Environment and Climate Change Canada

Environnement et Changement climatique Canada

Canada
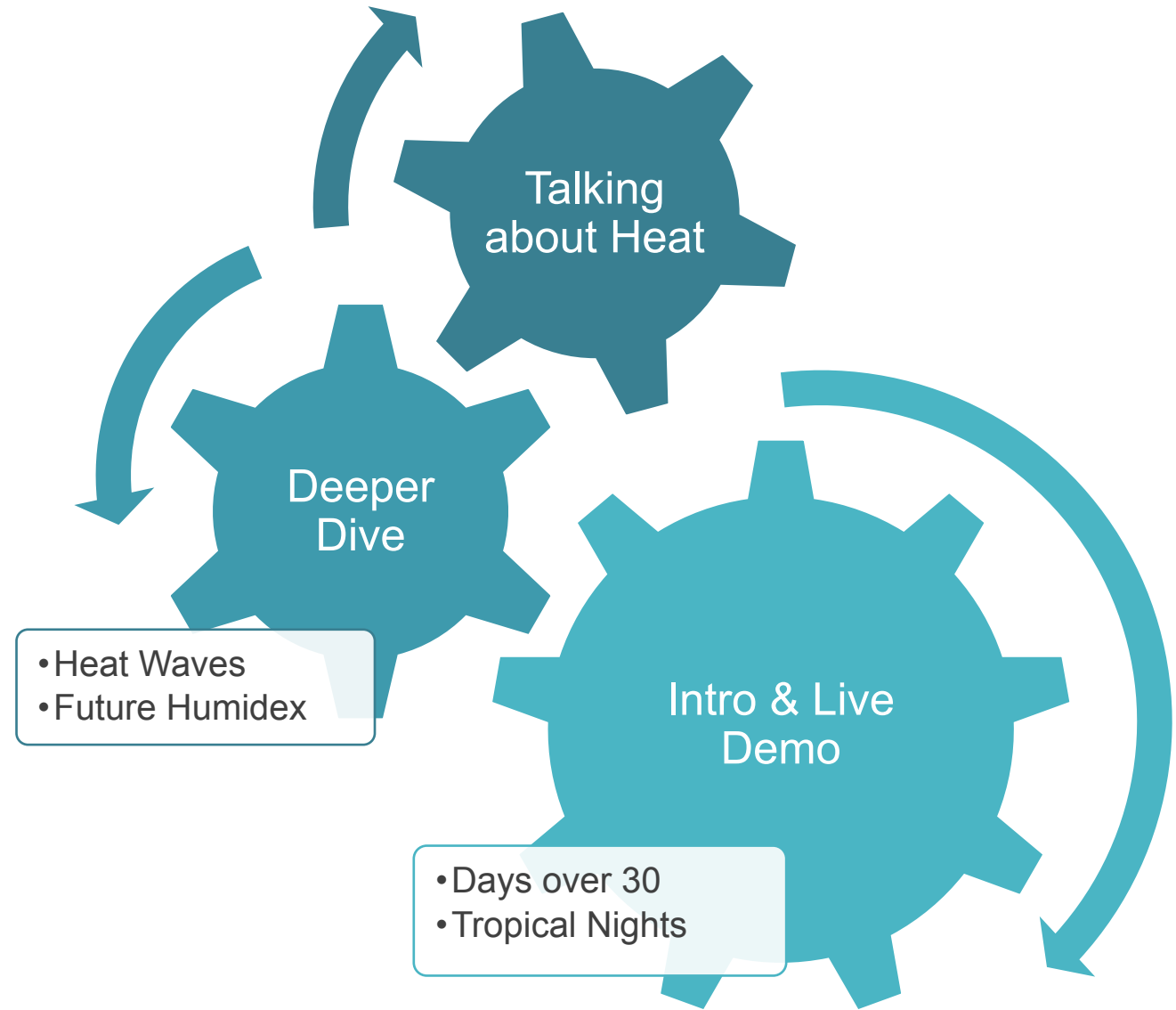
Project, Prepare, and Protect: Using climate data and tools to understand future extreme heat

National Collaborating Centre for Environmental Health

Centre de collaboration nationale en santé environnementale

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Agenda for today's session

Poll Question! Let us know where you are located.

Talking about Heat

Deeper Dive
- Heat Waves
- Future Humidex

Intro & Live Demo
- Days over 30
- Tropical Nights

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Who we are and where we are from
Please introduce *yourself* in the chat!

Elizabeth Fard
Training Team, Policy Advisor
Canadian Centre for Climate Services
Living and working in Tiohtiá:ke (Montreal), an unceded traditional Indigenous territory. Many Indigenous peoples converged here including the Kanien'kehá:ka (Mohawk) Nation, a member of the Haudenosauni Confederacy and the custodian of the water and lands of Tiohtiá:ke.

Elaine Barrow
Data and Products Office, Senior Advisor
Canadian Centre for Climate Services
Living and working in Treaty 4 territory, the original lands of the Cree, Ojibwe, Saulteaux, Dakota, Nakota, Lakota, and on the homeland of the Métis Nation.
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Craig Brown
Senior Scientist, Climate Change and Health
Vancouver Coastal Health

Living and working on the traditional territory of the Esquimalt and Songhees First Nations (Victoria, BC)

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Where does climate information play a role in public health?

Broad commitment to climate action

- High-level themes
- Trends for general variables like average temperature

**Poll Question! How do you use climate data – choose all that apply!**

Specific impact, program or project to deal with a changing climate

- More location-focused, more complex variables
- Intermediate level of detail
- General risk assessments

Detailed technical needs for specific issues like extreme rainfall

- Technical risk assessments
- In-depth, detailed data

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Weather, natural variability, and climate
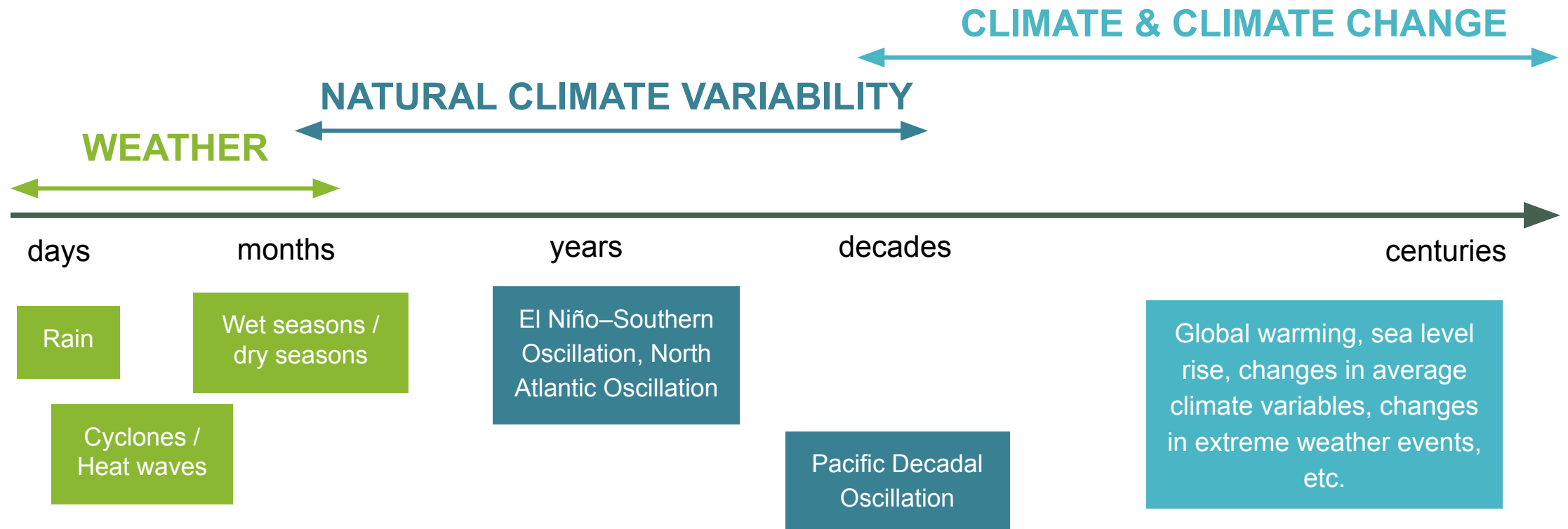
Climate variability over time

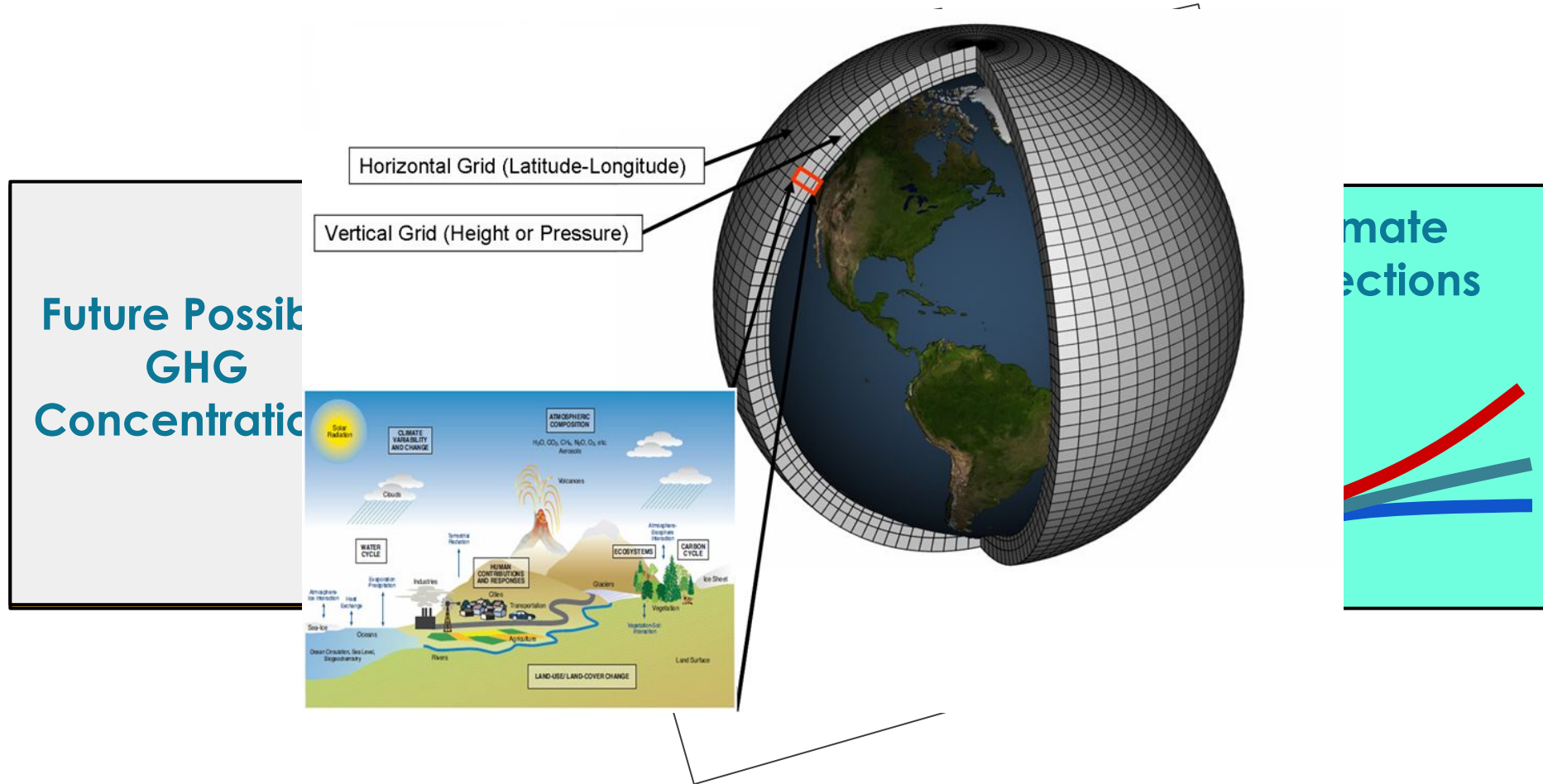Annual average temperature change for Canada as a whole, with respect to the 1961–1990 climate normal period.
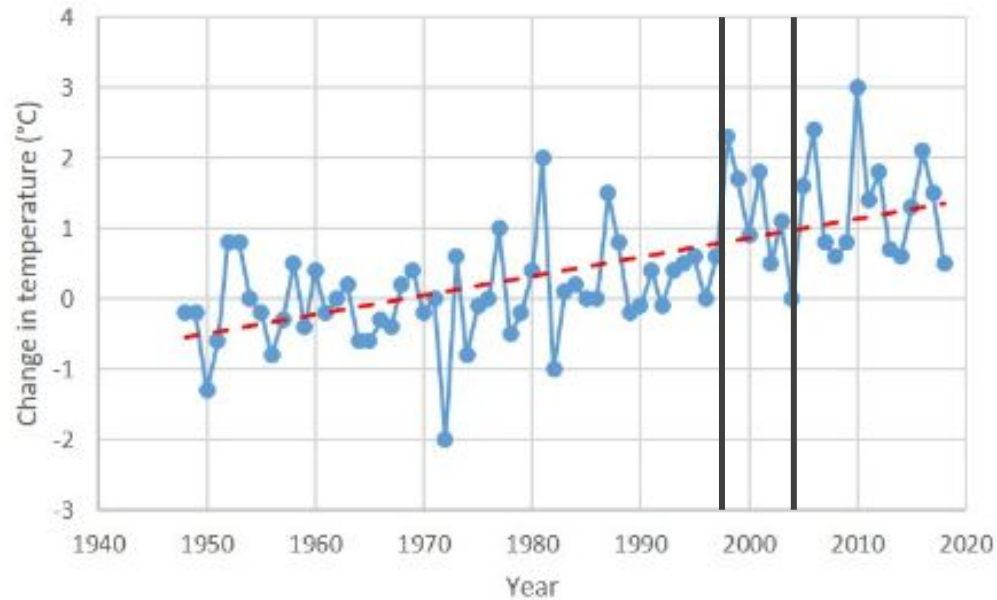
Blue line with markers – year to year anomalies with respect to the 1961–1990 average

Data Tip! Best practice is to use 30-year averages to represent climate and to compare changes

Red dashed line – trend in climate over the time period shown
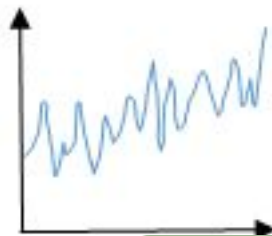
What are climate projections and where do they come from?

Future Possible GHG Concentrations

Horizontal Grid (Latitude-Longitude)

Vertical Grid (Height or Pressure)

...mate ...ections

We can represent the range of model outputs using multi-model ensembles

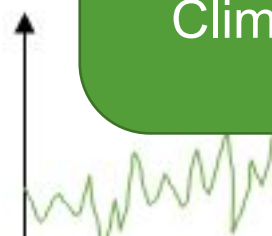**Individual model output**

Multi-model ensemble
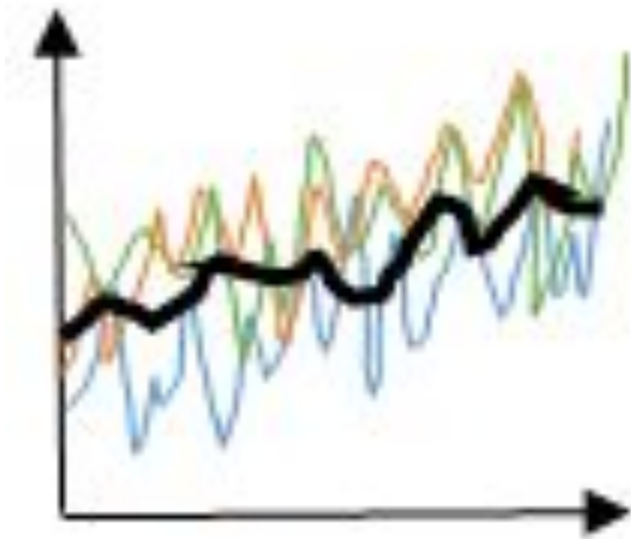
Future Projection 1

Future Projection 2

...
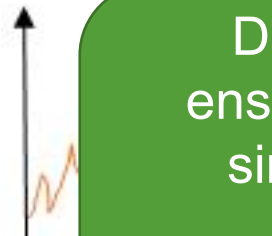
Future Projection n[th]

Data Tip! Best practice is to use ensemble data (multiple models, or, single model with multiple runs).

ClimateData.ca provides multi-model ensemble data.

Handling uncertainty:
Historical average temperature ☐ future temperature

Temperature Change in British Columbia (vs. 1971-2000 baseline)
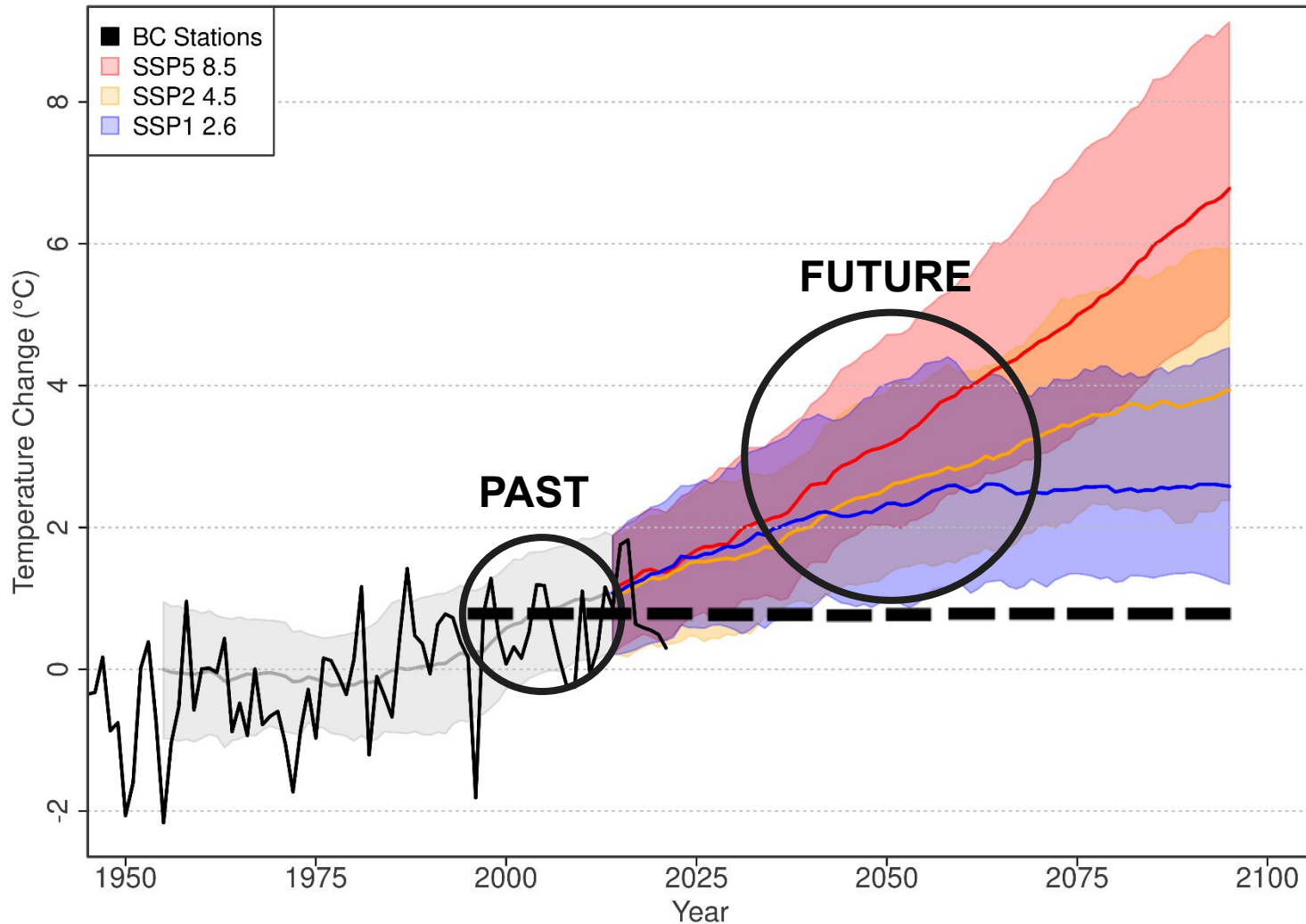
Summary:

1. Past conditions are not a good guide for future conditions.

2. Conditions keep changing with time in all but best case.

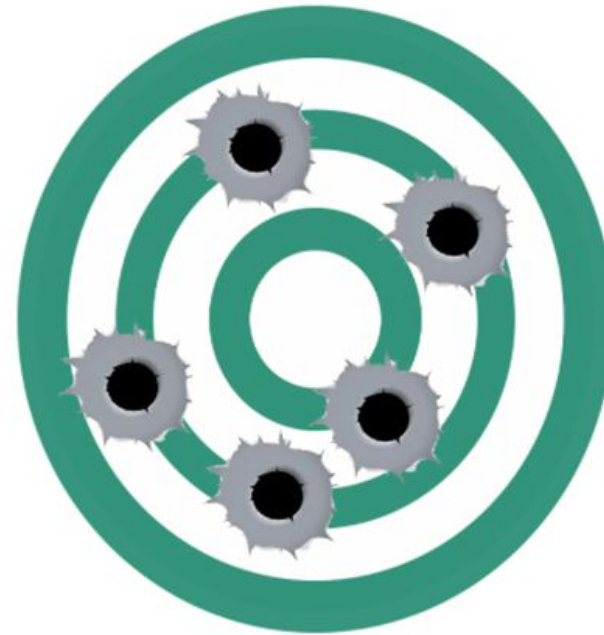3. Must accommodate a wider range of conditions in all cases.

Data Tip! Rather than choosing a scenario, consider what range you should plan for.

Targeting the future climate:
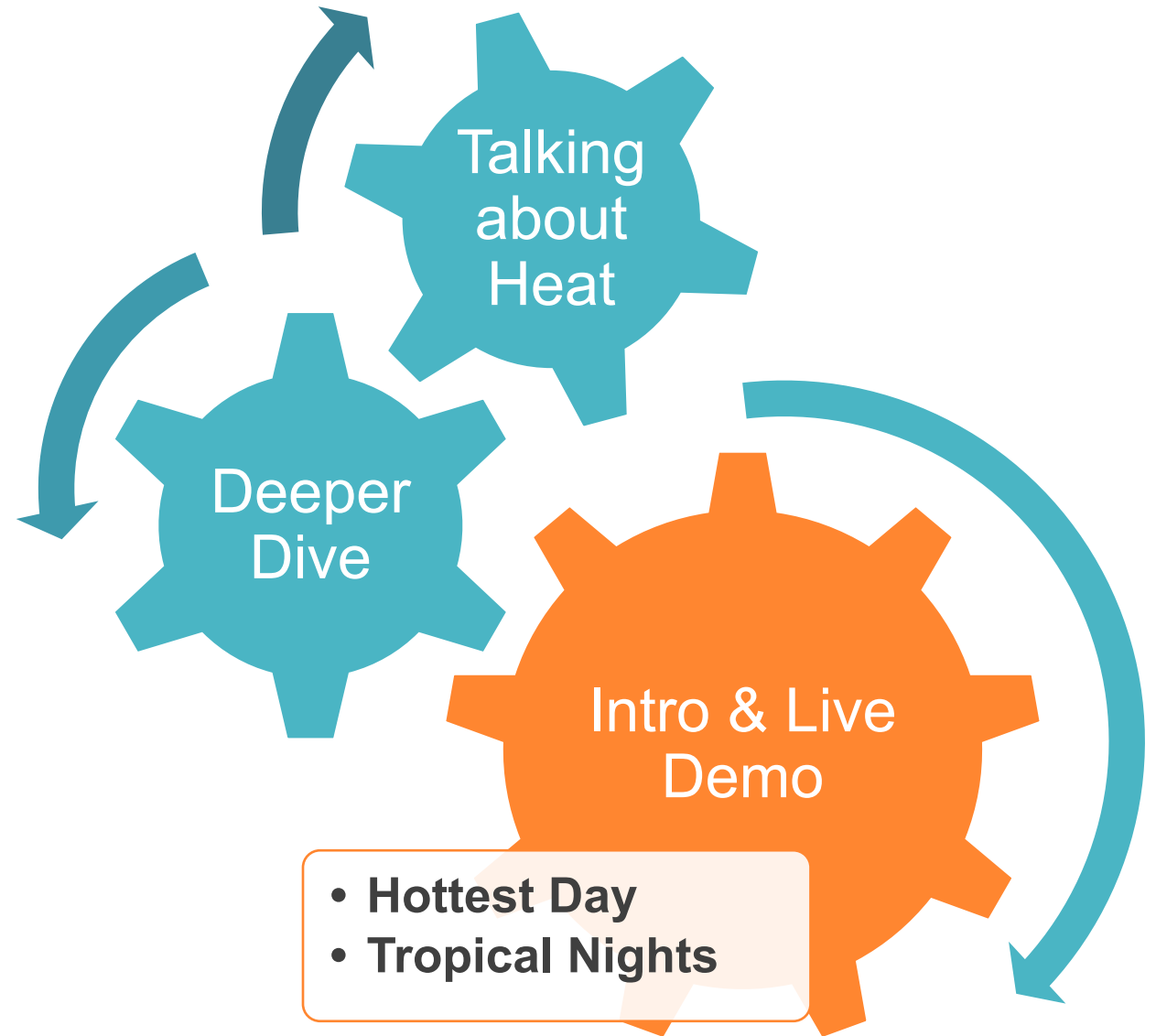# Precisely wrong vs generally accurate

"Past data are known quantities"

"Projections have uncertainties"

Finding heat-related climate data

- **Hottest Day**
- **Tropical Nights**

Talking about Heat

Deeper Dive

Intro & Live Demo

Examples of data portals

Climate Atlas of Canada

Start learning about climate change in Canada through mapping and storytelling

ClimateData.ca

Start exploring case studies and downloading location-based climate data by variable or sector

Power Analytics and Visualization for Climate Science (PAVICS)

Advanced tools for academia, climate scenario developers, and other expert users

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ClimateData.ca has 35+ variables and is customizable

Climate Data

- Resolution: 6x10km grid
- Temperature and precipitation variables, other climate indicators
- Three scenarios, out to 2100; ensemble values: 10th, median, 90th
- 30 year averages, change values
- Location-based summaries
- Sector modules, e.g. health

Customize climate data

- Select a variable or indices
- Select annual, seasonal or monthly
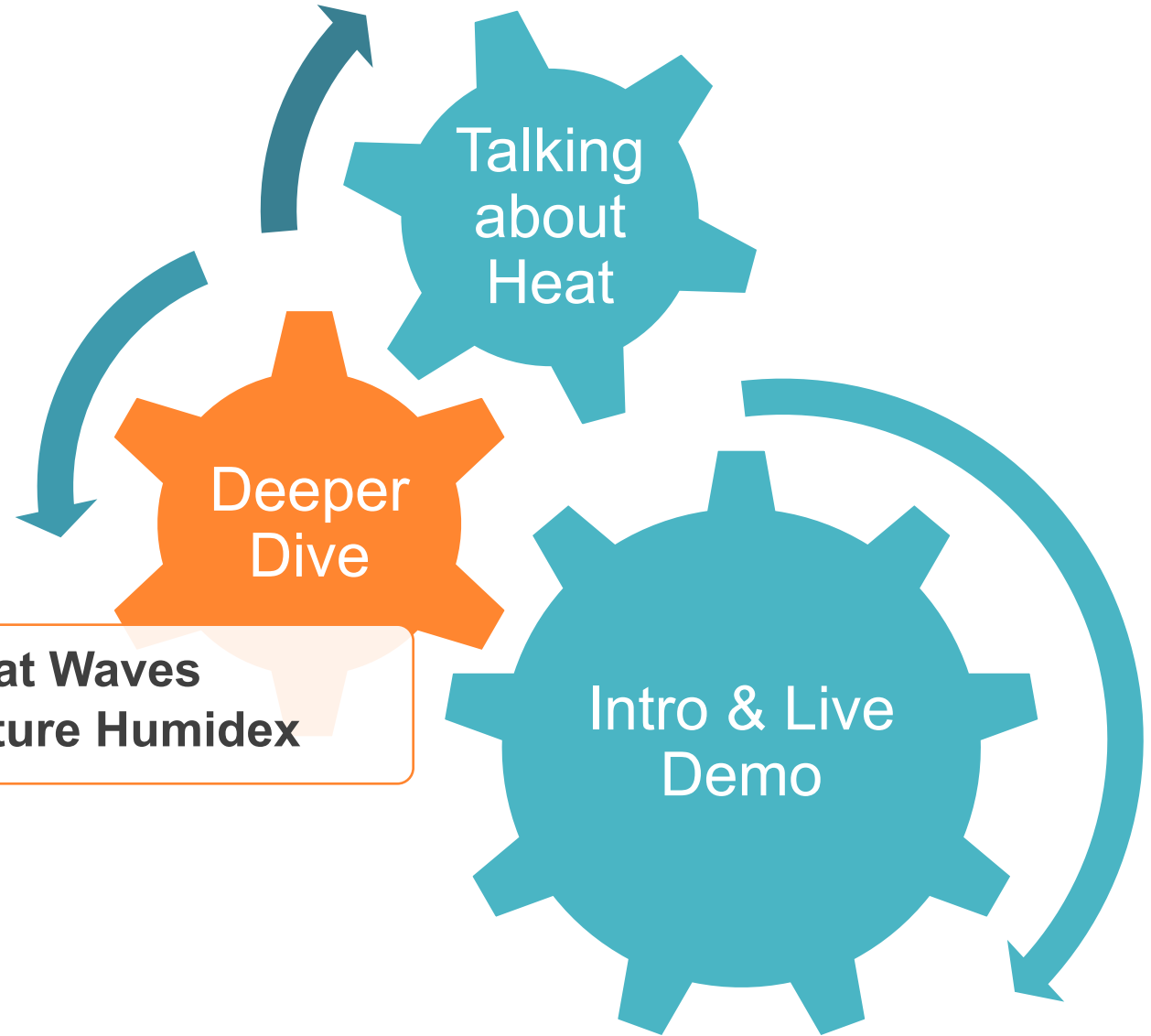- Select emission scenario
- Download data and chart image
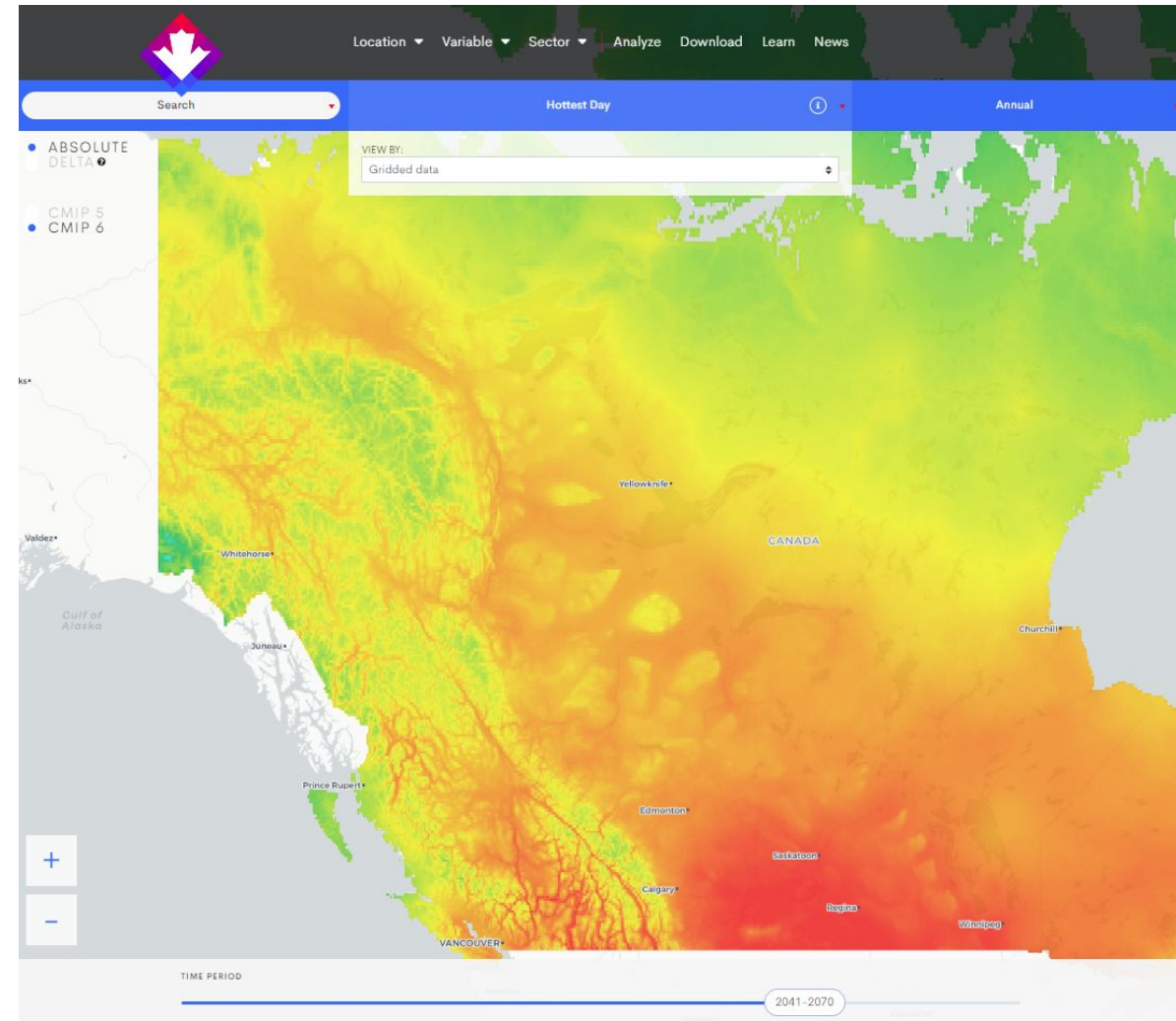
Questions, confusions, insights? Please ask in the chat or hold for the Q&A!

Heat-related Climate Data

Poll question – health-related climate data needs

Talking about Heat

Deeper Dive

- **Heat Waves**
- **Future Humidex**

Intro & Live Demo

Future Humidex (HX) projections

Humidex (HX) describes how hot the weather feels to a person, taking heat and humidity into account. The impacts vary by person and population vulnerability.

Humidex (HX) = outdoor index that describes how hot or humid weather feels to the average person. Recorded during summer.

$$HX = \boxed{T_a} + \frac{5}{9}(\rho - 10)$$

$$\rho = 6.112 \times 10^{7.5 \times T_a/(237.7+T_a)} \times \boxed{RH}/100$$

Diaconescu, E., Sankare, H., Chow, K., Murdock, T. Q., & Cannon, A. J. (2022). A short note on the use of daily climate data to calculate Humidex heat-stress indices. *International Journal of Climatology*, 1–13. https://doi.org/10.1002/joc.7833

Guide to summer comfort*

Humidex   Degree of comfort

Number of days with:
HX > 30
HX > 35
HX > 40

Warm season weather hazards - Canada.ca

Days with maximum Humidex (HX) > 30

Historical (1971-2000)
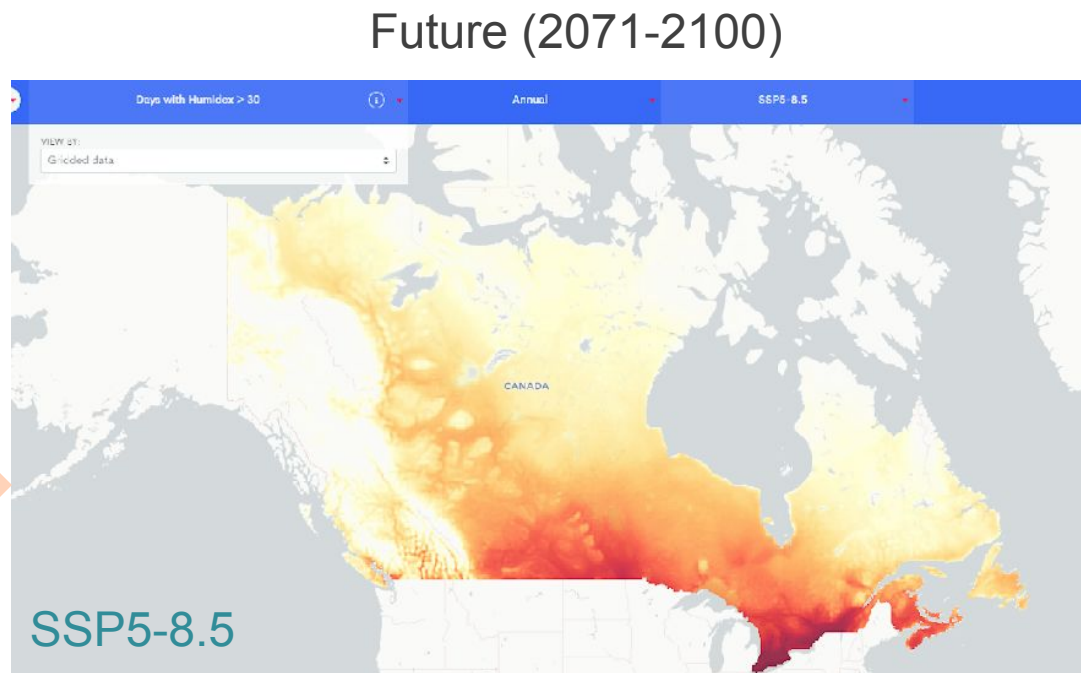
Future (2071-2100)

High

SSP5-8.5

Moderate

SSP2-4.5

120 Days

60 Days

0

ANNUAL

Days with Humidex > 35
Click and drag in the plot area to zoom in
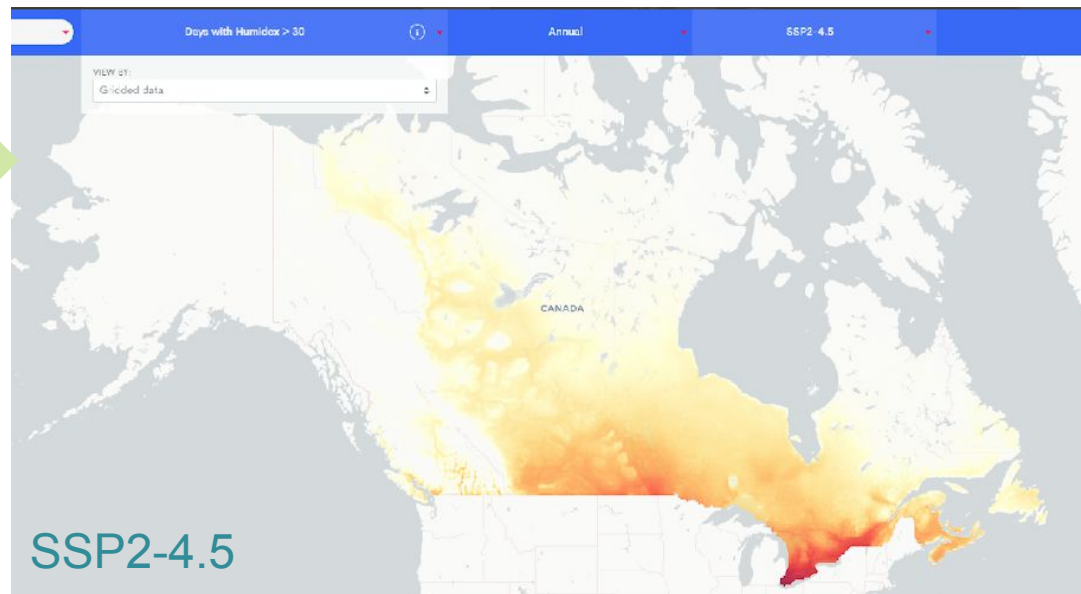
MODELED HISTORICAL — SSP1-2.6 MEDIAN — SSP2-4.6 MEDIAN — SSP5-8.6 MEDIAN

Nanaimo, BC
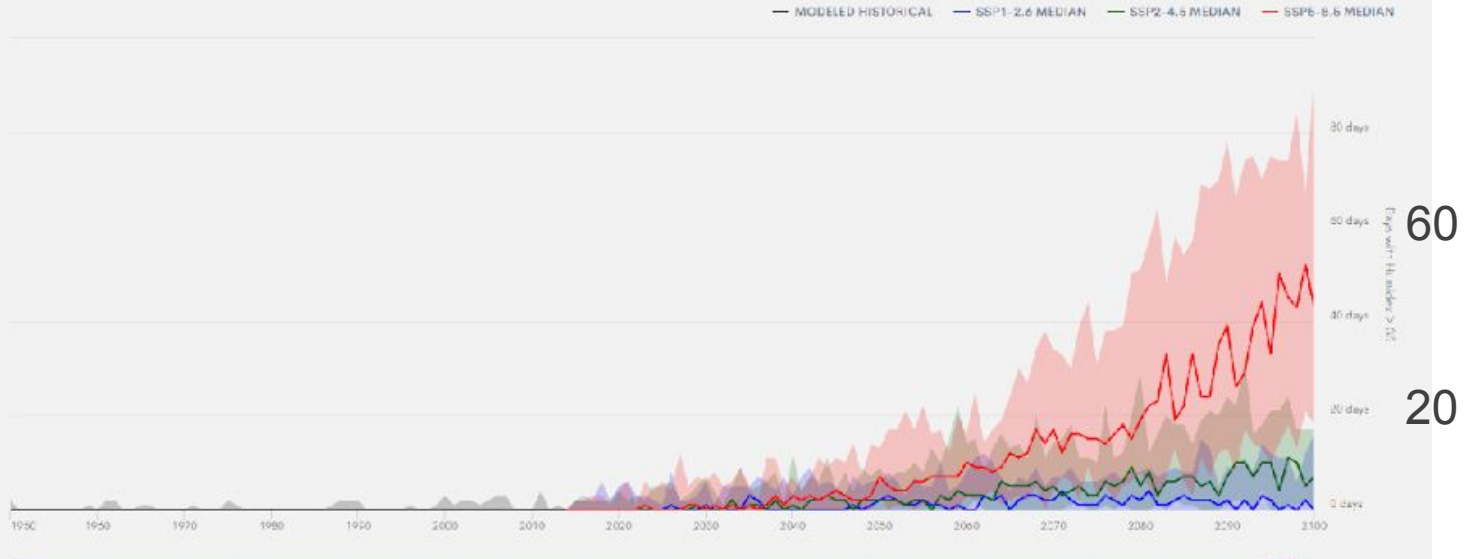
Days with Humidex > 35
Click and drag in the plot area to zoom in
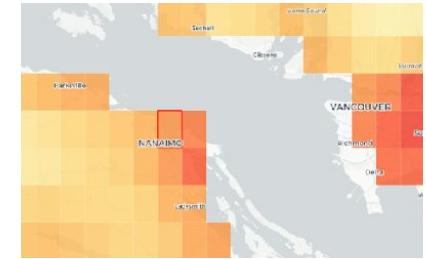
MODELED HISTORICAL — SSP1-2.6 MEDIAN — SSP2-4.6 MEDIAN — SSP5-8.6 MEDIAN
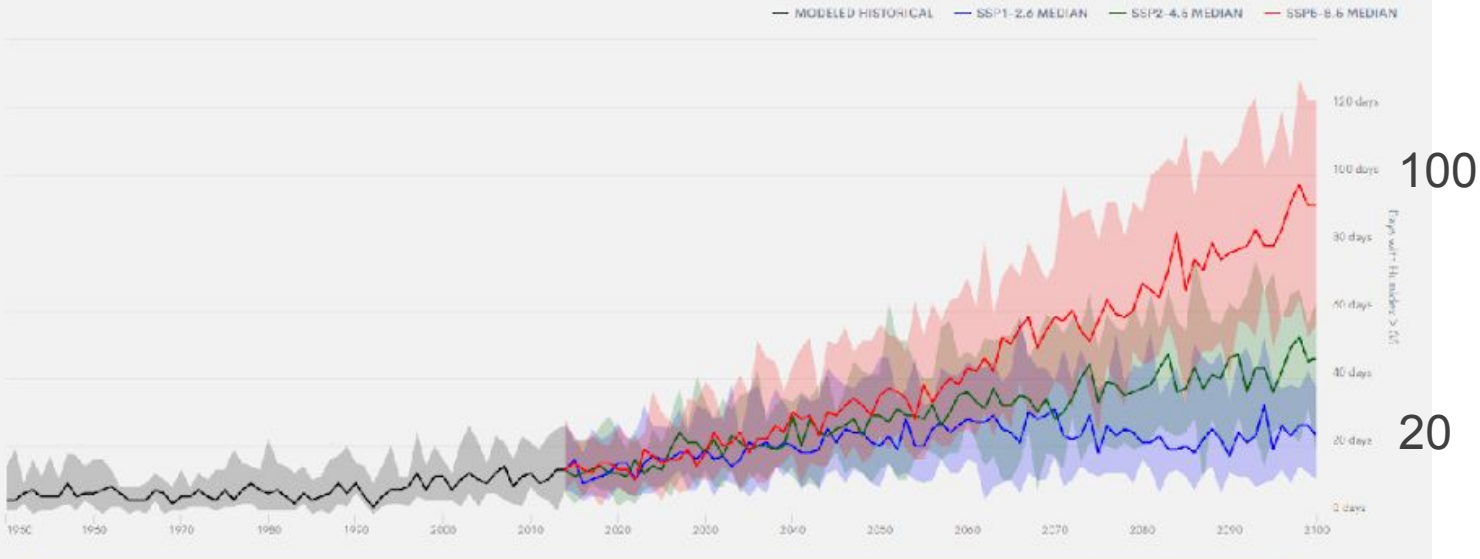
Barrie, ON
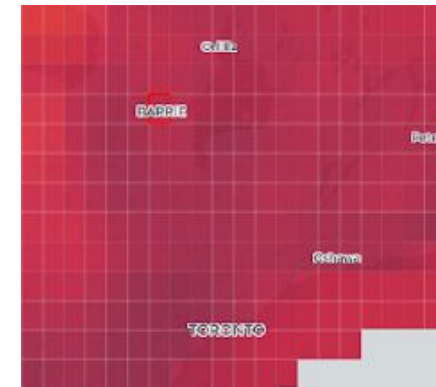
Custom heat waves analysis on ClimateData.ca

MSC Heat Warning Criteria

Poll question – humidex versus temperature thresholds for heat waves

Criteria*:

- (Tmax >=26°C and Tmin>=15°C) OR Hmax >= 34
- (Tmax >= 29°C and Tmin >=16°C) OR Hmax >= 36
- (Tmax >= 27°C and Tmin >= 18°C) OR Hmax >= 35
- (Tmax >= 30°C and Tmin >= 18°C) OR Hmax >= 36
- (Tmax >= 30°C and Hmax >= 40 OR Tmax >= 40°C) for at least 1 hour
- (Tmax >= 31°C and Tmin >= 21°C) OR Hmax >= 42
- (Tmax >= 31°C and Tmin >= 20°C) OR Hmax >= 40 **For two days**
- (Tmax >= 29°C and Tmin >= 18°C) OR Hmax >= 36
- Tmax >= 32°C and Tmin >= 16°C (OR Hmax >= 38 in SK & MB)
- (Tmax >= 29°C and Tmin >= 16°C) OR Hmax >= 34
- Tmax >= 29°C and Tmin >= 14°C (OR Hmax >= 34 in SK only)
- Tmax >= 35°C and Tmin >= 18°C
- Tmax >= 33°C and Tmin >= 17°C
- Tmax >= 29°C and Tmin >= 16°C
- Tmax >= 28°C and Tmin >= 13°C
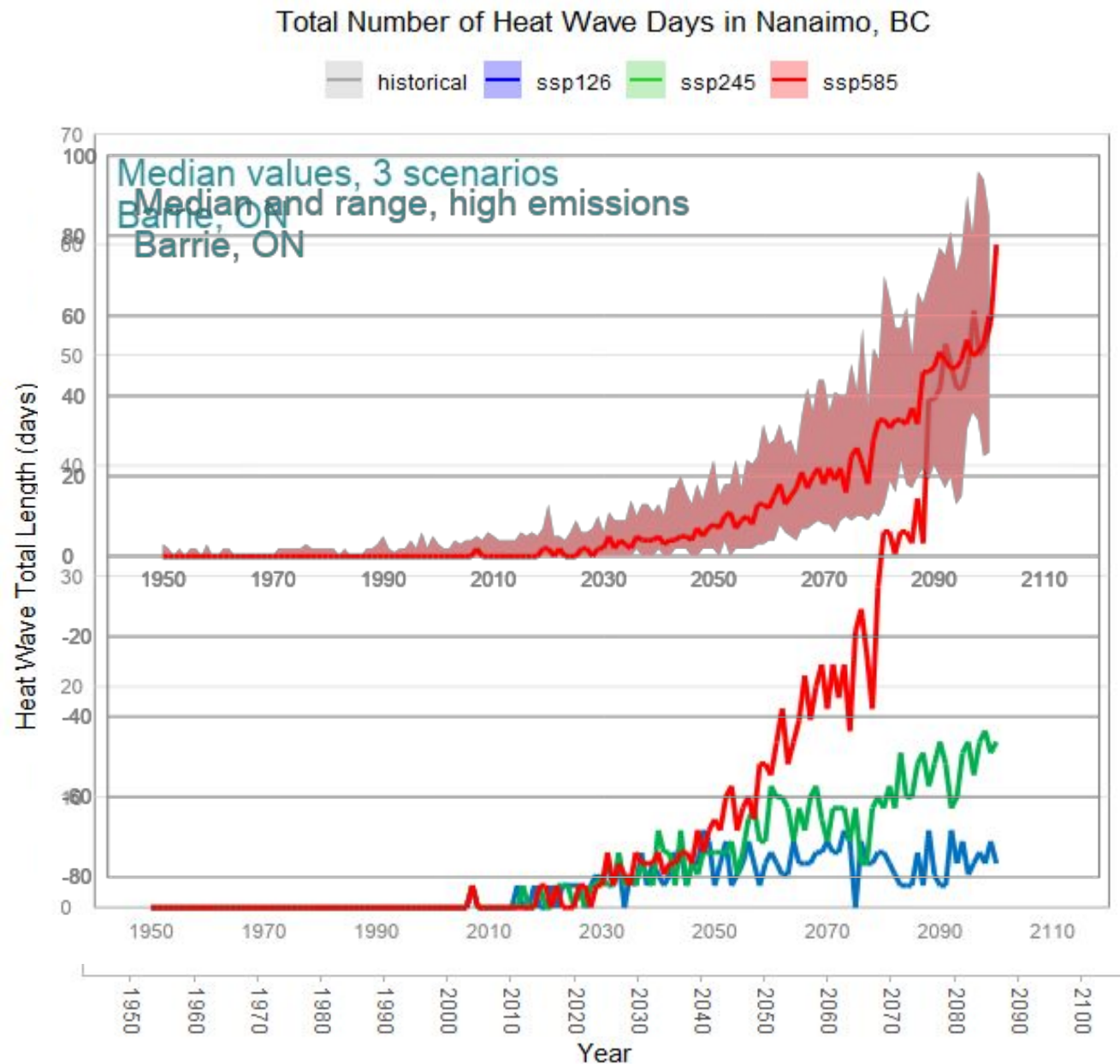
Examples:
Heat Wave Total Duration

- DO: create your own time series charts

- DON'T calculate 30-year averages from the results – they are percentiles and not single model results

  MSC Heat Warning criteria thresholds:
  Barrie, ON: Maximum temperature >31°C;
 Minimum temperature > 20°C; 2 consecutive days (or more)

  Nanaimo, BC:
  Maximum temperature >29°C; Minimum temperature > 16°C; 2 consecutive days (or more)

Total Number of Heat Wave Days in Nanaimo, BC

legend: historical — ssp126 — ssp245 — ssp585

Median values, 3 scenarios
Median and range, high emissions
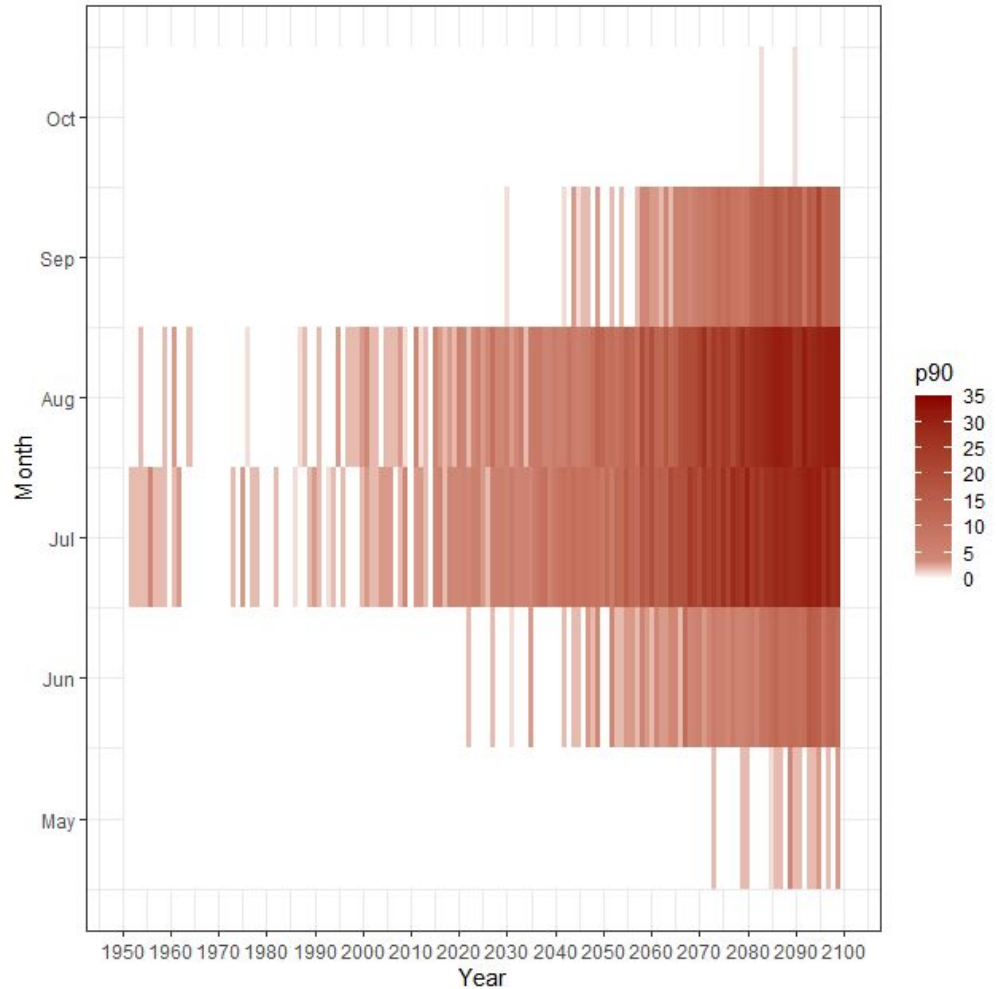Barrie, ON
Barrie, ON

Examining extended shoulder seasons

Created using R software and Heat Wave Total Duration, based on the MSC Heat Warning criteria for Nanaimo: Maximum temperature >29°C; Minimum temperature > 16°C; 2 consecutive days (or more). Temporal frequency: monthly. MEDIAN VALUES.

SSP5-8.5
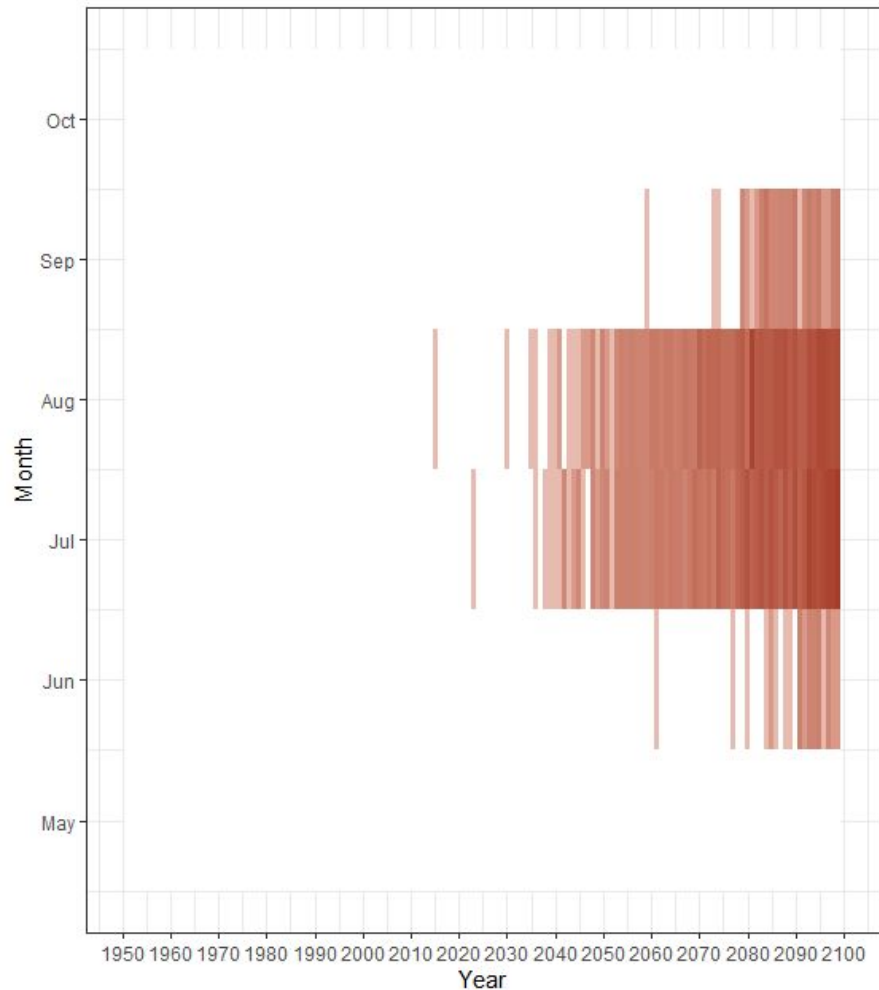
Questions, confusions, insights? Please ask in the chat or hold for the Q&A!

We're here to help!

Canadian Centre for Climate Services (CCCS)
www.canada.ca/climate-services
ccsc-cccs@ec.gc.ca
1-833-517-0376

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