Warm Arctic-Cold Continents

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Chukchi Sea

September 30, 2009
Negative Feedback- thin Ice grows fast
MULTIPLE Feedbacks

Global Warming

Arctic amplification

Reduction of Arctic sea ice

Atmosphere warming

Teleconnection and circulation pattern change

Ocean absorbs more heat

Heat releases to atmosphere in the fall.

Surface albedo decrease

OND Temp Anomaly

Sept Sea Ice Extent

JAS SSTA

Sept Sea Ice Extent
ARCTIC AMPLIFICATION:
The Arctic is Earth’s fastest-warming region

2002-2008 Air Temperature Anomalies Relative to 1968-1996
Extended annual mean SAT record for the northern North Atlantic region ($T_{NA}$). (Wood, et al. 2010). NO 60-80 Year Oscillations.
Climate impact of 1930s in Atlantic - Arctic

- **Parallel warming** from West Greenland to Northern Russia
- SST anomalies in Gulf Stream system, Nordic seas...
- Large declines in sea ice, glaciers, and tundra
- Increase in southerly winds & cyclones
- Changes in terrestrial & marine biogeography
Warm Arctic-Cold Continents
Sea ice concentration anomalies for October 2009
Loss of Sea Ice Impacts Larger Atmospheric Climate

Pacific Arctic

2002-2008 Fall temps Anomalies Reach upper troposphere

2002-2008 Fall 500-1000 mb Thickness Anomaly

Thermal Wind Reduces Polar West Winds

Overland and Wang, *Tellus*, 2010
Warm Arctic Cold Continent Pattern
More Negative NAO than El Nino (Seager et al. 2010)
Only 3 times in last 160 years
Sea ice is a thermostat for global climate
Arctic is Sensitive to Multiple FEEDBACKS-Arctic Amplification

Increased Links between the Arctic and Mid-latitudes
Winter 2009-2010 was a Large Surprise:
Warm Arctic-Cold Continent Pattern

http://www.arctic.noaa.gov/reportcard/
In 1896, Fram became the first vessel to have ridden the Transpolar Drift Stream - one of the Arctic's ice currents. This year, Tara was the second, making the journey in less than half the time. The Transpolar Drift Stream is pushed along by westerly winds, while the other major ice current in the Arctic is the clockwise-circling Beaufort Gyre, generated by the rotating winds created by a high-pressure atmospheric system.
End of April, 2010

Stroeve, et al. in press