Observing the State of Arctic Sea Ice

S. V. Nghiem\textsuperscript{1}, I. G. Rigor\textsuperscript{2}, P. Clemente-Colón\textsuperscript{3}, D. K. Perovich\textsuperscript{4}, H. Eicken\textsuperscript{5}, J. E. Overland\textsuperscript{6}, T. Markus\textsuperscript{7}, D. G. Barber\textsuperscript{8}, and G. Neumann\textsuperscript{1}

\textsuperscript{1}Jet Propulsion Laboratory, California Institute of Technology, CA
\textsuperscript{2}Applied Physics Laboratory, University of Washington, WA
\textsuperscript{3}U.S. Naval and National Ice Center, MD
\textsuperscript{4}Cold Region Research and Engineering Laboratory, NH
\textsuperscript{5}Geophysical Institute, University of Alaska, AK
\textsuperscript{7}NASA Goddard Space Flight Center, MD
\textsuperscript{8}CEOS, University of Manitoba, Canada

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Arctic Sea Ice Classes

- Perennial ice
- Seasonal ice
- Mixed ice
1970-1999: Decrease of 0.5x10^6 km^2/decade.

Stationary Process

\[ F_X(t) = F_X(t+\Delta t) \]

Long-term behavior is usable in forecast

Estimate for 2008: 3.8 million km^2
2000-2008: Decrease of 1.5x10^6 km^2/decade.

Non-Stationary

\[ F_X(t) = F_X(t, t+\Delta t) \]

The "Old Wisdom" is not applicable.

Measure in 2008: 1.7 million km^2
‘The Polar Express’
Nghiem et al. GRL, 2007

Ice compression from East to West Arctic

Ice compression into Transpolar Drift (TD)

Acceleration of TD\(^1\) carrying ice out of Arctic via Fram Strait

Warm Atlantic water effectively melted ice in Greenland Sea

\(^1\)Gascard et al., EOS, 2008: Acceleration of the TD
The Polar Express in 2007


Nghiem/6
Animation of sea ice
20 frames per second

SEA ICE CLASSES
- Seasonal
- Mixed ice
- Perennial
- Melt

2008-09-12
Products for Observing State of Arctic Sea Ice

- Sea ice melt detection by active and passive microwave sensors.
- Experimental melt product in Seasonal Ice Zone Observing Network (SIZONet).
- Composite sea ice product from scatterometer and synthetic aperture radar data.
Sea Ice Melt Detection and Albedo Transition
Comparison with C-ICE observations in the Parry Channel

[Graph showing backscatter, air temperature, and albedo changes over time in the Parry Channel (74.43N, 92.6W)].
Seasonal Ice Zone Observing Network
Experimental Product for Melt Detection
SAR signatures of various ice classes for sea ice classification

References:
Summary

- Non-stationary process of decrease in the extent of perennial sea ice.
- Loss rate tripled in decade of 2000s compared to that in 1970s-1990s.
- The Polar Express: Dynamic effects are important in contributing to perennial sea ice loss.
- The extent of perennial ice extent remained low in 2009.
- More products of observing state of Arctic sea ice: Melt, SIZONet, composite QS/GMM.