NOAA | National Ocean Service

Office of Response & Restoration

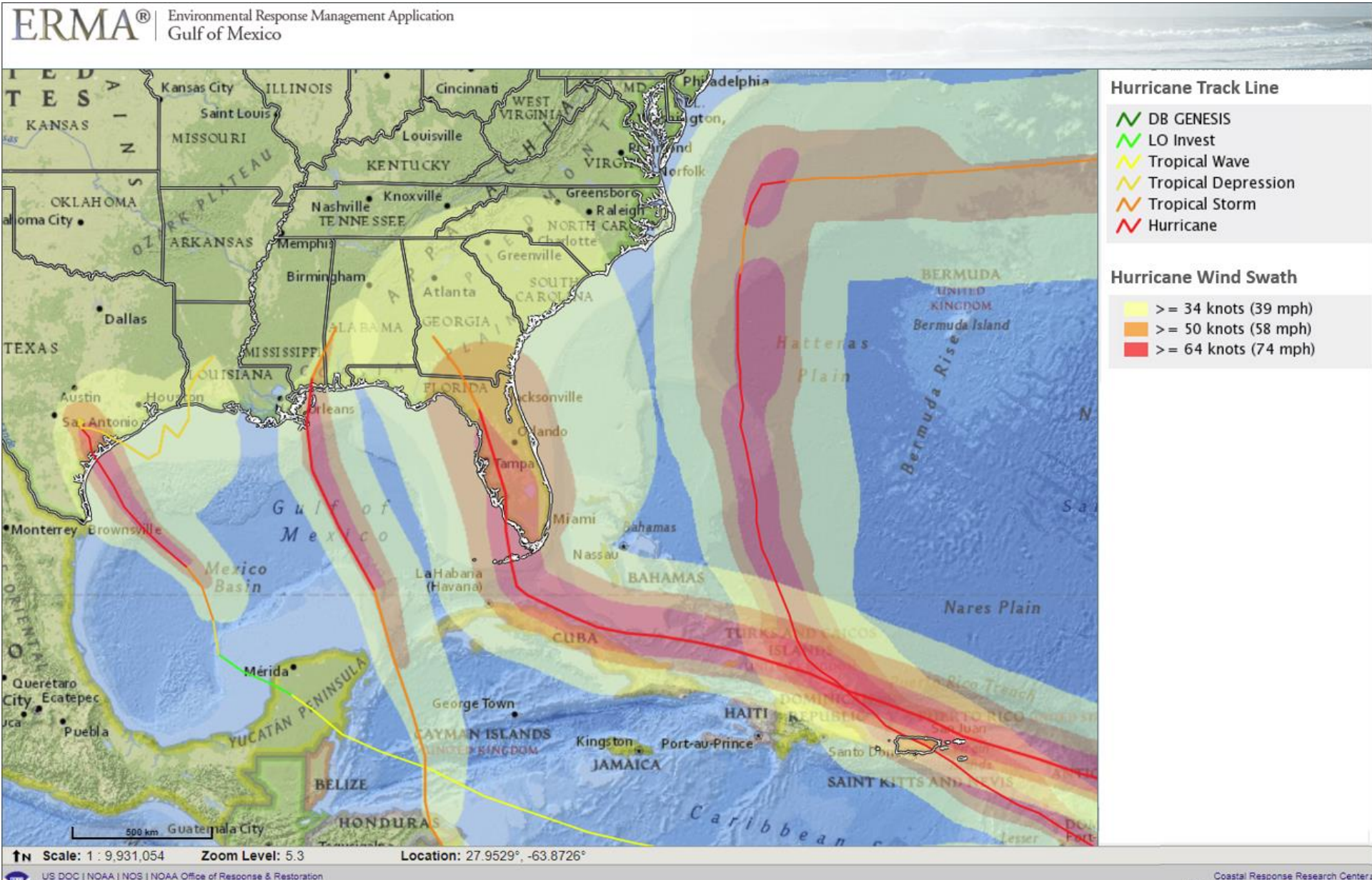
International Oil Spill Response Tool: Arctic Environmental Response Management Application (ERMA®)

Merten [1], A. A., Wright[2], R.K., Bruns[3], P, and, Holst-Andersen[4], J.P.

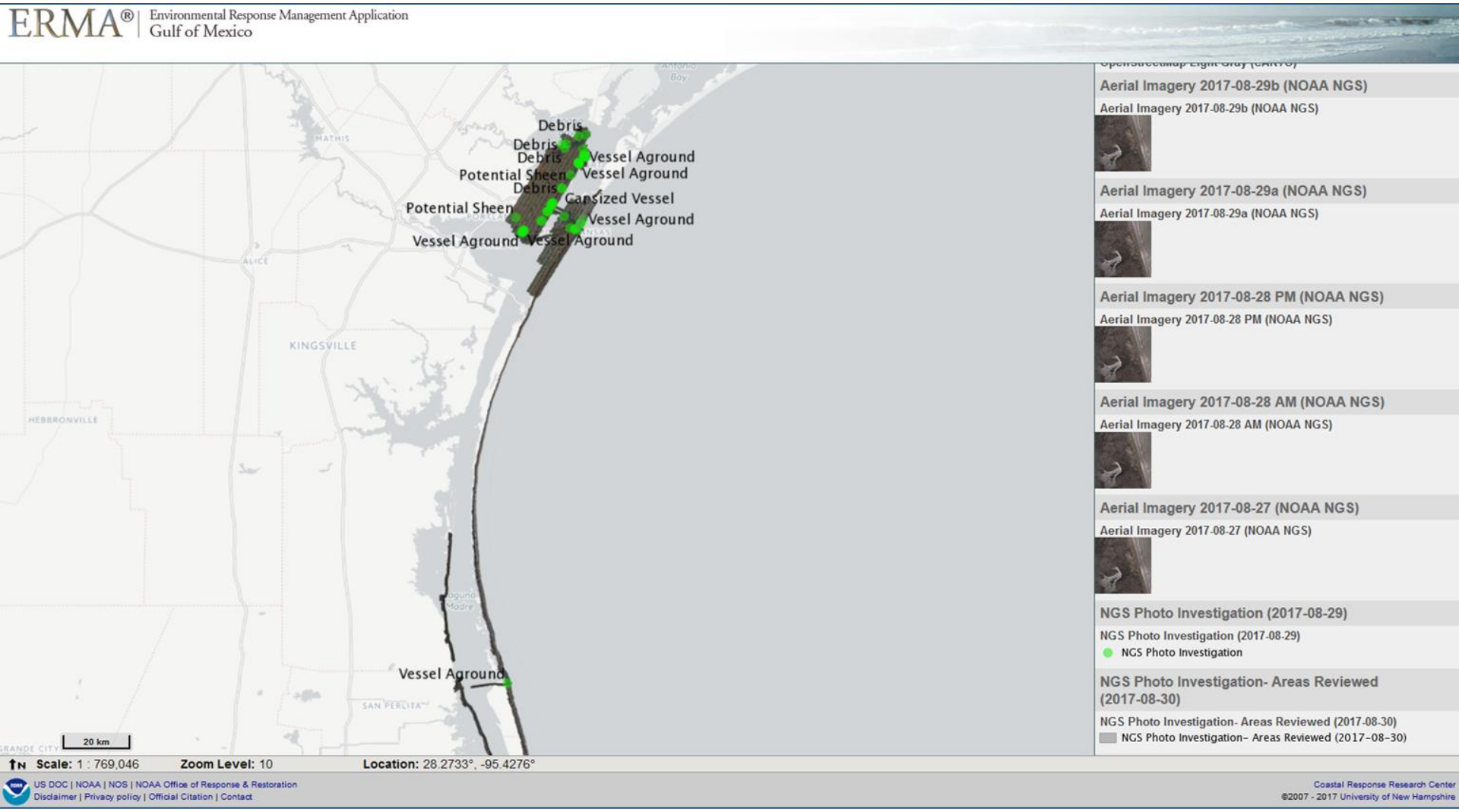
1. NOAA's Office of Response and Restorations, Seattle, WA; 2. NOAA's Office of Response and Restoration, Silver Spring, MD; 3. Arctic Council Secretariat, Tromsø, Norway. 4. Danish Ministry of Defense, Copenhagen, Denmark.

U.S. Canads Northern Oil and Gas Research Forum
October 12, 2017

Track and Wind Swaths for the Four ‘17 storms



NGS Imagery and ERMA Draw Tool used to find pollution targets and navigational hazards



NGS Imagery, 8/30, West Houston (top)

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Office of Response & Restoration

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Gulf of Mexico

Blank Base Layer

Blank Base Layer

Aerial Imagery 2017-08-30 (NOAA NGS)

Aerial Imagery 2017-08-30 (NOAA NGS)

Esri World Imagery

Esri World Imagery

N **Scale:** 1 : 5,870 **Zoom Level:** 16 **Location:** 29.7949°, -95.6088°

Current Civil Air Patrol Coverage as of 09-29-17

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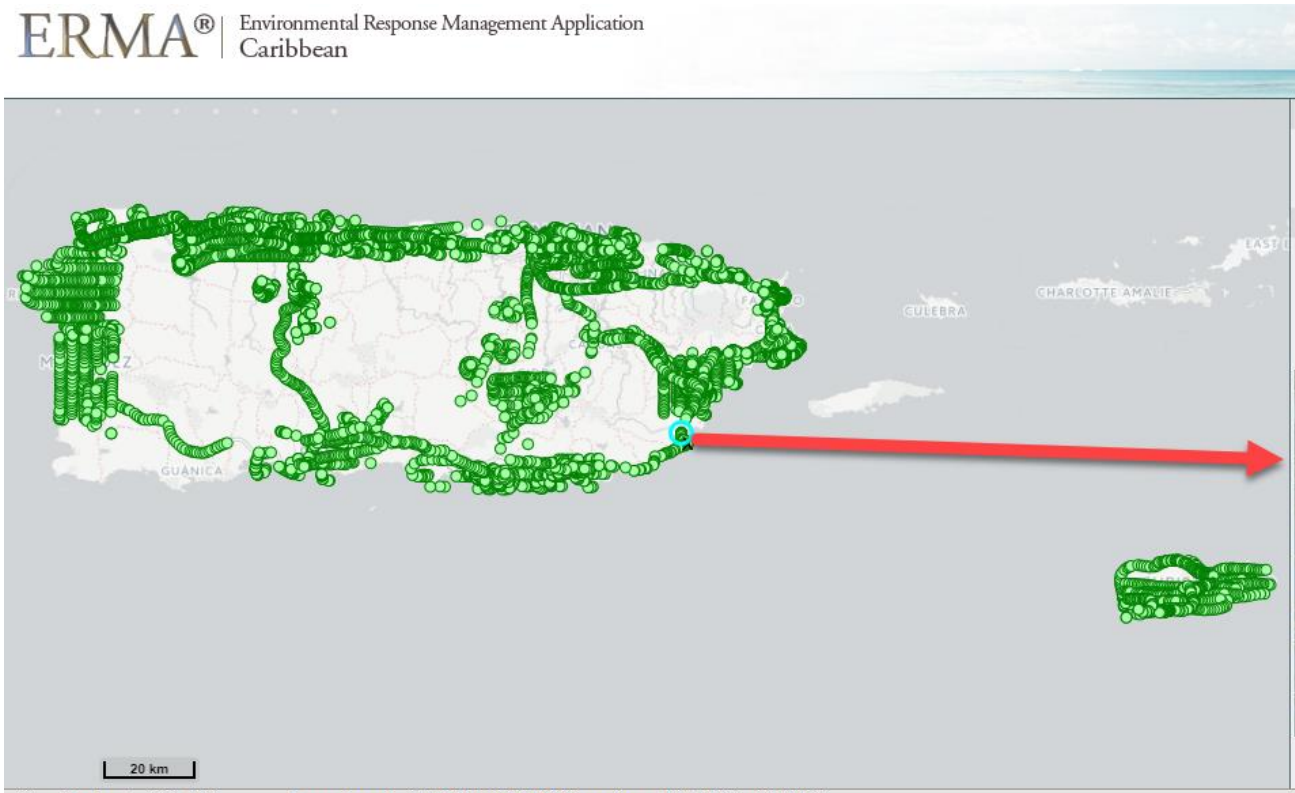


Civil Air Patrol Photos for Hurricane Maria (CAP)

Civil Air Patrol Photos for Hurricane Maria (CAP)

Civil Air Patrol Photos for Hurricane Maria (CAP)

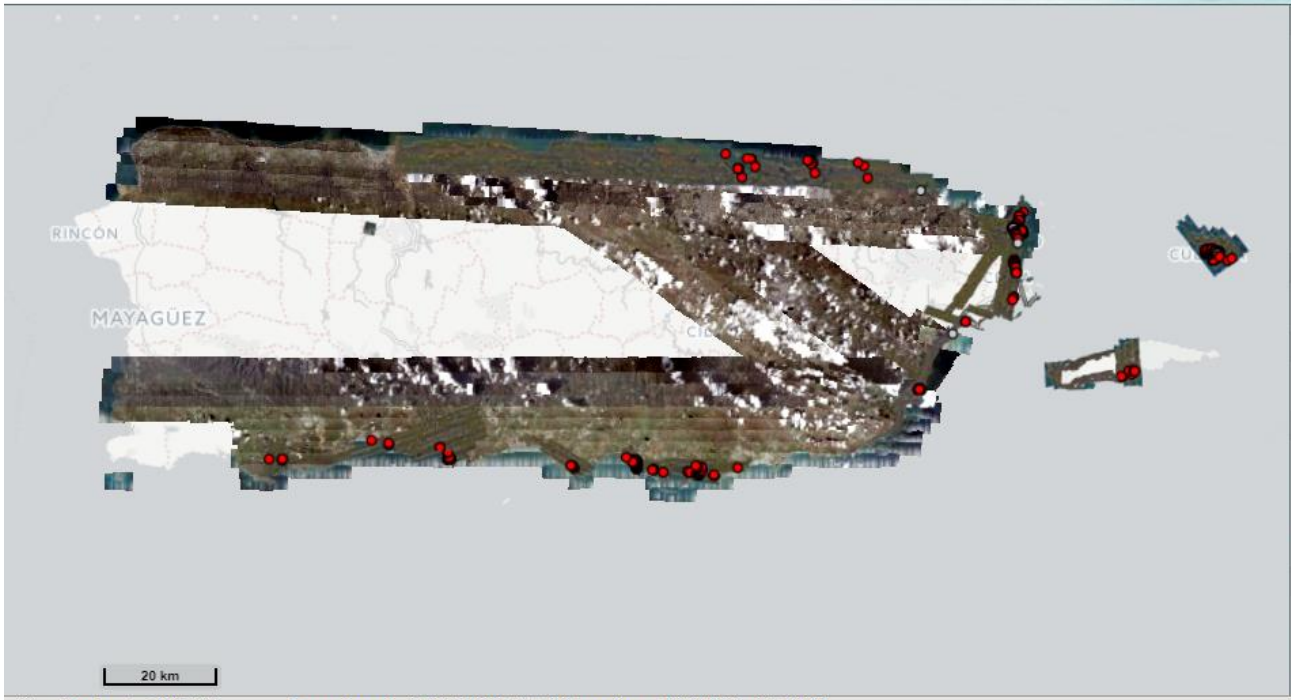
OpenStreetMap Light Gray (CARTO)

OpenStreetMap Light Gray (CARTO)

N **Scale:** 1 : 882,296 **Zoom Level:** 8.900000000000000 **Location:** 18.2965°, -64.5829°

Debris report for Irma and Maria 10-10-18

ERMA® | Environmental Response Management Application Caribbean



Aerial Imagery Identified Debris 09-Oct-2017 (RPI)

Aerial Imagery Identified Debris 09-Oct-2017 (RPI)

- Automotive
- Construction
- Debris Pile
- Trailer
- Unknown
- Vessel
- Oil Hazmat Container

Post-Harvey, Irma, Maria Imagery (Vexcel/NICB)

Post-Harvey, Irma, Maria Imagery (Vexcel/NICB)

Aerial Imagery 2017-0923b (NOAA NGS)

Aerial Imagery 2017-0923b (NOAA NGS)

Aerial Imagery 2017-0923a (NOAA NGS)

Aerial Imagery 2017-0923a (NOAA NGS)

Aerial Imagery 2017-0924a (NOAA NGS)

Aerial Imagery 2017-0924a (NOAA NGS)

↑N **Scale:** 1 : 707,213 **Zoom Level:** 9.21815928421628 **Location:** 18.6690°, -65.1655°

Nate, Potential Storm Surge Flooding, NOAA Locations 10/7@8am

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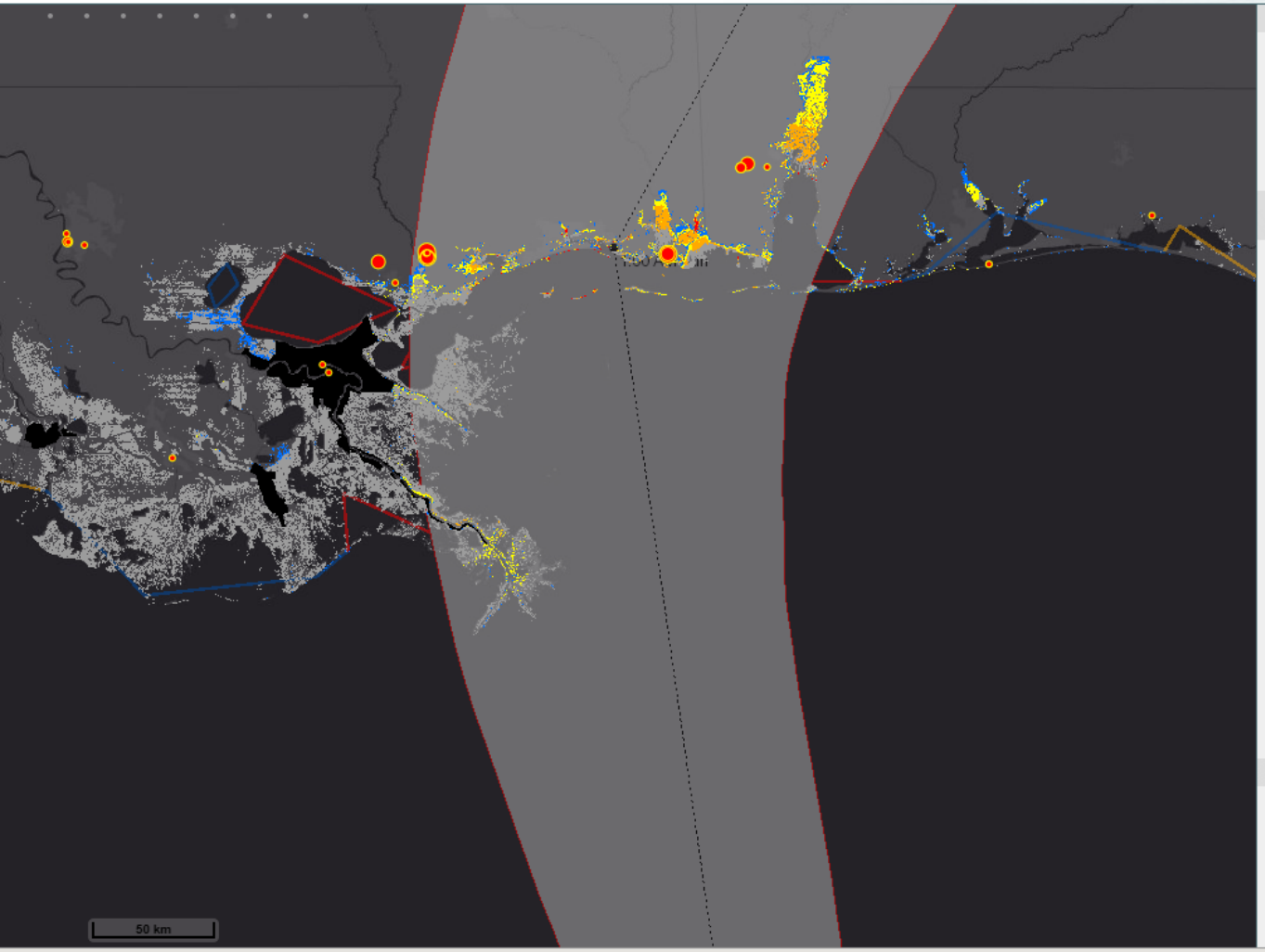
Gulf of Mexico



NOAA Locations with Staff Counts

NOAA Locations with Staff Counts
- 1-5
- 6-15
- 16-50
- 51-100
- 101-2700

Potential Storm Surge Flooding - With Intertidal Mask (visible through zoom level 12 only) (NOAA)

Potential Storm Surge Flooding - With Intertidal Mask (visible through zoom level 12 only) (NOAA)

Potential Storm Surge Flooding Map Boundary
- Potential Storm Surge Flooding Map Not Presently Available
- Potential Storm Surge Flooding Map Boundary

Levee Areas
- Levee Area - Contact local officials for flood risk

Potential Storm Surge Flooding - With Intertidal Mask

Image
- Less than 1 foot above ground
- Greater than 1 foot above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground
- Levee Area - Contact local officials for flood risk
- Intertidal Zone/Estuarine Wetland

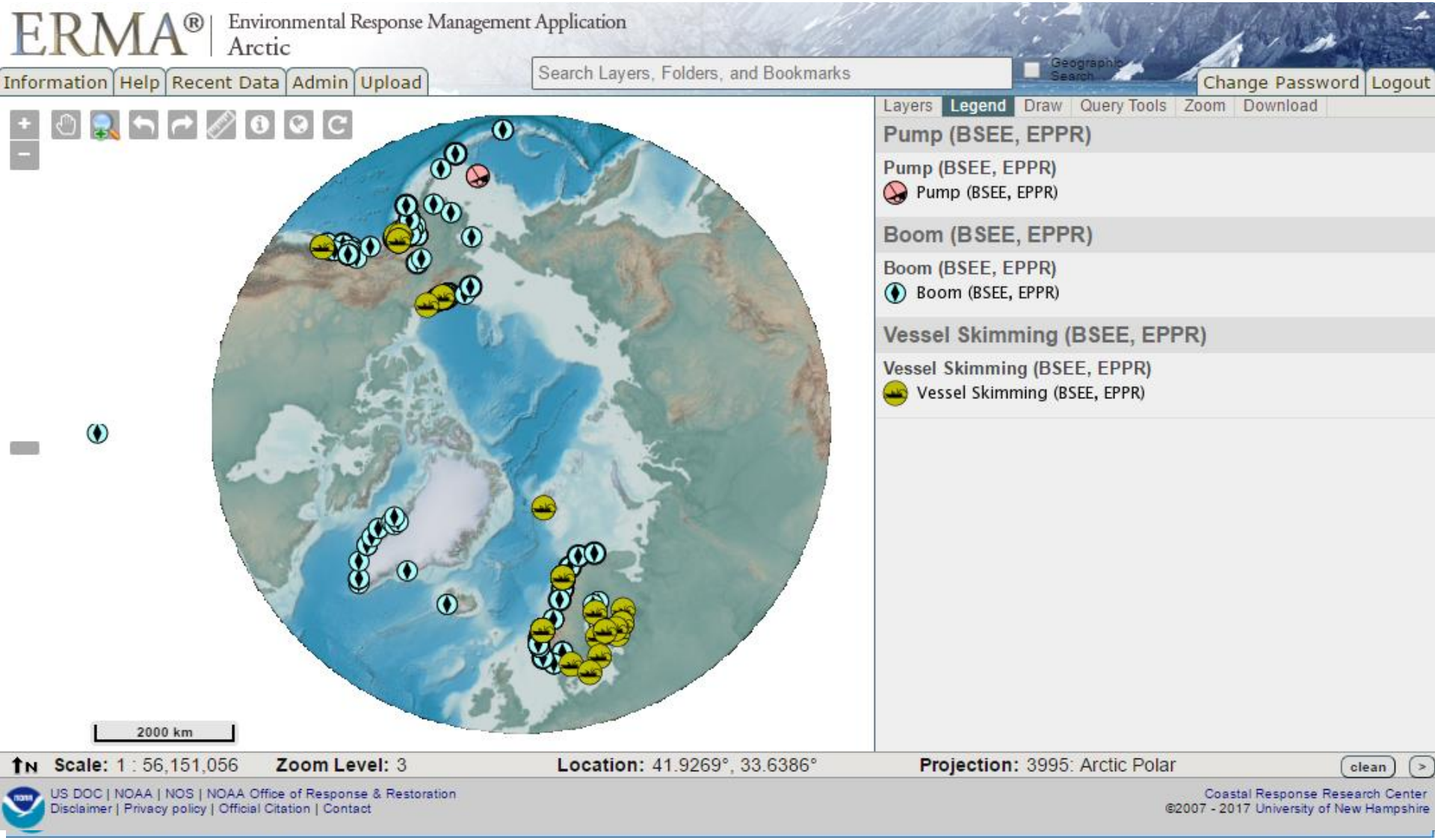
sat 2017-10-07 11:46 utc

IDP Hurricanes

IDP Hurricanes
- Post-Tropical Cyclone
- Tropical Cyclone
- 72
- 120
- Day 1-3

N **Scale:** 1 : 1,506,486 **Zoom Level:** 8 **Location:** 30.9253°, -86.0800°

Polar vs. Mercator



Polar Vs Mercator

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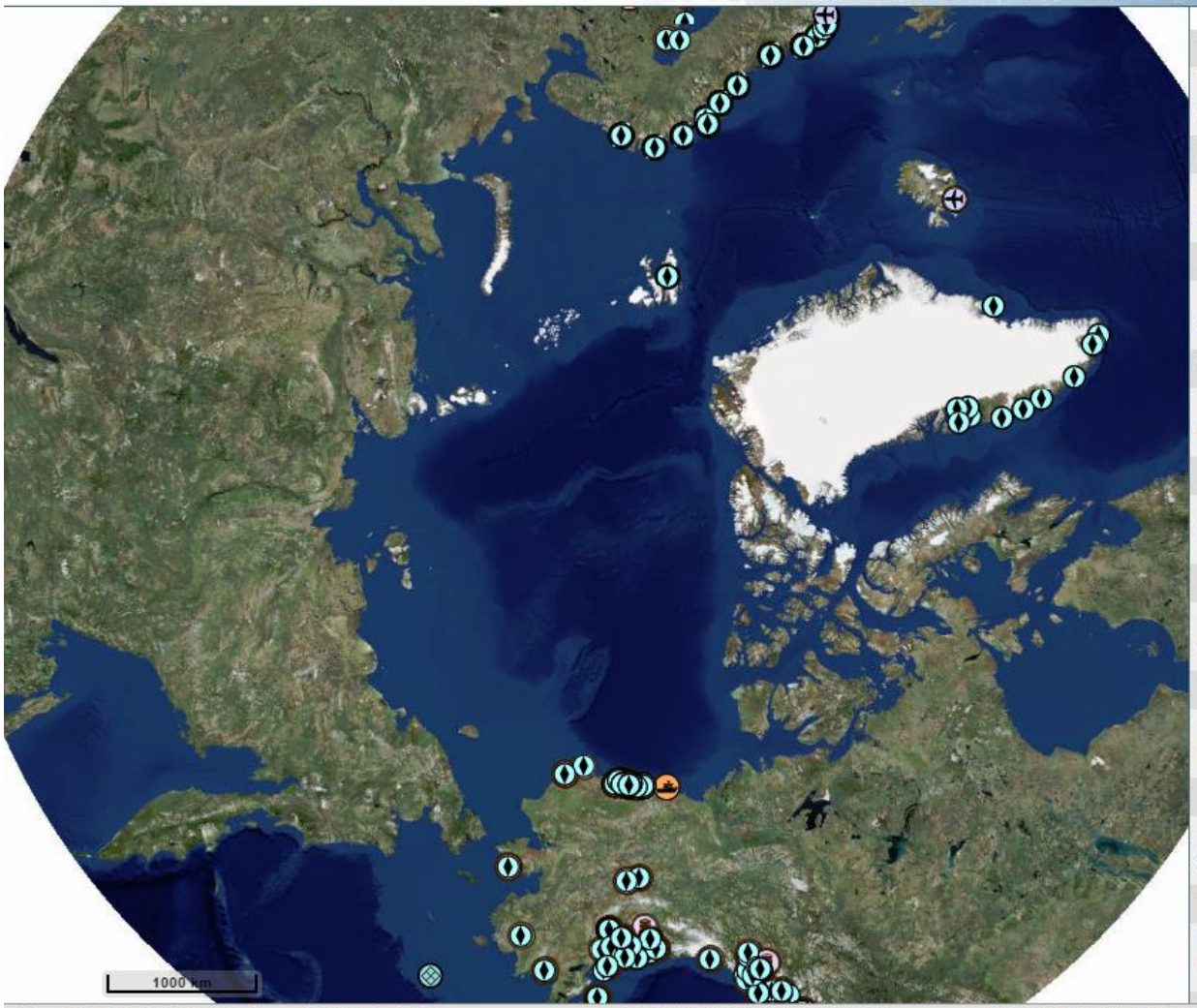
Arctic



Pump (BSEE, EPPR)
Pump (BSEE, EPPR)
Pump (BSEE, EPPR)

Vessel Skimming (BSEE, EPPR)
Vessel Skimming (BSEE, EPPR)
Vessel Skimming (BSEE, EPPR)

Skimmer (BSEE, EPPR)
Skimmer (BSEE, EPPR)
Skimmer (BSEE, EPPR)

Vessel Non-Skimming (BSEE, EPPR)
Vessel Non-Skimming (BSEE, EPPR)
Vessel Non-Skimming (BSEE, EPPR)

Shoreline Cleaner (BSEE, EPPR)
Shoreline Cleaner (BSEE, EPPR)
Shoreline Cleaner (BSEE, EPPR)

Sorbent (BSEE, EPPR)
Sorbent (BSEE, EPPR)
Sorbent Type (BSEE, EPPR)

Temporary Storage (BSEE, EPPR)
Temporary Storage (BSEE, EPPR)
Temporary Storage (BSEE, EPPR)

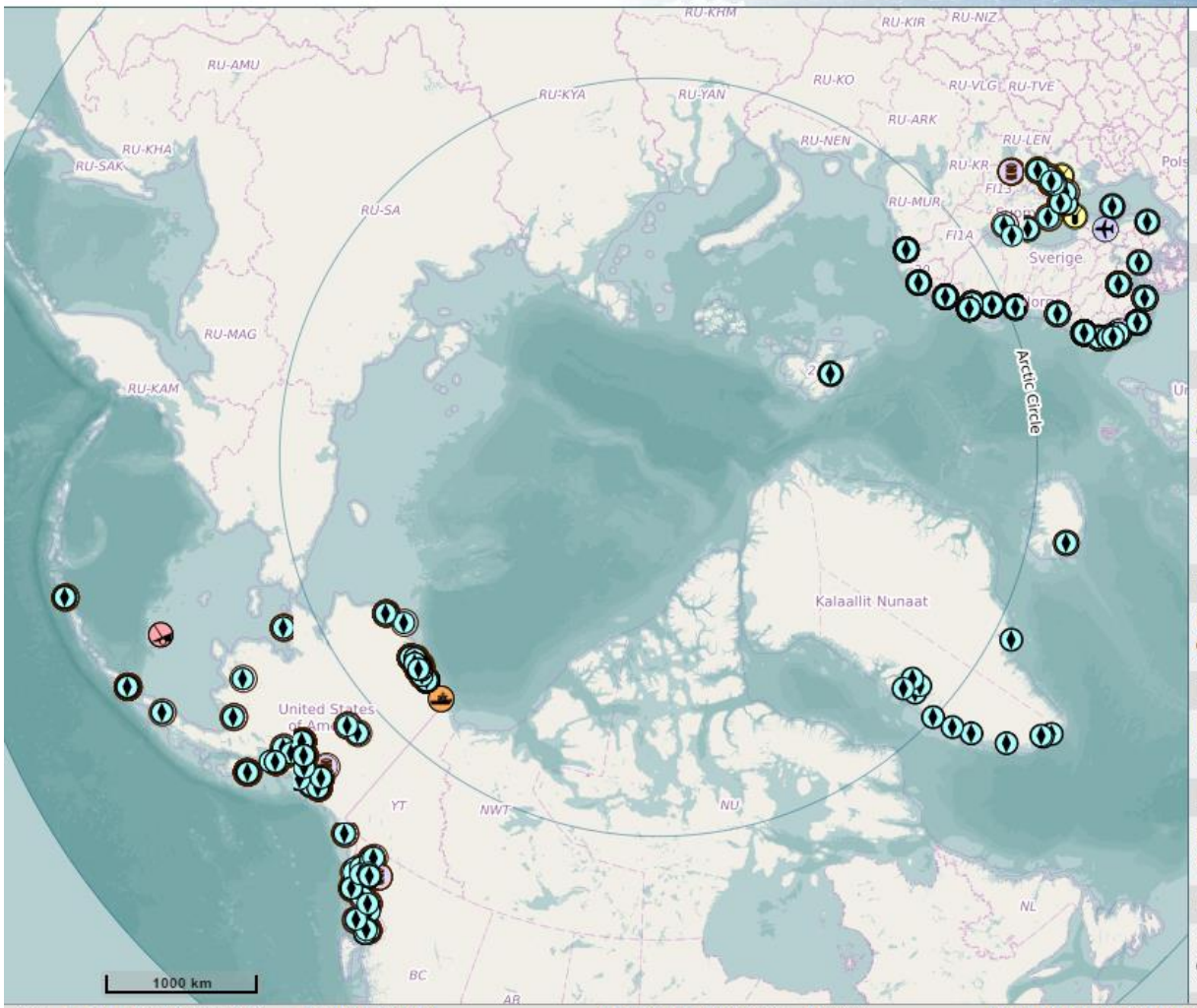
Specialist Vehicle (BSEE, EPPR)
Specialist Vehicle (BSEE, EPPR)
Specialist Vehicle (BSEE, EPPR)

Dispersant (BSEE, EPPR)
Dispersant (BSEE, EPPR)
Dispersant (BSEE, EPPR)

N **Scale:** 1 : 27,727,083 **Zoom Level:** 4 **Location:** 72.3377°, -74.3866° **Projection:** 5936: Alaska Polar

Polar Vs Mercator

ERMA® | Environmental Response Management Application
Arctic



Vessel Skimming (BSEE, EPPR)
Vessel Skimming (BSEE, EPPR)
Vessel Skimming (BSEE, EPPR)

Skimmer (BSEE, EPPR)
Skimmer (BSEE, EPPR)
Skimmer (BSEE, EPPR)

Sorbent (BSEE, EPPR)
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Specialist Vehicle (BSEE, EPPR)
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Shoreline Cleaner (BSEE, EPPR)
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Vessel Non-Skimming (BSEE, EPPR)
Vessel Non-Skimming (BSEE, EPPR)
Vessel Non-Skimming (BSEE, EPPR)

Dispersant (BSEE, EPPR)
Dispersant (BSEE, EPPR)
Dispersant (BSEE, EPPR)

Pump (BSEE, EPPR)
Pump (BSEE, EPPR)
Pump (BSEE, EPPR)

Oily Water Separator (BSEE, EPPR)
Oily Water Separator (BSEE, EPPR)
Oily Water Separator (BSEE, EPPR)

N **Scale:** 1 : 27,580,556 **Zoom Level:** 4 **Location:** 59.1795°, -1.0303° **Projection:** 3573: North Pole LAEA Canada

Sea Ice (National Ice Center)

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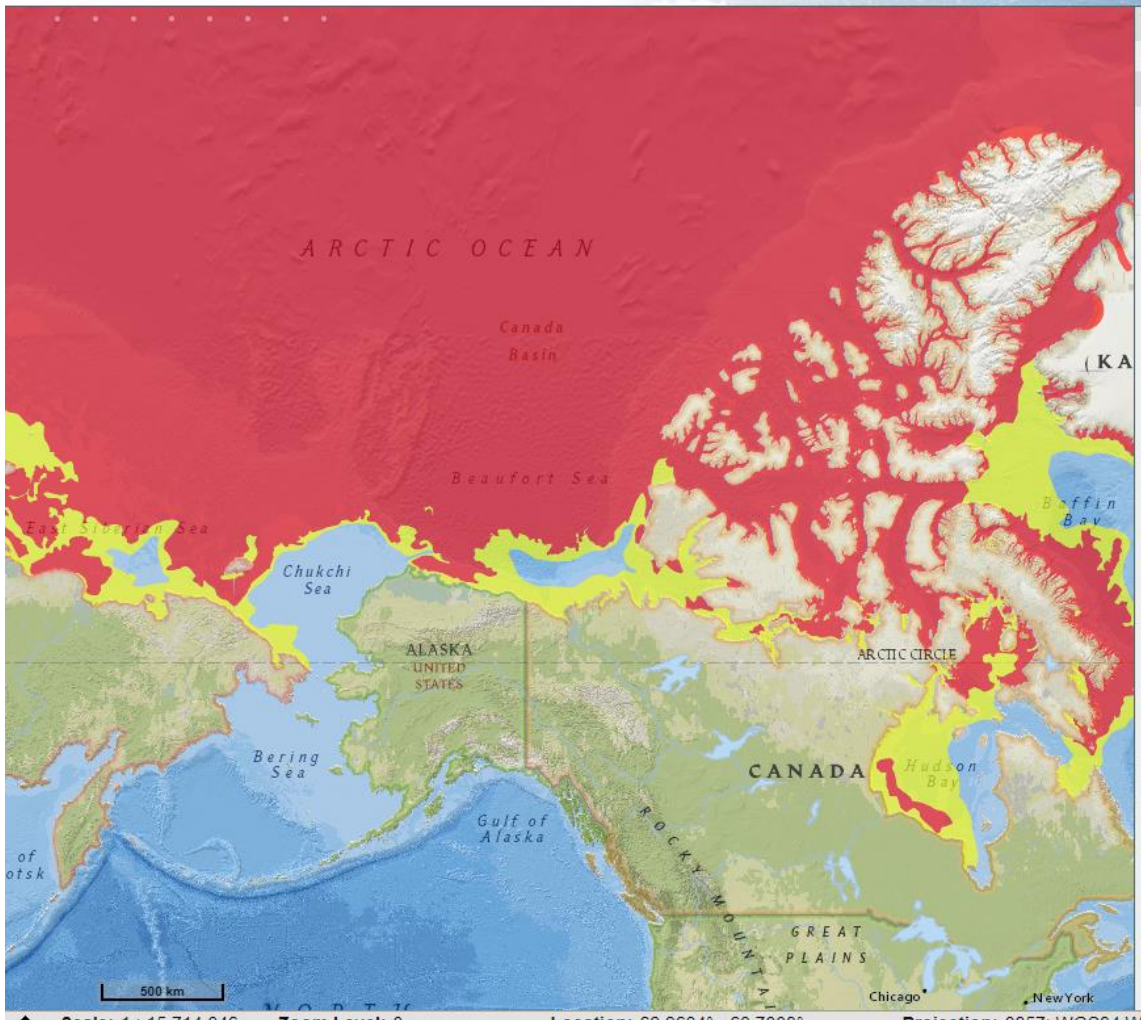


Esri National Geographic

Esri National Geographic

Daily Ice Edge and Marginal Ice Zone - Latest (NIC)

Daily Ice Edge and Marginal Ice Zone - Latest (NIC)

Marginal Ice Zone

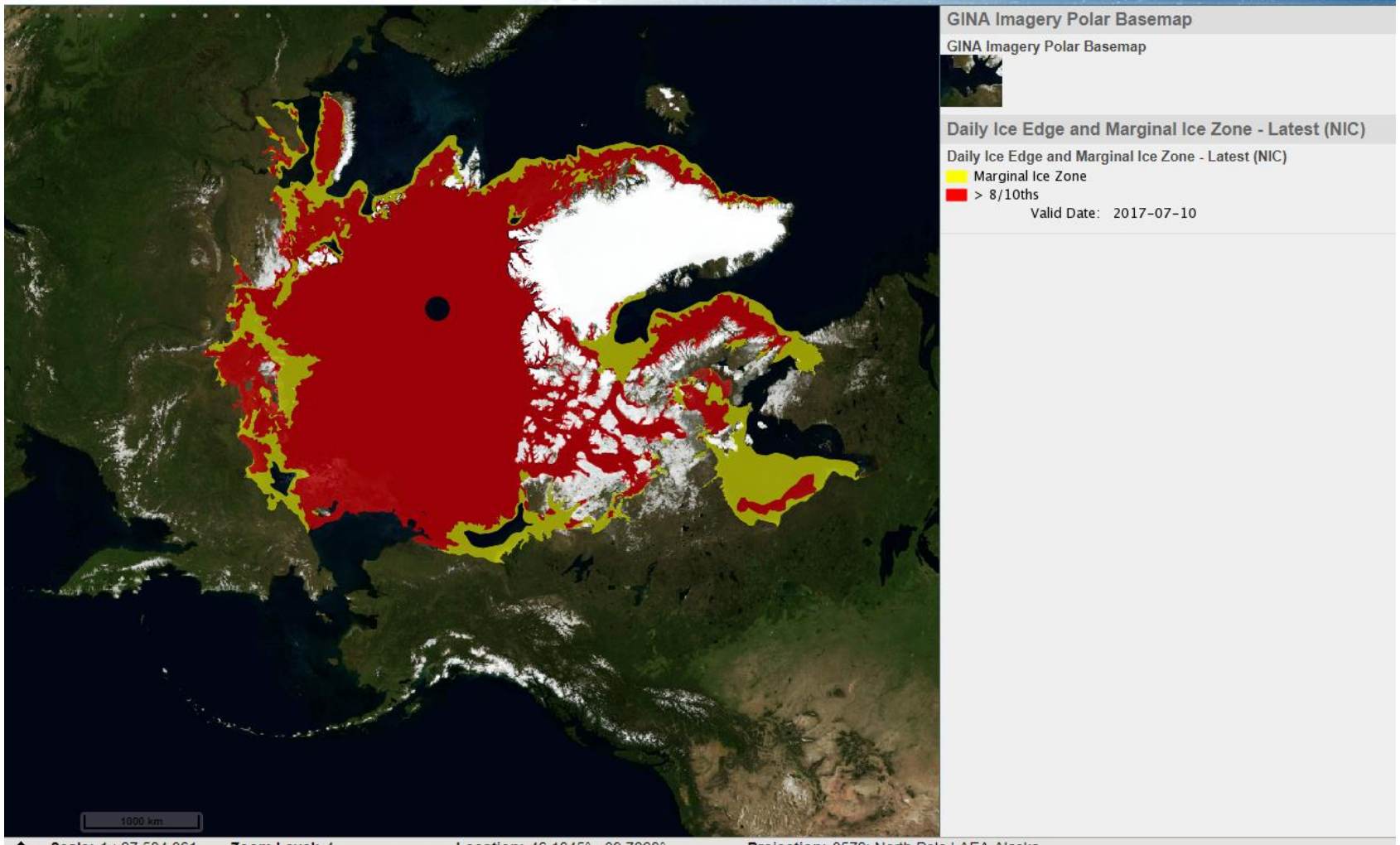
> 8/10ths

Valid Date: 2017-07-10

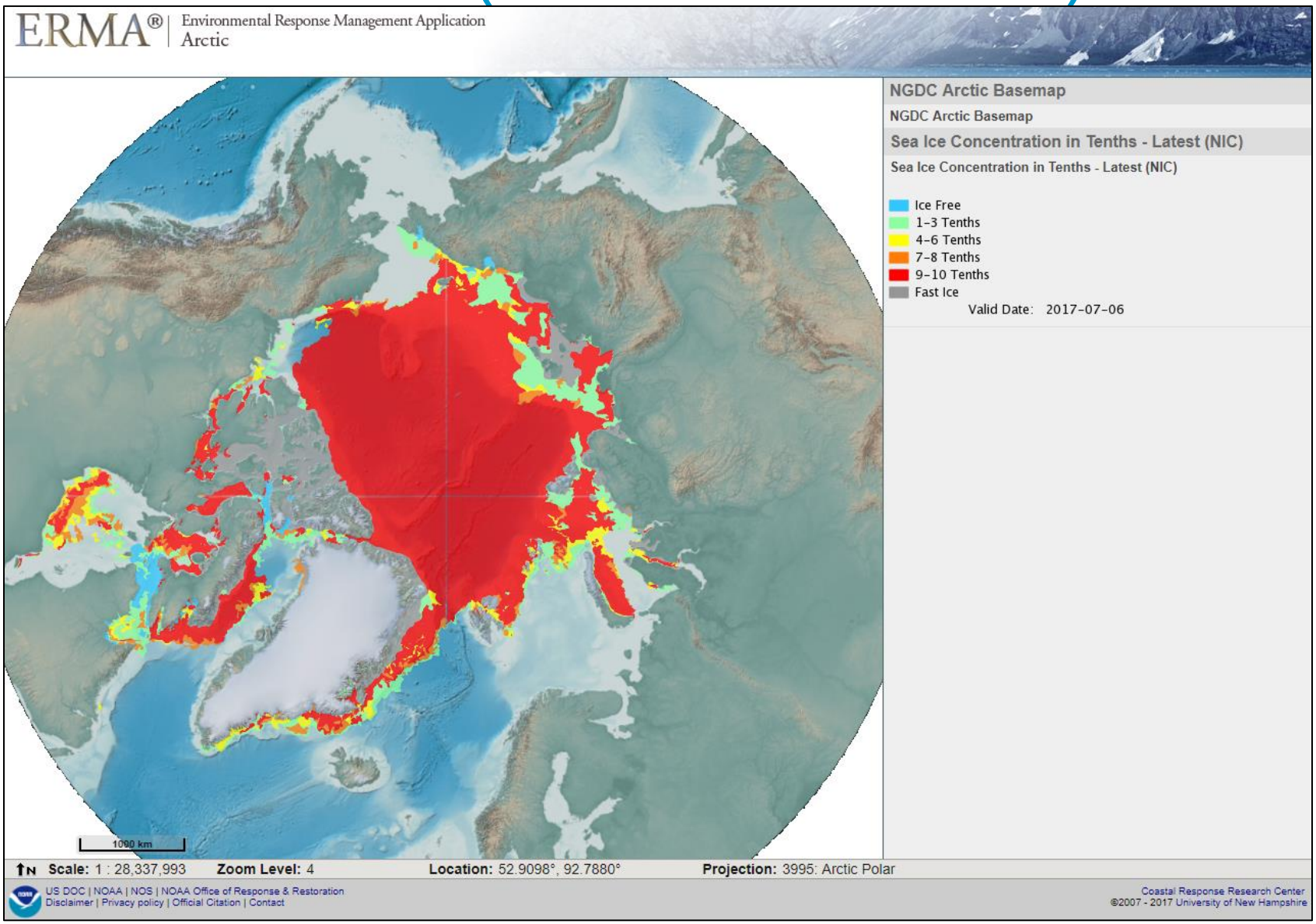
N **Scale:** 1 : 15,714,046 **Zoom Level:** 3 **Location:** 62.2604°, -60.7338° **Projection:** 3857: WGS84 Web Mercator

Sea Ice (National Ice Center)

ERMA® | Environmental Response Management Application Arctic



Sea Ice (National Ice Center)



Arctic Response Database

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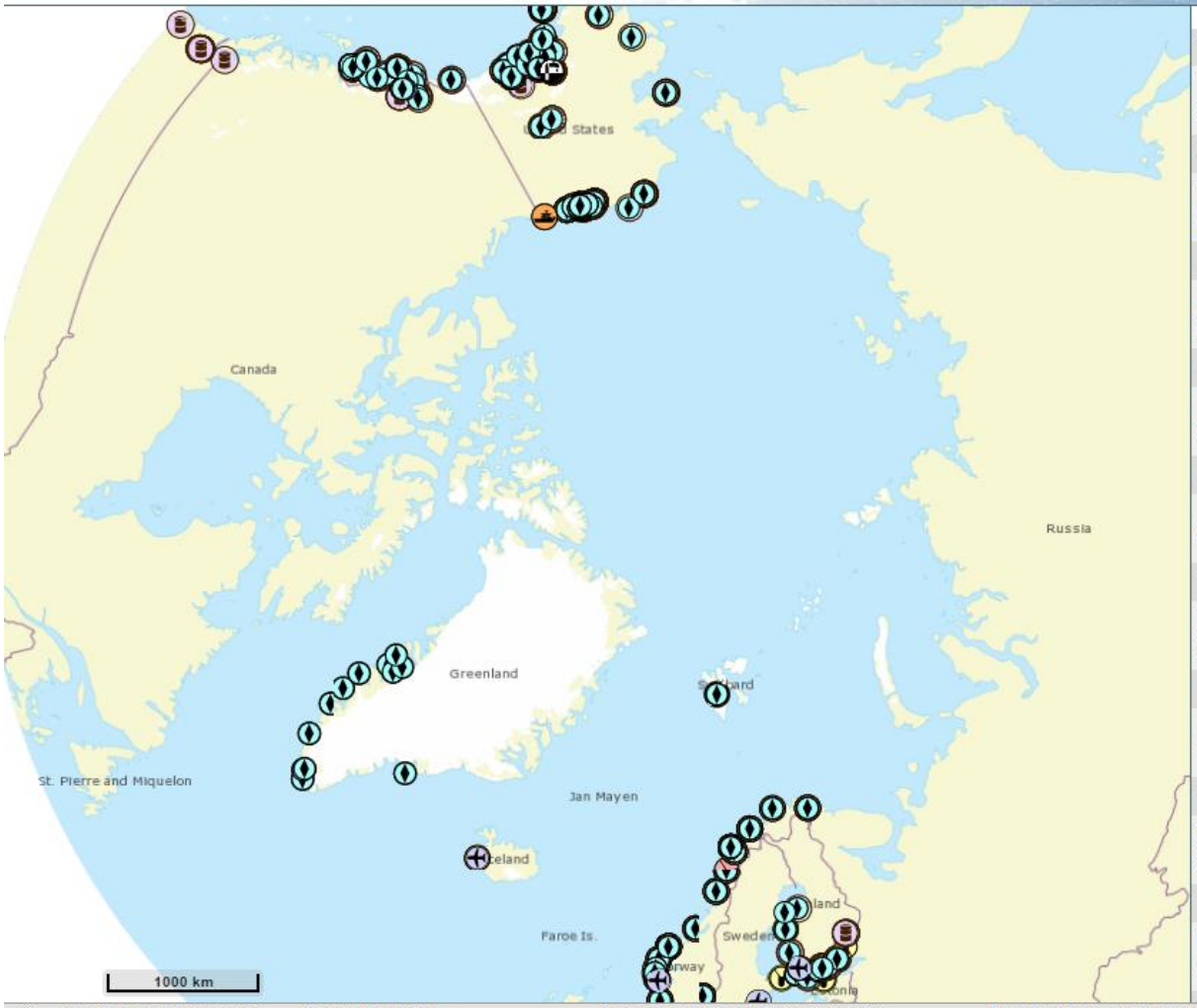
Arctic



Pump (BSEE, EPPR)
Pump (BSEE, EPPR)
Pump (BSEE, EPPR)

Vessel Skimming (BSEE, EPPR)
Vessel Skimming (BSEE, EPPR)
Vessel Skimming (BSEE, EPPR)

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Specialist Vehicle (BSEE, EPPR)
Specialist Vehicle (BSEE, EPPR)

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Skimmer (BSEE, EPPR)
Skimmer (BSEE, EPPR)

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Temporary Storage (BSEE, EPPR)

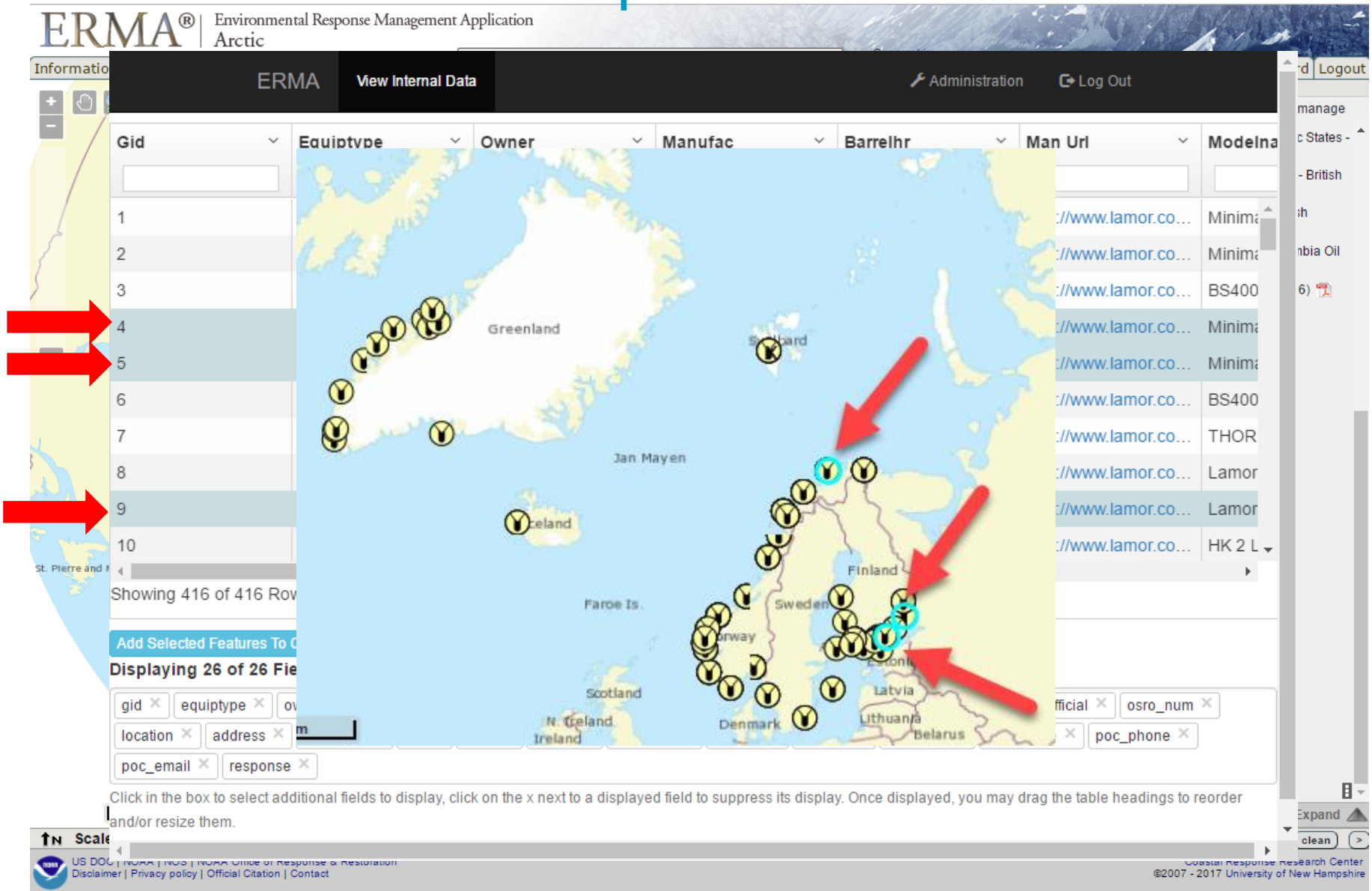
Shoreline Cleaner (BSEE, EPPR)
Shoreline Cleaner (BSEE, EPPR)
Shoreline Cleaner (BSEE, EPPR)

Vessel Non-Skimming (BSEE, EPPR)
Vessel Non-Skimming (BSEE, EPPR)
Vessel Non-Skimming (BSEE, EPPR)

Dispersant (BSEE, EPPR)
Dispersant (BSEE, EPPR)
Dispersant (BSEE, EPPR)

↑N **Scale:** 1 : 27,581,483 **Zoom Level:** 4 **Location:** 48.1857°, 57.2322° **Projection:** 3575: North Pole LAEA Europe

Arctic Response Database



Arctic Response Database

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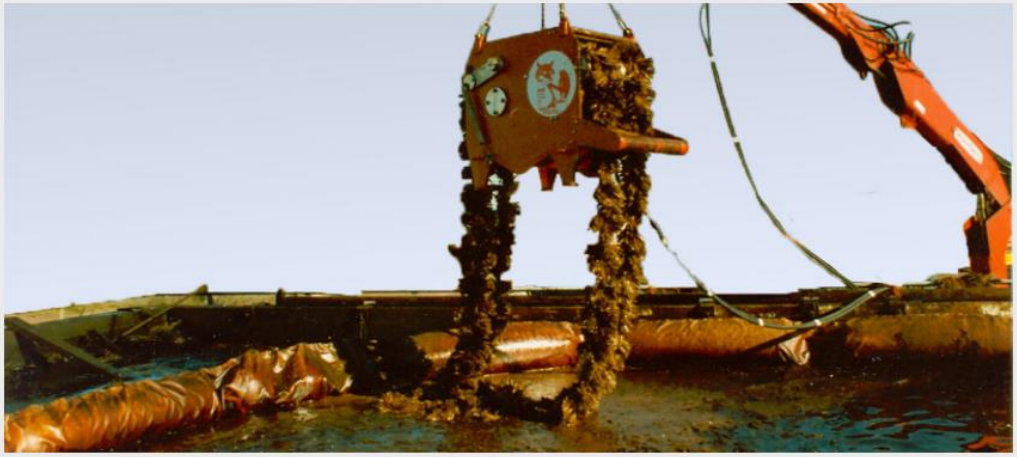
Arctic

Information

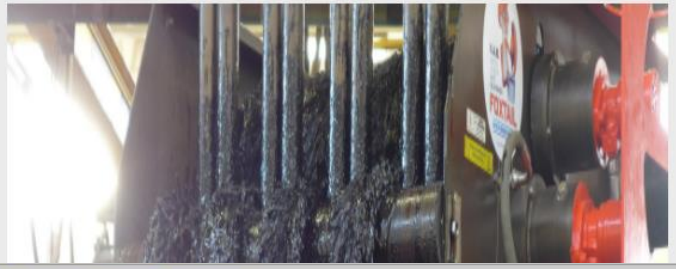
Oil Skimmers



Oil skimmers are machines that separate a liquid from another liquid, or from particles floating on it. A common application is removing oil floating on water.

FoxTail | FoxTailMini | FoxDrum | Hydraulic Power Pack

FoxTail



Vertical Adhesion Band Oil Skimmer

The V.A.B. FOXTAIL OIL SKIMMER was developed and tested at the Norwegian Pollution Control Authority (NPCA) base in Horten, Norway. Since 1984 several units have been in service in the North Sea on board specialized oil recovery vessels operated by the Norwegian Pollution Control Authority. Not only is the V.A.B. FOXTAIL OIL SKIMMER capable of recovering large quantities of oil, but it performs equally well also in rough sea. This can be seen from the illustration on the following pages. Patent Pending.

Re-project on the Fly

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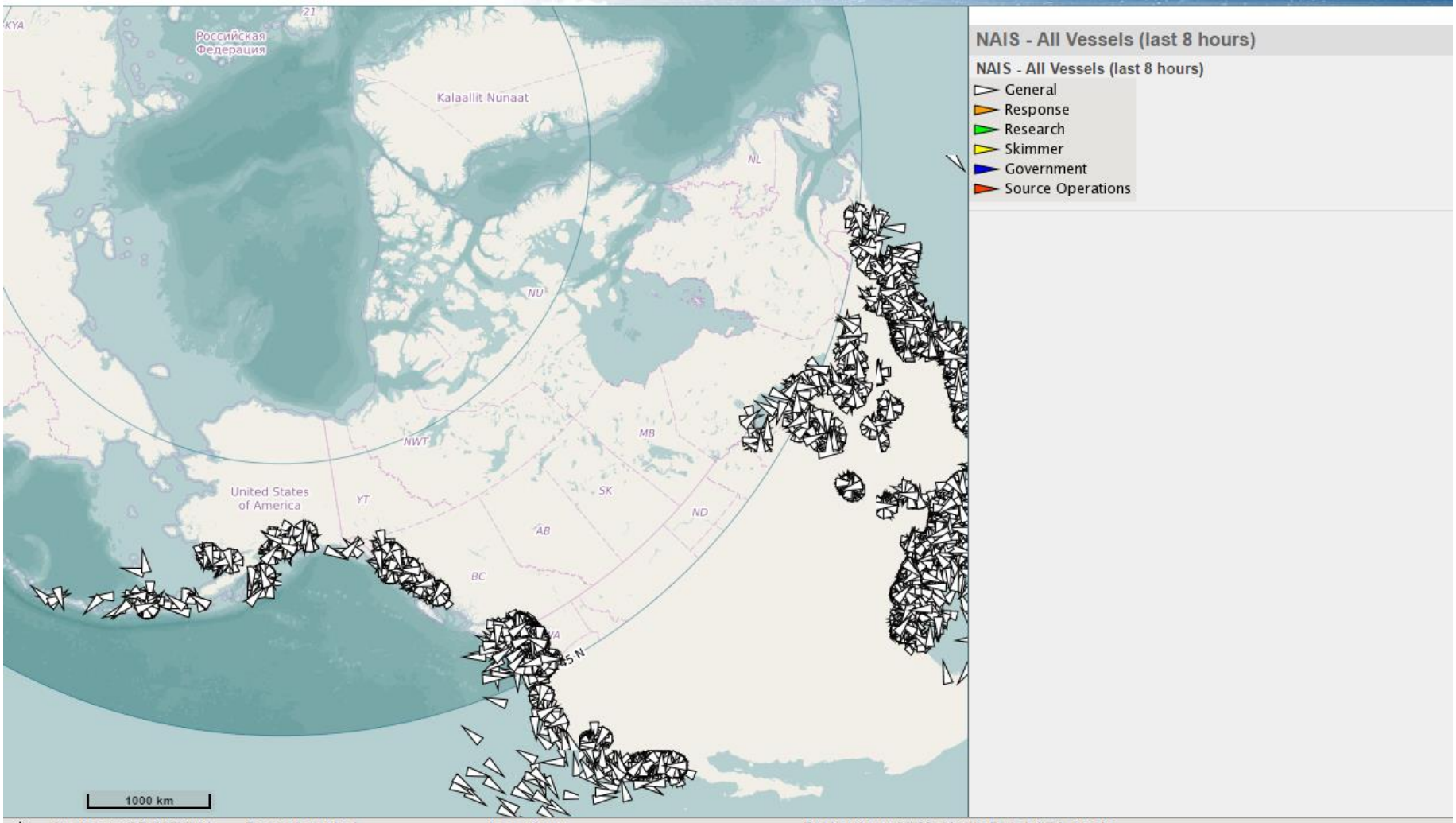
Arctic



N Scale: 1 : 27,627,844 Zoom Level: 4 Location: Projection: 3572: North Pole LAEA Alaska

MOSPA EXERCISE

AGREEMENT ON COOPERATION ON MARINE OIL POLLUTION PREPAREDNESS AND RESPONSE (MOSPA) AFTER ACTION REPORT

EP PR
EMERGENCY PREVENTION, PREPAREDNESS AND RESPONSE

ARCTIC COUNCIL

SCENARIO

Exercise Lead: U.S. in coordination with Host Nation (Norway).

Scenario: Fully loaded tank vessel transporting crude oil and a bulk cargo vessel collide near the Traffic Separation Zone outside Vardø

Target/ Product/ Volume: Tanker/Crude & Fuel Oil/ Partial loss; approximately 25,000 m^3 of cargo and 1,000 m^3 of fuel oil discharged.

Location: In vicinity of the Traffic Separation Zone.

Regulated vessel traffic scheme/ regulated waterway.

Weather: Heavy fog

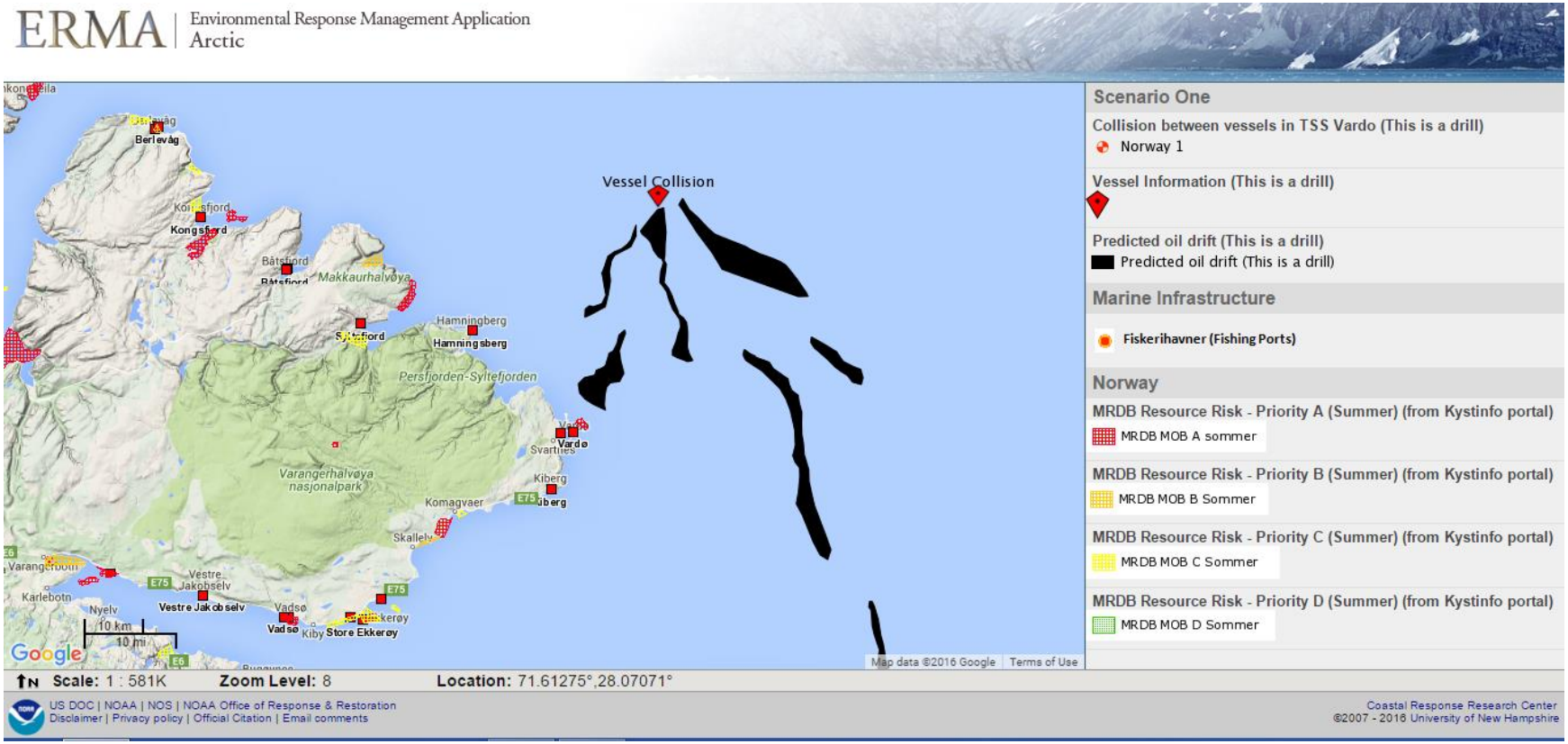
Key Impacts: Shoreline impacts w/ environmentally and culturally sensitive locations.

Request for Assistance: Desirable for at least one request.

The spill exceeds national or regional response capabilities warranting a request for assistance.

Each nation should review their internal protocols to effectively evaluate challenges and to test their process for getting approval to send assistance.

MOSPA SCENARIO



EP PR EMERGENCY PREVENTION, PREPAREDNESS AND RESPONSE

ARCTIC COUNCIL

HIGHLIGHTS

- 2nd MOSPA exercise took place in June 2016
- After Action Report (AAR) includes observations, recommendations and best practices.
- Provides recommendations for updating the Operational Guidelines.
- Marine Environmental Response Expert Group, mandated to address AAR recomendations and lessons learned. Will lead preparations for 2018 exercise.

Examples of Partnerships and Uses

- EPPR International Planning and Response
- Alaska Ocean Observing Systems (AOOS)
- UAF – Eiken – Local observations
- UAF – RiverWatch – UAS data assimilation
- UAF – Windsor – High resolution dye concentrations
- UAA – Arctic Domain Awareness Center
- WWF Russia
- USCG – Arctic Shield efforts
- Multiple drills and events

Sea Ice

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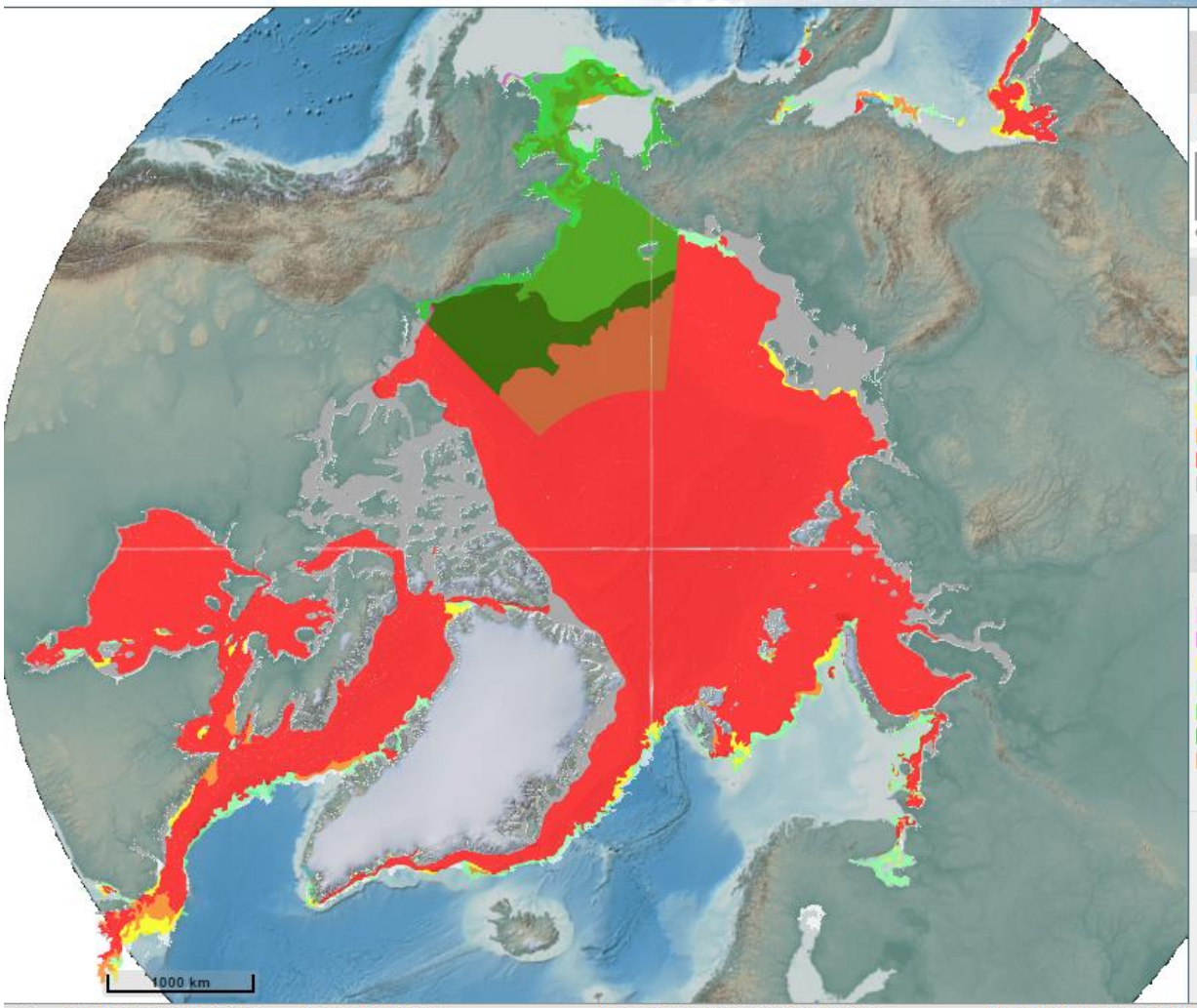
Arctic



Multisensor Analyzed Sea Ice Extent (MASIE), Northern Hemisphere, 4 km (NSIDC/NIC via AOOS)

Multisensor Analyzed Sea Ice Extent (MASIE), Northern Hemisphere, 4 km (NSIDC/NIC via AOOS)

0 0.25 0.5 0.75 1

%

Sea Ice Concentration in Tenths - Latest (NIC)

Sea Ice Concentration in Tenths - Latest (NIC)

- Ice Free
- 1-3 Tenths
- 4-6 Tenths
- 7-8 Tenths
- 9-10 Tenths
- Fast Ice

Valid Date: 2017-05-04

Ice Stage of Development - Latest (NOAA-NWS)

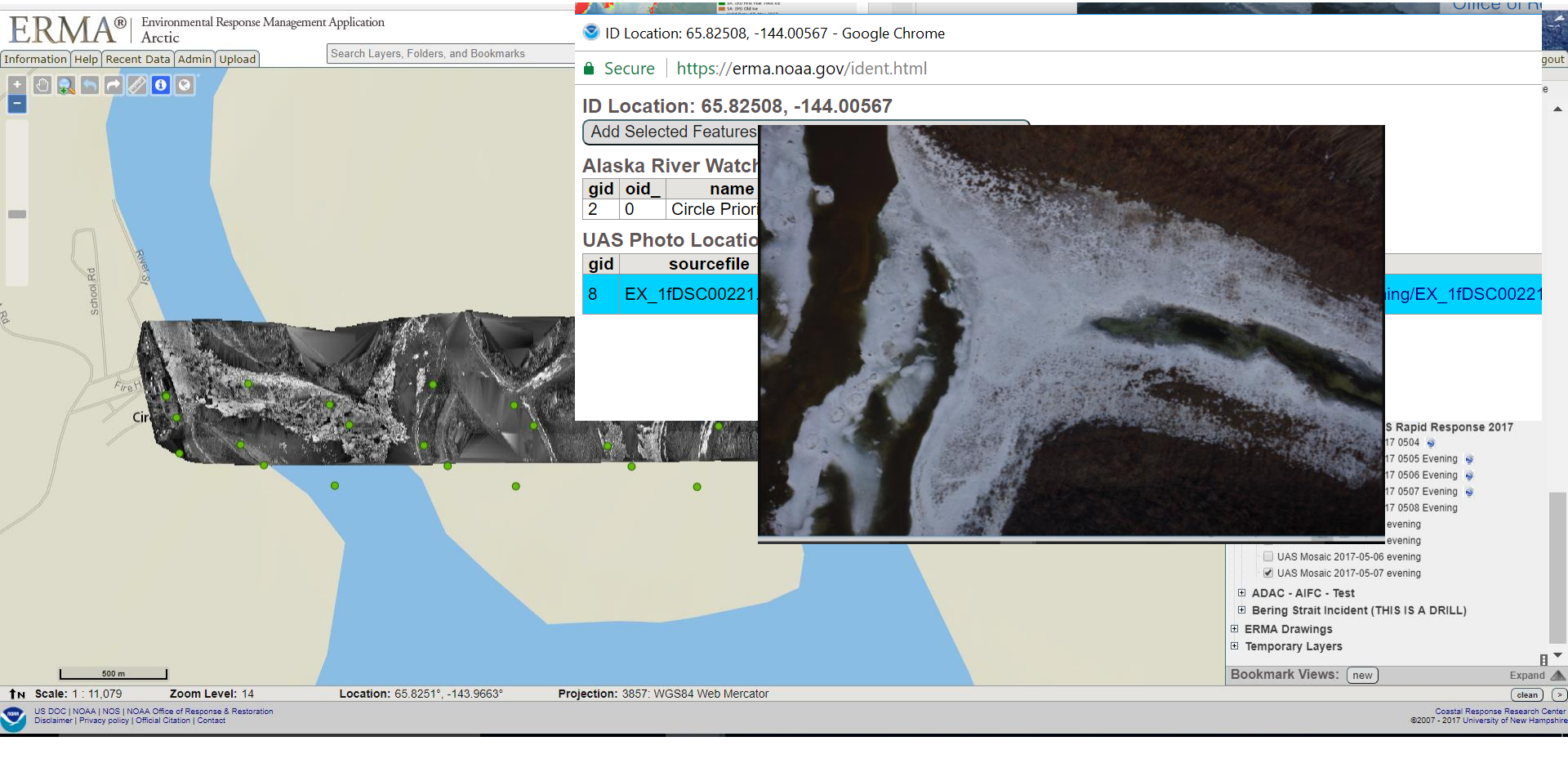
Ice Stage of Development - Latest (NOAA-NWS)

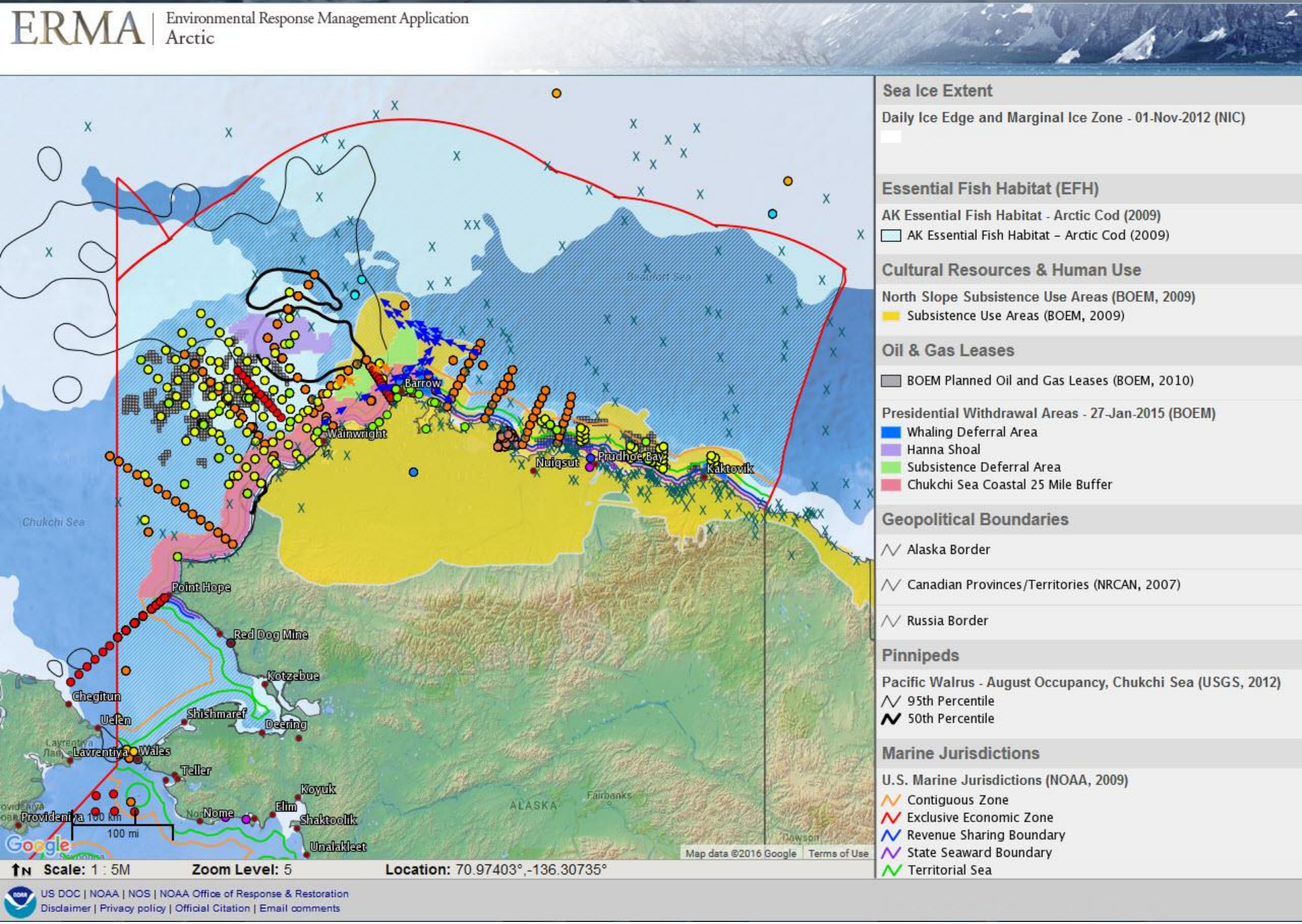
- SA: (81) New Ice
- SA: (83) Young Ice
- SA: (86) First Year Ice
- SA: (87) First Year Thin Ice
- SA: (91) First Year Medium Ice
- SA: (93) First Year Thick Ice
- SA: (95) Old Ice

Valid Date: 07-May-2017

↑N **Scale:** 1 : 55,396,736 **Zoom Level:** 3 **Location:** 55.3580°, 69.5365° **Projection:** 3995: Arctic Polar

River Watch 2017 – National Weather Service & University of AK - Fairbanks





Similar to Figure 1: Lovecraft *et al.*, AOS 2016

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Geopolitical Boundaries

- Alaska Border
- U.S. States and Provinces Boundaries
- Canadian Provinces/Territories (NRCAN, 2007)
- Russia Border

Marine Infrastructure

- Ports and Communities (PAME, 2009)

September 09 2015

ARCTREX2015 20150909T082023

- ARCTREX2015 20150909T082023
- 10
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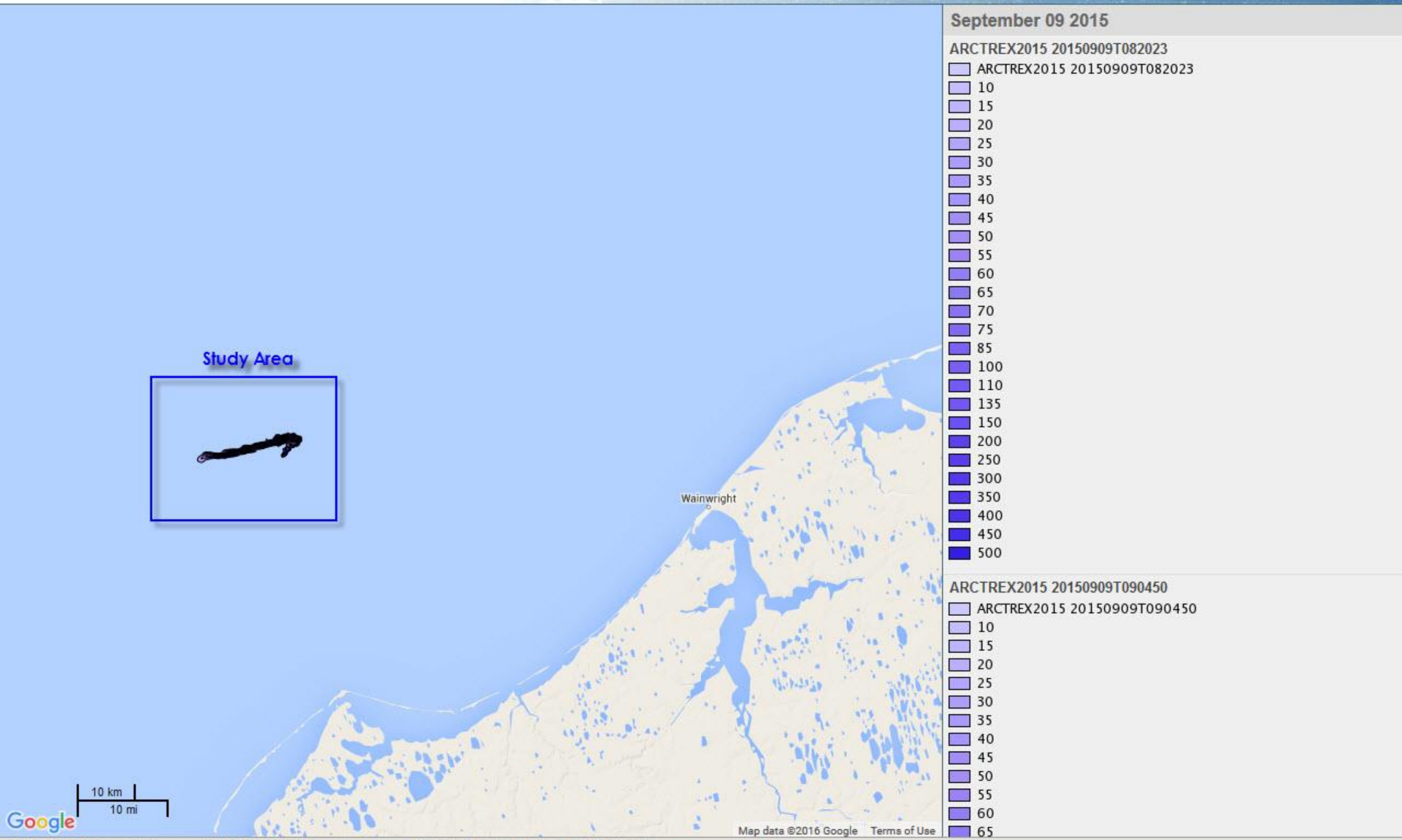
- 500

ERMA | Environmental Response Management Application Arctic



September 09 2015

ARCTREX2015 20150909T082023
- ARCTREX2015 20150909T082023
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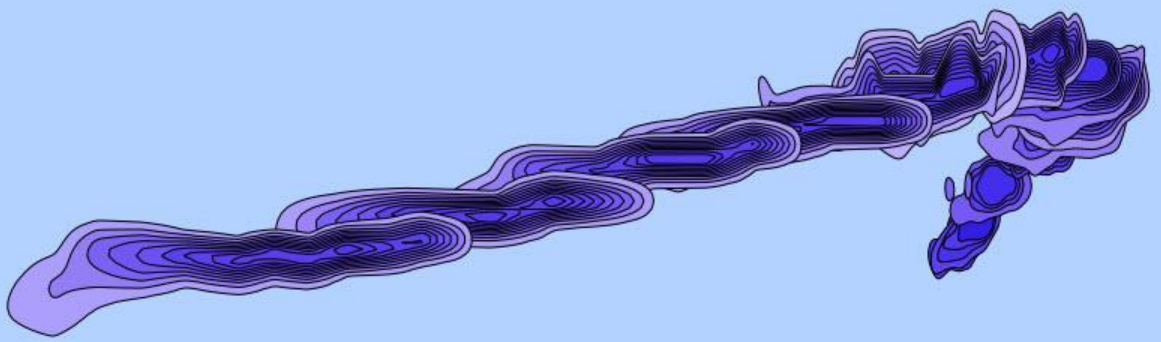
- 65

N **Scale:** 1 : 572K **Zoom Level:** 8 **Location:** 70.83205°,-160.43059°

ERMA | Environmental Response Management Application Arctic



September 09 2015

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- ARCTREX2015 20150909T082023
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ARCTREX2015 20150909T090450

- ARCTREX2015 20150909T090450
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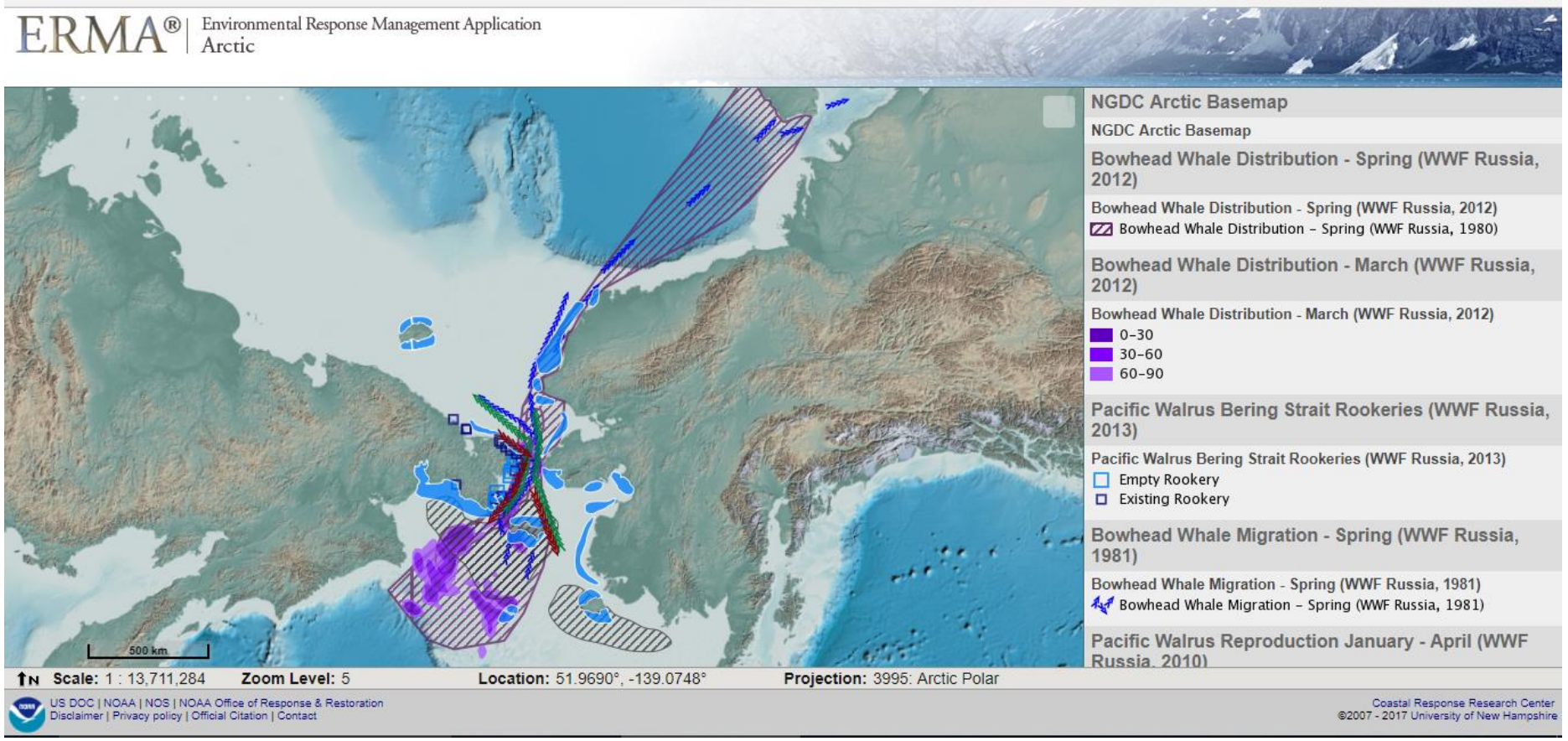
- 60
- 65

N **Scale:** 1 : 72K **Zoom Level:** 11 **Location:** 70.81242°,-162.46786°

Example: WWF-Russian Data



Areas of Collaboration

- Incorporating scientific/observing networks into exercise planning and response
- Identify priority data and products; develop work flows
- Identify research projects/assets to reorient for disaster response
- Optimize and automate electronic data capture, data volumes, and data management
- Optimize interoperability among systems; federated systems
- Link to broader disaster mitigation frameworks

Acknowledgments

- NOAA:
  - Amy Merten
  - Michele Jacobi
  - George Graettinger
  - Ben Shorr
  - Robb Wright
- Genwest Systems, Inc.:
  - Jill Bodnar
  - Michael Greer
  - JB Huyett
  - Zach Winters-Staszak
  - Rachel Fox
- I.M. Systems Group/Freestone:
  - Jay Coady
  - Nicolas Eckhardt
  - Matt Dorsey
- Development Team:
  - Aaron Racicot, Z-Pulley
  - Chander Ganesan, OTG
  - Robert St. Lawrence, UNH
  - Martin Ledoux, UNH

Funding Sources: Coastal Response Research Center, **US EPA Region II, Bureau of Safety and Environmental Enforcement**, U.S. Coast Guard, NOAA's Office of Response and Restoration and Coastal Storms Program, Oil Spill Recovery Institute,

Please Visit Our ERMA Regional Sites

Response.restoration.noaa.gov/ERMA