Climate Change in the Arctic

UT Svalex Evening Program April 17, 2013





August climate conditions:

T: 0.8 – 12C P: 23.9 mm, heaviest: 5.8mm/day Wind: 4.7 m/s, strongest 15.4 m/s



temperature, snow depths and wind. There may be missing data.

Last 30 days: Average temperature was -12.3 °C, 2.1 °C above the normal. Highest temp (rates area a 6.8 (2014) CP) and the lower was of the climate -20.8 °C (09 April). The total in the data strates are a strategiest data precipitation was 0.4 mm (27 March), measured at 7am (8am daylight savings) for the past 24 hours. Highest windespeed was 16.3 m/s (19 March Charles are a strategiest data) and a strategiest data are a strategiest data and a strategiest data are a strategiest data and a strategiest data are as a strategiest data are and strategiest data are a strateg



Graph explanation.

Tabular view for temperature and precipitation per month

Months	Temperature				Precipitation			Wind	
	Average	Normal	Warmest	Coldest	Total	Normal	Highest daily value	Average	Strongest wind
Mar 2013	-14.3°C	-15.7°C	-0.6°C Mar 28	-26.3°C Mar 5	3.8 mm	23.0 mm	1.2 mm Mar 14	5.5 m/s	16.5 m/s Mar 5
Feb 2013	-10.8°C	-16.2°C	2.7°C Feb 13	-23.9°C Feb 21	10.0 mm	19.0 mm	3.8 mm Feb 10	5.9 m/s	15.9 m/s Feb 22
Jan 2013	-8.3°C	-15.3°C	3.7°C Jan 6	-18.8°C Jan 25	17.8 mm	15.0 mm	4.2 mm Jan 7	6.4 m/s	17.5 m/s Jan 11
Dec 2012	-7.9°C	-13.4°C	2.8°C Dec 9	-23.7°C Dec 25	47.4 mm	16.0 mm	19.5 mm Dec 22	5.5 m/s	19.3 m/s Dec 31
Nov 2012	-6.4°C	-10.3°C	3.6°C Nov 5	-20.4°C Nov 24	13.1 mm	15.0 mm	5.2 mm Nov 21	5.9 m/s	16.3 m/s Nov 1
Oct 2012	-2.7°C	-5.5°C	5.6°C Oct 10	-18.4°C Oct 25	14.6 mm	14.0 mm	5.4 mm Oct 23	3.8 m/s	12.1 m/s Oct 22
Sep 2012	3.0°C	0.3°C	9.4°C Sep 3	-6.8°C Sep 26	24.7 mm	20.0 mm	9.6 mm Sep 3	5.0 m/s	19.5 m/s Sep 17
Aug 2012	5.7°C	4.7°C	12.0°C Aug 31	0.8°C Aug 24	23.9 mm	23.0 mm	5.8 mm Aug 28	4.7 m/s	15.4 m/s Aug 31
Jul 2012	6.6°C	5.9°C	13.0°C Jul 15	3.5°C Jul 30	19.2 mm	18.0 mm	5.4 mm Jul 4	4.2 m/s	16.0 m/s Jul 30
Jun 2012	3.9°C	2.0°C	8.6°C Jun 16	0.7°C Jun 4	6.7 mm	10.0 mm	3.1 mm Jun 15	3.6 m/s	12.0 m/s Jun 19
May 2012	-2.4°C	-4.1°C	3.3°C May 5	-10.0°C May 3	18.6 mm	6.0 mm	8.3 mm May 24	5.5 m/s	15.4 m/s May 19
Apr 2012	-9.2°C	-12.2°C	1.4°C Apr 24	-18.3°C Apr 6	3.3 mm	11.0 mm	0.7 mm Apr 3	4.3 m/s	11.7 m/s Apr 30







ICELAND

FAROE

Atlantic Ocean





Siberia

LAPLAND

SWEDEN

DENMARK

FINLAND

RUSSIA

The Arctic

- 1. Polaris, the North Star, is located almost directly above the North Pole. Around it are the stars the form the constellation known as Ursa Major, the Great Bear. Arctic comes from the ancient Greek word, Arktikos, the country of the Great Bear.
- 2. Arctic is home of an array of plants, animals and people that survive in some of the most extreme conditions on the planet. A sudden summer storm or freeze can wipe out an entire generation of young birds, thousands of seal pups and hundreds of caribou calves.
- 3. Life in Arctic has been both vulnerable and resilient. Vulnerable because of its relatively short growing season and smaller variety of living things compared to temperate regions.

-Arctic Climate Impact Assessment, 2004

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Arctic climate is highly variable and more vulnerable to climate change than any other regions on Earth

1000 Years of Changes in Carbon Emissions, CO₂ Concentrations and Temperature





Arctic Sea Ice has been decline since late 1970s



These before-and-after photographs show Petermann Glacier in July 2009, before the calving event, and again in July 2011. Photographs courtesy Jason Box (top), Alan Hubbard (bottom)



1980

2012



http://nsidc.org/data/seaice_index/archives/image_select.html

Why polar climate is more variable and recent warming is stronger than rest of the world?

- Ice feedbacks
- Shallower atmospheric boundary layer



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How would melting sea ice influence weather pattern?

• Winter on steroids







Warmer temperature increase fires in **boreal and Arctic** region



SOURCES: Alaska Forest Service and the Canadian Forest Service; Amber Sola; Global and Planetary Change (upcoming)





Arctic Ozone depletion

- Arctic Ozone hole is approaching the strength of Antarctic ozone hole in 2011.
- Ozone hole is worst in spring when ecosystems are most sensitive to harmful ultraviolet radiation (after long dark winter)
- Why Arctic ozone hole is deepening when Antarctic ozone hole is on the way of recovery?
- Colder stratosphere temperature is the dominant reason.



2011 Arctic Ozone hole (Manney et al. 2012, Nature)

Climate change' impact:



Mar Carlot









Influence arctic climate change on indigenous people's livelihood





How has climate changed over Svalbard?



Projected climatic impact on Svalbard permafrost:

- The permafrost has warmed by 0.9°C at 20 m and significant warming is detectable at 60 m during 1999-2009.
- Surface air temperature is expected to increase by about 4°C.
- Active layer thickness of the permafrost will increase, roughly double near sea-level and outer parts of the large glacier valleys, where human settlements are concentrated.



2080

2060



1940

1960

Projected impact of sea ice free Arctic on Svalbard's glaciers

- Global sea level would increase 0.02 m if all the glaciers on Svalbard were to melt.
- Svalbard is located at the edge of present day sea ice.
- If global atmospheric CO2 increase
- Melting of Arctic sea ice will increase winter temperature at Svalbard by 10C, and 15C if we also consider warming of sea surface temperature by the end of 21st century.





Final Remarks:

 Arctic climate has been more vulnerable and will be more vulnerable to global climate change

• Arctic climate change will influence global northern hemisphere climate and society.

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