

A red research vessel with a yellow crane is shown on a blue sea under a cloudy sky. The vessel is positioned in the center of the frame, with the crane extending to the left. The sky is filled with white and grey clouds, and the sea is a deep blue. The overall scene is a wide-angle shot of the vessel at sea.

# Observers' Arctic science goes beyond just observing

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# Outline

Observer state engagement; history, current status and scientific investment & contribution

Real world sample case; more similarity than dissimilarity

Becoming critical 'links' of the whole network

Summing up

# Observer states to Arctic Council; current status

13 observer states as of May 2017

8 from Europe

5 from Asia (3 from Northeast, 1 from Southeast, 1 from Southwest)

Pending states; EU and Turkey

Significant Arctic investments or stakes

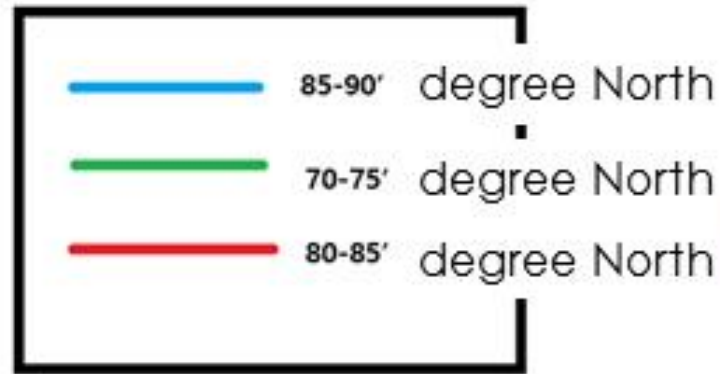
# Observer states to Arctic Council; history and evolution

Arctic Policy present for many nations, alike Arctic and non-Arctic members

Arctic policy in similarity; science, environmental stewardship, international cooperation emphasized, economic aspirations not really hidden but plainly indicated

# Real world sample case; ocean going survey in the Arctic

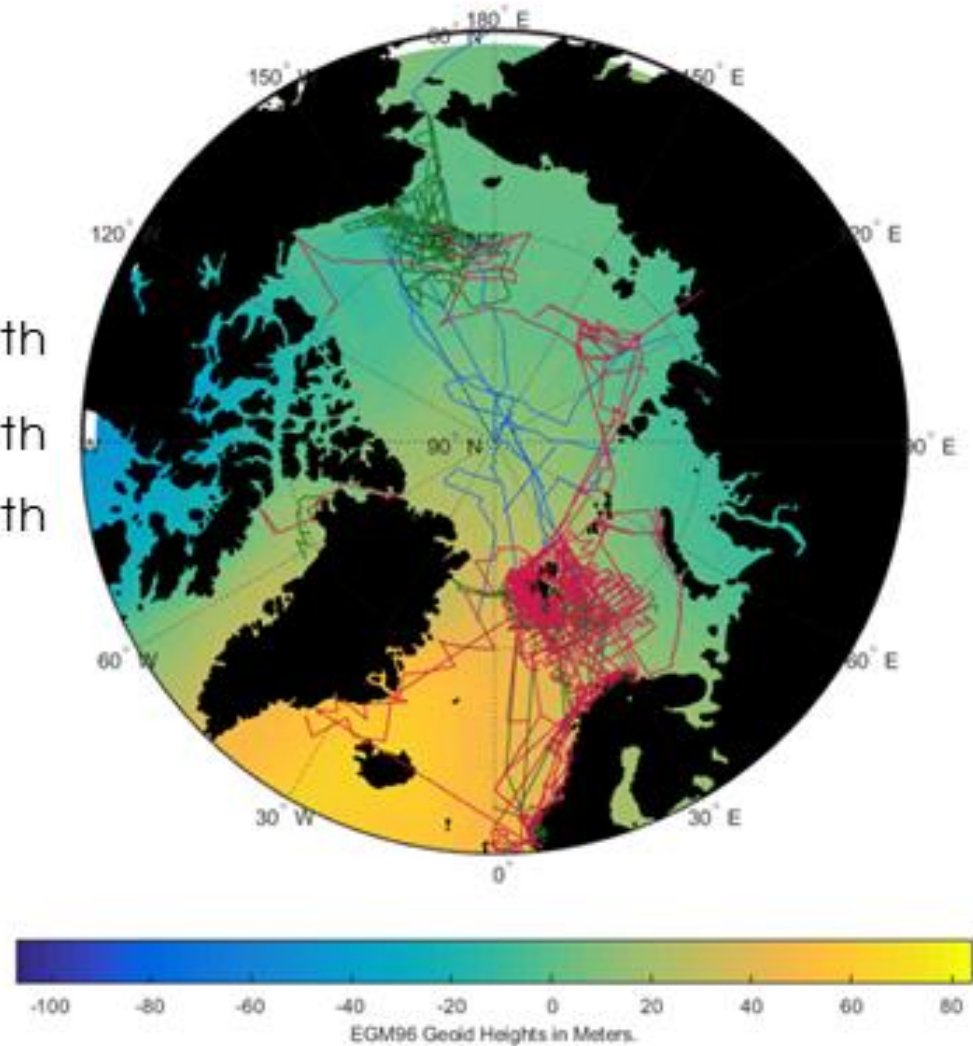
## Northern coverage



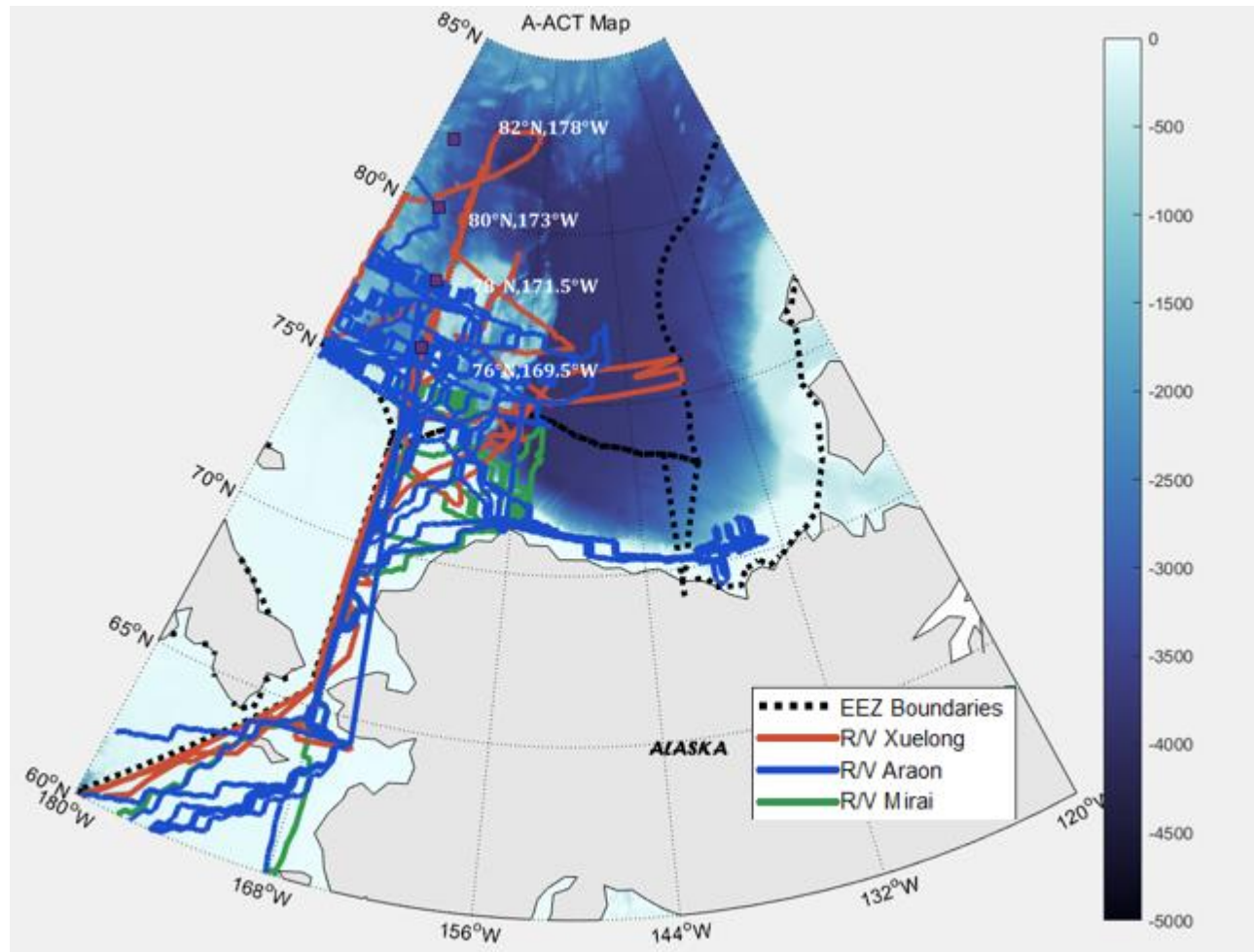
Only a few trips beyond 85 N

Atlantic voyages more northern  
(heavy traffic around Svalbard)

Pacific voyages not as northern



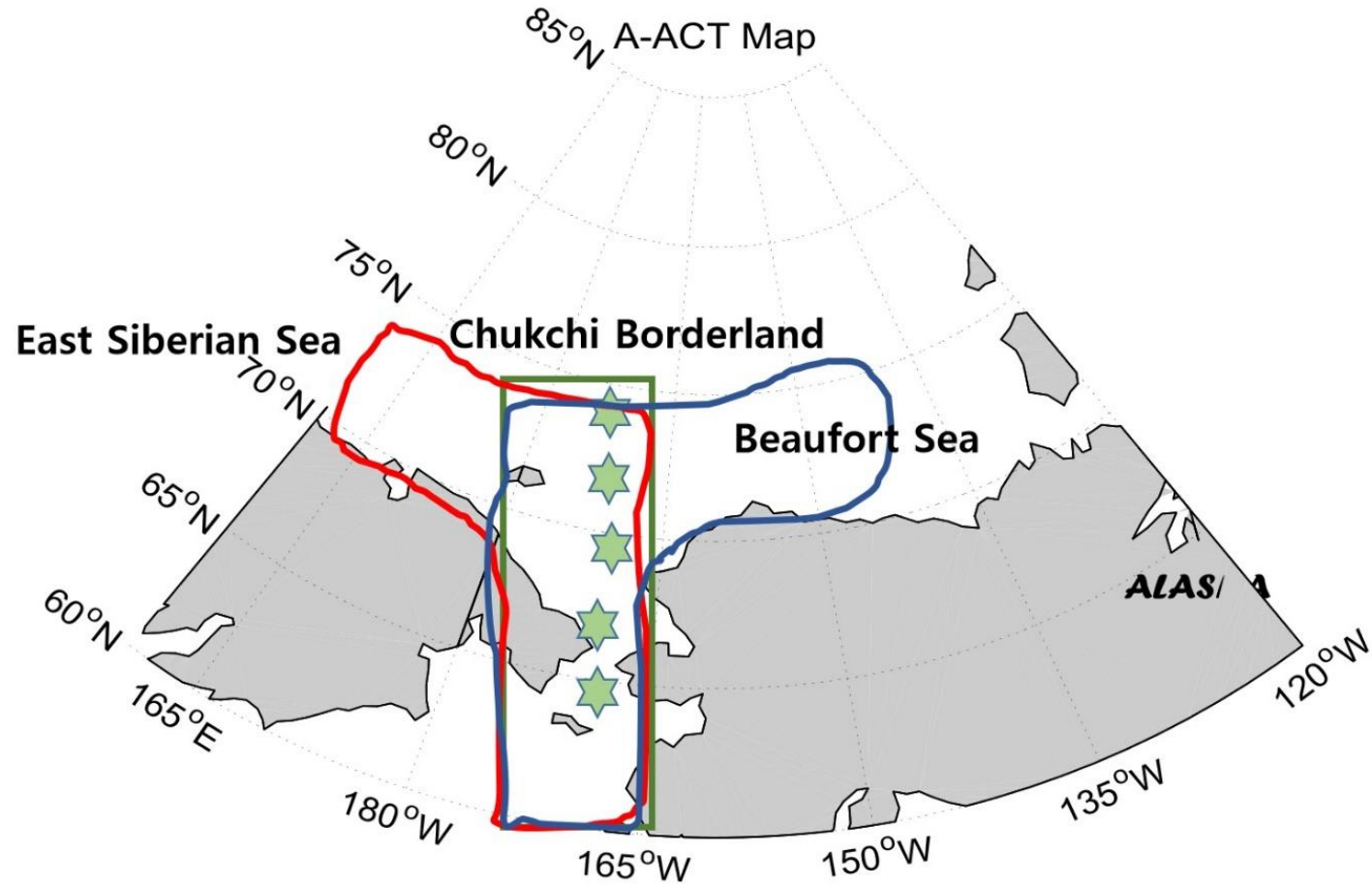
Compiled research voyage  
tracks 2000-2016



Past cruise tracks  
of 3 non-Arctic  
research ships  
2010-2016  
and EEZ  
boundaries

A series of selected oceanographic stations

Arctic coastal states' programs? More coastal emphasis



The pattern; common passage, then to either west or east

Becoming critical 'links' of the network;

SAON, AMAP, AOOS, or whatever

tighter collaboration among Arctic and non-Arctic

Arctic ocean in rapid transition; research ships operating in the Arctic

Permafrost break down and changing climate gas dynamics; network of stations

Arctic changes and mid-latitudes; interactions and impacts



What happens in the Arctic does not stay in the Arctic

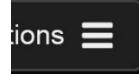
One way spread-out process?

What happens south of the Arctic does feed into the Arctic

Two-way process between interconnected systems

## Sea ice

# 'Extraordinarily hot' Arctic temperatures alarm scientists



The Washington Post



Energy and Environment

# *The North Pole is an insane 36 degrees warmer than normal as winter descends*

Crazy hot Arctic (20 degree warmer than usual)  
two years in a row

OPEN

## Major cause of unprecedented Arctic warming in January 2016: Critical role of an Atlantic windstorm

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In January 2016, the Arctic experienced an extremely anomalous warming event after an extraordinary increase in air temperature at the end of 2015. During this event, a strong intrusion of warm and moist air and an increase in downward longwave radiation, as well as a loss of sea ice in the Barents and Kara seas, were observed. Observational analyses revealed that the abrupt warming was triggered by the entry of a strong Atlantic windstorm into the Arctic in late December 2015, which brought enormous moist and warm air masses to the Arctic. Although the storm terminated at the eastern coast of Greenland in late December, it was followed by a prolonged blocking period in early 2016 that sustained the extreme Arctic warming. Numerical experiments indicate that the warming effect of sea ice loss and associated upward turbulent heat fluxes are relatively minor in this event. This result suggests the importance of the synoptically driven warm and moist air intrusion into the Arctic as a primary contributing factor of this extreme Arctic warming event.

Heat bomb flown from mid latitudes and dropped on to the Arctic

Observer investment; ~ 100 days of ship time,  
100s of science crew (Pacific Arctic for example)

Data; you will never be able to go back in time  
and re-collect

If not put into use?

'remiss' of both Arctic and non-Arctic  
stakeholders

Arctic science may assume multiple faces

What Arctic science can be

lubricant, opener, diplomacy, knowledge base

What Arctic science cannot be or should not be

vending machine, sugar coat

Thank you for your eyes  
But do something now



Photo courtesy of Dr Hyoung Min Joo at KOPRI