The changing Arctic sea ice cover: Regional and seasonal aspects

Ingrid H. Onarheim
Tor Eldevik and Lars H. Smedsrud
September Arctic sea ice area

http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=4301
September Arctic sea ice extent

-13.4% per decade


Sea ice extent (10^6 km^2)

Fourth lowest
Record low

NSIDC
September sea ice extent

1979

Total extent = 7.2 million sq km

2015

Total extent = 4.6 million sq km
Thinner sea ice cover

Old ice = thick ice = strong
Young ice = thin ice = fragile

Sea ice age ~ sea ice thickness

< 1 year old = thin = fragile
1 to 2 years old
3 to 4 years old
> 4 years old = thick = strong

http://www.arctic.noaa.gov/reportcard/sea_ice.html
Thinner sea ice cover

Old ice = thick ice = strong
Young ice = thin ice = fragile

March 1985

March 2015

Sea Ice Age

< 1 yr
1-2 yrs
3-4 yrs
> 4 yrs

http://www.arctic.noaa.gov/reportcard/sea_ice.html
NOAA Says The Arctic Will Be ‘Ice-Free’ In 25 Years

Arctic Sea Ice May Completely Disappear in Our Lifetime
Arctic Ocean sea ice extent

Sea ice extent [$10^6$ km$^2$]

- Blue line: March
- Black line: Year
- Red line: September

Year

1980 1990 2000 2010

Bjerknes Centre for Climate Research
Winter Ocean?

Summer Atmosphere?

Map of the Arctic with regions labeled:
- Beaufort
- Chukchi
- East Siberian
- Laptev
- Barents

Central Arctic
ASOF Meeting 2015:
Skillful prediction of Barents Sea ice cover

\[ A_{\text{ice}}^{n+1} = \alpha A_{\text{ice}}^n + \beta HT^n \]

\[ r = 0.84 \]

sign: 31/35
ASOF Meeting 2015:
Skillful prediction of Barents Sea ice cover

\[ A_{\text{ice}}^n = \alpha A_{\text{ice}}^{n-1} + \beta HT^{n-1} + \gamma V^n \]

+ Meridional wind

\[ r = 0.92 \]
Update 2016: Skillful prediction of Barents Sea ice cover

\[ A_{\text{ice}}^{n+1} = \alpha A_{\text{ice}}^n + \beta H T^n \]

Prediction for winter 2015-2016

\[ r = 0.84 \]

sign: 31/35
Update 2016:
Skillful prediction of Barents Sea ice cover

$r = 0.84$
sign: 31/35

Prediction for winter 2015-2016
Update 2016:
Skillful prediction of Barents Sea ice cover

Max 2016
24 March

$r = 0.84$

sign: 31/35

Prediction for winter 2015-2016
Update 2016:
Skillful prediction of Barents Sea ice cover

Max 2016
24 March

Anomalous meridional wind
November 2015
Decadal trends in winter sea ice extent

Cooling trend in the subpolar Atlantic leads to a slowdown in the rate of Arctic winter sea ice retreat.

Yeager et al., (2015) GRL
Summary

• Barents Sea dominates winter Arctic sea ice trends
• Canadian/Russian Arctic dominates summer Arctic sea ice trends
• New record low for Arctic sea ice this winter, dominated by a small sea ice cover in the Barents Sea

Thank you!

Ingrid.Onarheim@uib.no