

#### **Scientific Presentations**

**Regional Impacts** of Melting Ice and Snow

**International Conference** 

"Melting Ice – Regional Dramas, Global Wake-Up Call" Host: Norwegian Royal Ministry of Foreign Affairs

**Convinced in Conjunction with the Sixth Ministerial Meeting of the Arctic Council** 

Tromso, Norway

28 April 2009



## **Regional Impacts of Melting Ice and Snow**

#### **Scientific Panel:**

- Dr. Robert W. Corell (Moderator): Chair of the Arctic Climate Impact Assessment and The Heinz Center, USA
- Dr. Dorthe Dahl Jensen: Niels Bohr Institute, University of Copenhagen, Denmark
- Dr. Jan Gunnar Winter: Norwegian Polar Research Institute, Norway
- Dr. Yao Tandong: Lanzhou Institute of Glaciology and Geocryology, China
- Dr. Richard Armstrong: National Snow and Ice Center, Univ. of Colorado, USA
- Dr. Andres Rivera: Centro de Estudios Ceintifico, Chile
- Dr. Kenrick R. Lesie: Caribbean Community Climate Change Centre, Belize

# IMPACTS OF A WARMING ARCTIC CIIC CLIMATE INTS

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What have we learned from the **Arctic Climate Impact Assessment?** 

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#### **Key Findings of the Arctic Climate Impact Assessment:**

- 1. Arctic climate is now warming rapidly and much larger changes are projected.
- 2. Arctic warming and its consequences have worldwide implications.
- 3. Arctic vegetation zones are very likely to shift, causing wide-ranging impacts.
- 4. Animal species' diversity, ranges, and distribution will change.
- 5. Many coastal communities and facilities face increasing exposure to storms.
- 6. Reduced sea ice is very likely to increase marine transport and access to resources.
- 7. Thawing ground will disrupt transportation, buildings, and other infrastructure.
- 8. Indigenous communities are facing major economic and cultural impacts.
- 9. Elevated ultraviolet radiation levels will affect people, plants, and animals.
- 10. Multiple influences interact to cause impacts to people and ecosystems.



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#### **Key Findings of the Arctic Climate Impact Assessment:**

- 1. Arctic climate is now warming rapidly and much larger changes are projected.
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- 8. Indigenous communities are facing major economic and cultural impacts.
- 9. Elevated ultraviolet radiation levels will affect people, plants, and animals.
- 10. Multiple influences interact to cause impacts to people and ecosystems.

#### **Recent Findings:**

#### Arctic September Sea Ice Extent: Observations and Model Runs



# Arctic Sea Ice September 15, 2008

#### **Models Project Sea Ice Extent**

#### for Mid-September

Recent NASA Model Runs Suggest this by 2013



### **IMPACTS OF A WARMING ARCTIC**



There have been and are Increasing Consequences of a Changing Climate for the Indigenous Peoples of the Arctic Region. There has been a Substantial Increase in Studies of the Impacts on their Culture, Way of Life and the Future Sustainability of their World.

Source: Siku-Inuit-Hila Project



Region



"Right now the weather is unpredictable. In the older days, the edlers used to predict the weather and they were always right, but now, when they try to predict the weather, it's always something different....."

Z. Aqqiaruq, Igloolik



Calving Glacier in Greenland where the rates of Calving have Increased Substantially during past Several Decades

#### Arctic Marine Shipping Assessment (AMSA) A Comprehensive Assessment of Current and Future Arctic Marine Shipping Activity.



# Climate Change and the Arctic Cryosphere:



A Comprehensive Assessment of the Arctic Cryosphere that focuses on Arctic Sea Ice, the **Greenland** Icesheet and the Arctic Terrestrial Cryosphere.

Major Arctic Biomes (Vegetation Bones) CA77 2009

Mountain tundra Lowland tundra Northern taiga/ Forest tundra Middle boreal Arctic desert CAFF boundary Ice extent (August) Ice extent (February) Glacier



Studies of the Biodiversity and Structure of Ecosystems across the Arctic Region

### Fossil Fuel Emissions: Actual vs. IPCC Scenarios

We face an incredible challenge: Emissions now exceed the IPCC Worst-case Scenario.



# New Global Carbon Project October 2008 Report Data

- Since 2000, CO<sub>2</sub> emissions derived from human sources have been growing x4 faster than in the 1990s and are now above the worst case emission scenario of the Intergovernmental Panel on Climate Change.
- Despite 15 years of intense international climate negotiations, concentrations of CO<sub>2</sub> in the atmospheric have been growing 33% faster during the last 8 years than in the 1990s.
- These drivers of climate change are accelerating.

Changes in Atmospheric CO<sub>2</sub> Concentration

# Atmospheric CO<sub>2</sub> Concentration in 2008 ~388 ppm

Which is 43 % above Pre-Industrial Levels

Growth in Atmospheric CO, Concentrations/Year 1970 - 1979: 1.3 ppm/year 1980 - 1989: 1.6 ppm/year Accelerating 1990 - 1999: 1.5 ppm/year 2000 - 2007: 2.0 ppm/year 2007: 2.2 ppm/year Data Source: Pieter Tans and Thomas Conway, NOAA/ESRL 2008: 2.3 ppm/year

# Fate of Anthropogenic CO<sub>2</sub> Emissions (2000-2007) ~ 20%



The Capacity of the Oceans and Lands to Absorb  $CO_2$  is Down ~ 5% over the past several decades

# An Assessment of Current Copenhagen (CoP 15) Proposals by the 192 Countries of the UNFCCC

EU - Emissions 80% below 1990 by 2050	Brazil - 10-20% reduction of 2004 by 2020	China - Reduce emissions <b>intensity</b> 20% by 2020	South Africa - 40% below 2003 by 2050
US (Warn-Lieb) - 71% below 2005 by 2050	Other Latin America - bau	India - Reduce emissions <b>intensity</b> 20% by 2020	Other Africa - bau
Russia - 1990 levels	Mexico - 10% below 2004 by 2014	Other Asia - Reduce emissions <b>intensity</b> 20% by 2020	Global Deforestation - bau
Canada - 20% below 2006 by 2020	Middle East - bau	OECD Pacific - 60% below 2000 by 2050 (AUS)	Afforestation - bau

# CO<sub>2</sub> in Atmosphere Would Continue to Increase

CO2 in the Atmosphere



# **Total Fossil Fuel CO<sub>2</sub> Emissions**



### **Global Temperature Change**



### **Sea Level Rise**

#### Sea Level Rise from Year 2000



The Arctic is now experiencing some of the most rapid and severe climate change on Earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes. Changes in the Arctic climate will also affect the rest of the world.



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