First Annual Partners' Meeting Presentation

Integrated Framework to Identify, Track and Communicate Sea-Ice Hazards

Arctic Domain Awareness Center (ADAC)
A DHS Center of Excellence

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June 29 & 30, 2015

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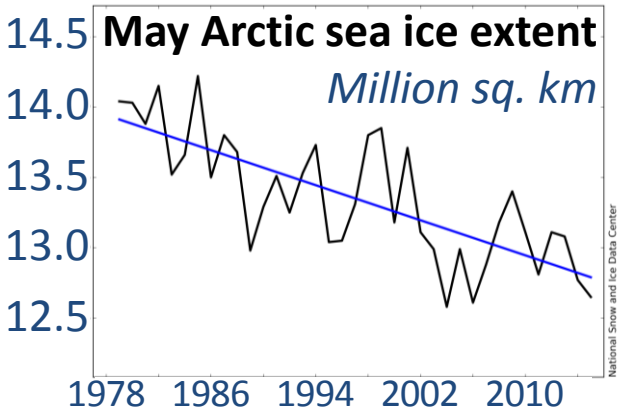
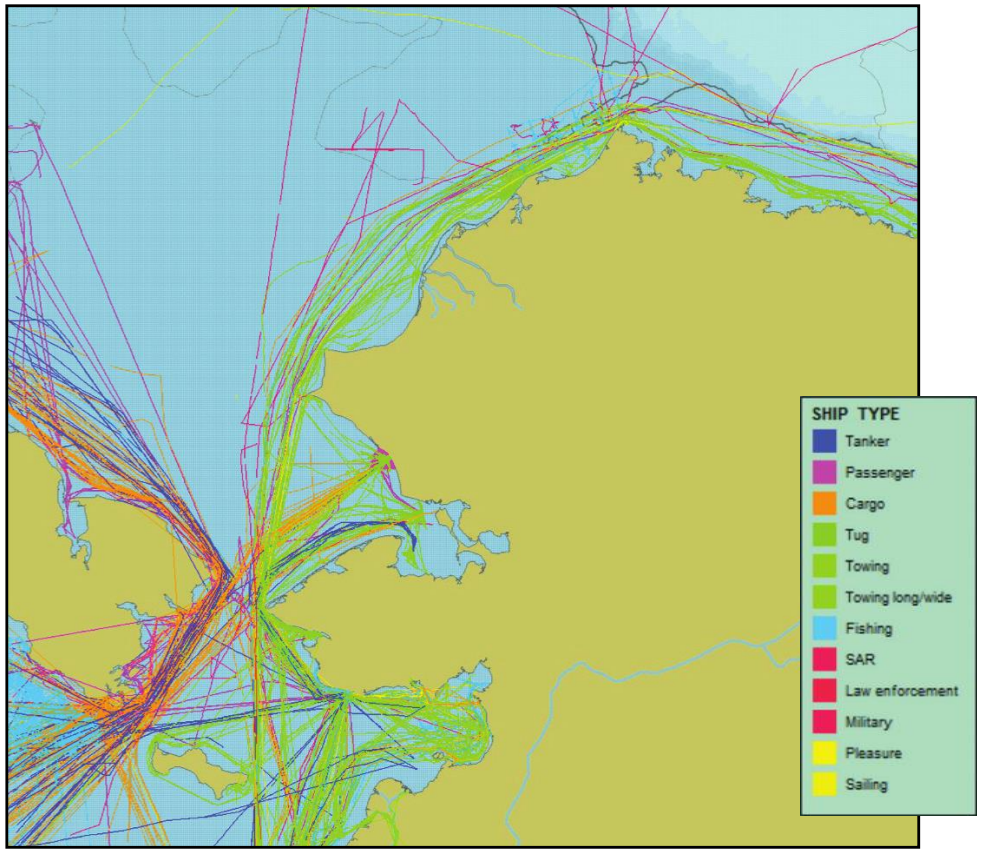
Overview

- Increasing Arctic maritime activity
- Driven in part by decreasing sea ice extent





AIS traffic, Jun 1 – Nov 30, 2013. [*from Brigham, 2014*]

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Risk posed by sea-ice hazards growing despite declining sea ice

Urgent need for enhanced sea-ice hazard awareness

- *Improved hazard detection*
- *Real time tracking*
- *Improved communication and data dissemination*

Barge NTCL II
Photo Stephan Hill Era Helicopters

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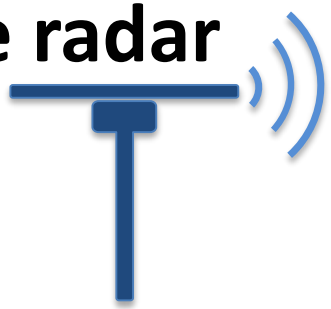
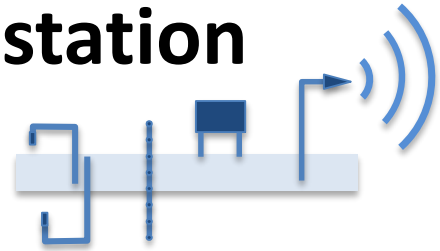
Approach

Ice radar



Mass balance station



GPS buoys

Real-time data

- *Ice detection*
- *Ice velocity*
- *Ice stability*
- *Ice thickness*
- *Ice temperature*
- *Sea level*
- *Ice motion*
- *Ice deformation*
- *Ice uplift*

Satellite data

Sea ice hazards Information products

- *Ice speed*
- *Ice pressure*
- *Ridge / crack formation*
- *Ice breakout*

Stakeholders

Barrow test bed

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Stakeholders & Partners

USCG District 17
Cdr. Shawn Decker, Rob Hynes
James Robinson

USCG R & D Center
Rich Hansen, Bert Macesker
Jason Story, Scott Trip

NOAA Office of Response and Restoration

Amy Merten — *Chief, Spatial Data Branch/Assessment and Restoration Div.*; *Chair, Arctic Council Emergency Preparedness & Prevention Working Group*

Nat. Weather Service Anchorage Ice Desk
James Nelson *NOAA-NWS Regional Scientist*
Rebecca Legatt Heim *Ice Forecaster*

Alaska Dept. Environmental Conservation
John Engles

Eskimo Walrus Commission
Vera Kingeekuk Metcalf *Executive Director*
Eugene Brower *President*

Alaska Clean Seas
Tony Parkin *Chair, Research & Development*

Barrow Search and Rescue
No formal contact at this time

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Milestones

1. **Completion of vector product for ice velocity field in format and delivery mode that conforms with USCG and NOAA ERMA needs (March 2015)**. Multi-parameter suite of products as vector and raster data available in May 2016. Baseline TRL-4, target TRL-6.
2. **Capabilities to produce mean velocity and divergence/convergence fields compatible with CMR model architecture and coastal HF radar data. (February 2015)**. Full time series from Barrow site processed by January 2016. Baseline TRL-4, target TRL-6.
3. White paper outlining North Slope/Barrow ADAC testbed, discussing relevant observing system resources, logistics support options, ADAC testbed elements and activities (December 2015). Baseline TRL-1, target TRL-2.
4. Identify and review suitable DGPS hardware for use in harsh Arctic sea-ice environment and compatibility with observing system infrastructure to detect small-scale deformation as threat precursor (April 2016). Baseline TRL-2, target TRL-5.

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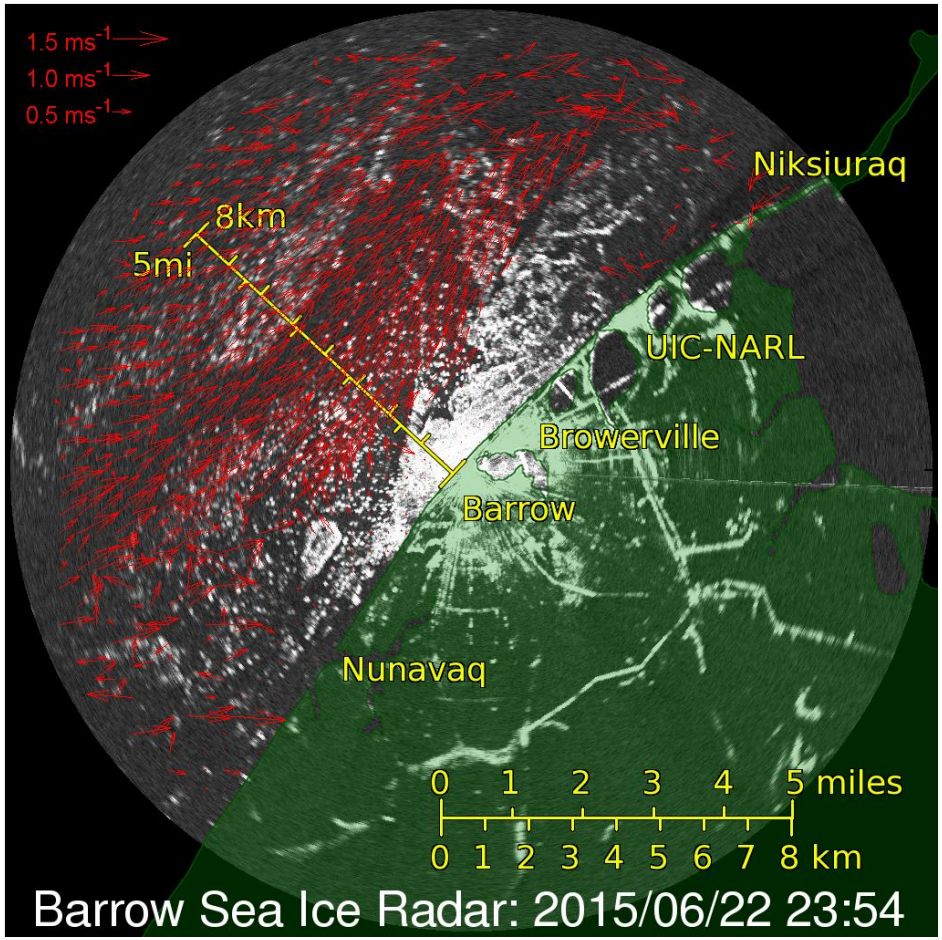
Radar-derived ice velocities

Milestone #1: Completion of vector product for ice velocity field in format and delivery mode that conforms with USCG and NOAA ERMA needs (March 2015)

- ***Gridded ice velocities now being calculated operationally from real time radar data***
- ***Data available in KMZ format for integration into Arctic ERMA and GoogleEarth***
- ***Awaiting feedback from USCG D17; Integrated feedback from Barrow Rescue Base***



Near-real data time at:
http://seaice.alaska.edu/gi/observatories/barrow_radar/sea-ice-velocity

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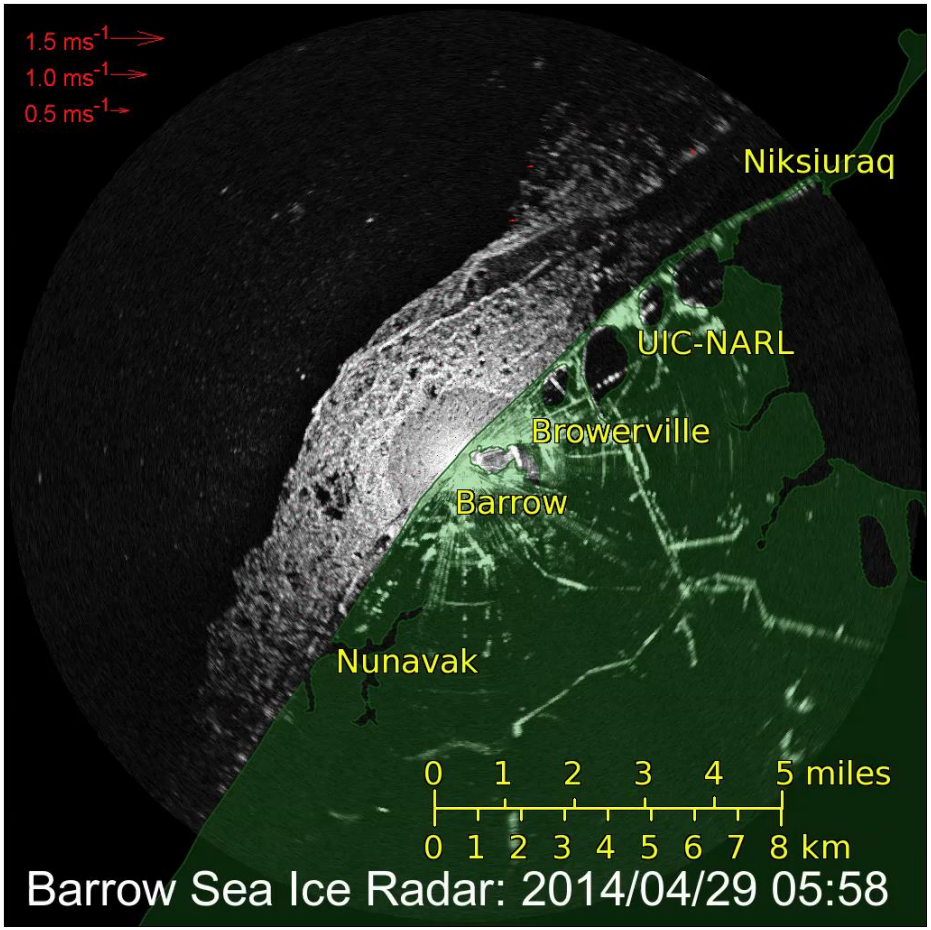
Real world application

UAF ice radar data used by Barrow Search & Rescue

April 29, 2014:

- *Mid-season breakout of landfast ice casts several hunters adrift*
- *Weather conditions prevent launch of SAR helicopter*
- *Radar data used to help coordinate rescue effort using small boats*
- *All people and gear safely recovered!*



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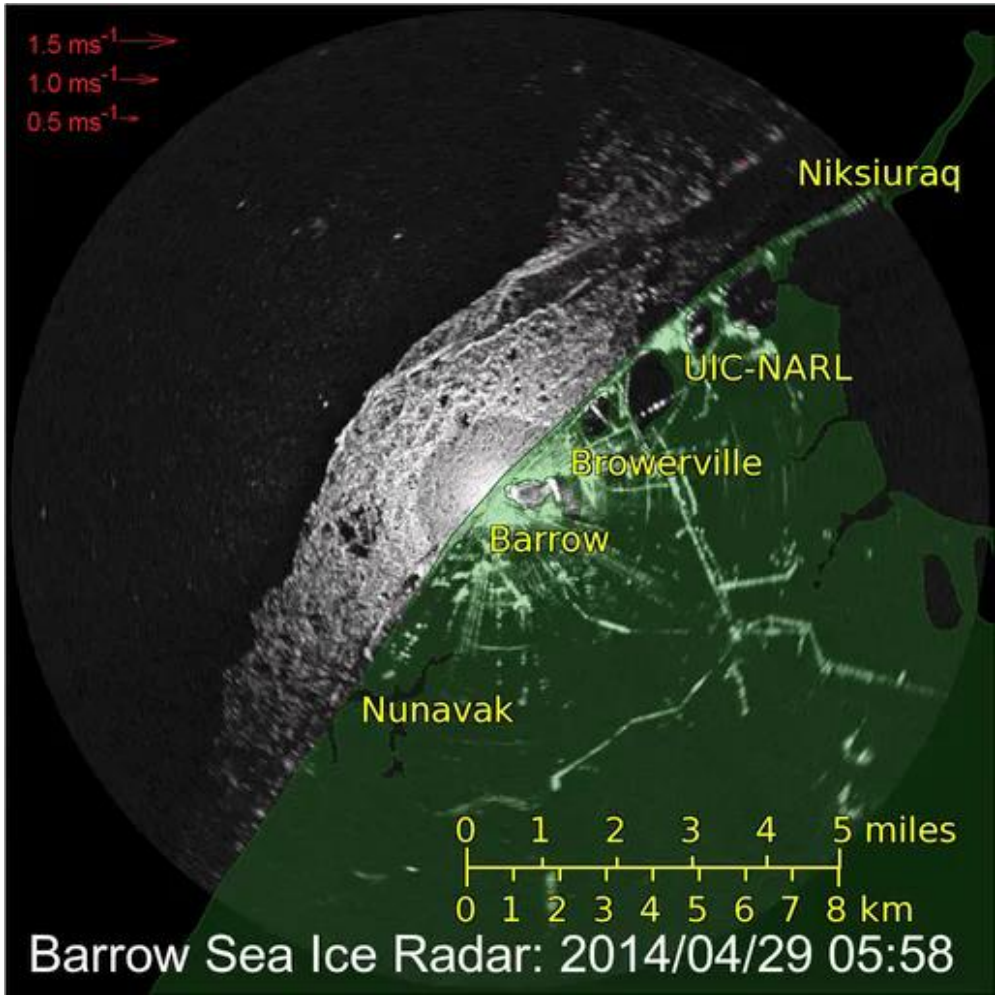
Ice divergence/convergence

Milestone #2: Capabilities to produce mean velocity and divergence/convergence fields compatible with CMR model architecture and coastal HF radar data. (February 2015)

- ***Algorithms developed to generate ice convergence / divergence fields***

- ***Red** indicates **closing/ridging** ice*
- ***Blue** indicates **opening** ice*

- ***Once operational, data can be formatted to meet stakeholder needs***



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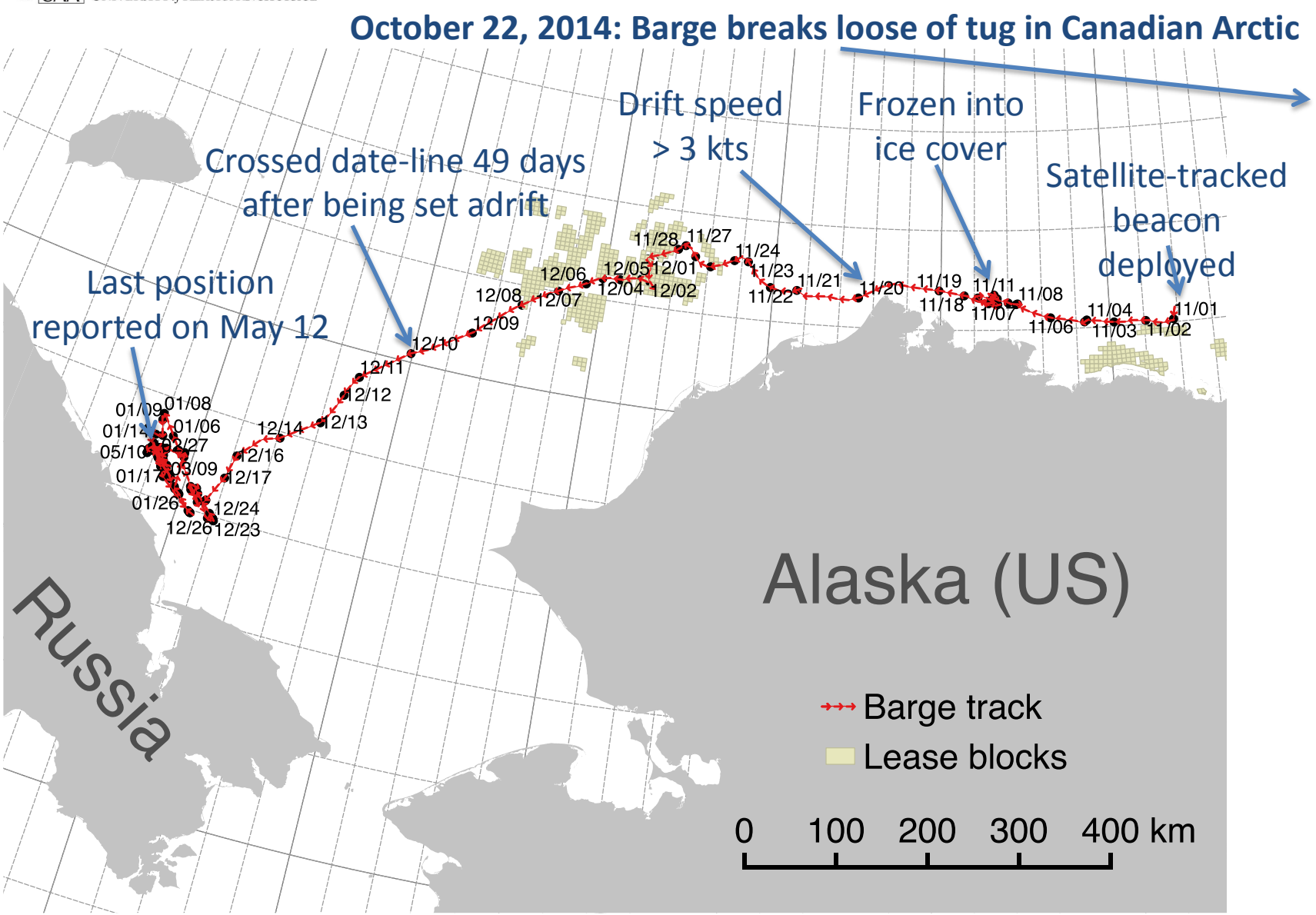
Barge NTCL II



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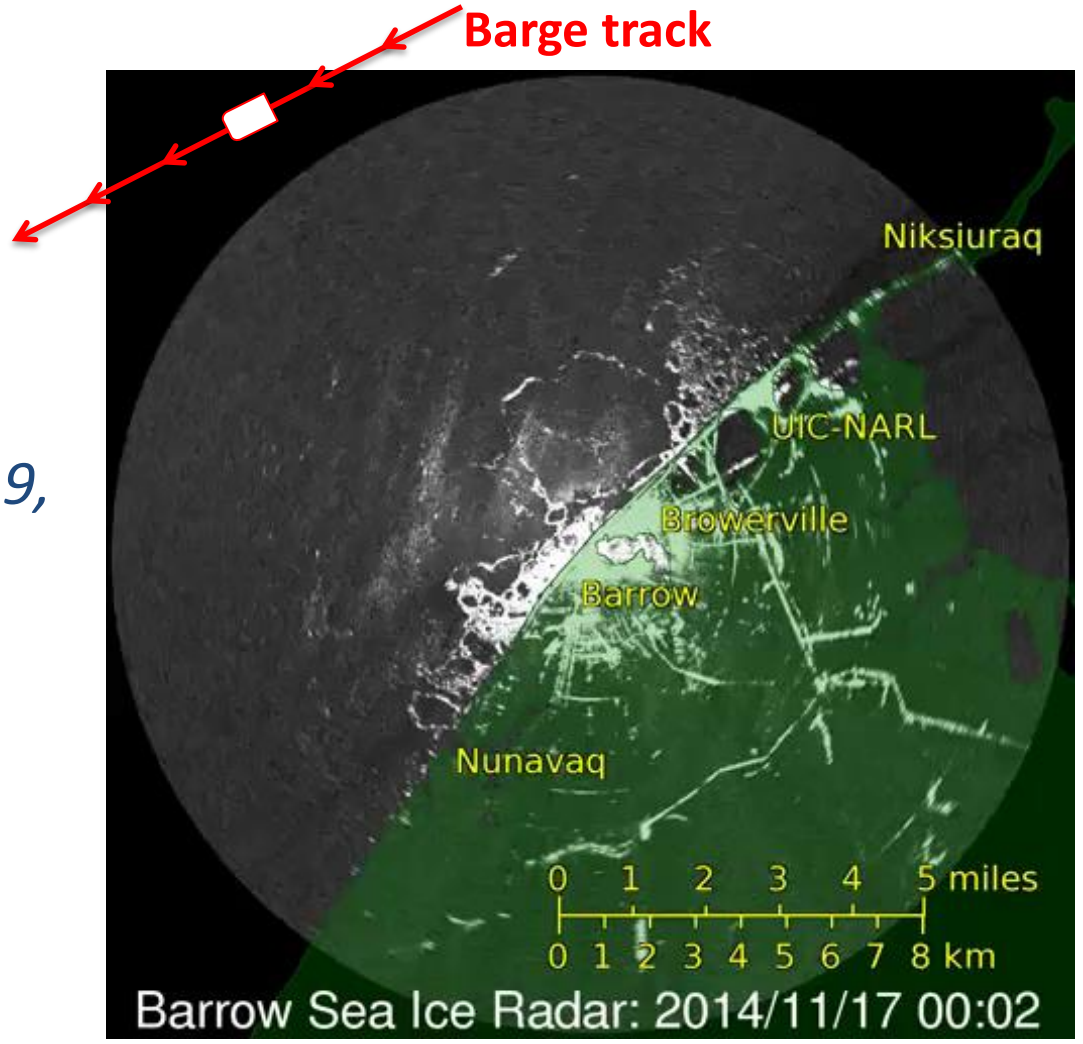
Passing Pt. Barrow

- *Barge passed Point Barrow just before midnight on October 19, 2014*
- *Closest approach: 11.3 km offshore*
- *Ice motion highly complex*
- *No landfast ice*



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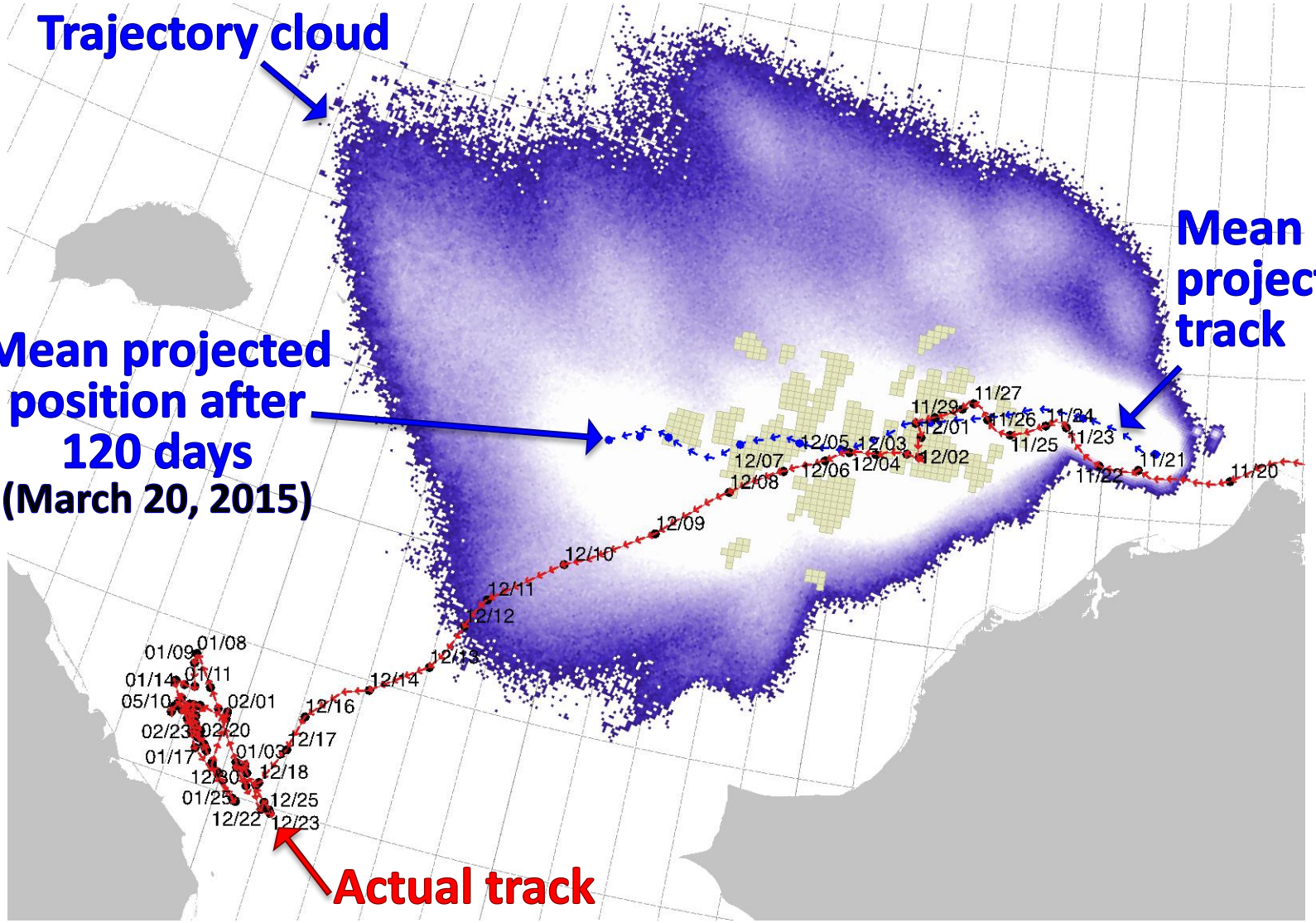
Projected barge drift
(on Nov 21, 2014)



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Gaps and Lessons Learned

Search and rescue operations in ice-infested waters can benefit from radar data

- Particularly during periods of poor visibility
- Ice velocity data most useful
- Simple, low-bandwidth products most suitable for local first responders

Calculating differential ice motion high precision data

- Spurious data needs to be removed with additional signal processing
- Unclear how this would apply on moving vessel

There are significant gaps in our ability to forecast long-term drift patterns

- With ongoing rapid change, historical data must be used with caution
- Ice drift near coast particularly difficult with current satellite data

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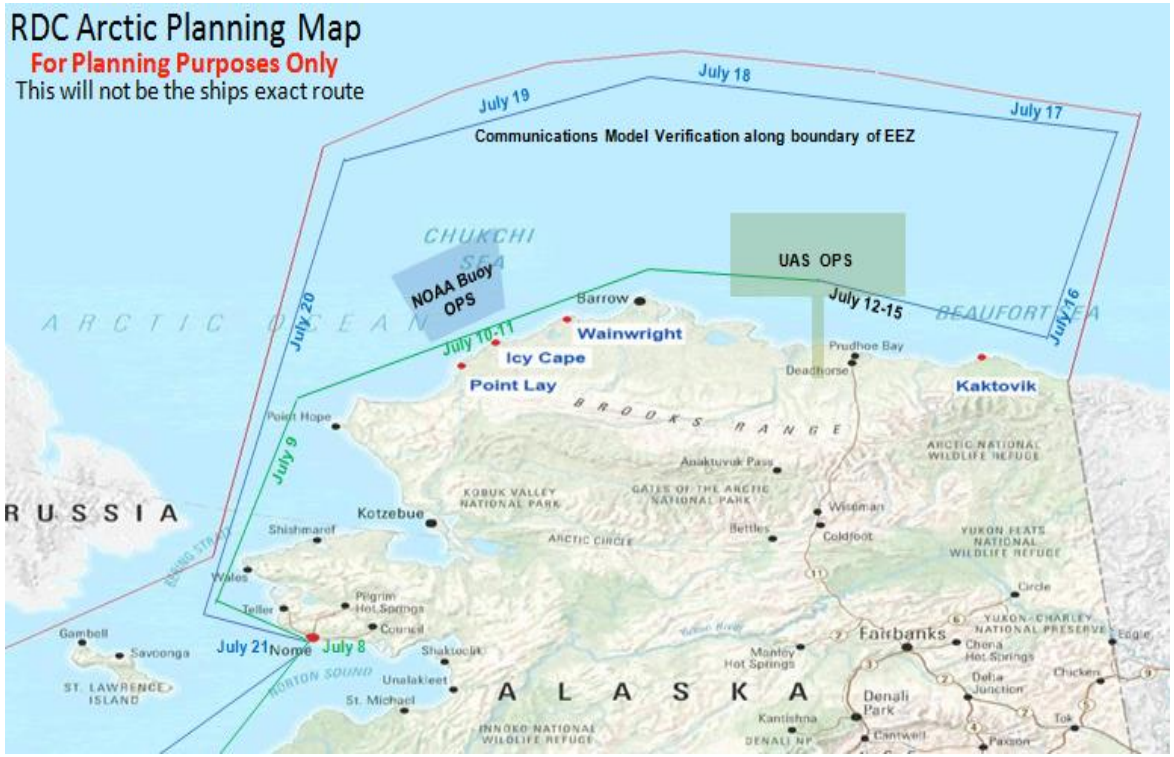
Next steps

July 8-22: Arctic Shield 2015 Technology Evaluation

- *Test ice radar performance while under way*
- *Deploy autonomous buoy to monitor ice hazards*



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Next steps

Barrow test bed (2015/16)

- *Deployment of high-precision DGPS beacons to monitor cracking, ridging and break-outs*
- *Development of integrated of ice motion / mass balance data product for storm/ocean model validation*
- *Engagement with stakeholders to assess value of data products for application in past and future scenarios*
- *Framework for collaborative sensor, model & response assessments*