Climate Change in the Northwest Territories

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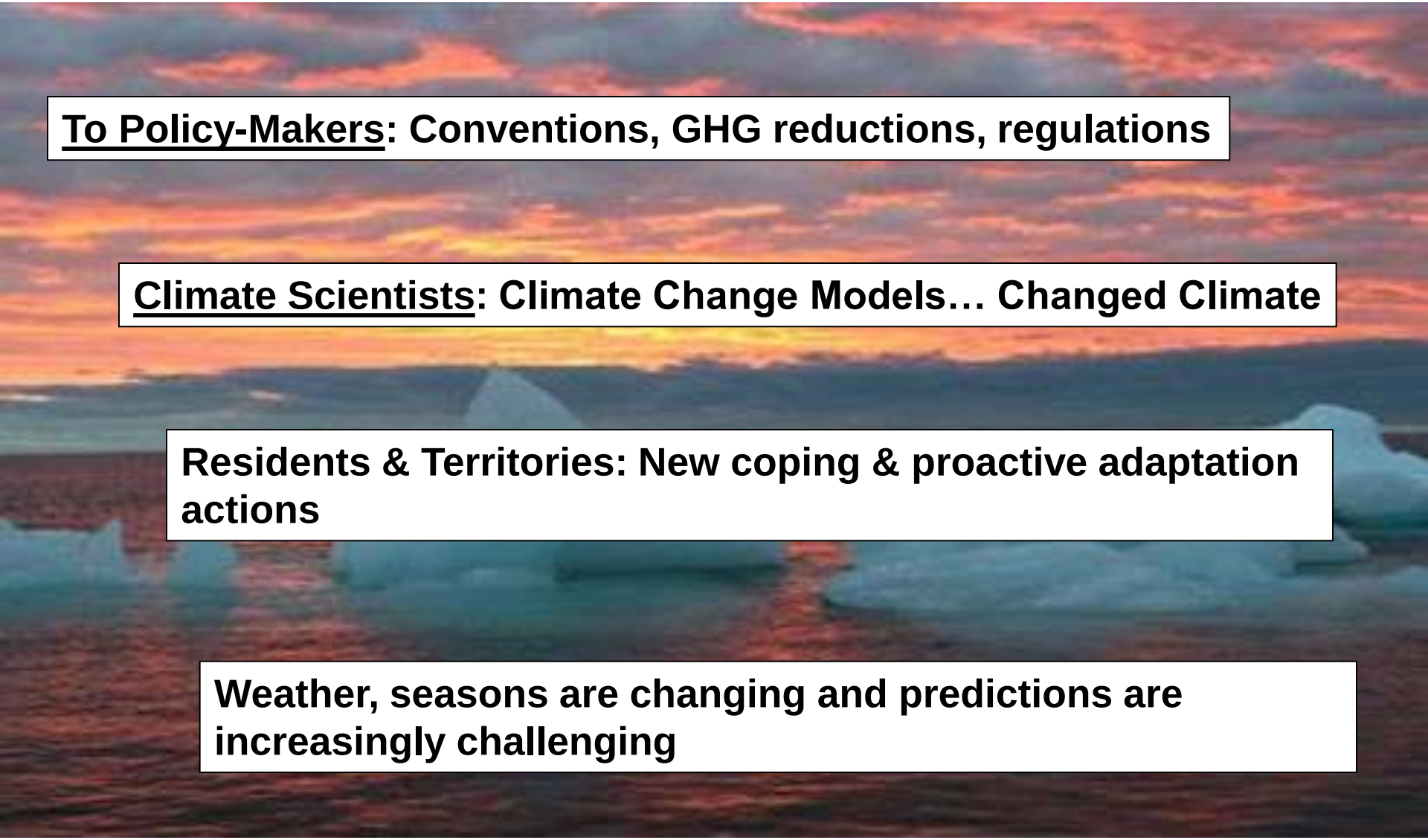
Climate Change means…????



<u>To Policy-Makers</u>: Conventions, GHG reductions, regulations

<u>Climate Scientists</u>: Climate Change Models… Changed Climate

Residents & Territories: New coping & proactive adaptation actions

Weather, seasons are changing and predictions are increasingly challenging

Depends on what actions are needed and by whom…

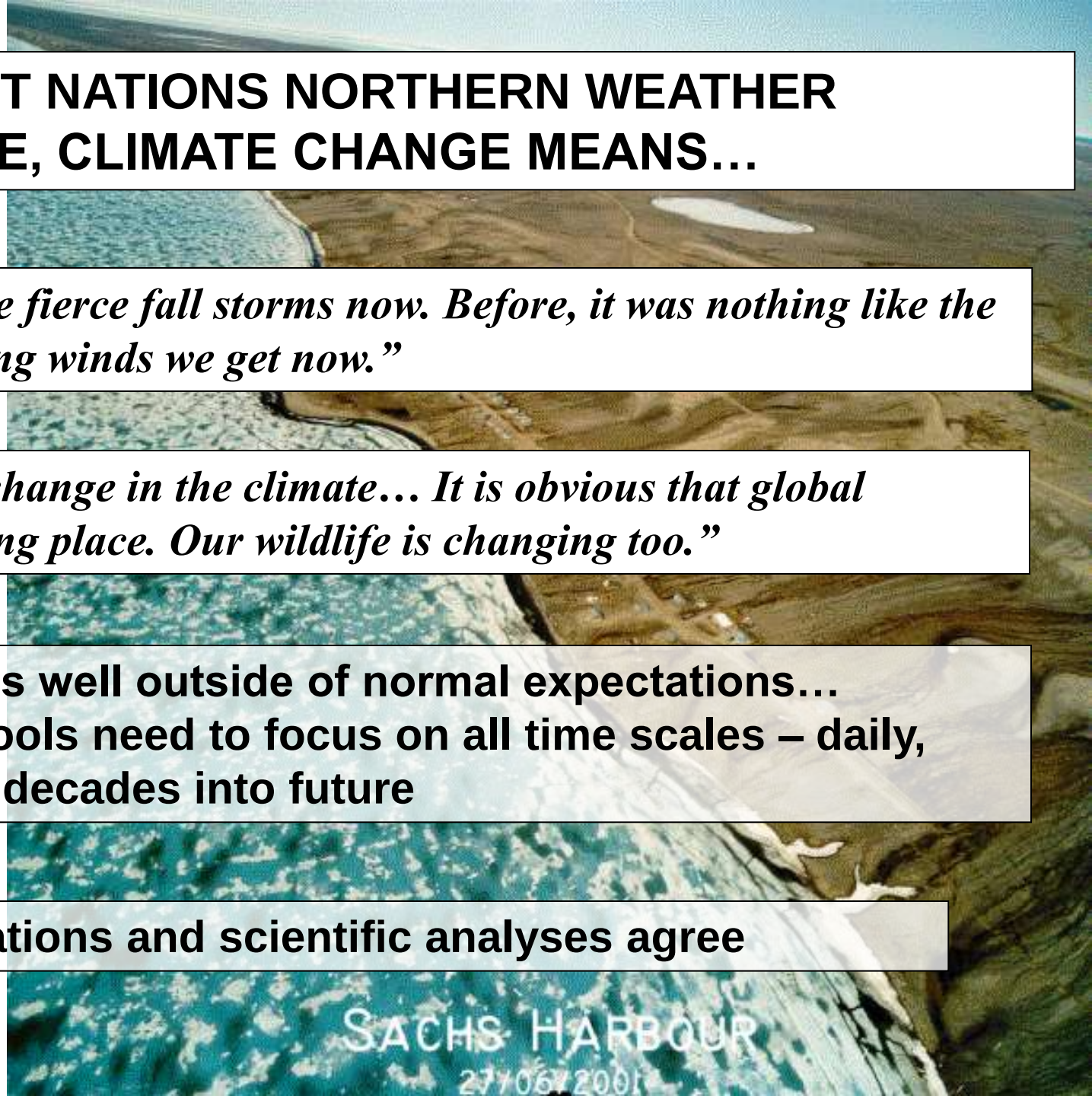
FROM A FIRST NATIONS NORTHERN WEATHER PERSPECTIVE, CLIMATE CHANGE MEANS…

"There are more fierce fall storms now. Before, it was nothing like the storms and strong winds we get now."

"I can feel the change in the climate… It is obvious that global warming is taking place. Our wildlife is changing too."

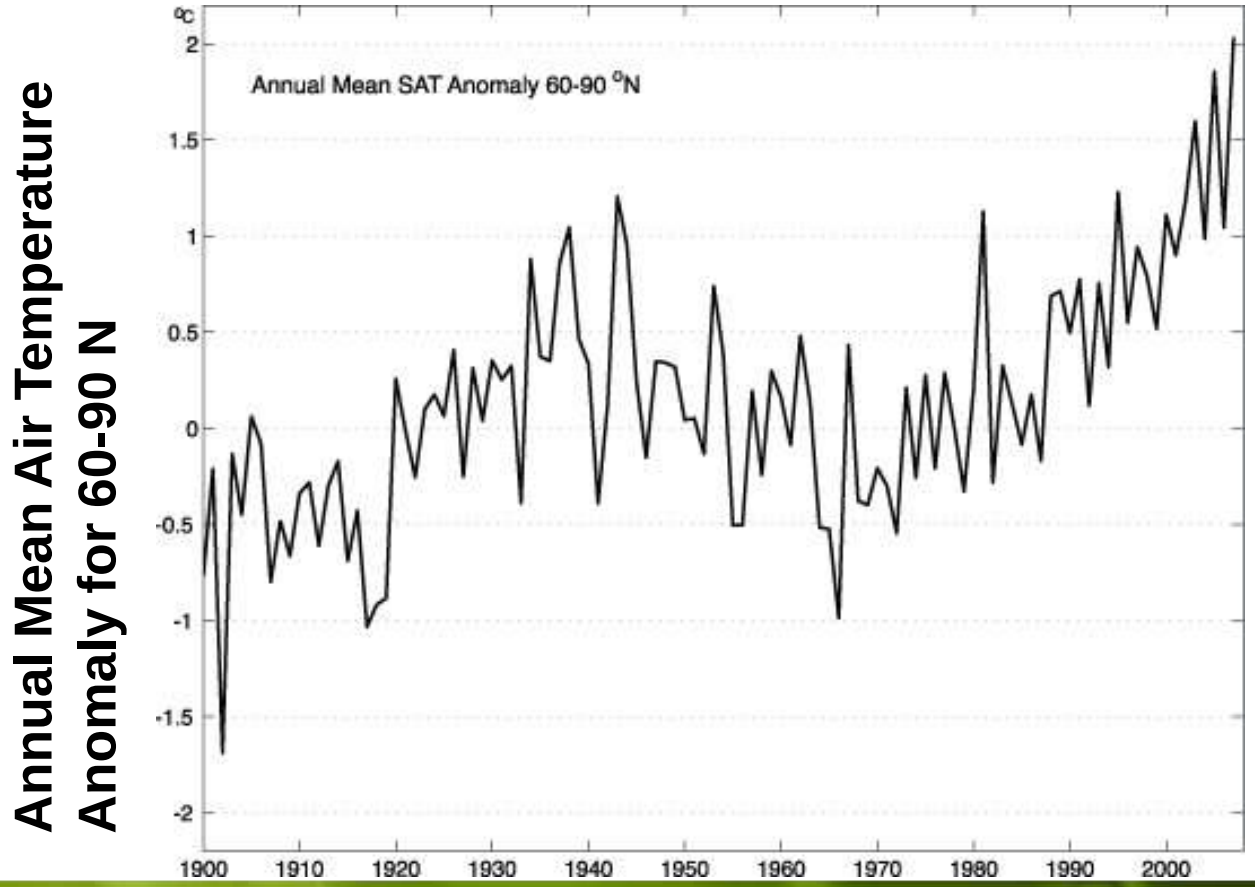
Weather that is well outside of normal expectations… Forecasting tools need to focus on all time scales – daily, seasonal and decades into future

Local observations and scientific analyses agree



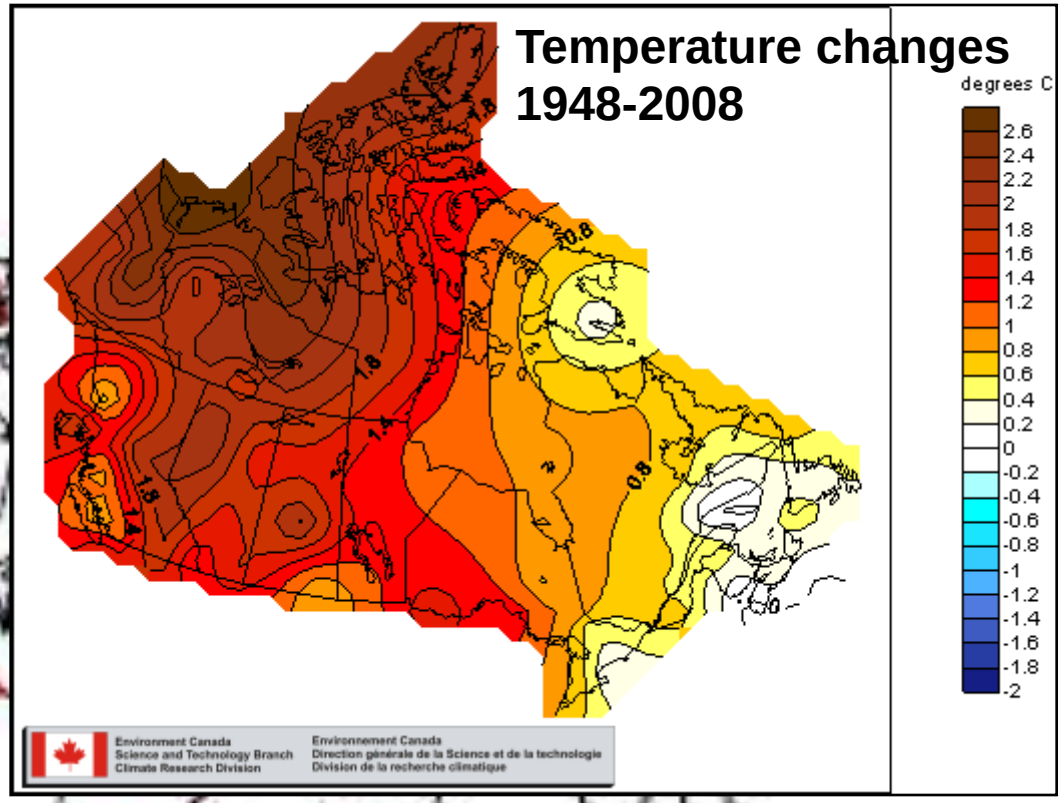
FROM A CLIMATE CHANGE SCIENCE PERSPECTIVE…

Global Circumpolar Arctic temperatures have increased rapidly since the 1960s.



Canada warmed at almost twice the rate of global average.

Mean Annual Temperature Trends 1950-2007



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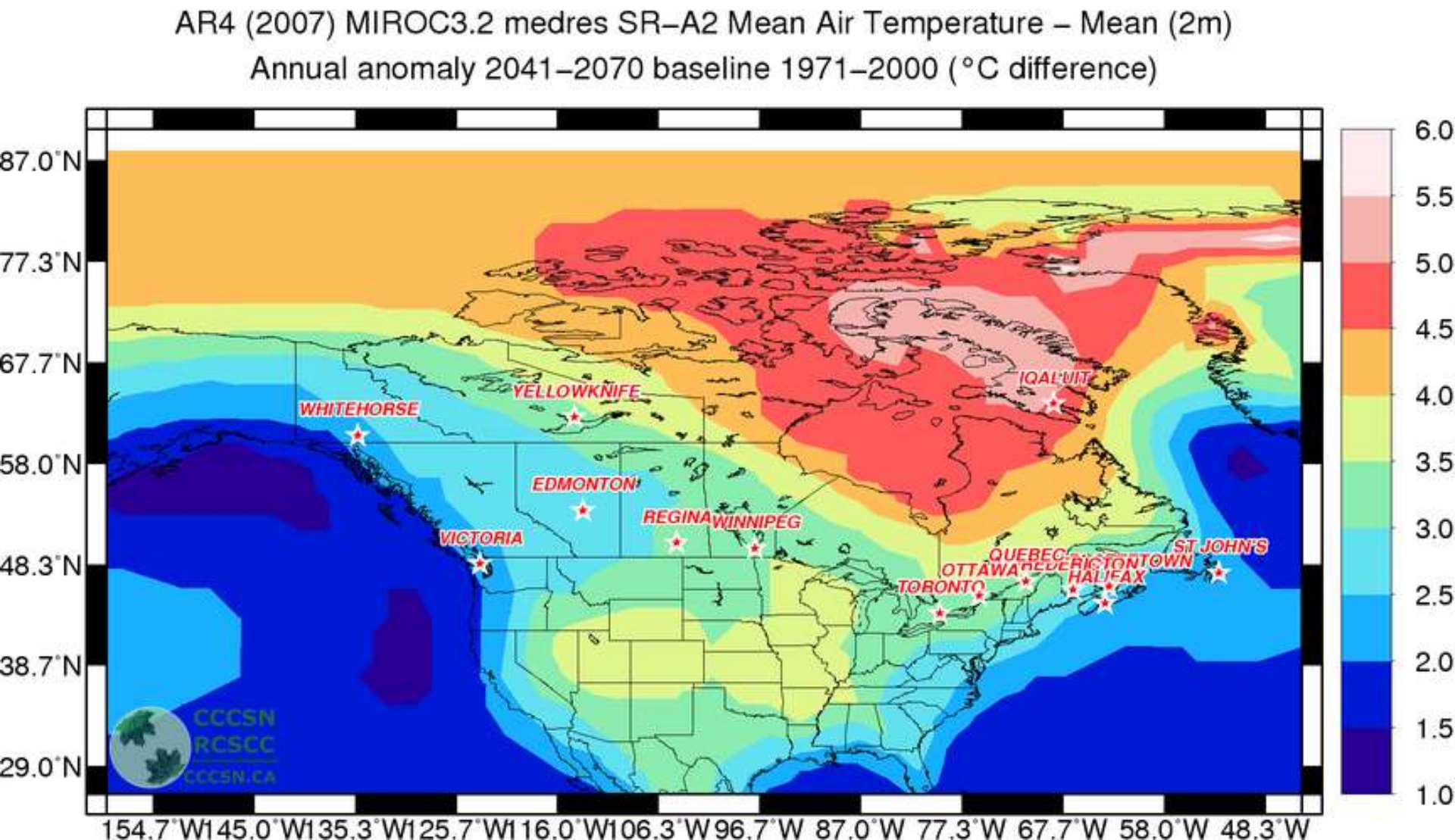
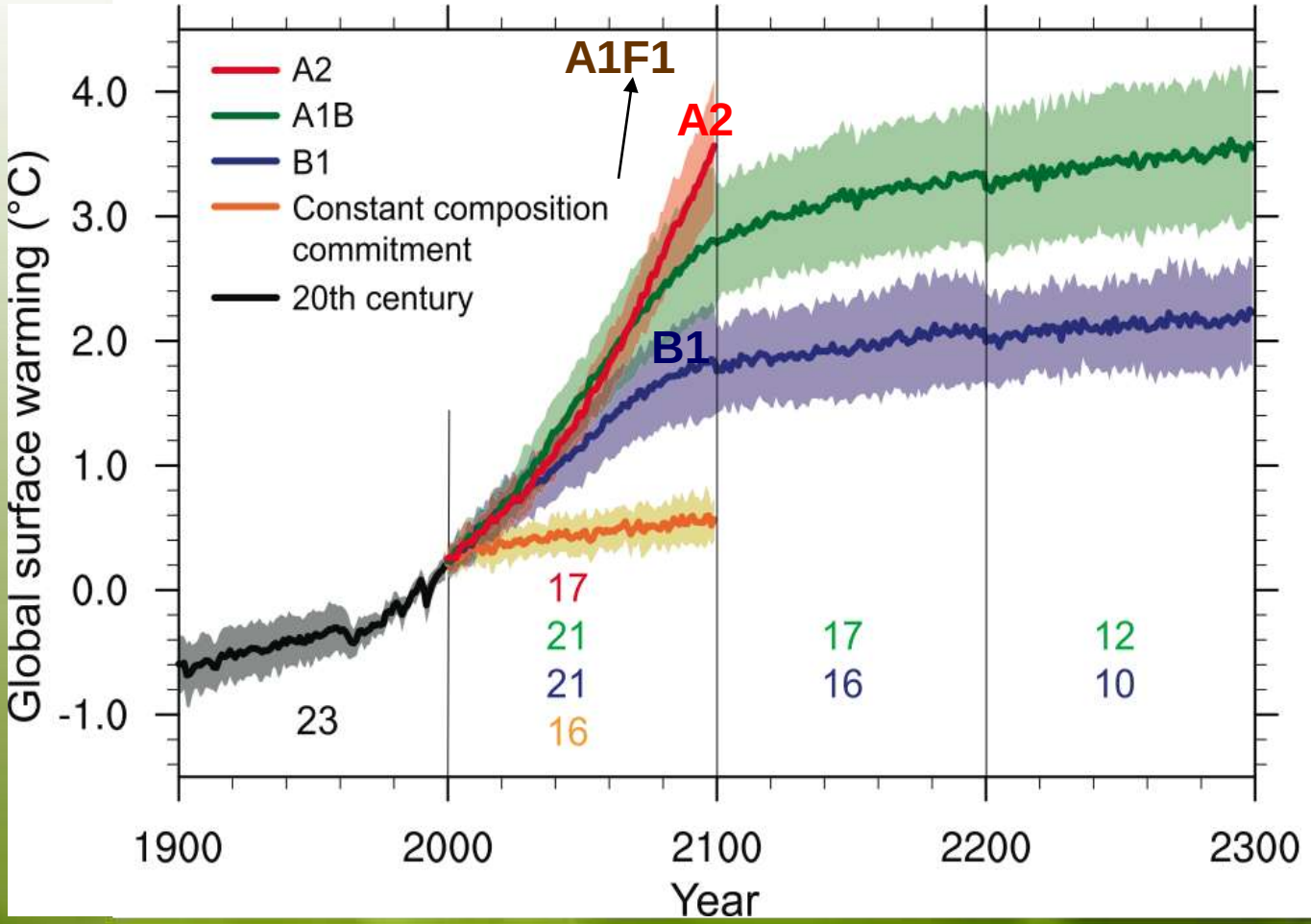
With Up to another 4-6 C of Warming by 2050s (depends on the climate model used



FROM A POLICY-MAKER AND ENERGY PERSPECTIVE, GREENHOUSE GAS EMISSIONS NEED TO BE REDUCED…



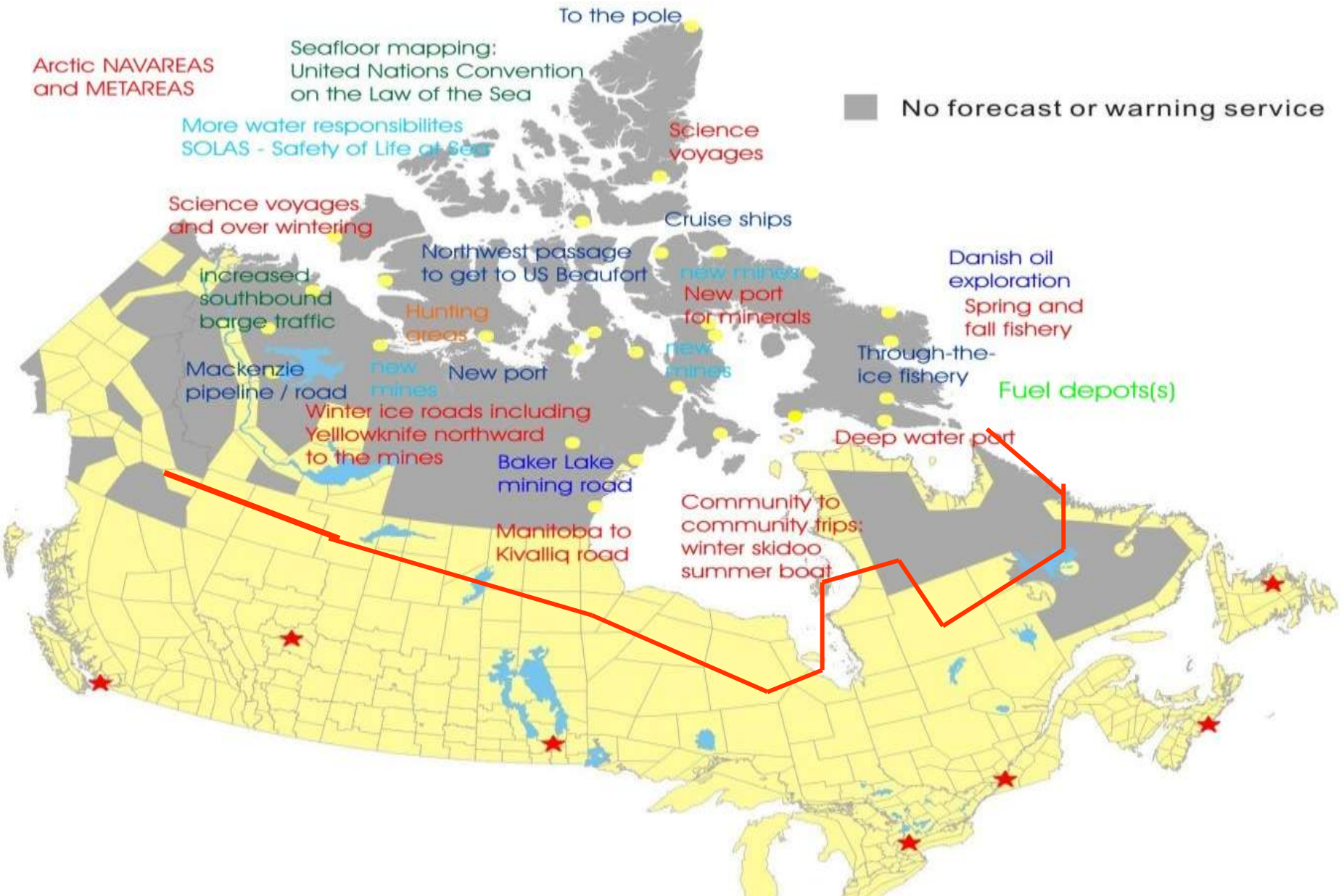
- Recent research indicates that it will be **more difficult** to lower atmospheric temperatures than previously thought.
- Strong evidence suggests that time scales of **hundreds** of years will be required for temperatures to decline once the atmosphere exceeds the **2 C** threshold globally.

Source: IPCC 2007 (WGI/AR4)

What policy actions are needed?

Need Mitigation (or reduced greenhouse gases globally) … and Adaptation for inevitable climate changes

Climate Change Risks, Opportunities and Hazards will affect all Northern activities and communities



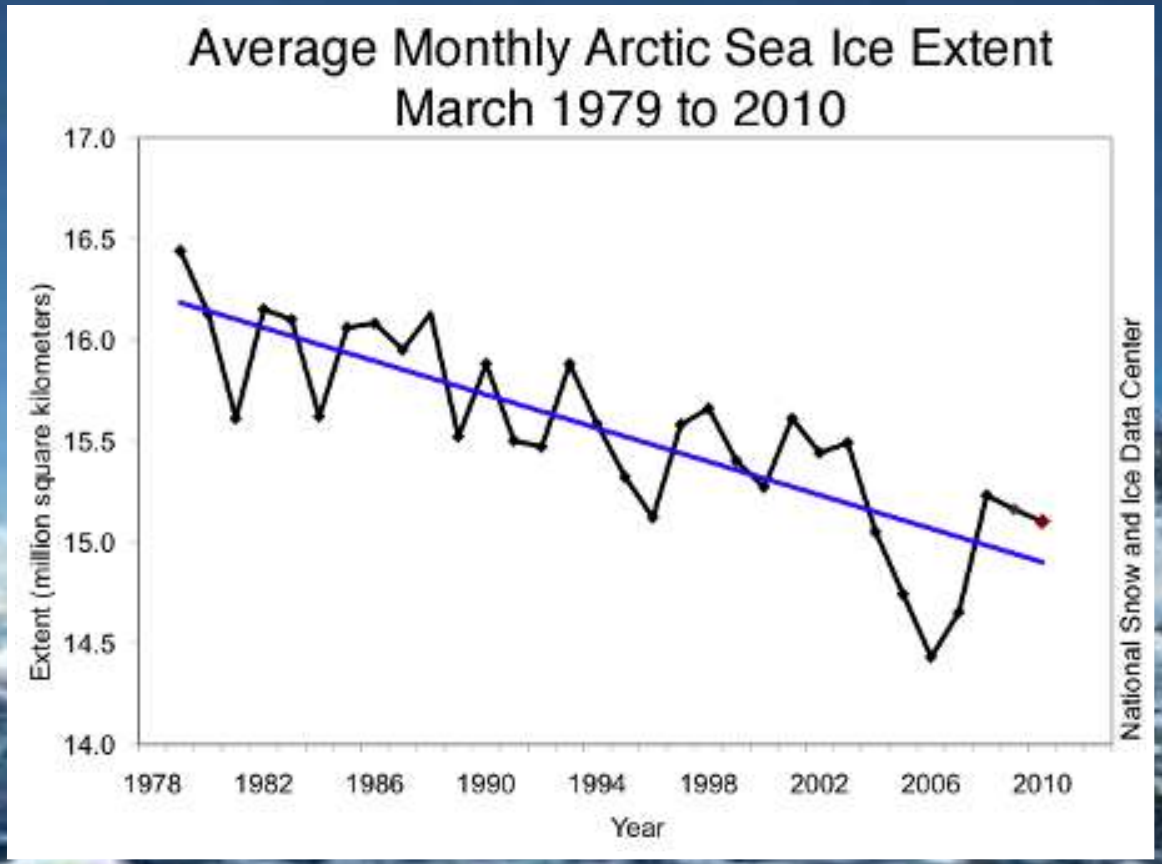
Changing Snow, Flooding and Hazard Risks

Increased snowpacks, earlier melting, warmer winter temperatures, rain on snow, increased rainfalls…

- **Increasing snowmelt, rain runoff and flooding risks;**
- **Potentially increased disaster risks, greater emergency response capacity needed**

Pangnirtung

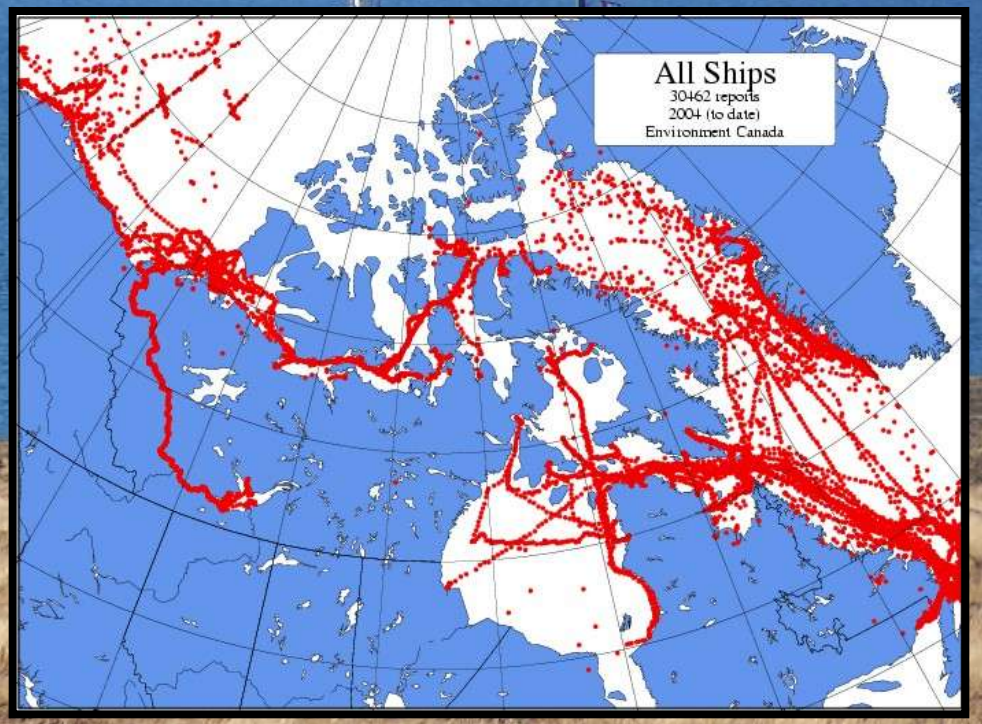
Arctic ice that is melting much faster than projected by most climate models… Multi-year ice disappearing quickly.



More ice-free seasons, melting glaciers and ice sheets, erosion

Consider the new infrastructure & services required to support increased marine & other transportation

- New marine hazards, disaster risks
- New opportunities
- Sovereignty challenges



Opportunities and costs

More Risk Management for Erosion, Storm Surges, Sea Level Rise and Flooding Risks…

Increased open water, increasing storm intensities & storm surges, sea level rise, regional land subsidence (West)… erosion, flooding…

Requirements for Disaster Management Planning

Tuktoyaktuk … Beaufort Sea storms are eroding the original permanent settlement and requiring the relocation of some community buildings.

Future of Winter Roads?

Warming winters are shortening the winter road season and increasing demand for air transport

Other integrated transportation opportunities?

Planning for Warming and Thawing Permafrost and Implications for Foundations

Northern infrastructure designed for stable characteristics of permafrost.

- **Permafrost will partially or completely disappear over large areas of the Arctic.**
- **Requires new designs of foundations, mining tailings ponds, etc for warming permafrost**

permafrost will partially or completely disappear over large areas of the north

Changing and New Building Codes and Standards?

Our infrastructure is designed to withstand weather hazards… including extreme weather conditions

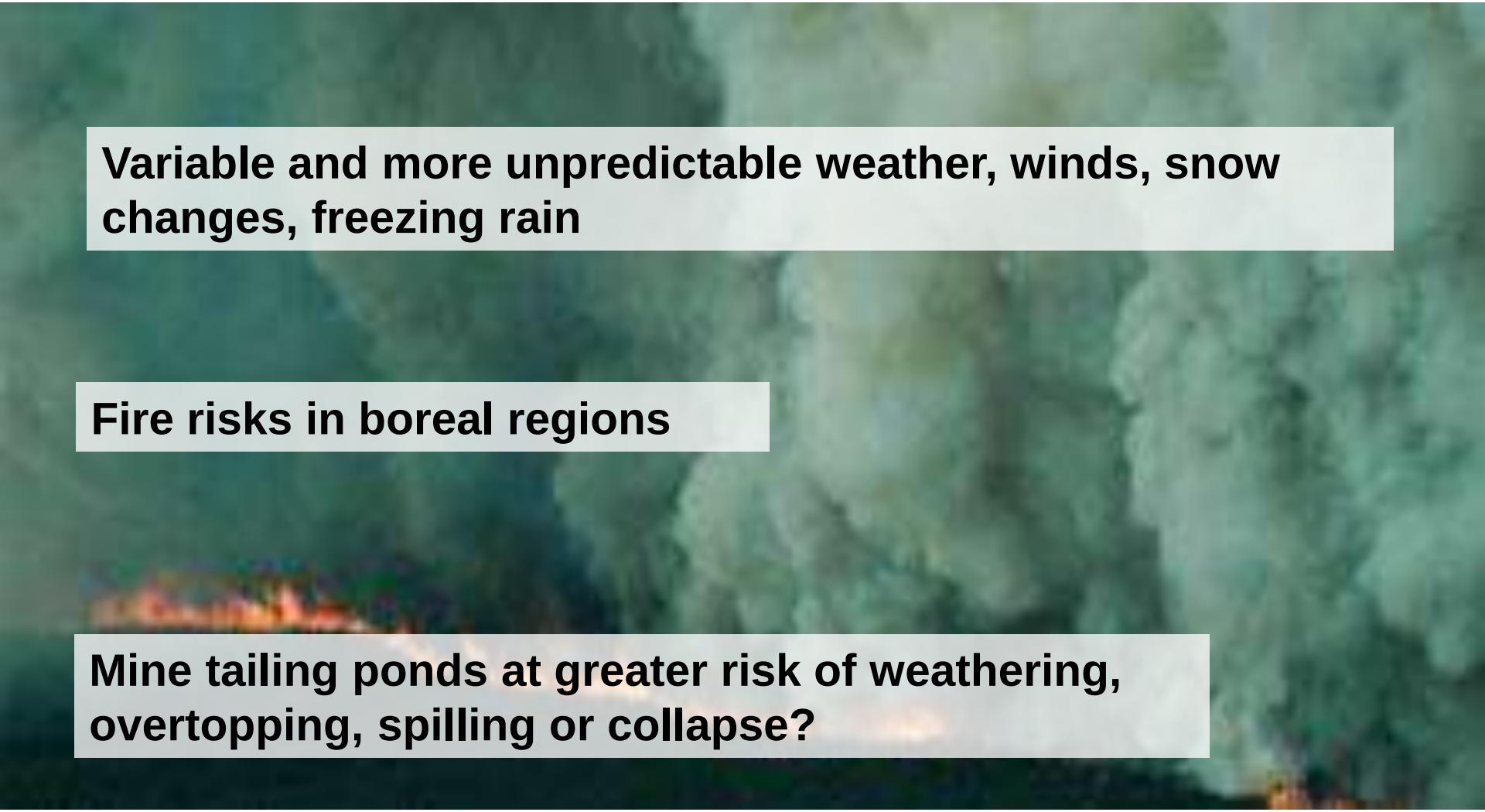
Almost all of our structures designed using past weather extremes … assume past extremes will represent the future

- ***Need to design structures for weather of today and the future…***

e.g. Changing snow conditions – bigger extremes being observed

(~20% of public access buildings in NWT renovated or under watch for changing snow weight risks (loads))

Hazards, Disaster Management, Infrastructure at Risk…



Variable and more unpredictable weather, winds, snow changes, freezing rain

Fire risks in boreal regions

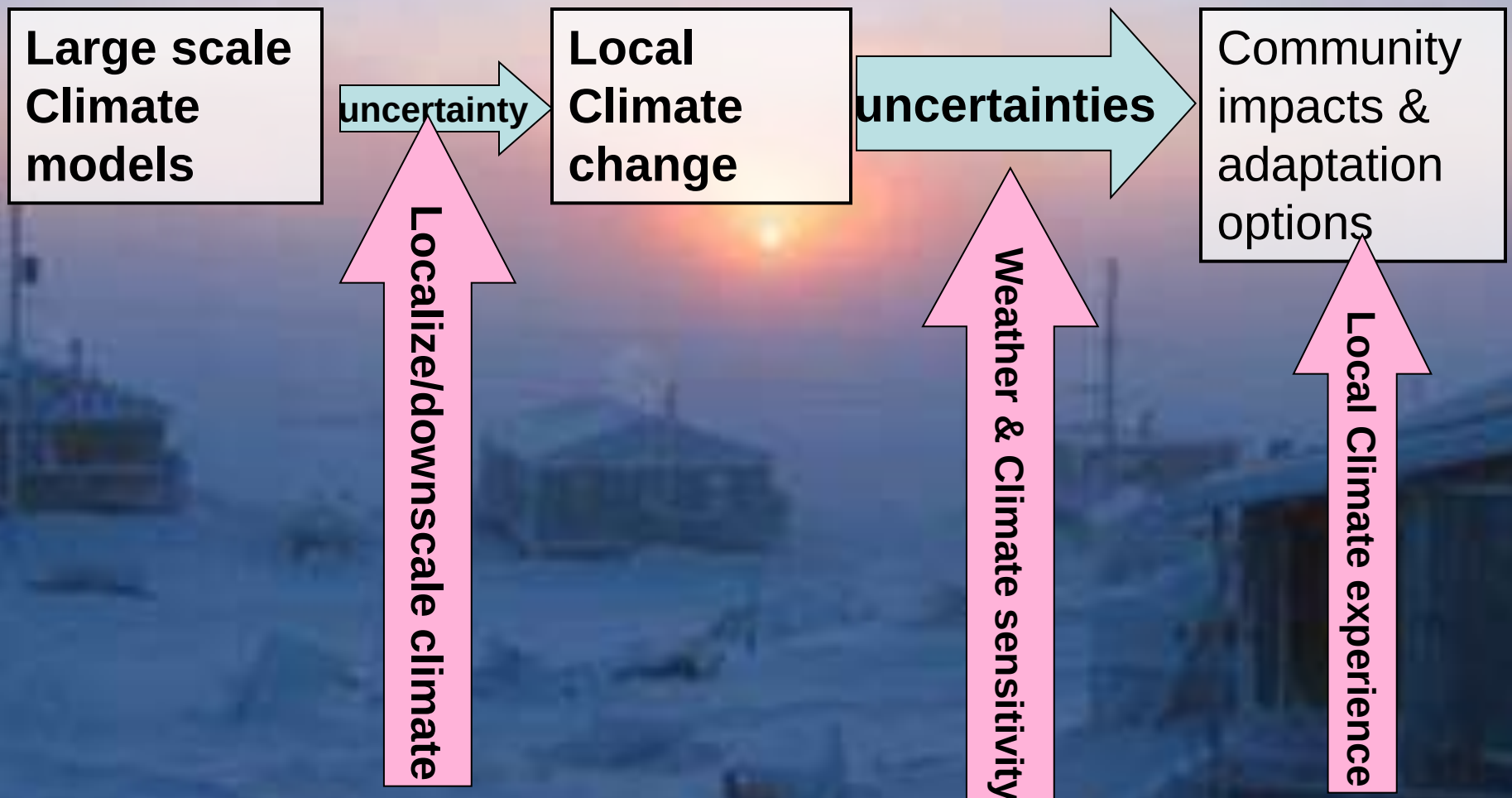
Mine tailing ponds at greater risk of weathering, overtopping, spilling or collapse?

New Species Moving North…

Some native species regionally at risk …
Perhaps some opportunities

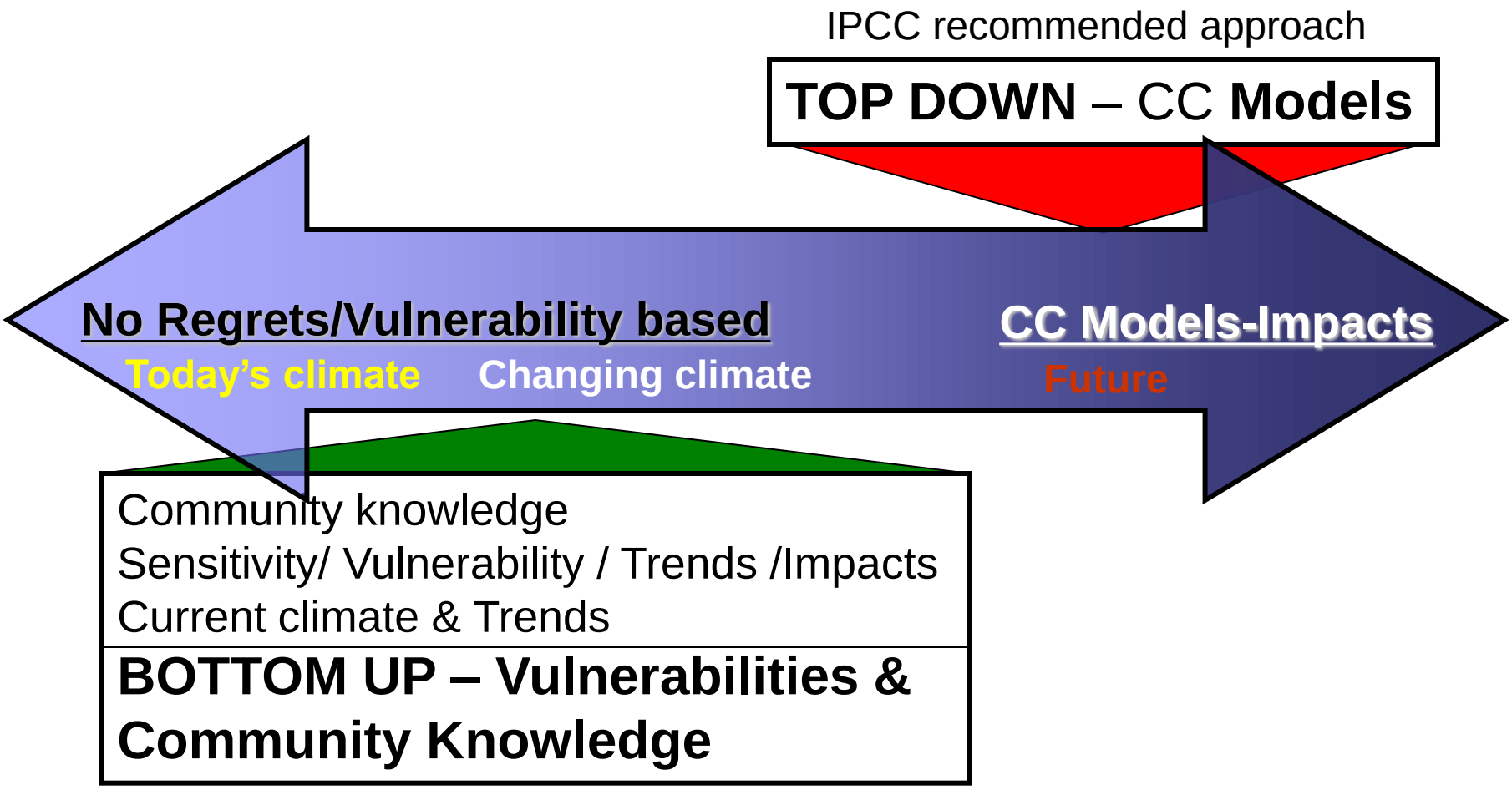
Climate change adaptation… How to Adapt and to What?? Climate change model "top-down" approaches

<u>Traditional</u> "top-down" impacts & adaptation approaches (IPCC):



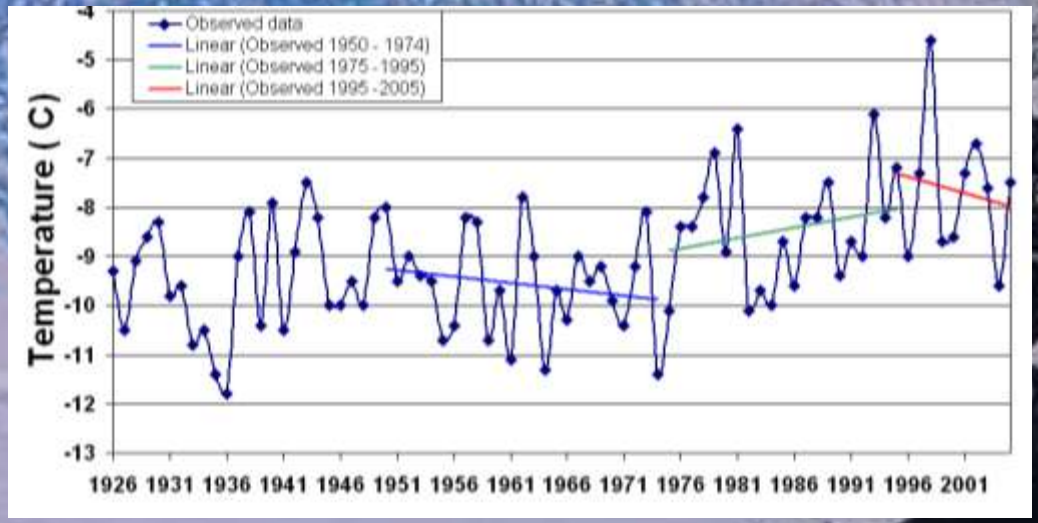
AND… VARIATIONS on ADAPTATION APPROACHES: VULNERABILITIES AND COMMUNITY KNOWLEDGE

(although the past will likely NOT represent the future)

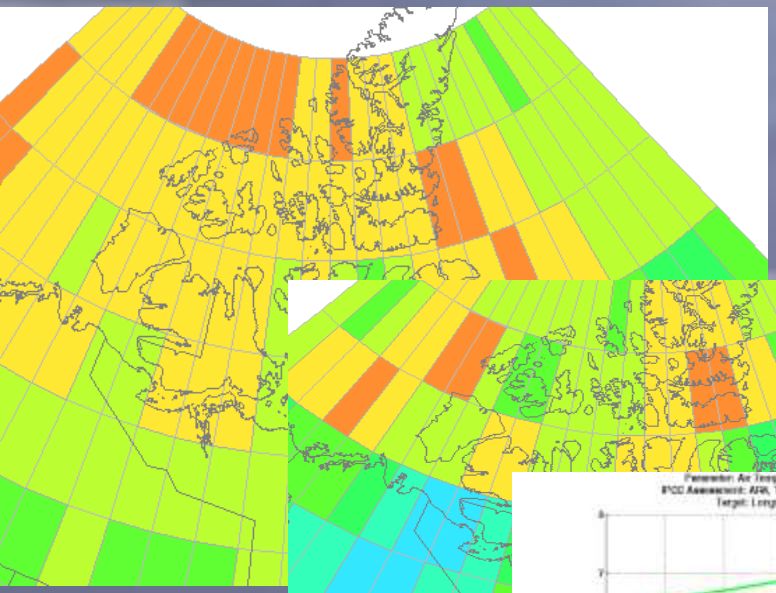


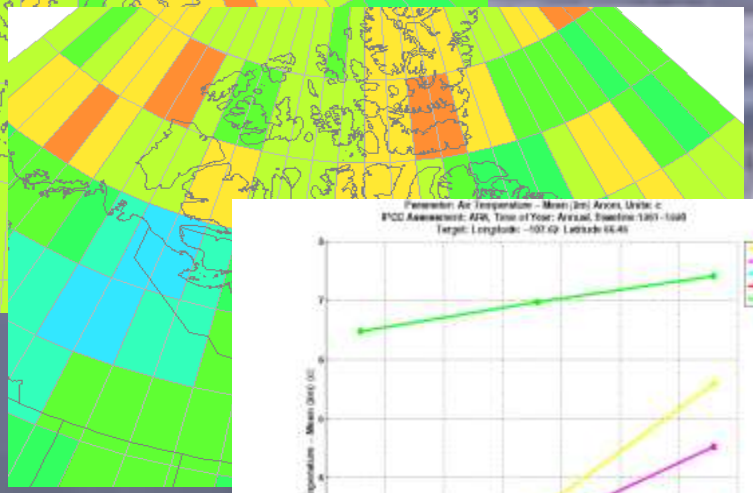
Climate change models face challenges in the North… future climate more difficult to handle

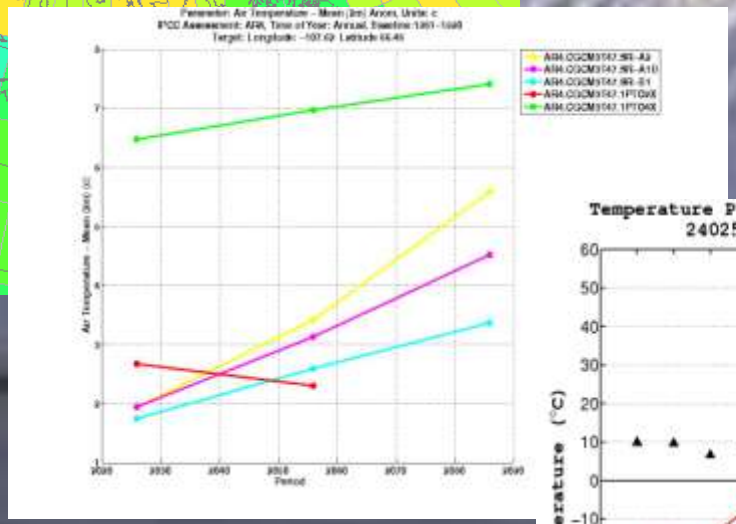
- Climate swings are amplified, compared to southern Canada –even historically
- Changes will not be gradual (linear)
- Fortunately, new tools and guidance are available

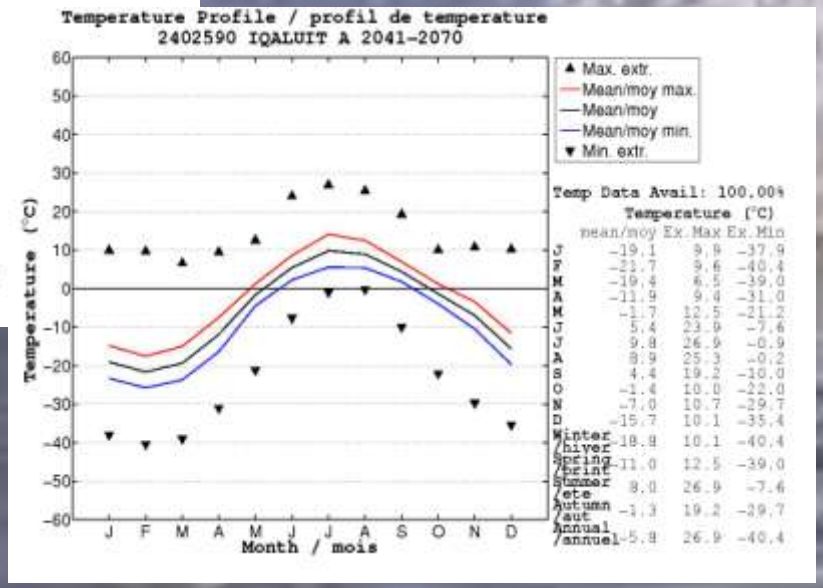


New Climate Change Science (www.cccsn.ca)









- New Global Climate Change Models
- New Regional Climate Change Models
- New Climate Change Scenarios, Impacts and Adaptation

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CLIMATE CHANGE SCENARIOS and DOWNSCALING for 23 SITES in NORTH…

Climate change scenarios node for the North

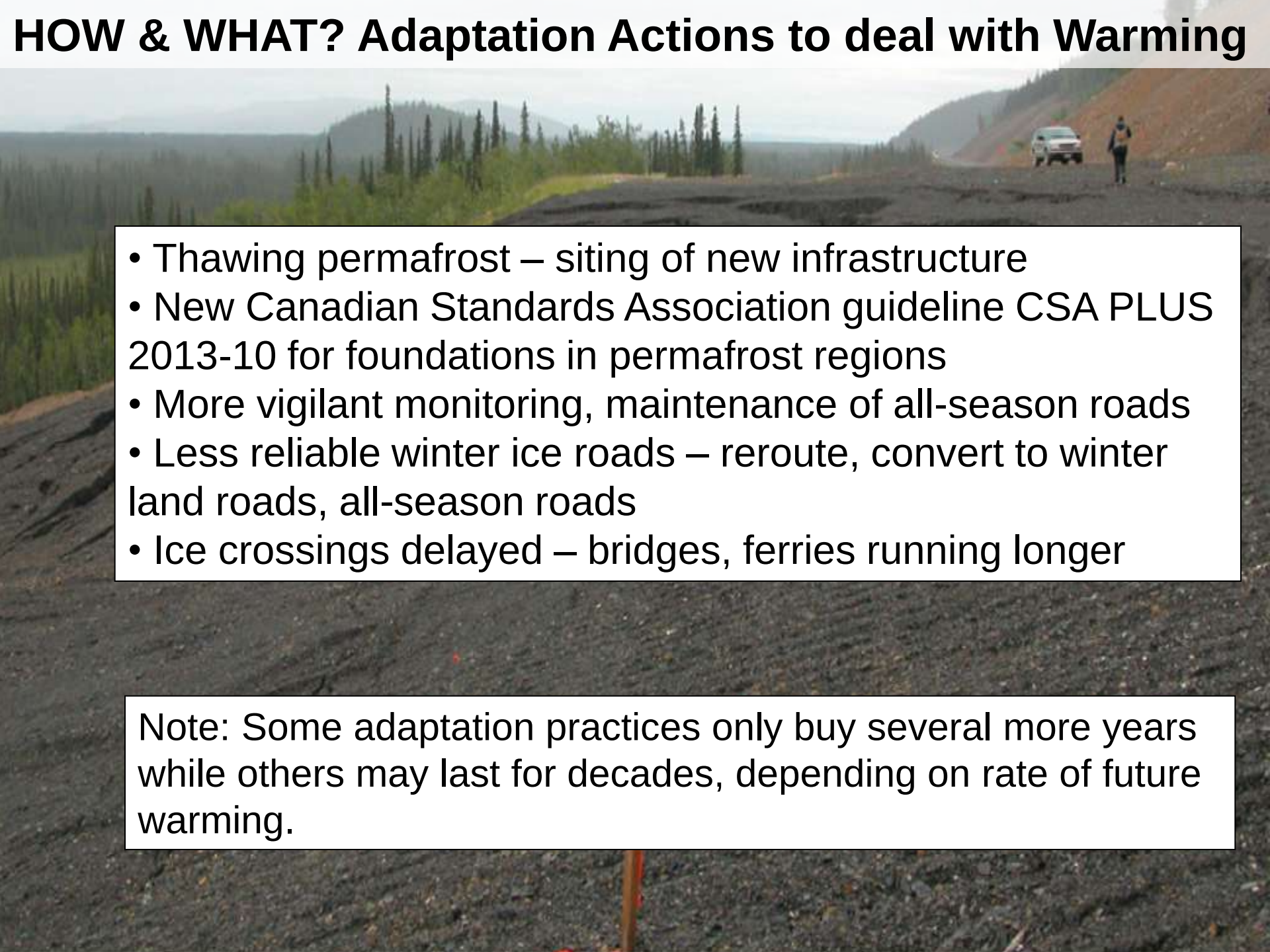
www.cccsn.ca … IPCC Climate Change Scenarios from 24 modelling centres worldwide

Best performing models have been selected for North using the most recently observed climate trends …

Environment Canada ha completed local projections (DOWNSCALING) for mean temperatures for 23 sites in the North … 9 climate models & 2 sets of GHG emissions

More downscaling results likely – extreme winds, accumulated snow loads, precipitation…

HOW & WHAT? Adaptation Actions to deal with Warming



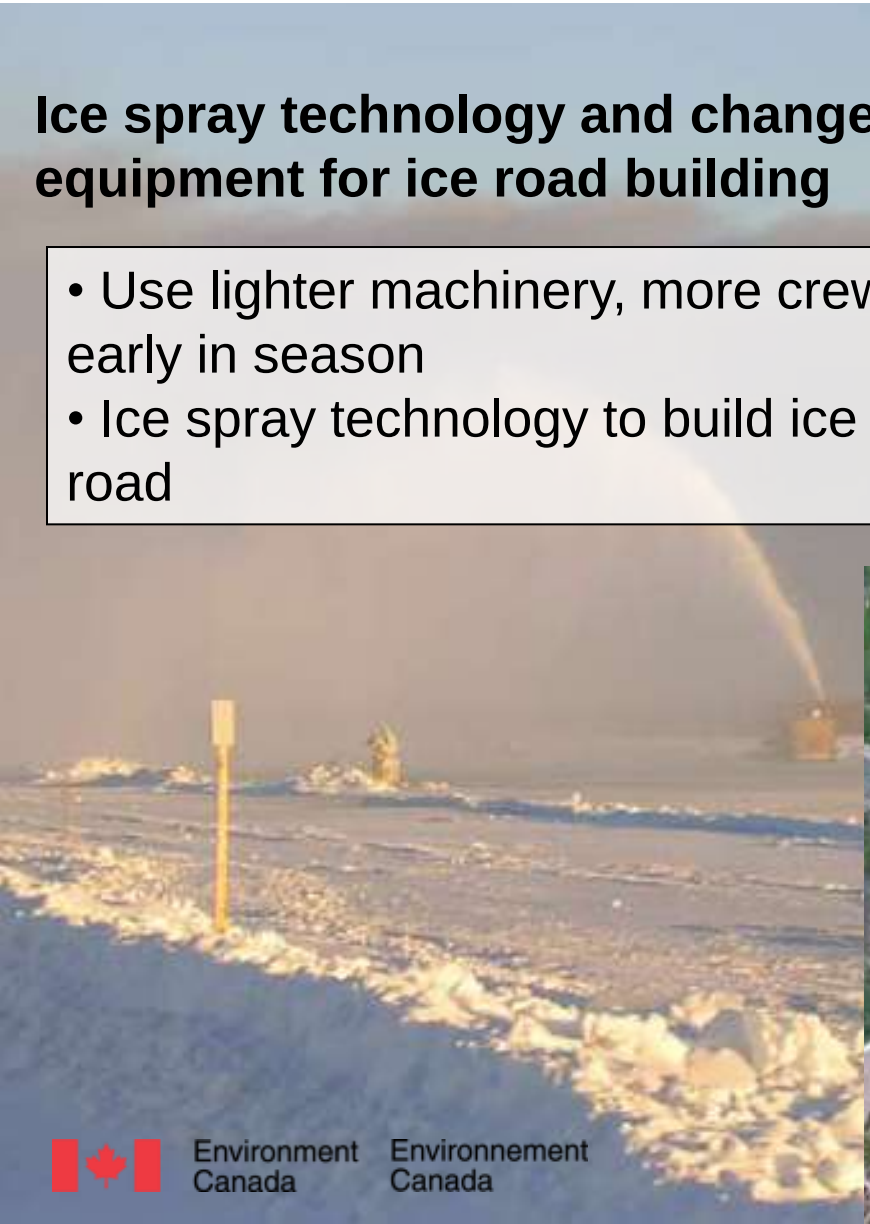
- Thawing permafrost – siting of new infrastructure
- New Canadian Standards Association guideline CSA PLUS 2013-10 for foundations in permafrost regions
- More vigilant monitoring, maintenance of all-season roads
- Less reliable winter ice roads – reroute, convert to winter land roads, all-season roads
- Ice crossings delayed – bridges, ferries running longer

Note: Some adaptation practices only buy several more years while others may last for decades, depending on rate of future warming.

HOW & WHAT? Disappearing Ice Roads, Ice Crossings and Permafrost

Ice spray technology and change equipment for ice road building

- Use lighter machinery, more crew early in season
- Ice spray technology to build ice road



New foundations that distribute weight and absorb stress

Bridge on Mackenzie Valley ice road river crossing

- Use temporary bridges
- Extend ferry crossing season

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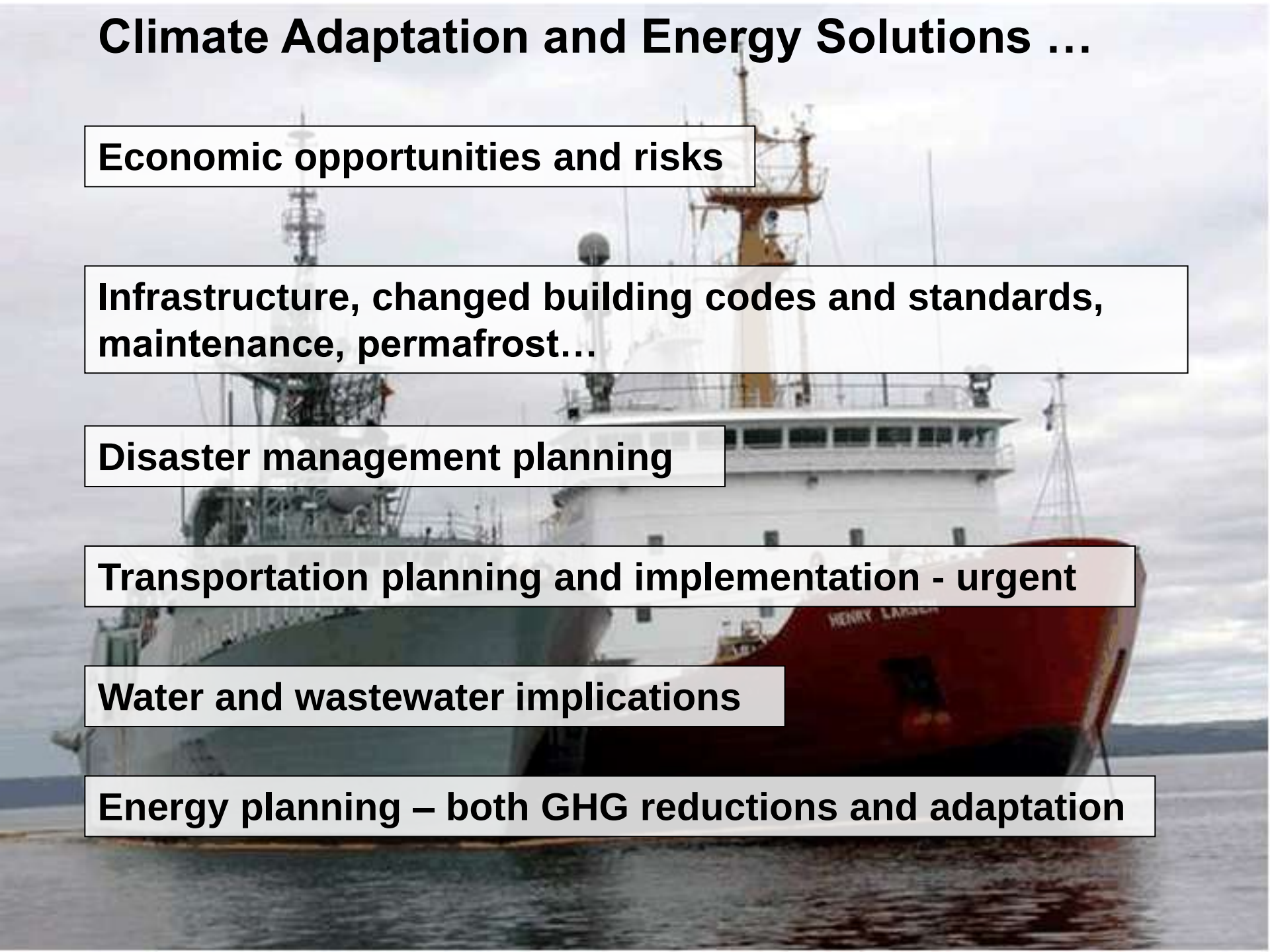
CSA Standard for Foundations in Permafrost (CSA PLUS 4011)

- General guidance … mainly for new infrastructure
- Appropriate for buildings, utilidors, water treatment plants, towers and tank farms, bridges, …
- CSA Guide applies a risk management approaches and tools, siting, etc… use most recent climate data and “best performing” climate change models
- Roads … See TAC (2010) “Transportation Construction in Permafrost Regions”

Climate Adaptation and Energy Solutions …



- Economic opportunities and risks
- Infrastructure, changed building codes and standards, maintenance, permafrost…
- Disaster management planning
- Transportation planning and implementation - urgent
- Water and wastewater implications
- Energy planning – both GHG reductions and adaptation

SUMMARY & NEEDS

- Rapid changes likely will continue… variability an issue
- MORE Infrastructure and Disaster Risk Management
- New specifications for codes/standards in North? NRTEE
- Need downscaled climate variables … working on it
- Work with infrastructure lifecycles… Better Maintenance

- Expect more surprises!