

Climate Change and Variability

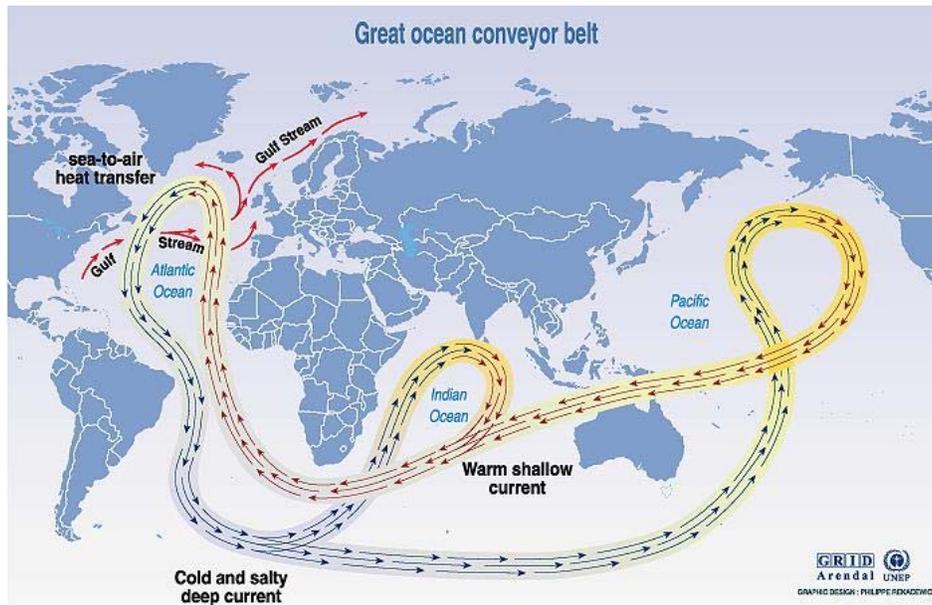
Climate change occurs when the amount or distribution of energy stored by the global climate system is changed. Natural mechanisms can upset this balance, such as fluctuations in the Earth's orbit, variations in ocean circulation and changes in the composition of the Earth's atmosphere.

Human-made pollution, specifically emission of greenhouse gases (GHG) and aerosols, is accentuating these natural mechanisms. Global warming has different effects in different parts of the Earth. For example, global warming may in fact mean colder temperatures along the Eastern Coast of North America because melting polar ice is cooling the Gulf Stream.

The principal driver in climate change is ocean temperature. Understanding how oceans work and how they affect other Earth systems is critical to understanding and modelling climate change processes and their impacts.

Program responses to climate change include:

- research and monitoring to understand and track climate change itself, and its causes and effects
- reducing the human causes of climate change, for example:
 - limiting emission of greenhouse gases resulting from fossil fuel use;
 - maintaining or increasing the areas / amount of photosynthesis by land and ocean plants;
- mitigating and adapting to the effects of climate change, such as:
 - higher risks of flooding or drought;
 - more volatile and variable weather and precipitation;
 - changing vegetation regimes and habitats;
 - warming of sea ice and melting permafrost.



Source: Broecker, 1991, in Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

The Government of Canada released the Climate Change Plan for Canada in November 2002. It details steps to work towards Canadian targets under the Kyoto Protocol, to increase competitiveness and to improve the quality of life for all Canadians.

Forests and agricultural land can act as carbon sinks as they absorb carbon dioxide (CO₂) from the atmosphere and they are projected to provide a carbon sink of 30 megatonnes. The forest and agriculture sectors are key components of the Climate Change Plan for Canada. To take advantage of this opportunity, the Government of Canada is establishing a framework to enable forestry and agriculture sinks to be sold as offsets into a domestic emissions trading system.

Key players:

The Government of Canada **Climate Change Secretariat**, which was established by the Prime Minister in February 1998, is playing an integral role in the development of the National Implementation Strategy on Climate Change <http://www.nccp.ca>

The **Earth Science Sector** of Natural Resources Canada focuses its research and development programs on innovative projects whose objectives are to improve the quality of life of Canadians. The generation and dissemination of new knowledge to contribute to the well being of Canadian citizens is at the forefront of all ESS activities. http://www.nrcan.gc.ca/ess/index_e.php

Industry Canada plays an important role in relation to climate change through its regulation of industry, particularly of greenhouse gas emitting industries. <http://www.ic.gc.ca>

Climate change science networks play a key role in advancing international knowledge in relation to climate change.

The **Canadian Foundation for Climate and Atmospheric Sciences** (CFCAS) funds research that improves the scientific understanding of processes and predictions, provides relevant science to policy makers and improves understanding of the ways in which these challenges affect human health and the natural environment in addition to strengthening Canada's scientific capacity. <http://www.cfcas.org>

The **OURANOS Consortium** pools the expertise and disciplines of numerous researchers in order to advance the understanding of the issues and the associated requirements for adaptation resulting from climate change on the scale of the North American continent. <http://www.ouranos.ca>

Environment Canada: the **Meteorological Service of Canada** (MSC, <http://www.msc-smc.ec.gc.ca>), is Canada's source for meteorological information. The Service monitors water quantities, provides information and conducts research on climate, atmospheric science, air quality, ice and other environmental issues.

Provincial and territorial decision-makers, as well as industry leaders will play a key role in deciding how Canada implements its Kyoto obligations and addresses climate change.

“Hot” issues:

- Some of the largest global producers of GHG are resisting commitments to change in industrial and consumer practices (US, Russia);
- Kyoto ratification by Russia (or its failure, given that Russia and US together account for 17% and 36% of GHG emissions, and that Kyoto requires support from countries representing at least 55% of emissions);
- Implementation of Kyoto protocol in Canada (no agreement with provinces or private sector on how to do this despite most aspects being in provincial jurisdiction);
- Raising awareness amongst Canadians on how their individual consumption choices contribute to the emissions that drive climate change.
- What stronger roles, and potentially conflict-resolving roles, might Canadian and international space-based EO play in these matters?

Space and Climate Change:

Canadian space missions are contributing significantly to climate change research, particularly in two key areas:

- atmospheric science (ozone research, aerosols, tropospheric pollution and stratospheric winds), to understand and monitor changes in air composition and dynamics; and
- cryospheric science, to understand the role of sea ice, snow cover, freshwater ice, glaciers and ice caps, frozen ground/permafrost in climate change and enable long-term modeling and prediction.

Other climate change activities include using satellite data for national carbon accounting and modelling.

Issues for the CSA:

- How does the CSA position itself with regard to mainstream climate change priorities (play a visible, leadership role)?
- As part of Industry Canada, with Environment Canada as its main federal climate change client, how will CSA position itself to support Canadian goals regarding climate change? What strategic research questions will it support? What monitoring will it give priority to, for tracking climate change itself, as well as tracking its causes and its effects - serving prediction, mitigation, adaptation, understanding, and enforcement?
- Should the CSA become more involved in oceans research, or remain focused on atmospheric research?
- What is the appropriate level of support to climate change monitoring?

Related themes:

Biodiversity & Ecosystem Conservation
Cities and Urban Issues
Coastal and Marine Ecosystems
Disasters
Energy and Mineral Development
Weather
North/Arctic
CEOS
GMES

References:***Basic Information:***

Climate Change Plan for Canada (2002): http://www.climatechange.gc.ca/plan_for_canada/

Canada's National Climate Change Process <http://www.nccp.ca>

Athena Global for CSA, *Environmental Science Strength: Climate Change* (1-pager, February 2004). An overview of Canadian climate change science satellite missions.

Latest update:

Government of Canada Climate Change website <http://www.climatechange.gc.ca>

Environment Canada's Climate change website <http://www.ec.gc.ca/climate/>

OURANOS website. For background and updates on effects, mitigation, and adaptation. Focused on Quebec, but with national and continental references. <http://www.ouranos.ca/>

ClimateArk is a Climate Change Portal and Search Engine dedicated to promoting public policy that addresses global climate change through reductions in carbon dioxide and other emissions, renewable energy, energy conservation and ending deforestation. <http://www.climateark.org>

The Intergovernmental Panel on Climate Change (IPCC) has been established by WMO and UNEP to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. <http://www.ipcc.ch/>

United Nations Framework Convention on Climate Change <http://unfccc.int/>

Gateway to Global Change Data and Information <http://globalchange.gov/>

Closer look:

JONES, Matt, MASTERSON, Bob, RUSSELL Doug, *Too many Cooks?: Dealing with Climate Change in Canada*, Working Paper 2003(1), Queen's University
http://www.iigr.ca/pdf/publications/295_Too_Many_Cooks_Dealing_w.pdf

Government of Canada, *Canada's Third National Report on Climate Change: actions to meet commitments under the United Nations Framework Convention on Climate Change*, 2001

GreenFacts.org: Scientific Facts and Climate Change and Global Warming, This study contains a faithful summary of the Third Assessment Report of the IPCC and is written in a language for non-specialists and presented in a 3 levels structure of increasing detail (Summary, Details, Source)
http://www.greenfacts.org/studies/climate_change/index.htm