The Change in Climate Change

(Anticipating research opportunities in the Atmospheric Sciences)

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Atmosphere Related Research in Canadian Universities (ARRCU) Workshop.
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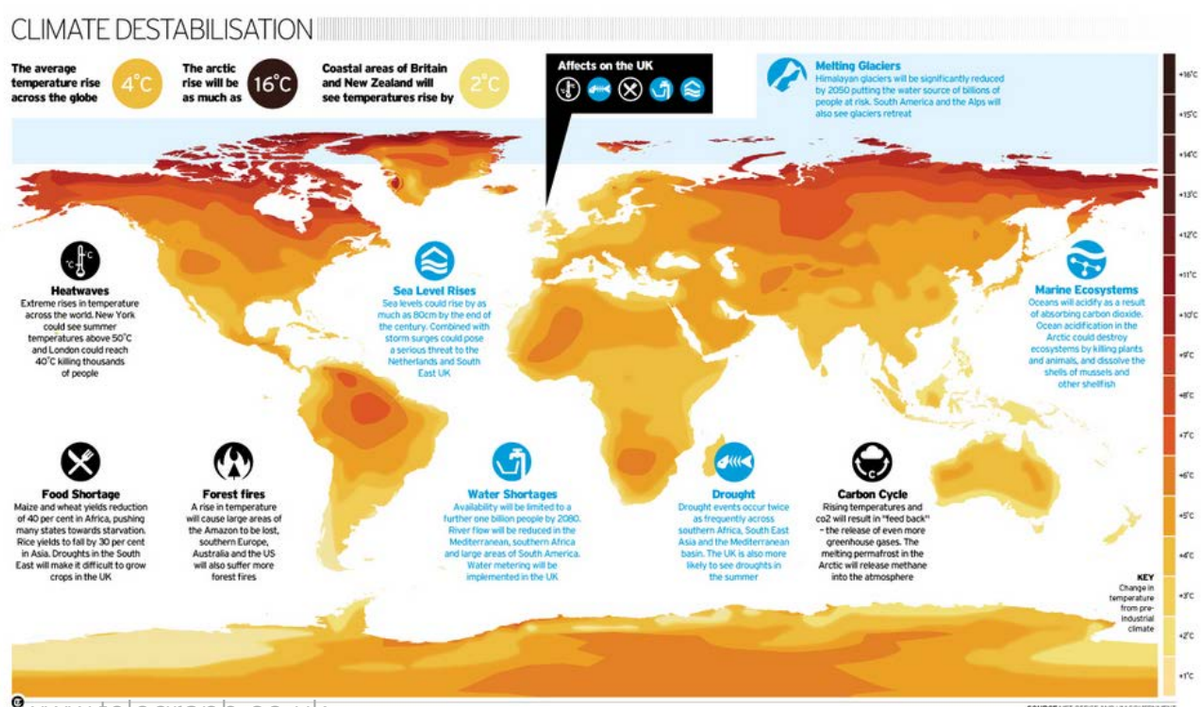
In a changed climate . . .

What will be future societal stresses?

Who will be the winners and losers?

How can Canada capitalize on the changes?

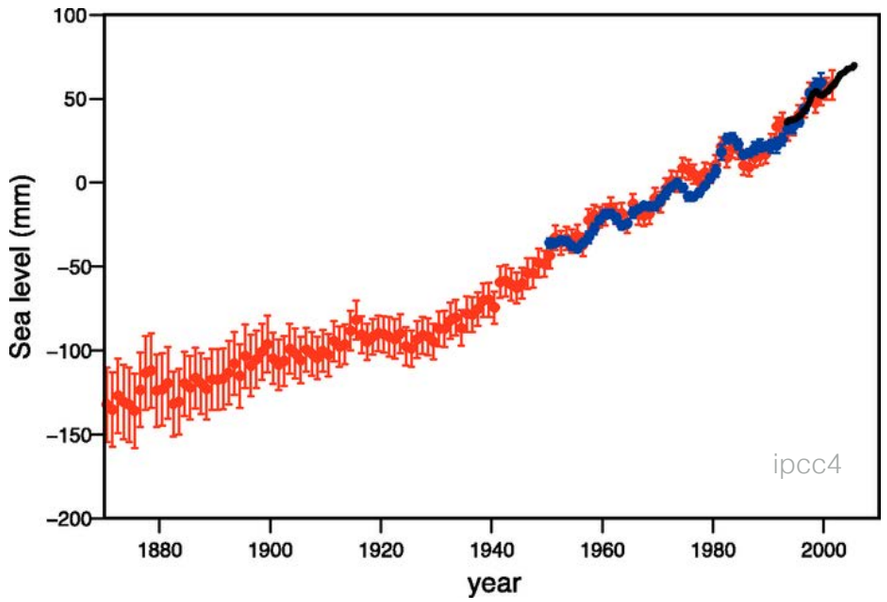
What research can atmospheric scientists do to maximize Canadian prosperity?



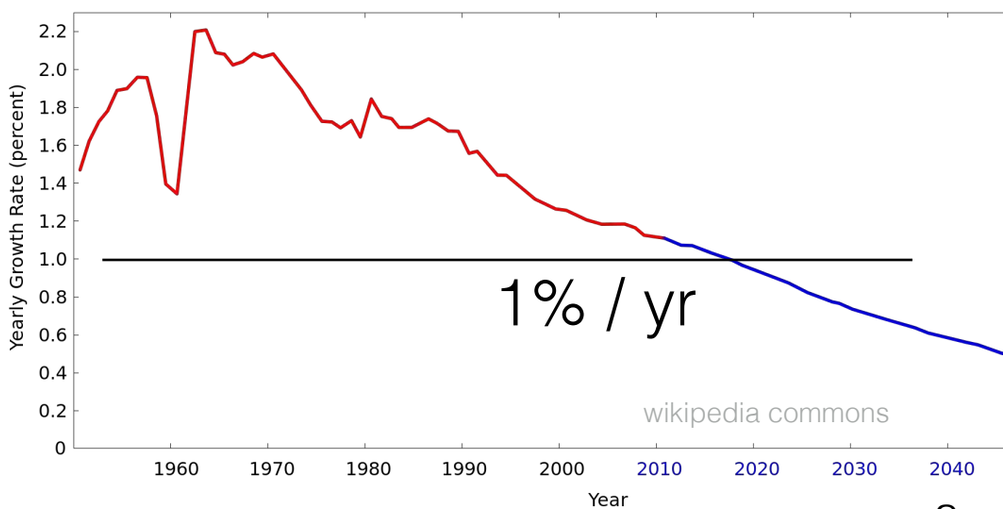
www.telegraph.co.uk

Future Societal Stresses

- Climate change is slow and easily accommodated by individuals.
  - Sea-level rise (3.2 mm/yr)
  - Temperature (0.03°C/yr ≈ 0.01% / yr)
  - Average N. American moves 11.7 times in their lifetime (~ once every 7 years), causing individuals to experience <u>much greater change due to their move</u> to a new local climate.



- Population growth is faster, causing noticeable stresses to which individuals must respond.
  - Shortages in food, water, energy.
    Depleting aquifers; water rationing.
    Gasoline prices up 13% / yr since 1965.
  - Living space is limited. More people "living on the edge" in marginal zones threatened by weather-related natural hazards



As Many Winners as Losers

- Former thriving harbors that became silted-in become thriving again.

wikipedia

- Polders and other low or diked regions become flooded.

- Growing seasons lengthen.

wikipedia

- Former arable lands become semi-arid.

- Habitat ranges for animals reduced.

- Habitat ranges for other animals enlarged.

- Changed thunderstorm tracks bring needed summer rains.

Wolf Read

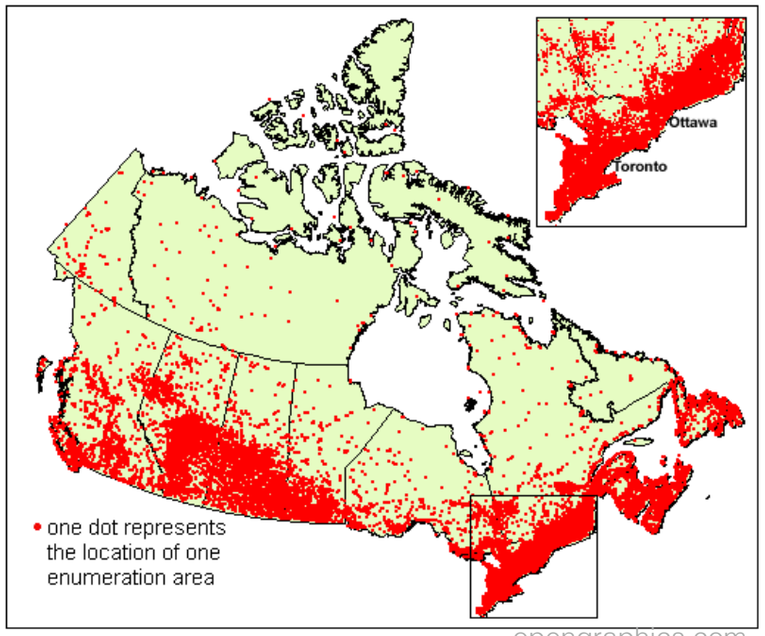
- Changed thunderstorm tracks increase tornado, wind & hail hazards.

- Domestic heating costs reduced.

- Domestic air-conditioning costs increased.

As Many Winners as Losers

- Canada wins.
  - Larger region that is comfortably habitable.
  - Longer growing season — better food supply.



opengraphics.com

75% of Canadians live within 100 miles of US border

- Canada loses.
  - Shorter ice-road season hampers mineral extraction operations.
  - Pests (bugs, rodents, invasive plants) increase.
  - Forest fires more likely.

- USA loses.
  - Hotter, drier uncomfortable regions expand.
  - Less irrigation & hydro-power water — reduced food supply & energy.

Capitalizing on Changed Climate

- Build communities in expanded living space.
- Change crops for new temperature & precipitation.
- Opening new transportation corridors. Northwest Passage — new ice-breaking ore-carrying ships.
- Expanded wind- and solar-power opportunities.
- Design more resilient infrastructure.

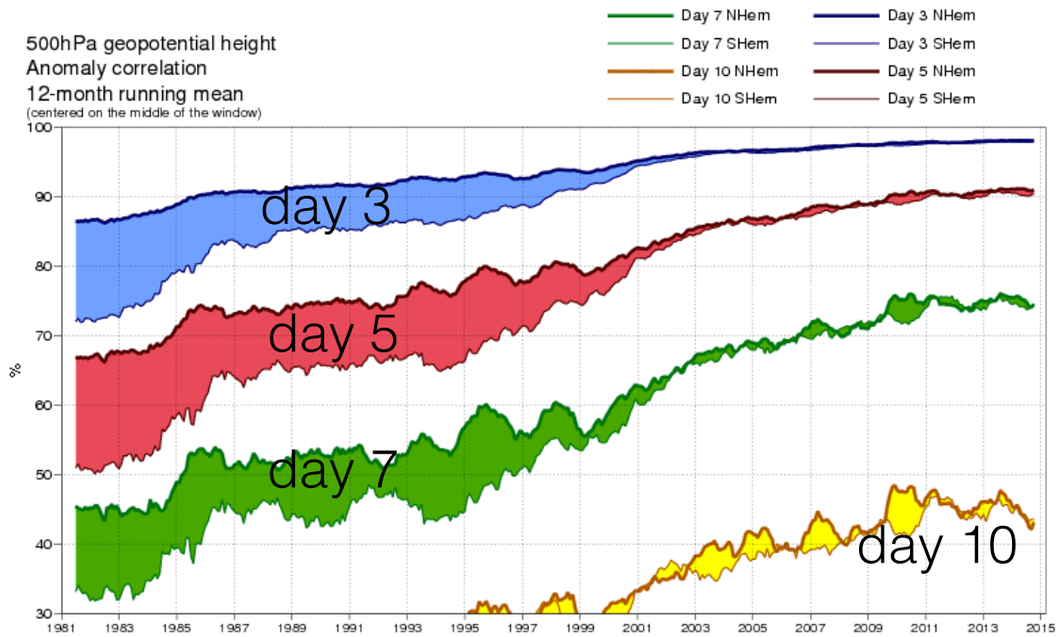
Bear Mtn Wind Farm, BC

Nunavik ice breaker ore carrier

Recent Break-throughs in Atmospheric Science…

- **Numerical forecast skill exceeds human skill**, because of science advances in atmospheric physics, numerical methods, and observing systems.

- **Climate-models are increasingly sophisticated**, because of science advances in understanding radiation balances, global atmospheric and ocean circulations & interactions with the Earth's surface.



ecmwf

… are Exciting Paradigm Shifts.

- Opening new research directions and needs.

- Requiring a revolution in education of future experts.


ubc.ca

Atmospheric Research Fields

to Maximize Canadian Prosperity in a Changed Climate

- Cloud & Precipitation Microphysics

  Snowpack for water supplies. Rain for ag., hydro energy, flood forecasting.

- Synoptics, Dynamics, Mesoscale, Mountain Met.

  Storm predictions. Wind power. Avalanche & landslide weather.

- Boundary Layer, Turbulence & Atmos. Dispersion

  Air quality in growing metropolitan areas. Environment impact studies.

- Radiation, Remote Sensing & Weather Instruments

  Better monitoring of changing conditions. Better warnings to the pubic.

- Numerical Weather, Climate & Ocean Prediction

  Coupled models. Ocean currents & waves for shipping and erosion.

Atmospheric Research Fields

to Maximize Canadian Prosperity in a Changed Climate

- Weather Statistics & Theory

  Insurance. Commodity futures. Energy trading. Safety thresholds.

- BioGeoChemical & Health

  Environmental Stewardship & Engr. Carbon budgets. Urban climate.

- Cryosphere / Canadian Arctic

  Sea and land ice. Glaciers. Permafrost. Expanded commerce.

ALL fields of atmospheric & physical oceanographic research are relevant to increasing Canadian prosperity.

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- What will be future societal stresses?
- Who will be the winners and losers?
- How can Canada capitalize on the changes?
- What research can atmospheric scientists do to maximize Canadian prosperity?

We are on the threshold of exciting advances in atmospheric sciences that can benefit all Canadians.