



# CRYOSPHERE

Products in Joint Proving Ground

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Chief ESSD NWS/ARH

Thursday, May 10, 2012



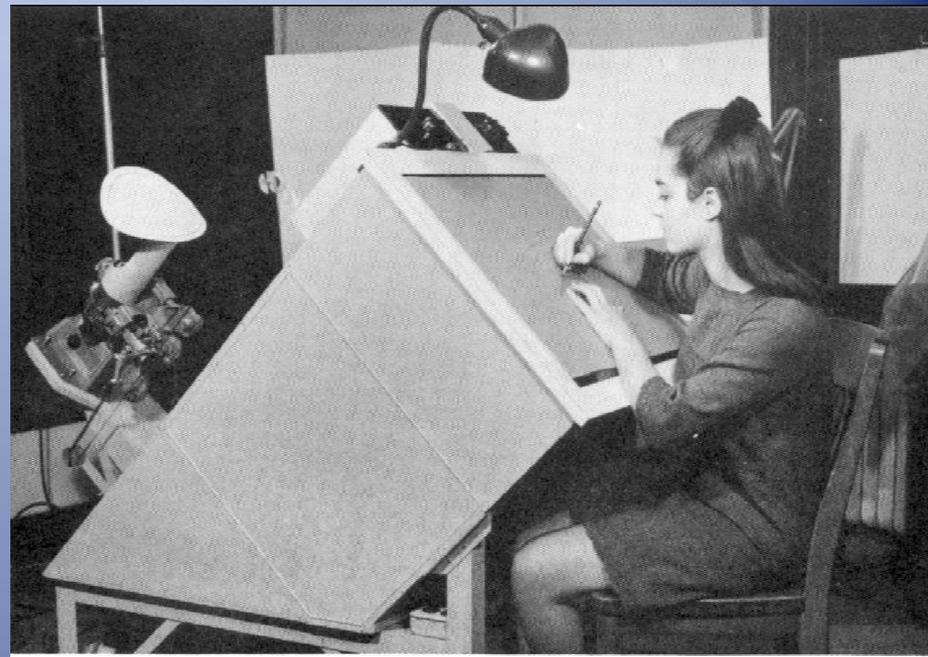
# Outline

- Products
- Alaska's Challenges
- Weather Events
- Needs and Why It's Important



# PRODUCTS

- Ice Cover
- Sea and Lake Ice: Age
- Sea and Lake Ice: Concentration
- Sea and Lake Ice: Motion
- Snow Depth (Over Plains)
- Snow Cover
- River Ice (Monitor/Detect)
- Surface Temperature and Moisture (Permafrost)
- Glaciers (Temp/Extent) (Climate)
- \* Sea Surface Temperature



# Alaska's Environmental Challenges

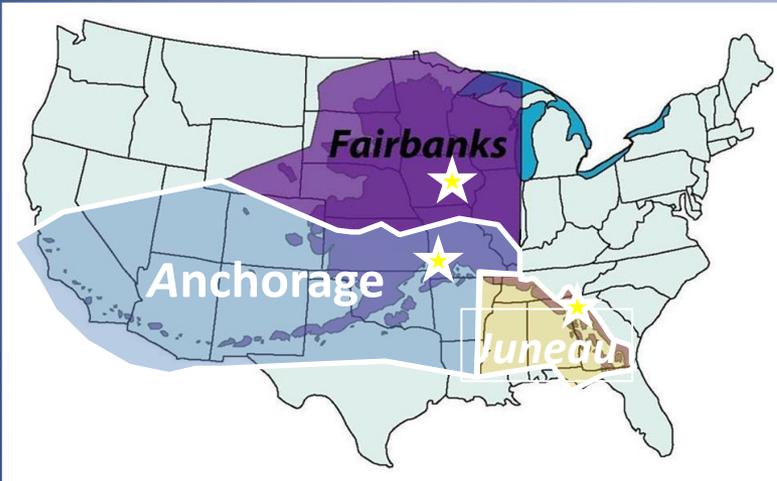
- High Wind
- Ice Storms
- Volcanic Ash
- High Wind and Open Water
- Extreme Cold and High Pressure
- Blizzards
- Heavy Snow
- Space Weather
- Tsunami
- Flooding
  - Ice Jam
  - Coastal Storm Surge
  - Coastal Erosion
- Wild Fire
- Sea Ice
  - Resupply
  - Access
- HAZMAT...on ice...below zero...protected, sensitive ecosystems
- Gloom of Night

# Alaska's Environmental Challenges

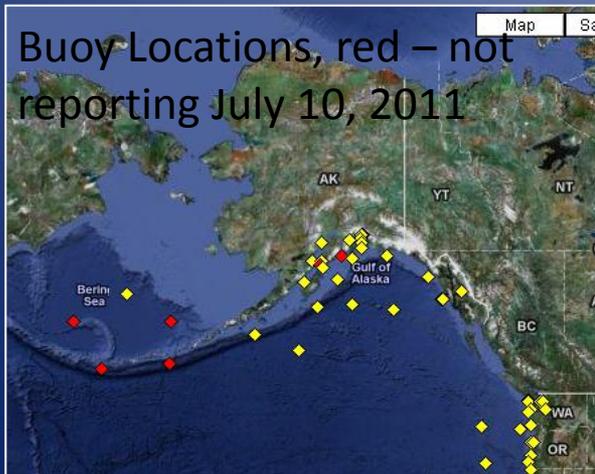
## Long Term Trend

- Open Water in Arctic
- More frequent and heavier snow events in the Arctic Northwest
- Exposed Shoreline
  - Increased coastal erosion
- Interior Snow Pack
  - Later snow fall and freeze up -  
- that is problem
  - Impacts traditional modes of winter transportation
- Permafrost Melting
  - Structural integrity issues
  - shifting

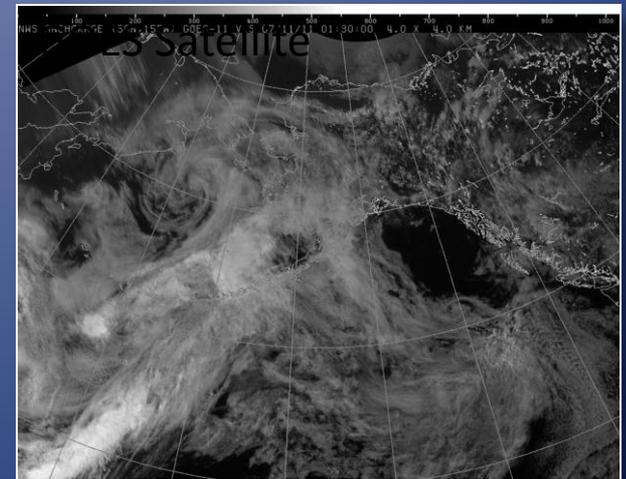
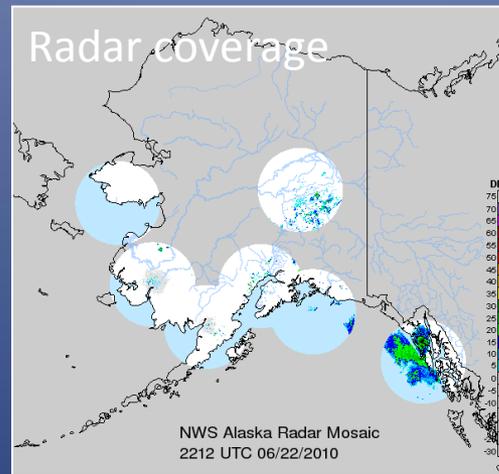
# Alaska's Unique Environmental Challenges



- Very large state with much lower density of observations than CONUS
  - Small percentage of radar coverage
  - Geostationary Satellite data has poor viewing angle in north and west Alaska
  - Remoteness and weather severity makes maintenance of equipment difficult

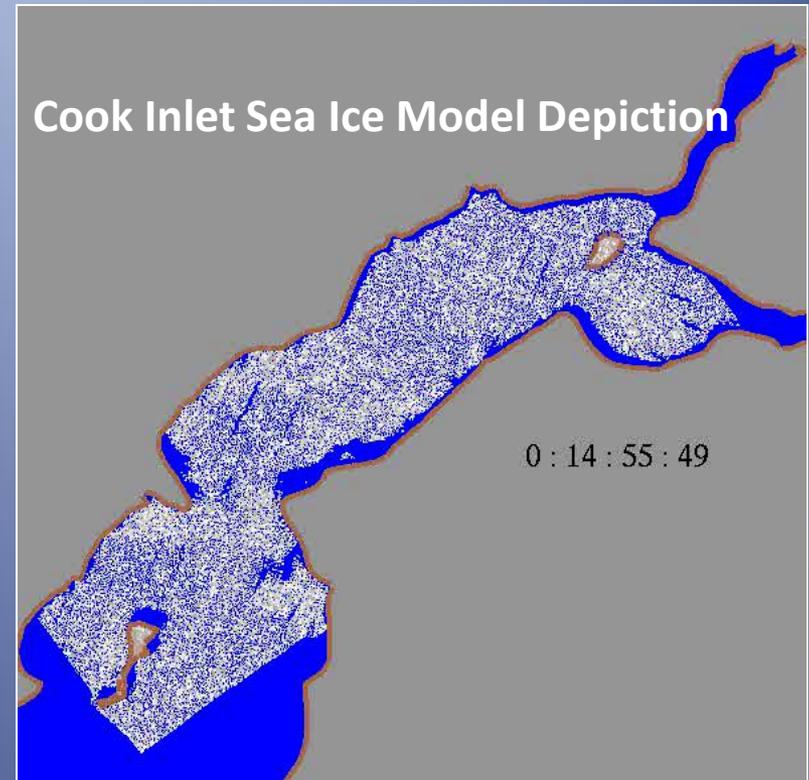


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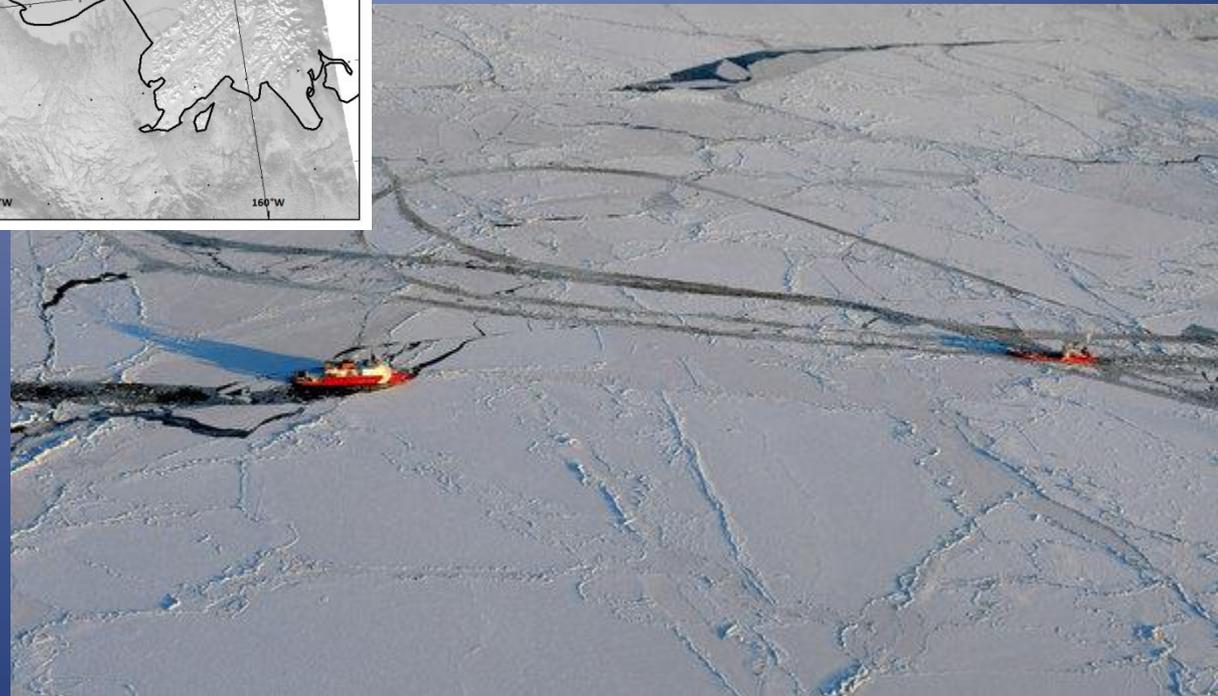
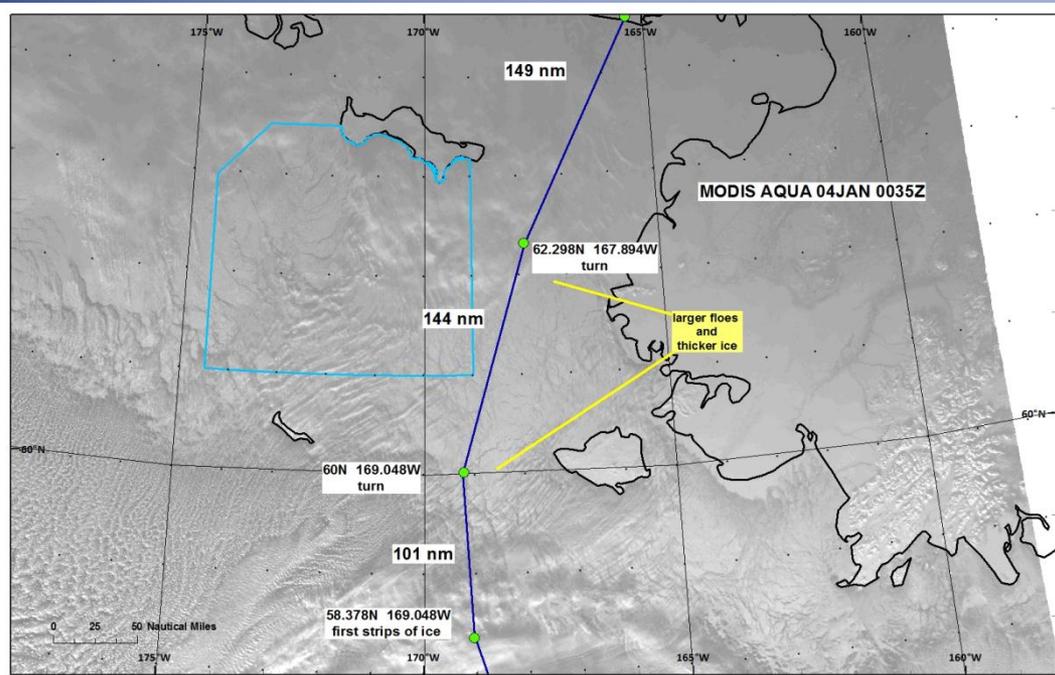
# Challenges - Sea Ice and Tides



- Sea ice combined with strong tides (over 30 feet) can challenge ships coming into Anchorage
- Frequent winter cloud cover and long nights make for very difficult analysis of sea ice In Cook Inlet

# Challenges – Sea Ice

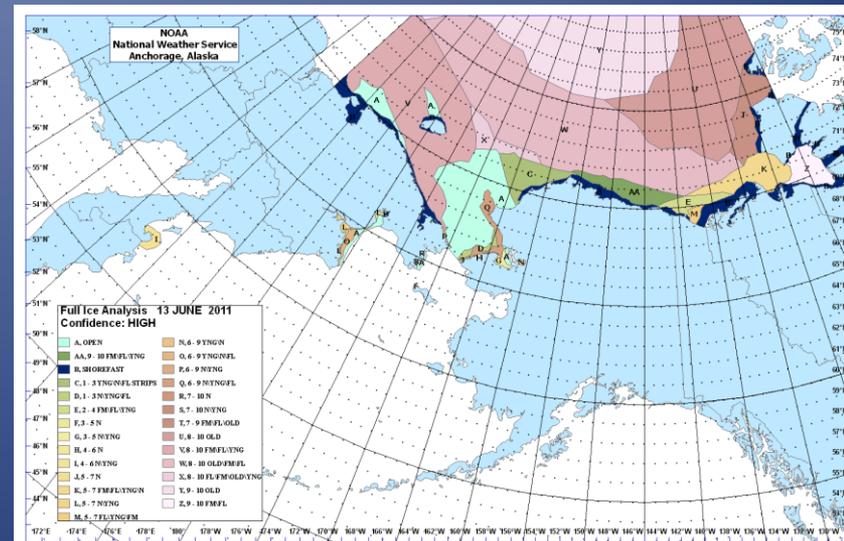
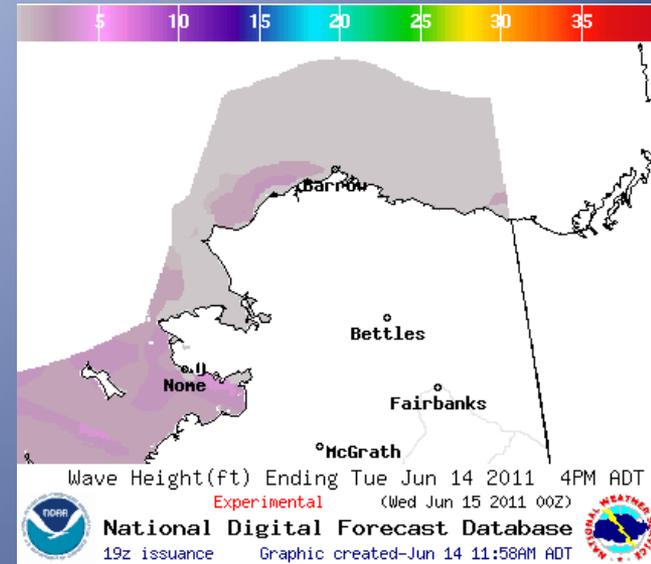
Nome Fuel Resupply December 2011-January 2012



# Alaska Sea Ice Program

## Sea Ice Services

- Sea Ice Analysis and Outlook
- Decision Support Services (DSS)
  - Spot support for Search & Rescue (SAR)
  - Hazardous Material Release (HAZMAT)
- Direct contact with mariners for delivery of critical information and collection of volunteer observations
- Integrated in the marine forecast and warning services for the Bering, Chukchi and Beaufort Seas



# Challenges - Freezing Spray



# Challenges - Arctic Oil, Gas and Mineral Development



- \$2.67B - Chukchi Leases
  - 12 billion barrels of oil
  - 54 trillion cubic feet of natural gas
- Red Dog Mine
  - One of the world's largest zinc mine



# Challenges - Permafrost



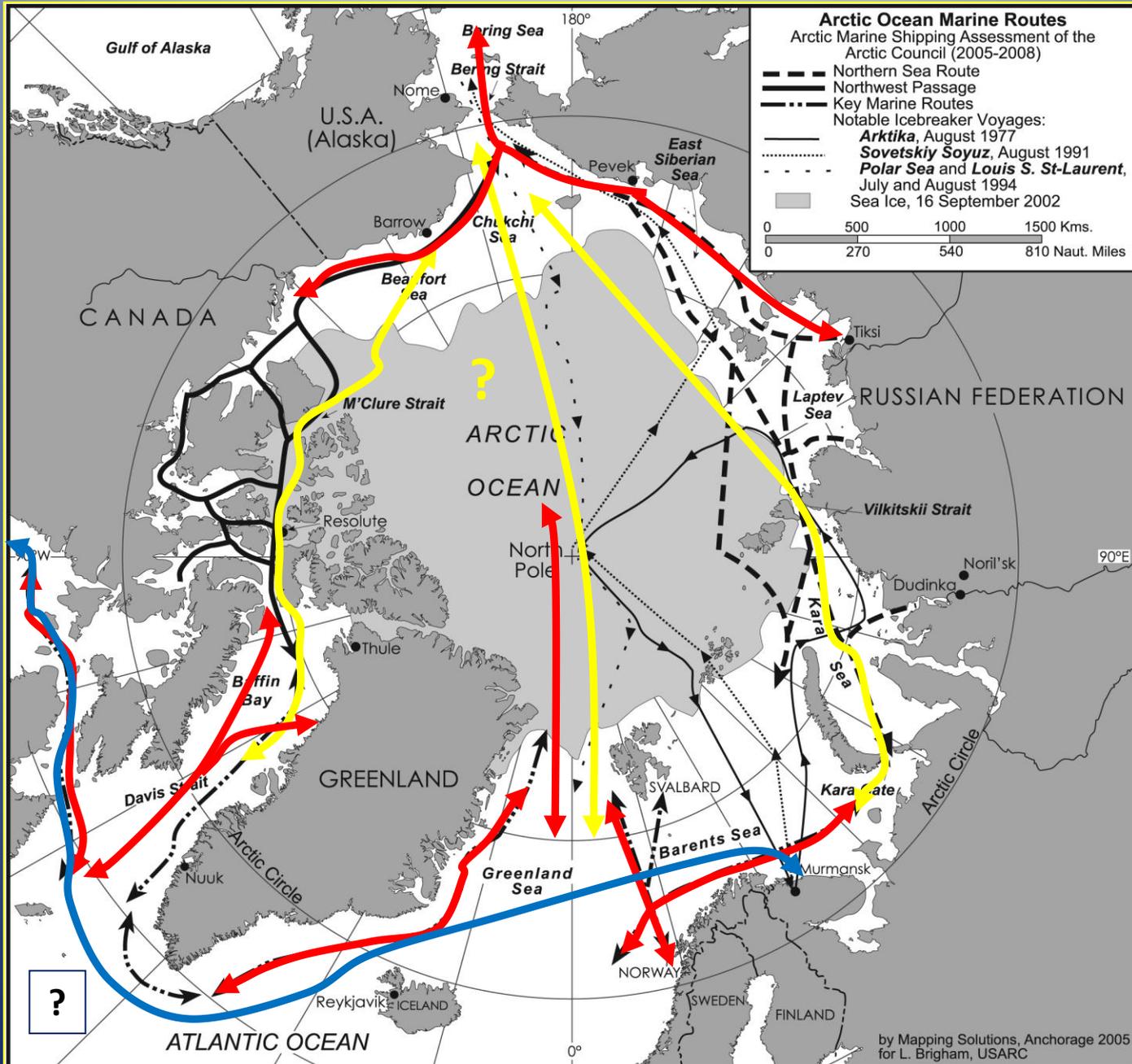
# Challenges - Snow Depth

What 368" of snowfall in a season looks like



May 10, 2012

# Challenges - Arctic Marine Transport Modes



Churchill  
to  
Murmansk  
Route

# Challenges – River Ice/Flood



# Challenges- SAR and HAZMAT



Cutting up hatch cover #3 at low tide



# Challenges - Ecosystem

## Conceptual Model of Arctic Oil Spill Exposure and Injuries (theoretical)

**Wetlands, low coastal tundra, lagoons:**  
Provide refuge, nesting, and spawning areas. Highly productive.

**OIL IMPACT**  
Oiled, degraded or eroding habitat reduces productivity.

**Pelagic Zone**  
Productive area for food web.

**OIL IMPACT**  
Surface and dispersed oil affects food web. Fish eggs and larvae are especially sensitive.

**Benthos**  
Can be highly productive, important in cycling nutrients.

**OIL IMPACT**  
Oil in sediments reduces productivity and affects food web.

### Top Predators

Marine mammal and bird populations are of global significance.

### OIL IMPACT

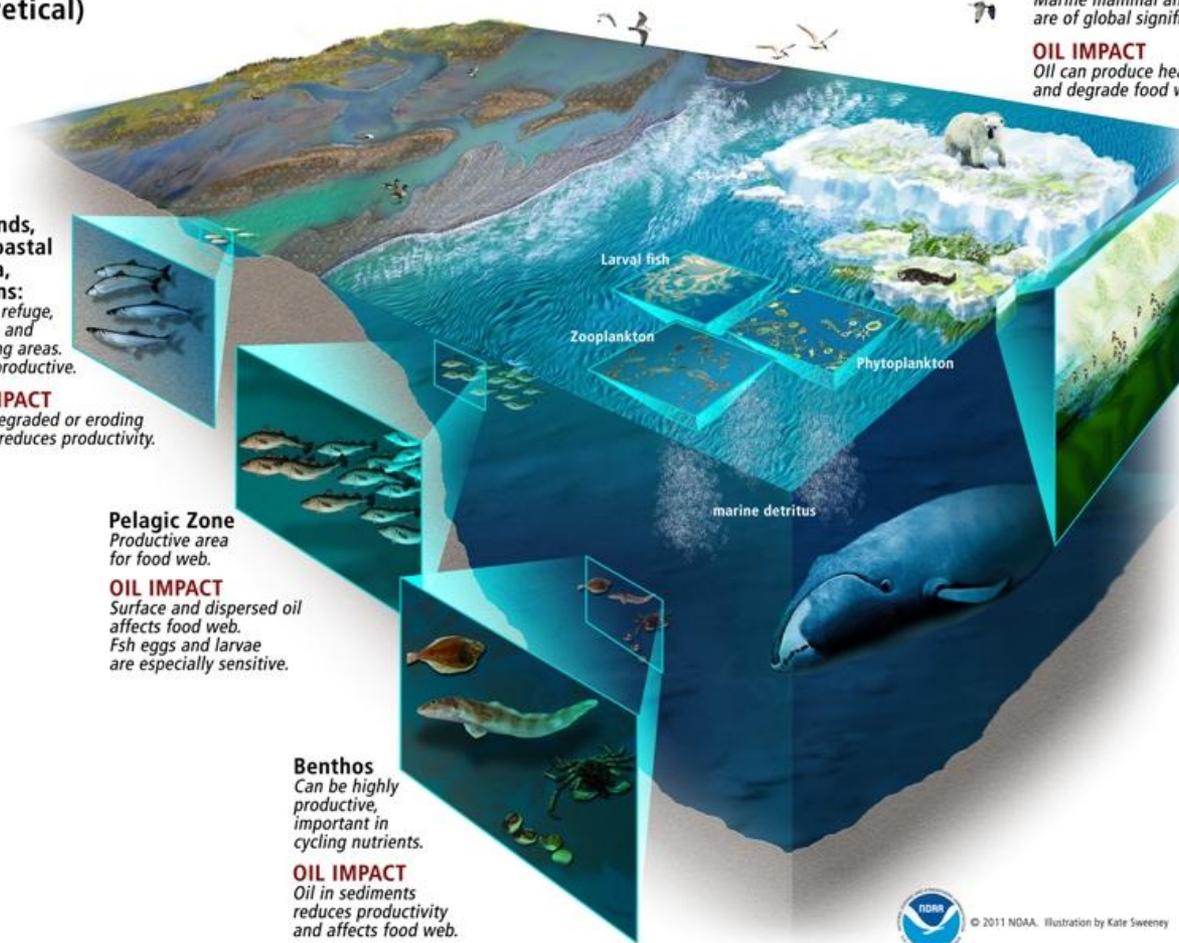
Oil can produce health effects and degrade food web.

### Ice Habitat

Seasonally important source of production, habitat for marine mammals.

### OIL IMPACT

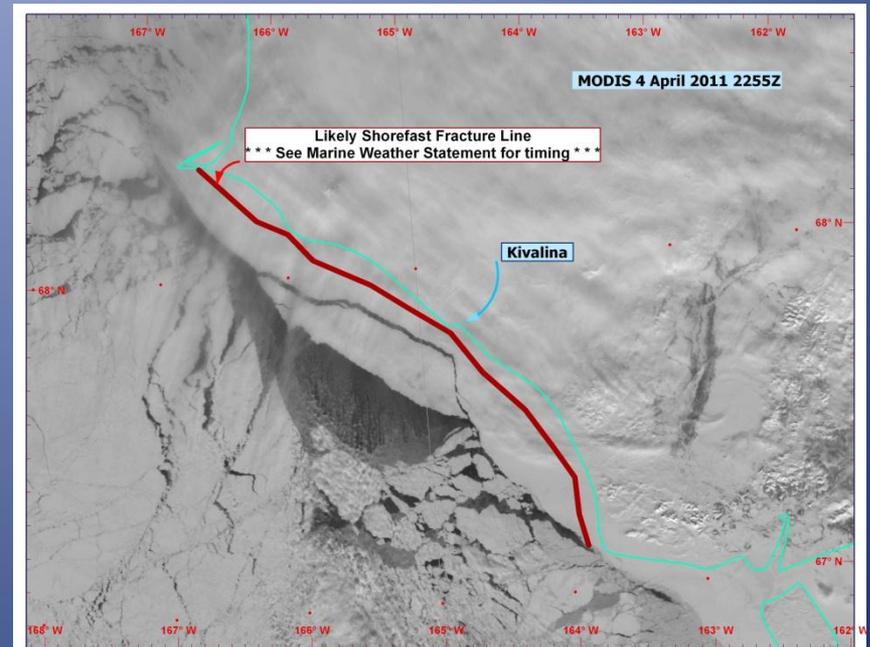
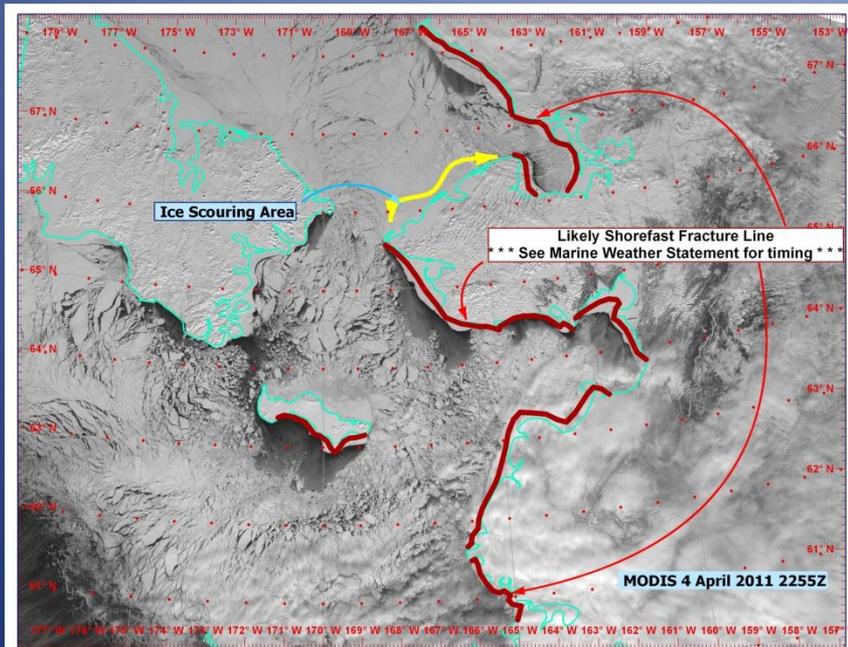
Sensitivity to oiling is poorly studied.



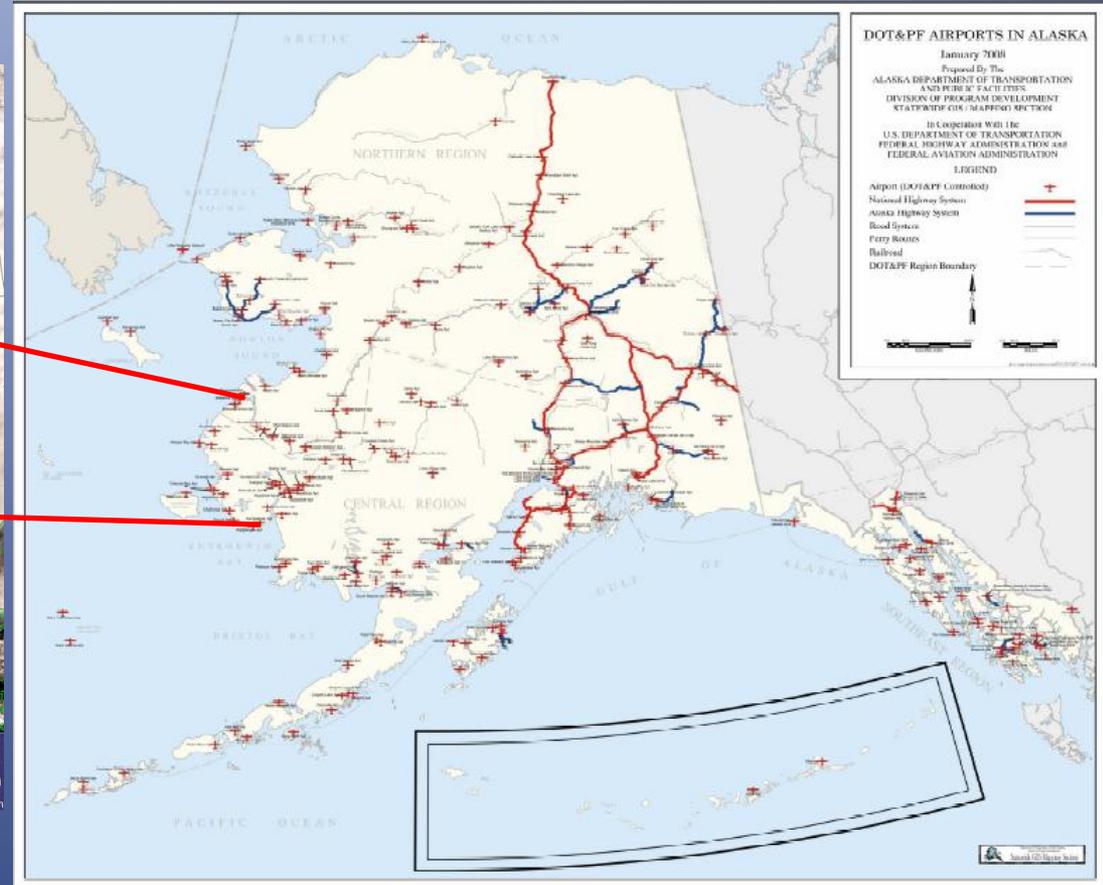
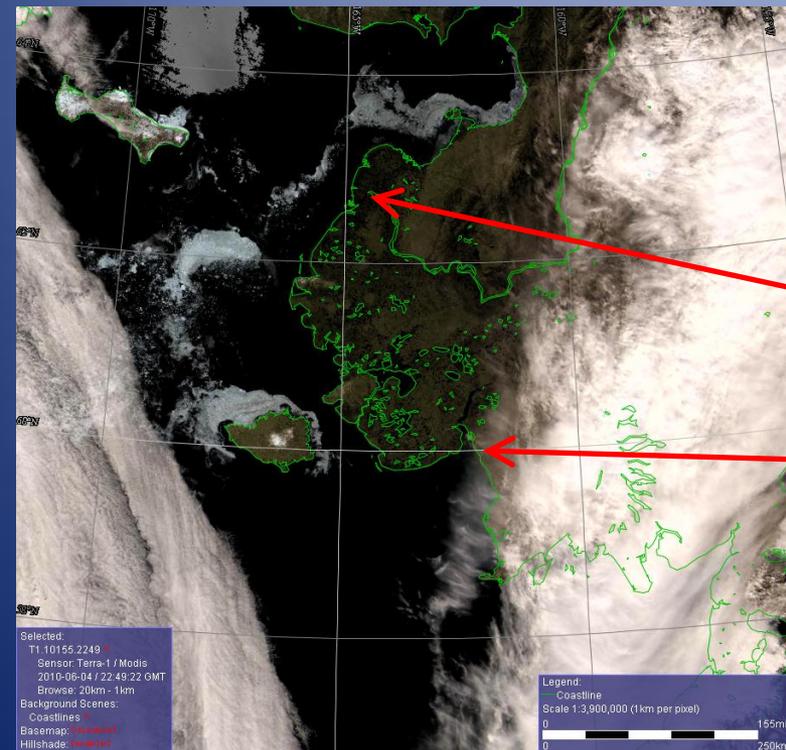
Weather events  
Sept 2010 to June 2011

# Shorefast Ice Fractures (Awareness)

## April 4<sup>th</sup> 2011 (DSS)



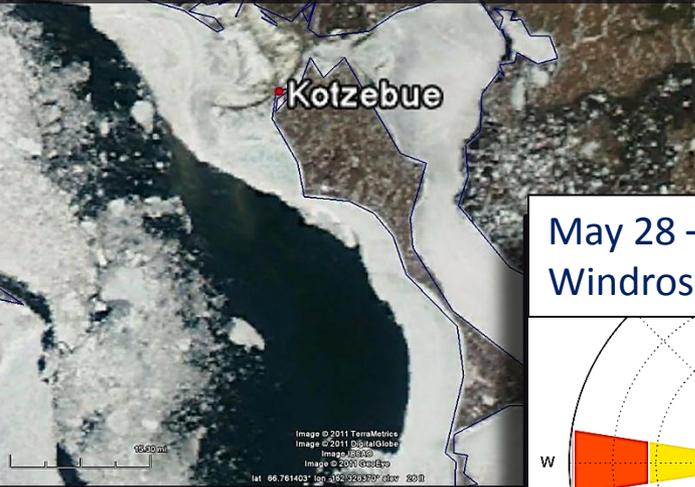
# Resupply to the Alaska Interior (DSS)



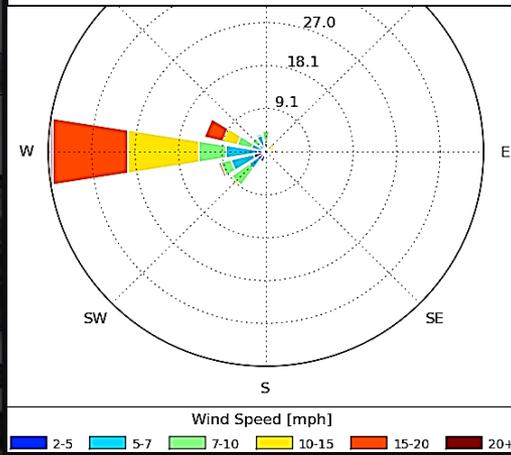
Supply Chain Management - Fuel and food for rural Alaska

# Sea Ice Damage Kotzebue May 2011

May 27, 2011 - Shorefast locked in place



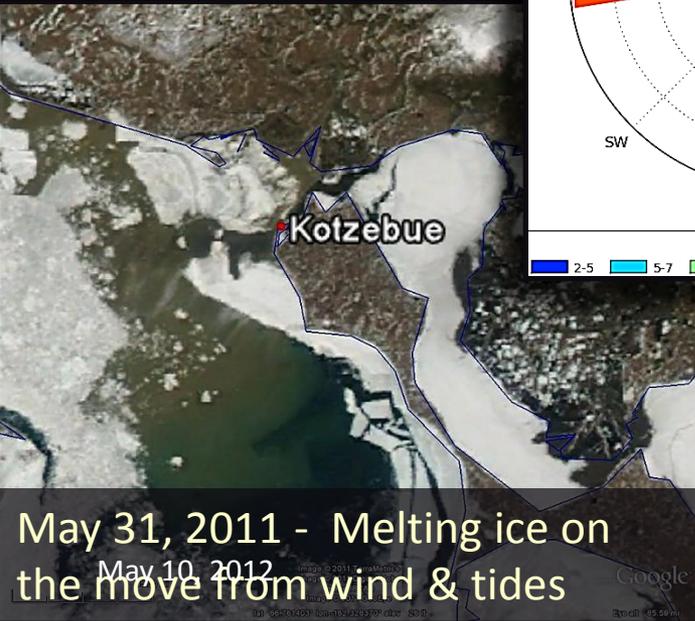
May 28 – Jun 2, 2011  
Windrose Kotzebue, AK



Ice Breakup in Kotzebue can turn damaging when winds combined with high tide push ice onshore

Damage can occur with normal tides and west or northwest winds of 10 to 20 mph.

Similar threats across the Arctic



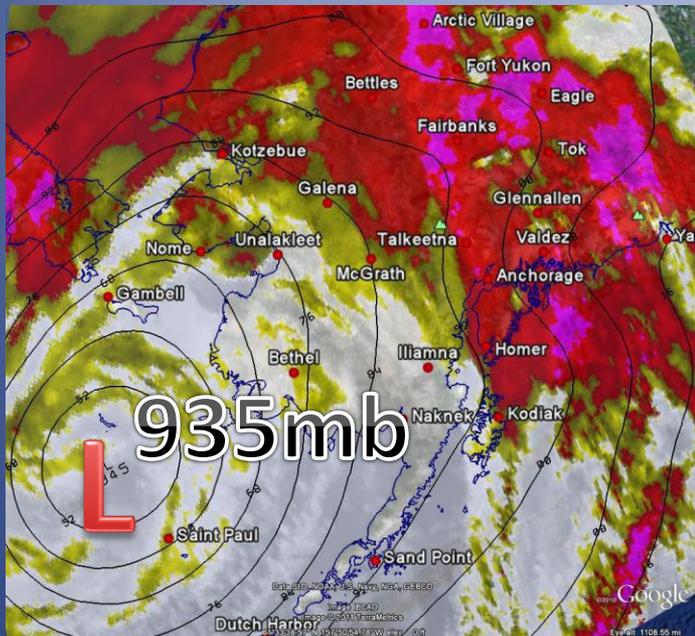
May 31, 2011 - Melting ice on the move from wind & tides



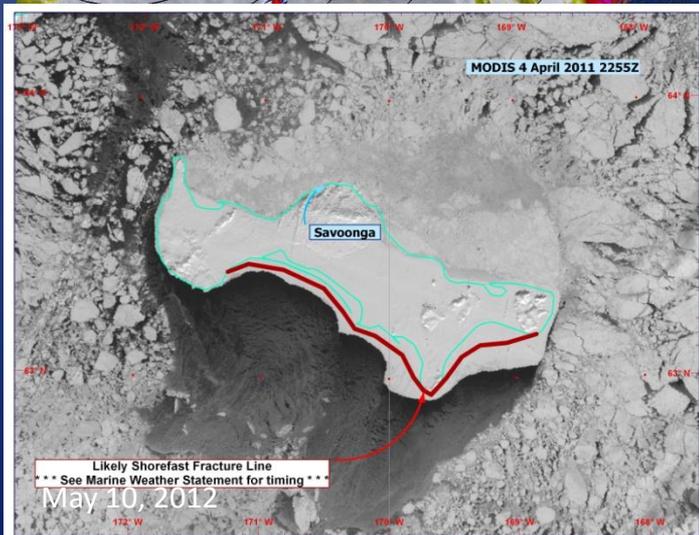
May 30, 2011 - Sea ice damages structures in Kotzebue, AK

# April 6-7, 2011

## Category 2 to 3 hurricane force storm



- Wind Damage from Saint Paul and Unalaska to Anchorage with areas of power outages
- Air and Marine traffic severely limited across the western half of the state due to strong winds, high seas, visibility and turbulence.
  - Including large cargo vessels seeking shelter in Unalaska
  - Kotzebue transportation completely shut down
  - Nome had no incoming or outgoing flights



- Temporary subsistence hunting camps on shorefast ice were moved inland due to expected changes in sea ice

# Erosion at Shishmaref

Before...



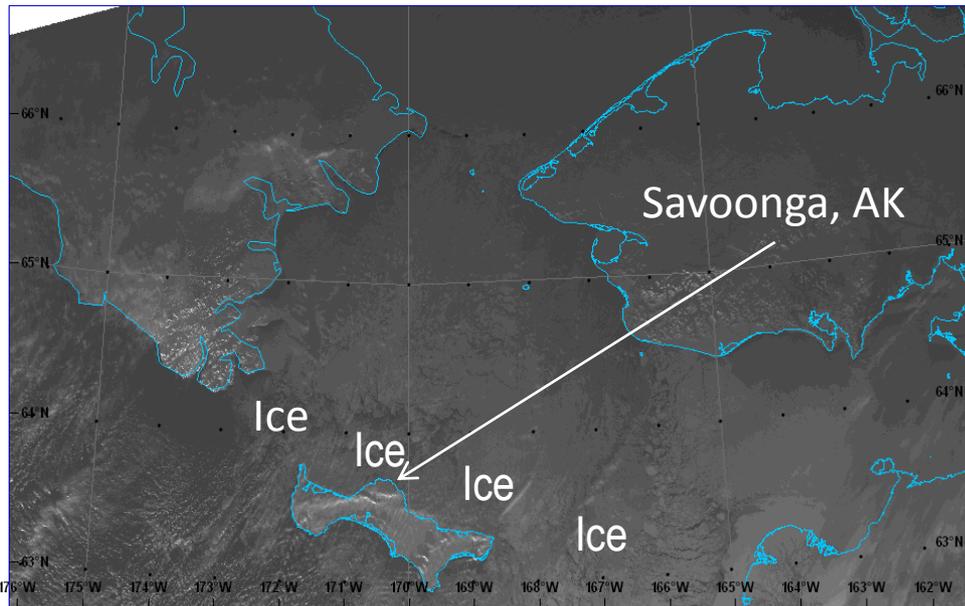
...After



# Power Outage Savoonga, AK

## Dec 26 2010 to Jan 3, 2011

- Intermittent power outage for 6 days
- Temperatures ranging from 5F to -10F with 30-50 mph winds
- Nearly  $\frac{3}{4}$  of residents lost power
- 25-30 homes experienced bursting pipes and flooding
- At least 20% of the 700 village residents sought refuge in the school (on generator)
- Weather hindered the ability to send in food, plumbing supplies, and repairmen



MODIS AQUA 29 DECEMBER 2010 0005Z

**“The extreme cold caused the salt spray to freeze on electrical equipment. Initial outages were caused by line slap from iced-up conductors, but later problems were caused by electrical arcing through conductive salt. We are concluding that the lack of sea ice was a major contributor to this situation.”**

*-Meera Kohler, Alaska Village Electric Cooperative*

# What Do We Need? (Why Should you Care?)

- Full of Characterization of Cryosphere (products), including GOES-R where it makes sense
- Decision Support tools utilizing integrated products/observations
- Fully coupled Atmosphere-Ocean-Ice Modeling Capability
- Poorly characterized sea ice: impacts BL energy balance; impacts BL momentum fluxes.
- Impacts storm track and intensity
- Supply Chain Management (Oil transport, Unimak Pass, ANC)

# Any Questions?

