# The Arctic Report Card

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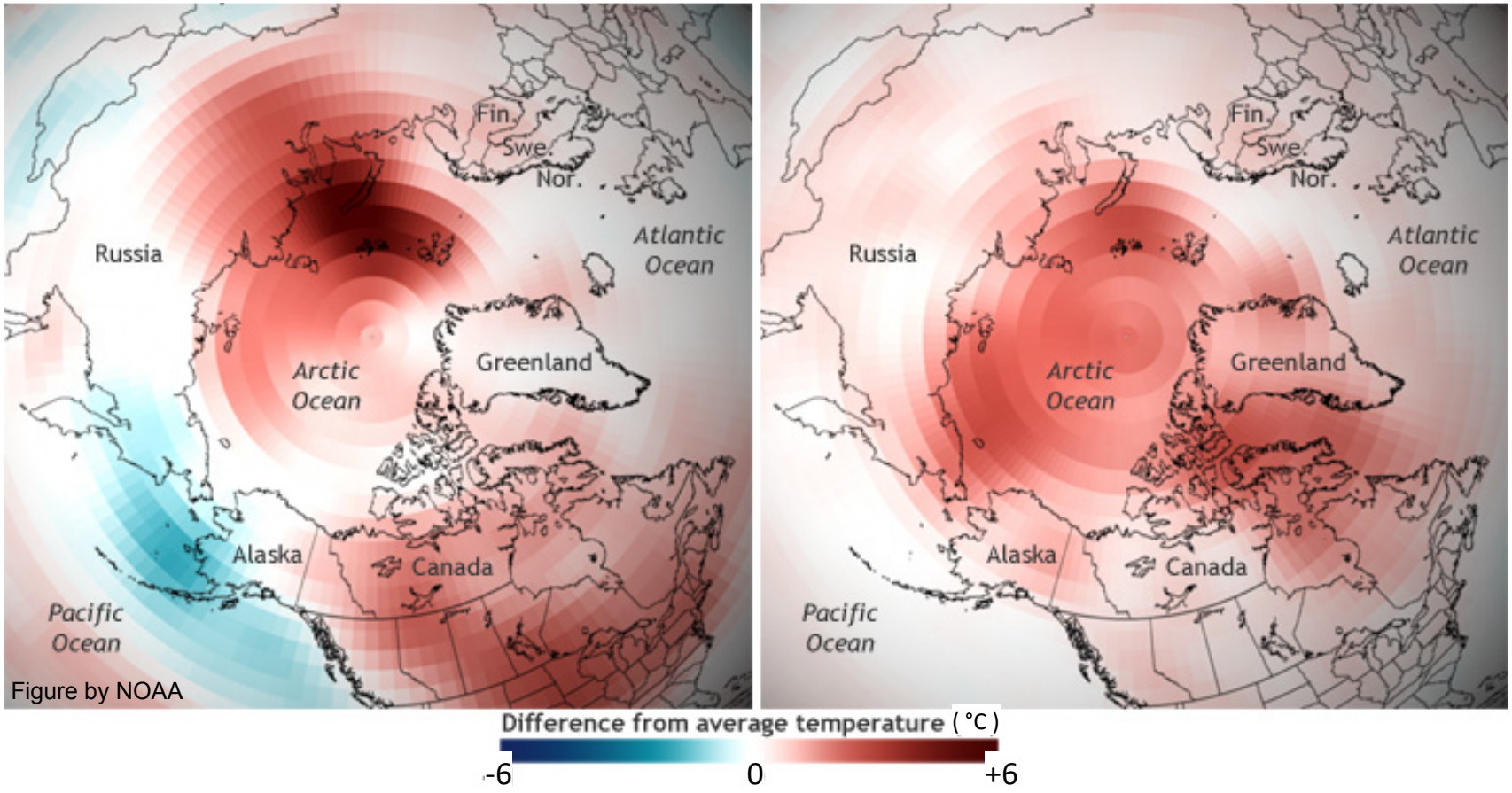
NOAA AVHRR image, 8 March 2013

Revolutionary Research . . . Relevant Results

# The Arctic Report Card

- An online, peer-reviewed source for clear, reliable and concise information on the current state of the Arctic environment relative to observational records.
- First published in 2006, the Report Card is intended for a broad audience, including scientists, teachers, students, decision-makers, policy-makers and the general public interested in the Arctic environment and science.
- Report Card 2012, the sixth annual update, comprises 20 essays on physical and biological topics prepared by an international team of 141 scientists from 15 different countries. The Report Card is organized into five sections:
  - Atmosphere (coordinated by Jim Overland, NOAA)
  - Sea Ice & Ocean (coordinated by Mary-Louise Timmermans, Yale University)
  - Marine Ecosystem (coordinated by Sue Moore, NOAA & Mike Gill, Environment Canada)
  - Terrestrial Ecosystem (coordinated by Michael Svoboda, Environment Canada)
  - Terrestrial Cryosphere (coordinated by Marco Tedesco, City College of New York)
- Web site by Nancy Soreide and Tracey Nakamura (NOAA PMEL)
  **http://www.arctic.noaa.gov/reportcard/**
- An inter-agency, international, multi-disciplinary publication.

# Arctic Amplification of Global Warming

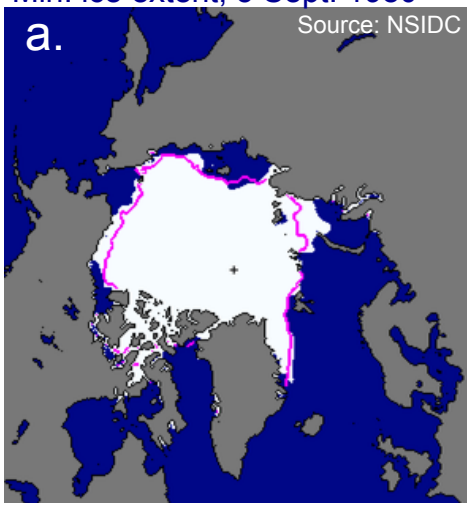


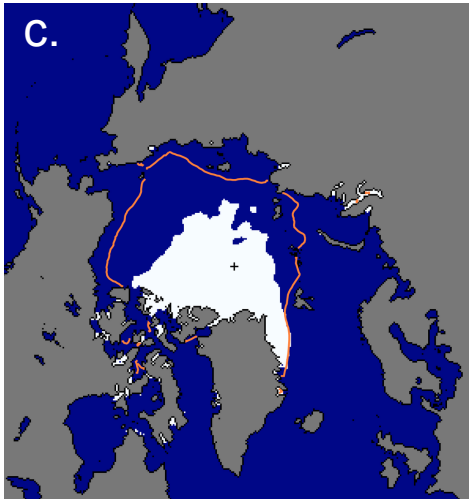

Temperature anomaly (°C) for October 2011 - September 2012 relative to the 1981-2010 average.

Temperature anomaly (°C) for 2001-2011 relative to 1971-2000.

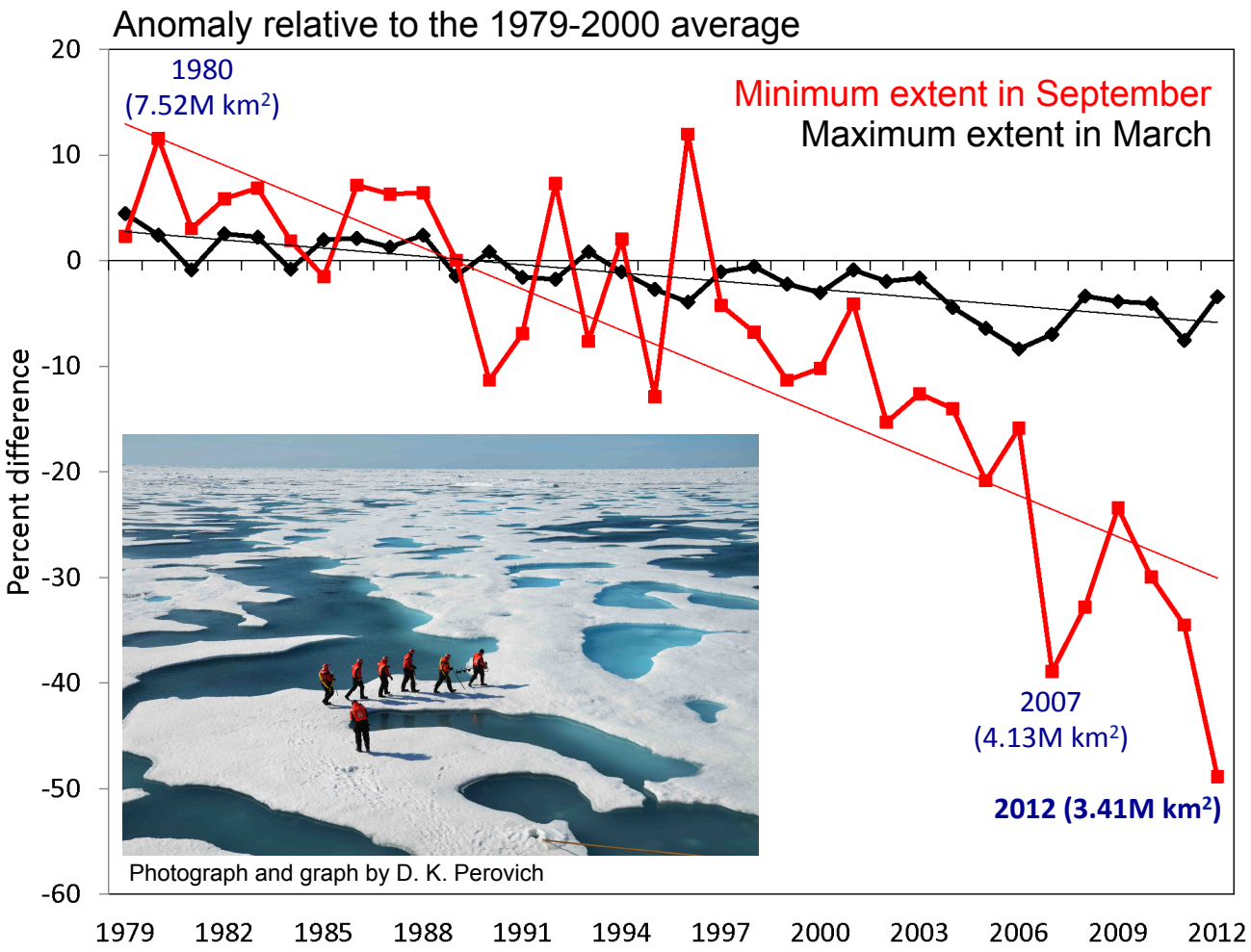
# Declining Sea Ice Extent

Min. ice extent, 5 Sept. 1980




Min. ice extent, 16 Sept. 2012




Trend of minimum ice extent: -13.0% per decade

Trend of maximum ice extent: -2.6% per decade

# Declining Spring Snow Extent on Land

June 2012 snow extent anomaly on land relative to 1971-2000

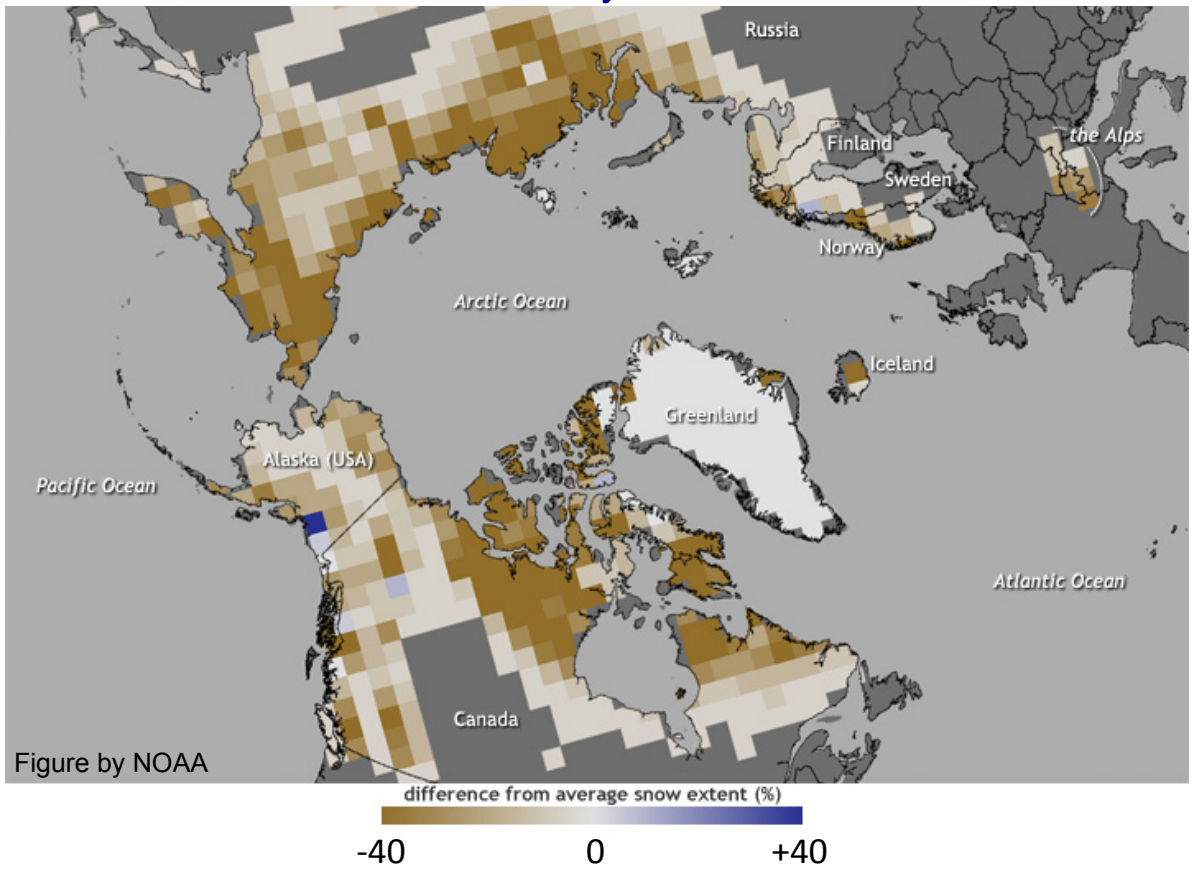
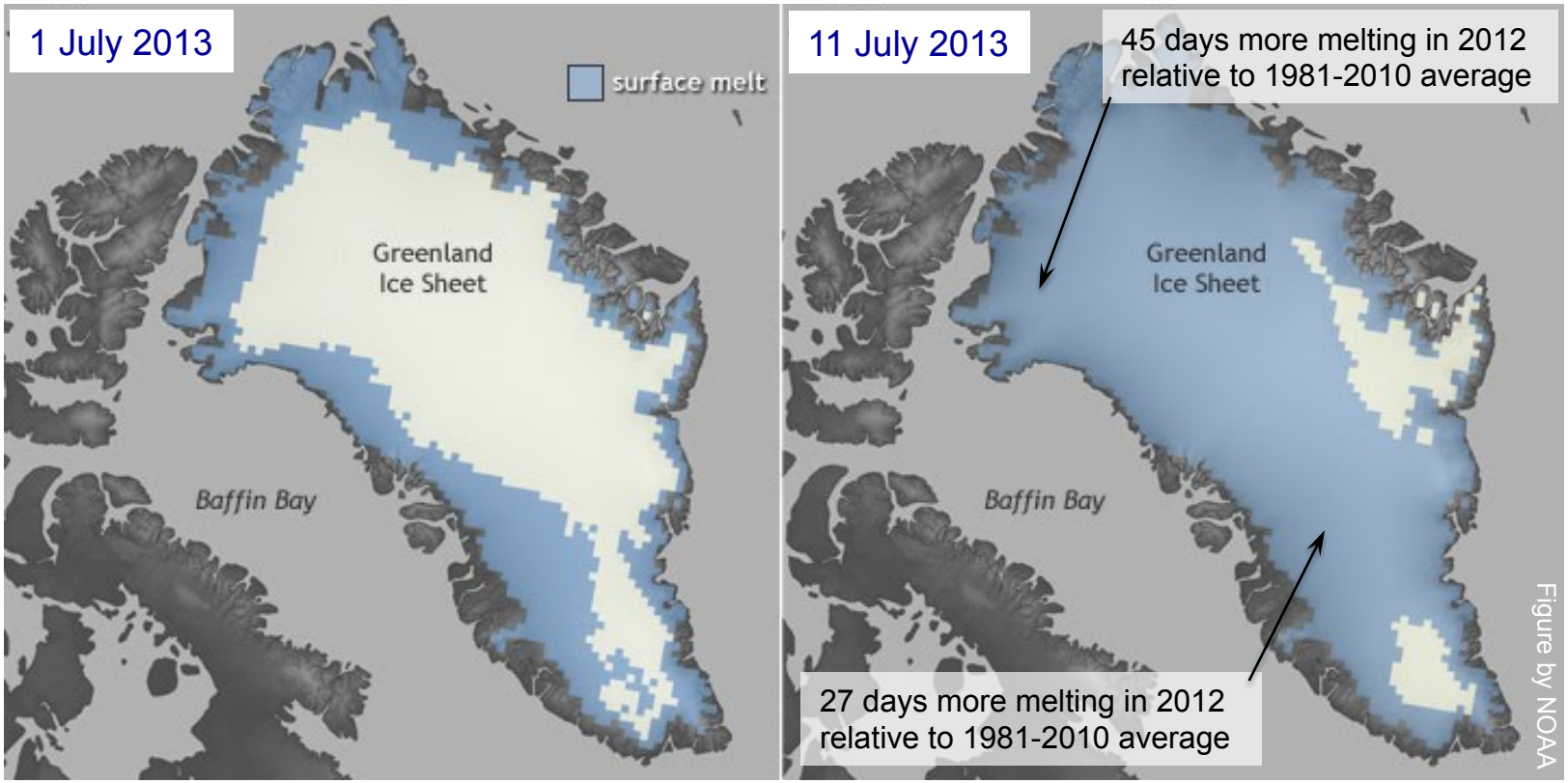



Figure by NOAA

Snow cover extent in both Eurasia and North America hit new record lows in June 2012. It is the third time in five years that North America has set a new record low, and the fifth year in a row in Eurasia.

The rate of snow cover loss in June during 1979 - 2012 (-17.6% per decade relative to the 1979-2000 mean) is greater than the loss of September sea ice extent (-13.0% per decade) over the same period

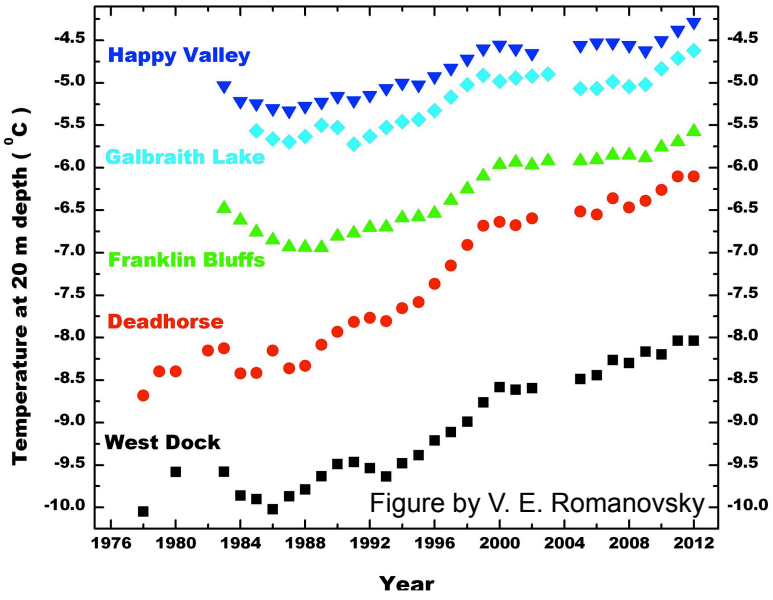
# Melting at the Surface of the Greenland Ice Sheet



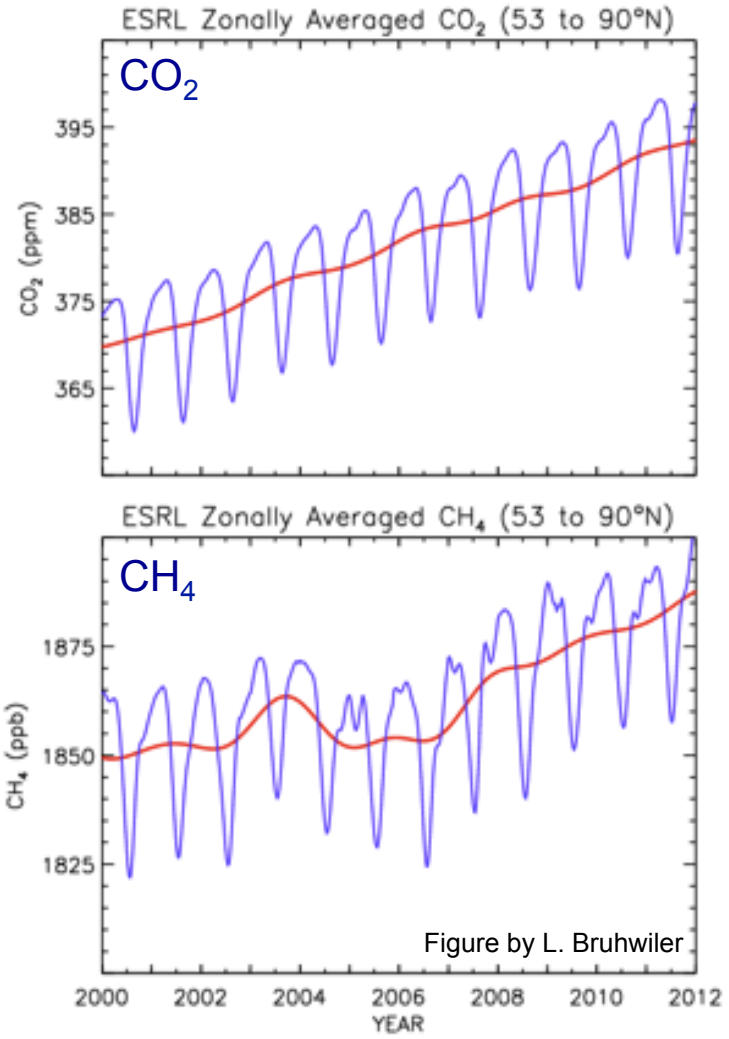

The duration of melting at the surface of the ice sheet in summer 2012 was the longest in the satellite record (1979-2012), and a rare, near-ice sheet-wide surface melt event was recorded by satellites for the first time. Area-averaged albedo (reflectivity, 0.685) of the ice sheet was the lowest in the satellite record (2000-2012).

# Permafrost, Carbon Dioxide ($CO_2$) & Methane ($CH_4$)

Arctic atmospheric $CO_2$ and $CH_4$ concentrations are rising, but this is due to export from lower latitudes. As yet, there is no evidence that Arctic terrestrial or offshore $CO_2$ and $CH_4$ emissions are contributing to the increasing Arctic atmospheric greenhouse gas load.




The increase in permafrost temperature on the North Slope of Alaska exemplifies Arctic-wide permafrost warming, and raises concerns about mobilization of $CO_2$ and $CH_4$ to the atmosphere and amplification of the impact of the global increase in atmospheric greenhouse gases.



# Ecosystem Changes

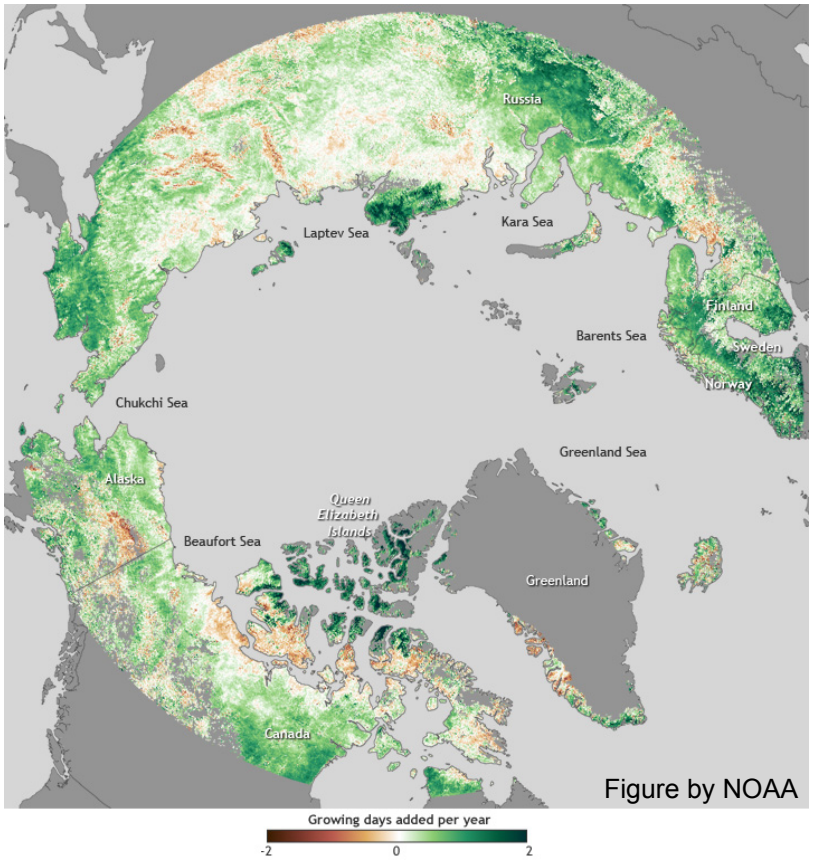
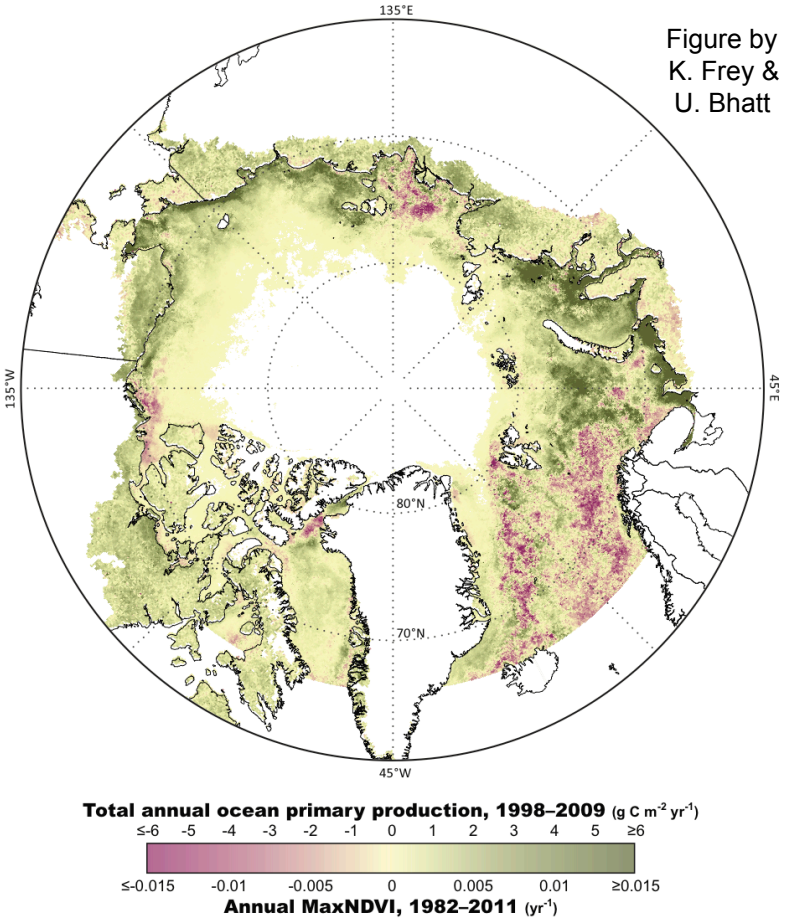



Figure by NOAA

Between 1982 and 2008 the length of the growing season increased, e.g., by as much as 3 weeks in parts of Eurasia.

Figure by K. Frey & U. Bhatt




Since 1998 there has been an increase in tundra MaxNDVI, a measure of vegetation greenness and above-ground biomass at the peak of the growing season, and since 1982 there has been an increase in ocean primary production (e.g., photosynthesis by algae and phytoplankton).

# Summary

- In 2012, the Arctic environment headlines were dominated by:
  - New record low snow extent: May in Eurasia, June in Northern Hemisphere
  - Record melt duration and a near-ice sheet-wide surface melting event in Greenland
  - New record minimum sea ice extent in September
- Significant change continues to occur throughout the Arctic environmental system.
  - Physical and Biological
  - Atmosphere, Land, Ocean & Cryosphere
- Loss of snow and ice reduce albedo (reflectivity), providing momentum for further change via ice-albedo positive feedback.
- It is very likely that major changes will continue to occur in the Arctic in years to come, particularly in the face of projections that indicate continued global warming.

Support for the Arctic Report Card is provided by the Arctic Research Program
and Climate.gov in the NOAA Climate Program Office & by the Office of Naval Research

# Coming Soon

## The Arctic

• Air Temperature, Atmospheric Circulation and Clouds •
• Ozone and UV Radiation • Carbon Dioxide and Methane •
• Snow • Glaciers and Ice Caps • Greenland Ice Sheet • Permafrost •
• Lake Ice • Sea Ice • Ocean • Ocean Acidification •
• Extreme Storm of August 2012 • Arctic Observing Systems •

*in* 'State of the Climate in 2012'

Press conference and roll-out on 6 August 2013
& publication in the *Bulletin of the American Meteorological Society (BAMS),* Vol. 94, No. 7

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