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Arctic Alerts Media Roundtable
National Press Club
July 13, 2016

The Study of Environmental Arctic Change
Advancing and communicating scientific understanding to help society respond to a rapidly changing Arctic
Summary

Dr. Brendan P. Kelly
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Summary

- Record winter heat wave at the North Pole;
- Warming reflected in record low sea ice;
- Record surface temperature in Greenland;
- Sea level rise increased by Greenland melts;
- Diminishing snow cover amplifying warming;
- Permafrost thaw amplifying warming via $CO_2$;
- Warming Arctic increases extreme events.
Arctic Sea Ice

Dr. Walt Meier

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NASA Goddard Space Flight Center
Greenbelt, MD
2016 Arctic Alerts: Sea Ice

- Unusual weather over the ice so far in 2016
- Record low sea ice through June
- Response of sea ice to weather is changing because the ice is thinner
A New Year’s Heat Wave

Data from NOAA NCEP Climate Forecast System (CFS) Version 2
April 23

Alaska

Ice drift

~700 miles
May 20

Alaska
July 1

Alaska
Arctic Ocean area covered by sea ice in September
1979 - 2015

The decline is outpacing climate model projections

September trend: -13.4 % per decade

2X size of Alaska
40% of Lower 48 U.S.
Melting Ice Sheets and Sea Level Rise

Dr. Marco Tedesco

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Lamont-Doherty Earth Observatory
of Columbia University
Impact and feedback

- Global sea level rise
- Ocean circulation
- Ecosystems
- Earth’s climate (albedo)
- Atmospheric patterns
- Sea ice
Surface melting is becoming the major contribution to mass loss in Greenland.

Average loss = 270 Gt/year

2012 loss record = 638 Gt

*) 362 Gt is equal to 1 mm in sea level rise
MELT EXTENT IN GREENLAND HAS BEEN INCREASING

12% of Greenland is melting more on average today than in 1979 (~ extent of Kansas)
MELTING AND SURFACE TEMPERATURE IN 2016

Number of melting days (Apr 1 – July 5\textsuperscript{th}, 2016)

Surface temperature deviation from the mean

www.cryocity.org
SURFACE TEMPERATURE RECORD

April through June averaged temperatures

Warmer than average

Colder than average

New record (2016)

Previous record (2005)
2016 Arctic Alerts: Melting Ice Sheets and Sea Level Rise

1) Surface melting has been the major contribution to sea level rise from Greenland over the past years

2) Over the past 30 years melt extent has been increasing, covering ~ 12% more of the Greenland ice sheet than 37 years ago

3) In 2016, melting in Greenland started early and is above the average through July 5th

4) Surface temperature in Greenland set new records for the period April – June 2016
Declining Spring Snow Cover Extent Over Northern Hemisphere Lands

Dr. David A. Robinson

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Rutgers University,
Piscataway, NJ
Unusually early 2016 snow melt:
Alaska & eastern Siberia

April 21, 2016: MODIS

May 29, 2016: MODIS
Average Northern Hemisphere continental snow cover extent
NH Spring (March-June) snow extent anomalies

Anomalies derived from 1981-2010 mean
May continental snow cover extent anomalies: deviations from normal 1967-2016
Summing up

Spring decline in snow extent

- Occurring from the middle latitudes to the Arctic
- Shows significant Arctic decline during the past 10 years in May and June
- The loss of spring continental snow extent is similar to the loss of late summer Arctic sea ice extent

Spring (March-June) Northern Hemisphere continental snow cover extent: 1967-2016

Source: www.snowcover.org
Changing Permafrost

Dr. Ted Schuur

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Permafrost Action Team Lead,
Study for Environmental Arctic Change Program (SEARCH)

Center for Ecosystem Science and Society,
Northern Arizona University
Permafrost is Perennially Frozen Ground

- **Active Layer**
- **Ice Wedge**
- **Permafrost Soil with Carbon**
Permafrost Distribution

Brown 1998
Permafrost Temperatures Are Increasing

Increasing temperatures over decades

Record high levels at many sites in 2015

Conditions point towards record temperatures in 2016

Romanovsky 2016
Triggers of Permafrost Thaw

**Climate:**
- Arctic warming 2x faster than globe
- 2016 record warm conditions

**Ecosystem Disturbance:**
- Fires burn soil organic layer, which insulates permafrost
- Increased frequency of large fire years + extreme fire events
- **2015** Alaska fire season, 2nd largest area burned
Why Should Arctic Residents Care?

What we want to know:
- Where’s the ground ice?
- How to anticipate abrupt thaw?

Inuvik Airport, NWT
Siberia, Russia
Drew Point, AK
Alaska, DOT

Permafrost weakens, even at <0°C degrees.
Why Should Global Society Care?

What we want to know:

- How much?
- How fast?
- What form?

Organic matter decomposition

Permafrost thaw

CO$_2$, CH$_4$

°T

Schuur 2013
Permafrost Carbon Emissions

Permafrost Zone
Soil Carbon
Vulnerable Fraction
5-15% by 2100

Equivalent to
~75 ppm atm CO$_2$

Similar in amount
to biospheric sources
(deforestation)
Less than human sources
(fossil fuels)

Schuur 2015 Nature
Atmospheric Response to a Warming Arctic

Dr. Jennifer Francis

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Sea Ice Action Team Lead,
Study for Environmental Arctic Change Program (SEARCH)

Rutgers University
What’s Up with the Atmosphere?

- A trigger for rapid Arctic warming
- A responder to disappearing ice and snow
- A connection to mid-latitude weather
Surface Air Temperature Anomaly °C

Jan. – June Air Temperatures

Mid-latitudes (40°N to 60°N)

Arctic (70°N to 90°N)

2016

Anomaly relative to 1981-2010

Data from NOAA/NCEP/ESRL

J. Francis: francis@imcs.Rutgers.edu
A Warm Arctic:

=> smaller N-S temperature difference

=> disrupted jet stream
Why care about a weak jet stream?

Strong

Weak

Warm Arctic => Extreme Events More Likely

NASA/NOAA

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Extreme events in 2016

Colors: Arctic atmospheric height anomalies

- Russia: cold/snow
- Record blizzard Mid-Atlantic, Record cold East Asia
- Record Northeast cold, snowstorms Europe & Canada
- Midwest snowstorms
- Cold/Snow NE US & Colorado blizzard
- Late snow UK & CO
- Greenland melt
- Record cold/rare spring snow US
- Greenland melt event
- Rare May snow Northeast & California
- Record flooding Europe & TX
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