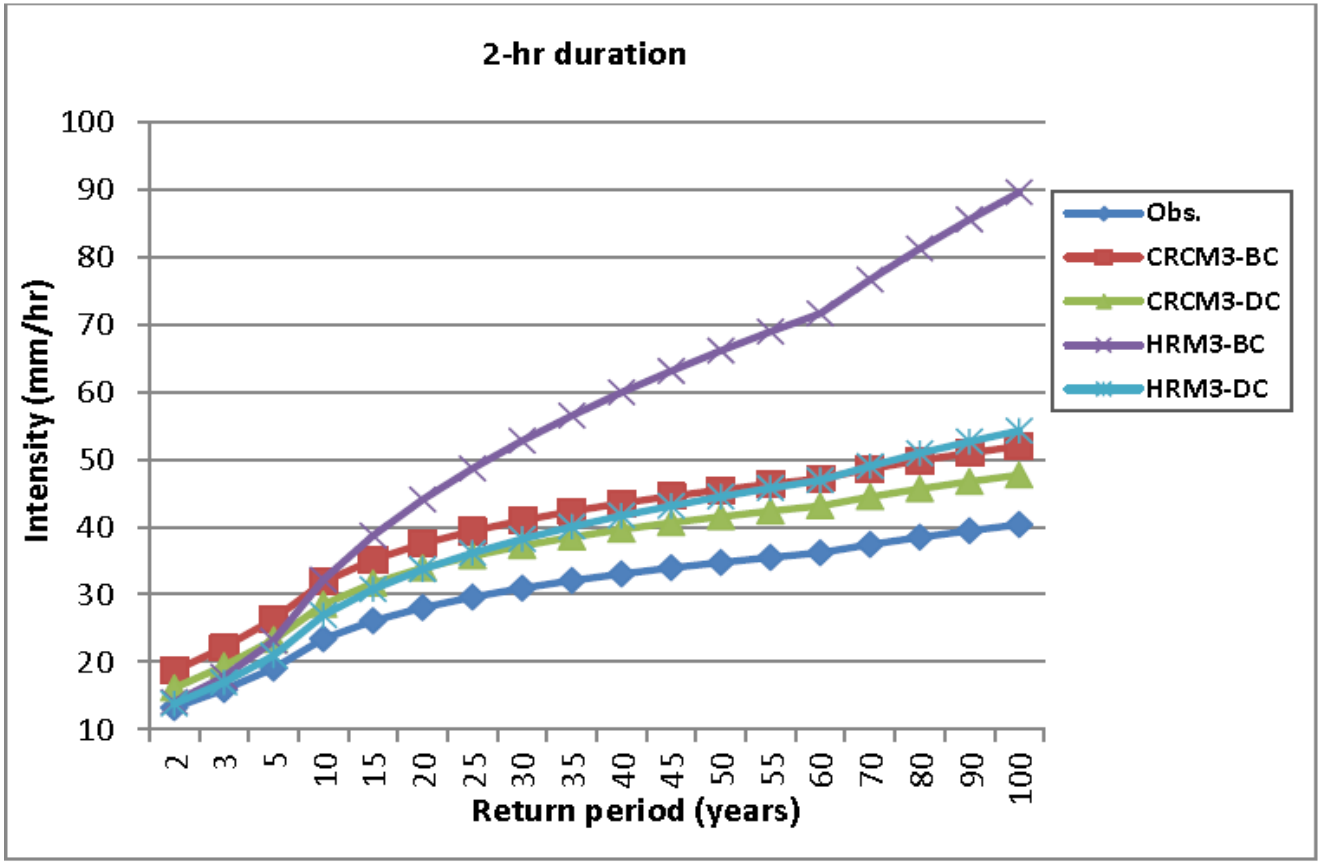
Uncertainty!



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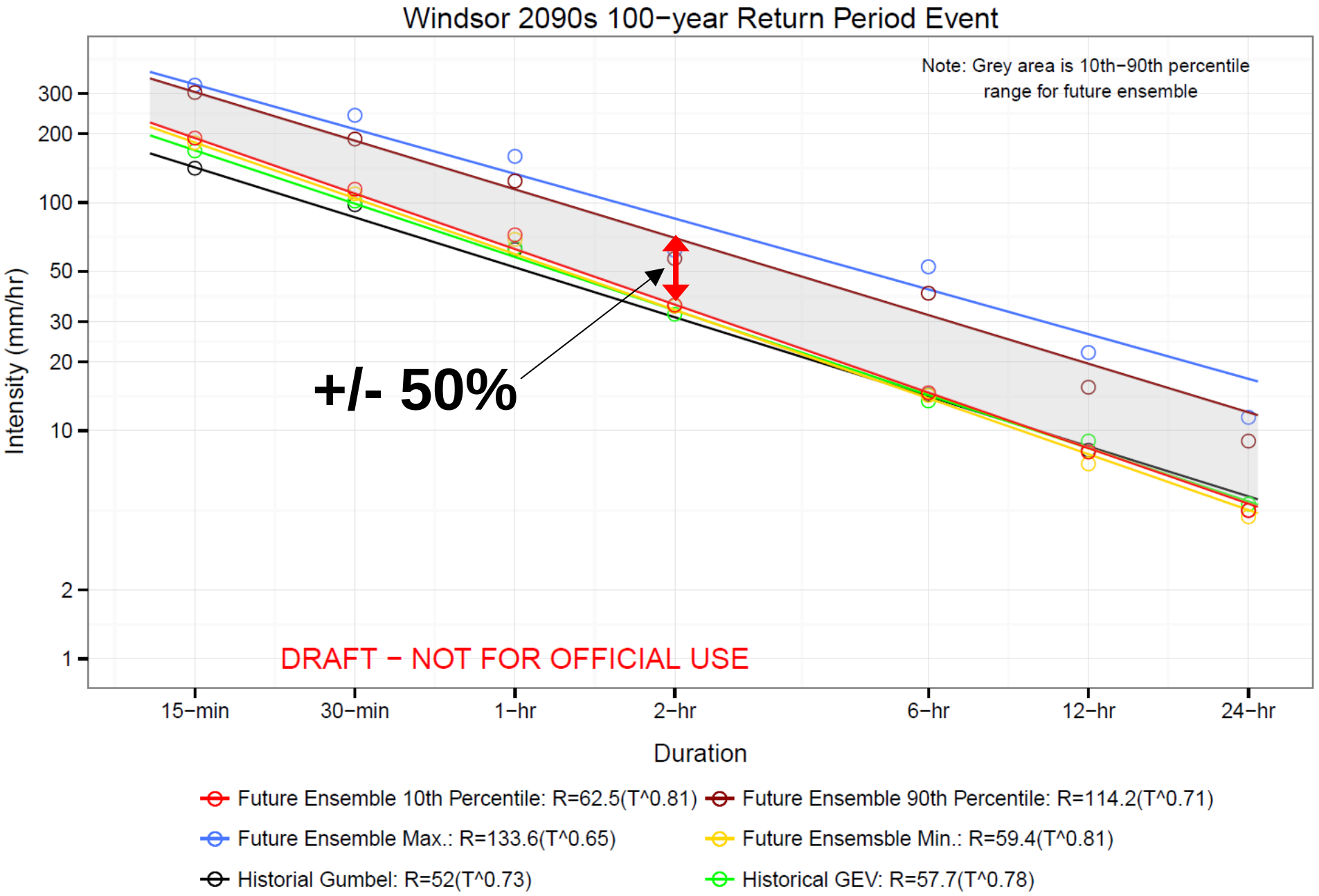
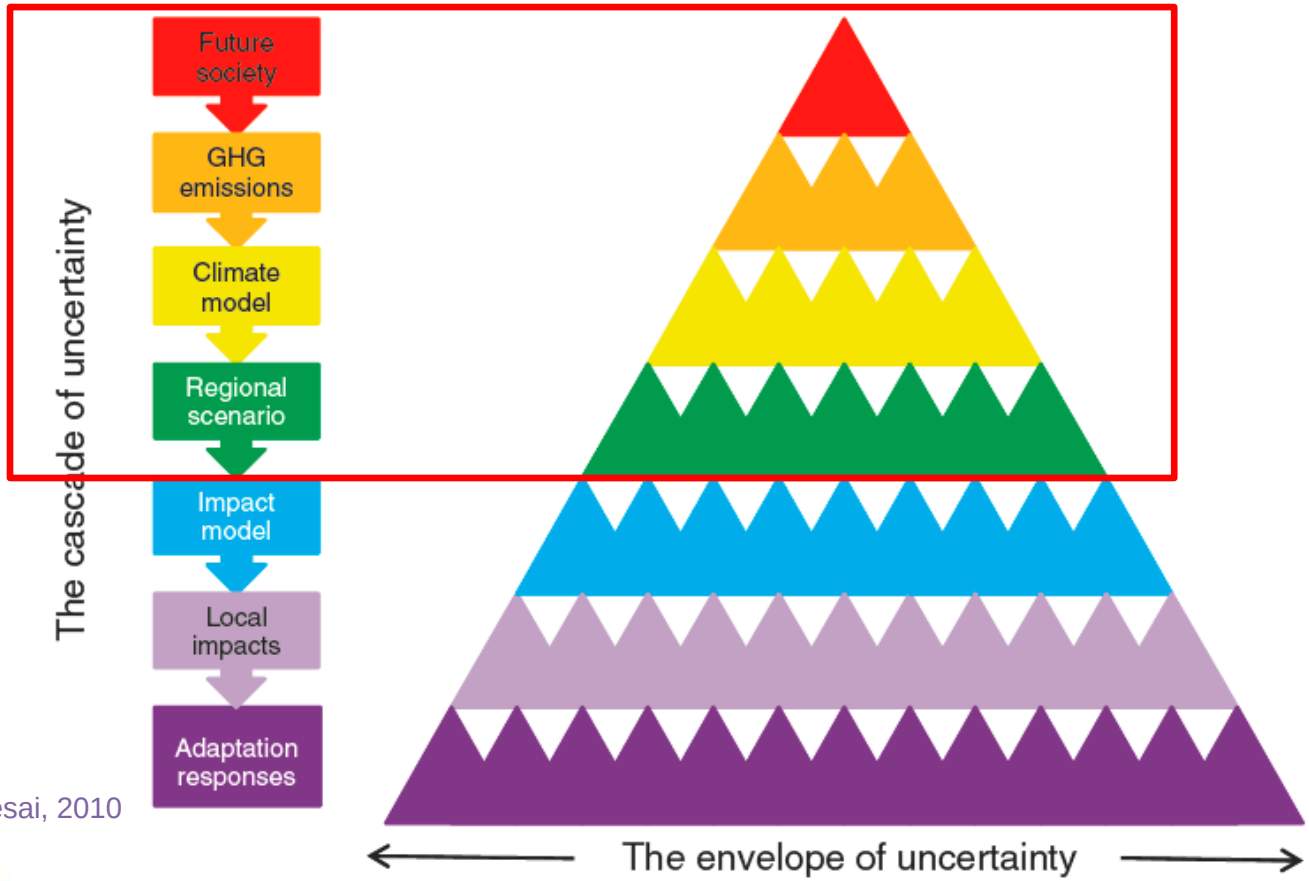

Windsor 2090s 100−year Return Period Event
Note: Grey area is 10th−90th percentile range for future ensemble
+/- 50%
DRAFT − NOT FOR OFFICIAL USE
Intensity (mm/hr)
300
200
100
50
30
20
10
2
1
15−min
30−min
1−hr
2−hr
6−hr
12−hr
24−hr
Duration
Future Ensemble 10th Percentile: R=62.5(T^0.81)
Future Ensemble 90th Percentile: R=114.2(T^0.71)
Future Ensemble Max.: R=133.6(T^0.65)
Future Ensemsble Min.: R=59.4(T^0.81)
Historial Gumbel: R=52(T^0.73)
Historical GEV: R=57.7(T^0.78)

Accuracy of Climate Change Information – A Red Herring?



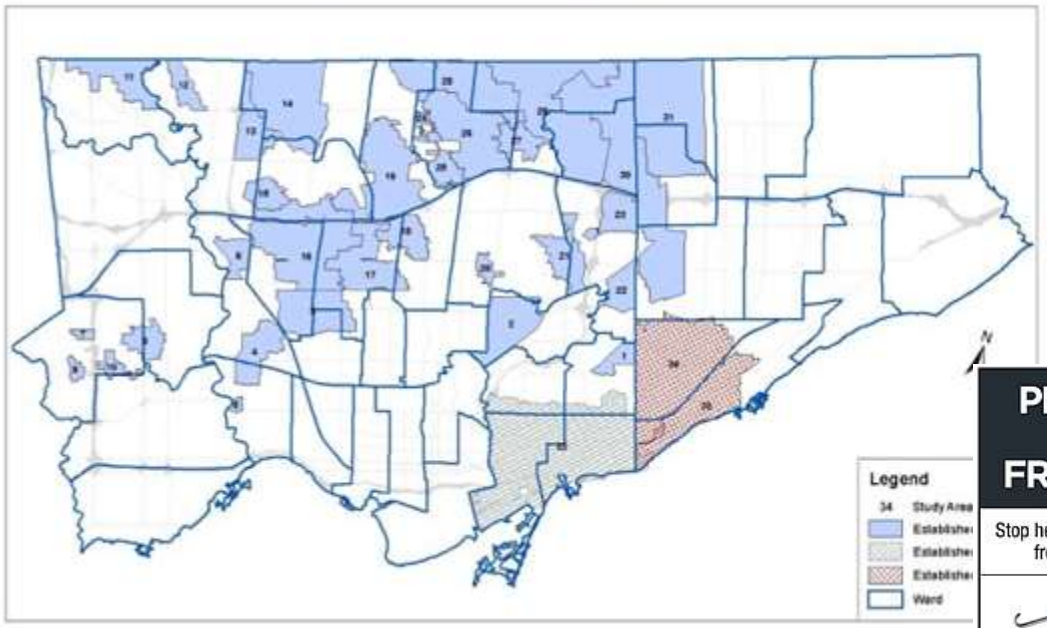
From: Wilby and Desai, 2010

What to do?

Focus on the Greatest Risks

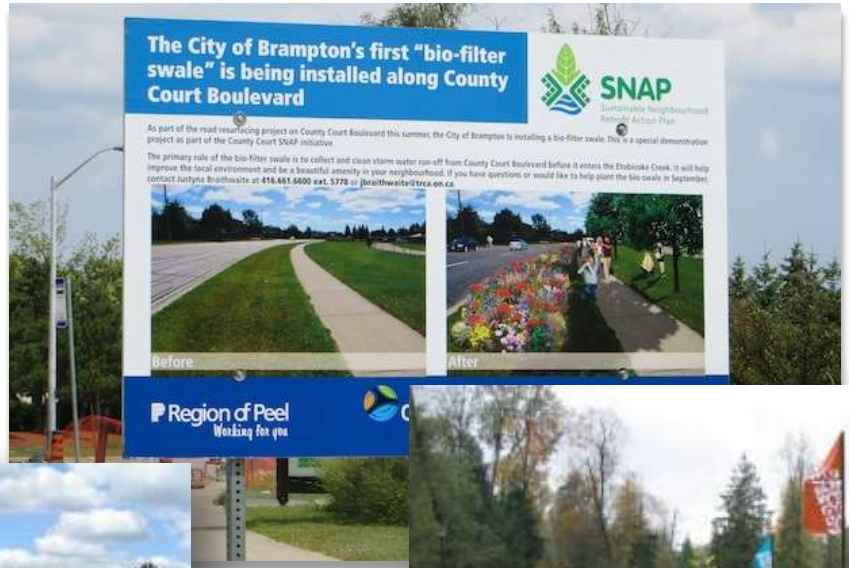
E.g. City of Toronto Basement Flooding Program

Figure 9: Basement Flooding Study Areas



Flexible Solutions, Multiple Benefits

E.g. Low Impact Development - LID



CONCLUDING THOUGHTS

On the status of climate information

- A*vailability* of climate data and information is generally not a problem in Ontario
- Ontario users need help with *application*
  - What data is required?
  - What dataset(s) should it be extracted from?
  - How can it be used appropriately?
  - What **shouldn't** be attempted with the data?

On the use of climate information

- The current ad-hoc climate information environment in impact assessment and adaptation planning in Ontario is leading to:
  - Inconsistent methods and incomparable results
  - Insufficient reflection on uncertainty and scale
  - Inefficient or ineffective adaptation measures
  - Inaction

Looking Ahead

- Climate change projections are highly uncertain and will stay that way
- An exclusive focus on climate data and information can be counterproductive and lead to inaction
- Good adaptation planning should lead to flexible and resilient solutions, not just overdesigned engineered infrastructure

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Ontario Climate Consortium

Mission

- To equip public and private sector decision makers with regionally-specific climate data, intelligence and adaptation services that enable effective policy and investment responses to climate uncertainty in Ontario.;

Objectives

- Provide one-window access to multi-disciplinary, multi-sectoral and multi-institutional climate change expertise in Ontario;
- Generate high quality, regionally-specific climate intelligence that empowers Ontario stakeholders to meet mitigation and adaptation needs; and
- Cultivate constructive collaboration between public and private sector climate practitioners to advance climate research and build a world-class climate industry in Ontario.

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Thank you.

For more information, please visit:

http://climateontario.org | www.trca.on.ca

Contact Email:

rness@trca.on.ca

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