The Science and Technology Center (STC) for Oil Spill Prevention and Preparedness in the Arctic

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UNIVERSITY OF ALASKA FAIRBANKS

Deepwater Horizon: 20 April 2010

- *Deepwater Horizon* exploded and sank in the Gulf of Mexico with 11 souls on board
- The resulting well gusher flowed for nearly 4 months and resulted in one of the largest manmade oil spills ever on Earth

Recommendations from the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling

1. A comprehensive federal research effort to provide a **foundation of scientific information on the Arctic**, with periodic review by the National Academy of Sciences.
2. **A comprehensive research program** to address oil spill containment and response issues in the Arctic should be developed and the resulting analysis should inform when and where leasing will occur.
3. The Department of the Interior should ensure that the containment and response plans proposed by industry are adequate for each stage of development and that the **underlying financial and technical capabilities have been satisfactorily demonstrated in the Arctic**.

The Science and Technology Center (STC) for Oil Spill Prevention and Preparedness in the Arctic

Wise decision-making concerning Arctic oil spill response and prevention by working to fill gaps in knowledge needed by agencies, industry, oil-spill responders, and the public.

Focus on the preparedness, prevention, response, monitoring, and mitigation of marine oil spills in the Arctic.

The Science and Technology Center will:

- identify knowledge gaps through stakeholders and subject experts.
- sponsor fundamental research in science relevant to the Arctic environment.
- sponsor applied research with joint funding from industry as well as state and federal agencies.
- administer fellowships and grants related to education in Arctic science and technology.
- transfer knowledge gained via workshops, meetings, literature, training, and electronic media.
- create feedback mechanisms to continuously identify knowledge gaps and evaluate efficacy of results.

Improving Environmental Security & Oil-Spill Response Through an Integrated Coastal Observing System

*Remote sensing** (km-scale): Coastal environments & infrastructure, ice hazards

*Coastal radar** (sub-km scale): Vessel & ice tracking, ice dynamics & potential disaster response

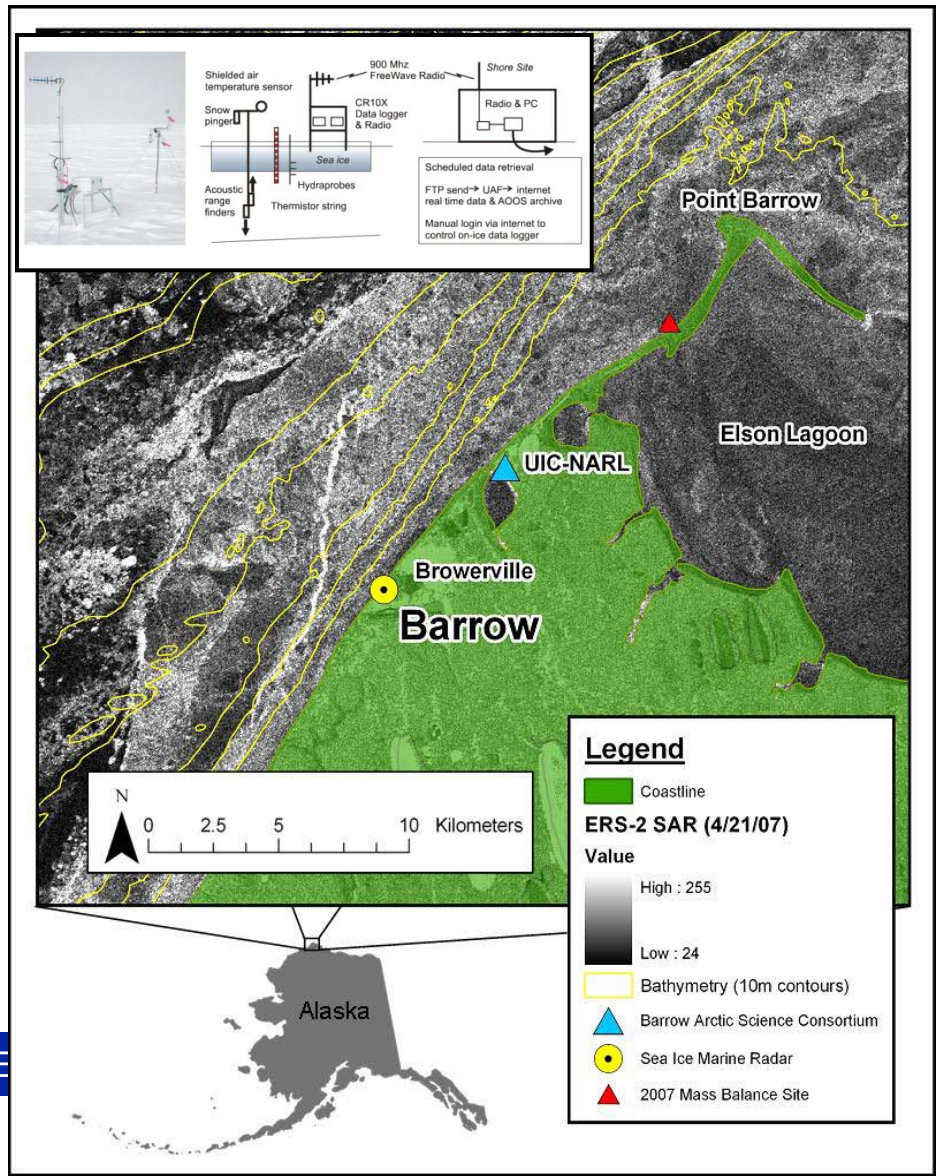
*Aerial surveys (including UAVs), ice & sub-ice sensor systems**

*Local knowledge**: Potentially important role for disaster response

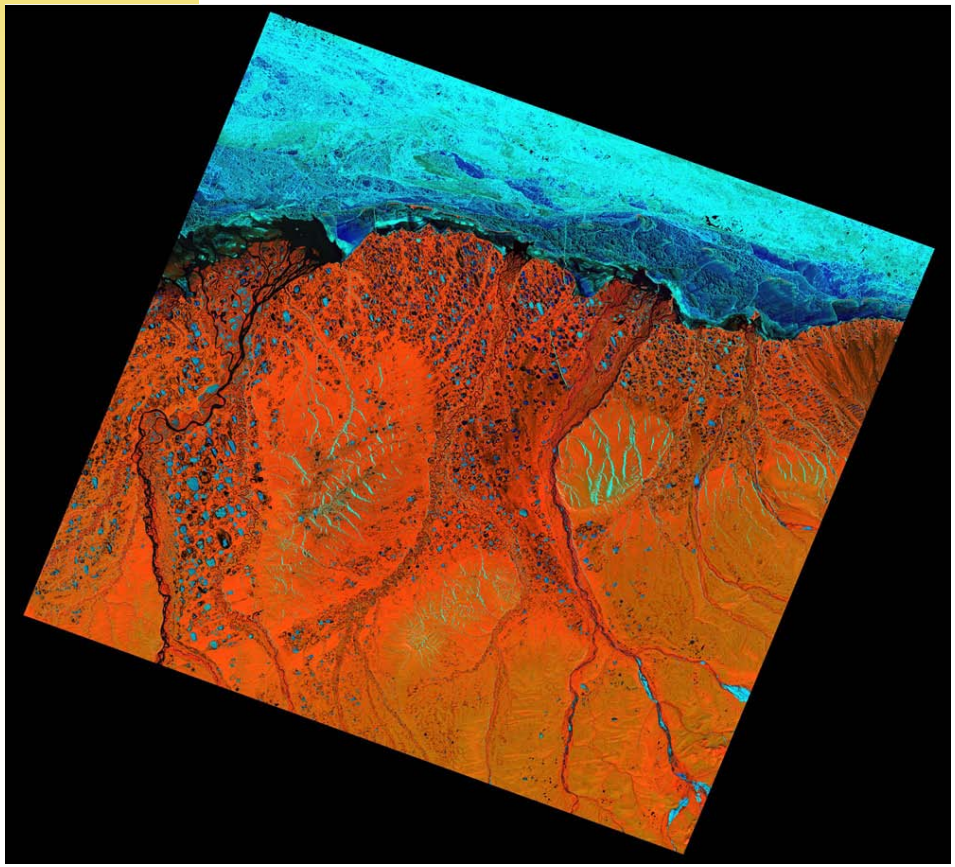
Integration of data streams, GIS-based decision support systems

* Leveraged through integration & assimilation of existing coastal observing system resources supported by NSF, DHS, and NOAA

Eicken, Petrich, Mahoney, et al.; www.sizonet.org



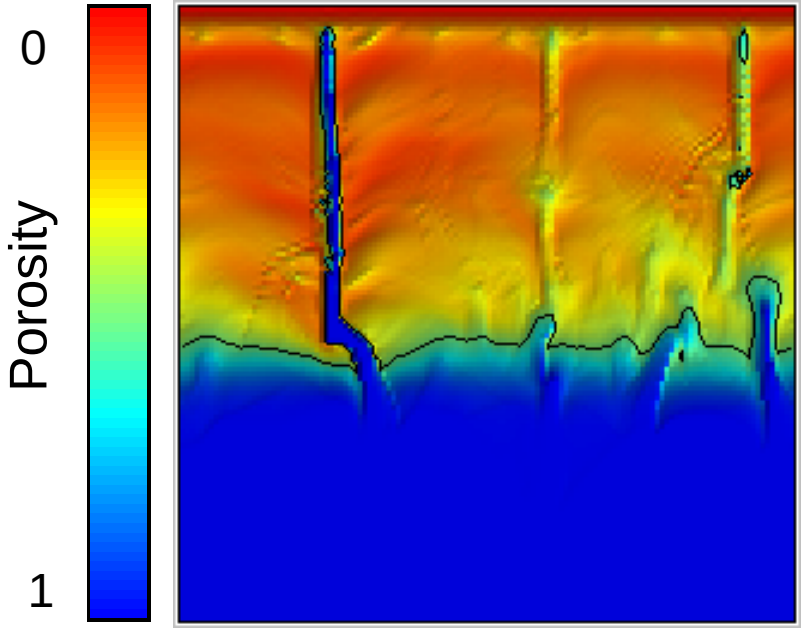
Real-time reception and processing of high-resolution optical and infrared satellite data

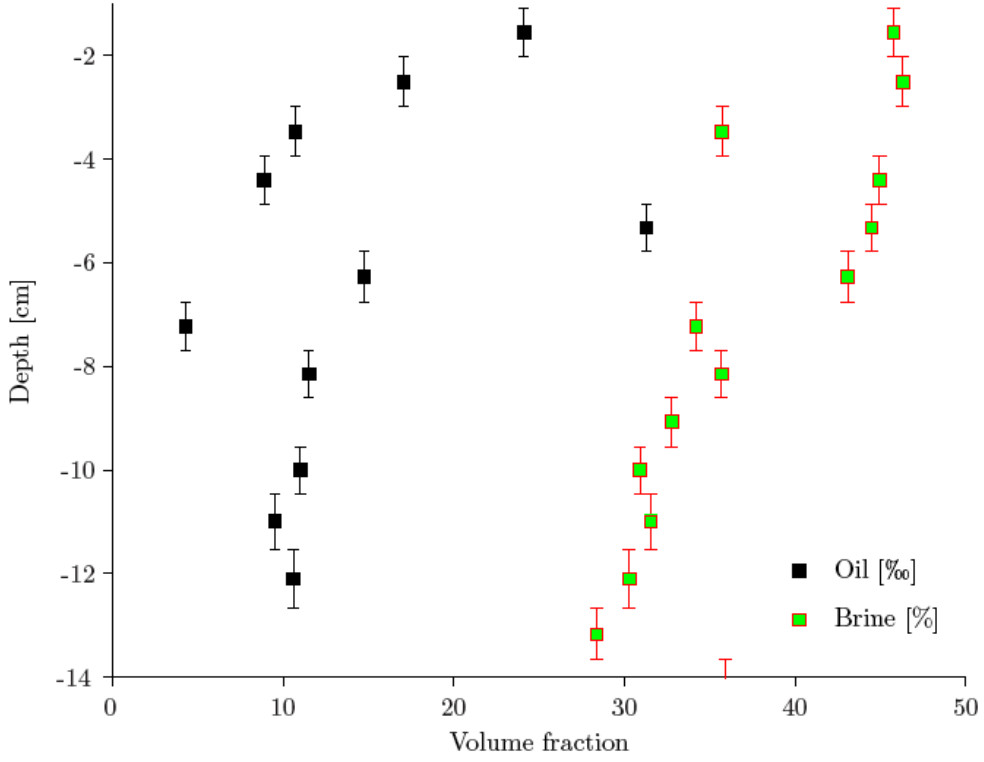


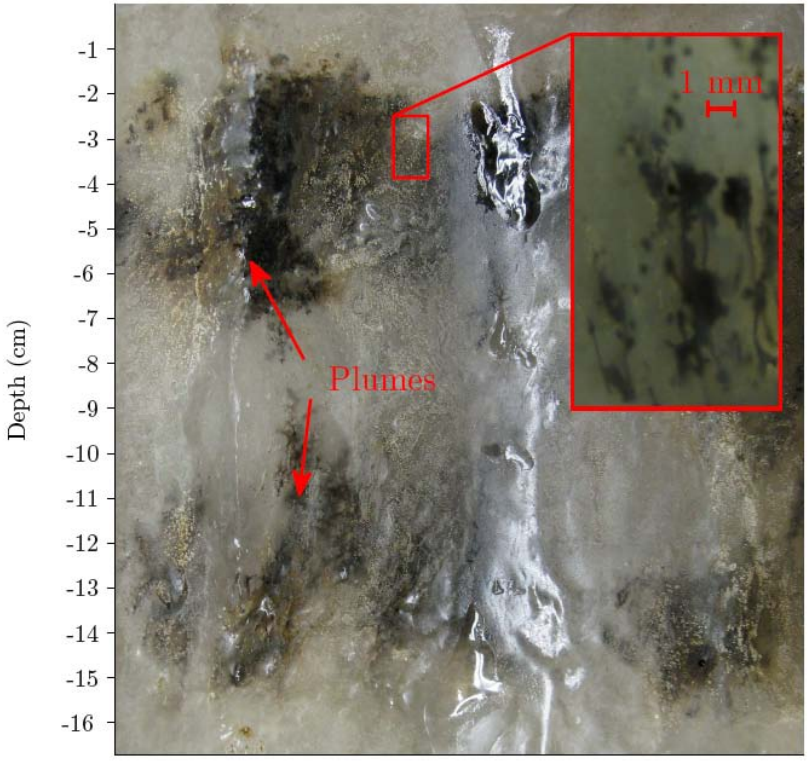
- UAF and partners can receive higher spatial resolution data that could help map oil in sea ice
- Receiving and processing these data would be straightforward and would add significant capability to an oil-spill center

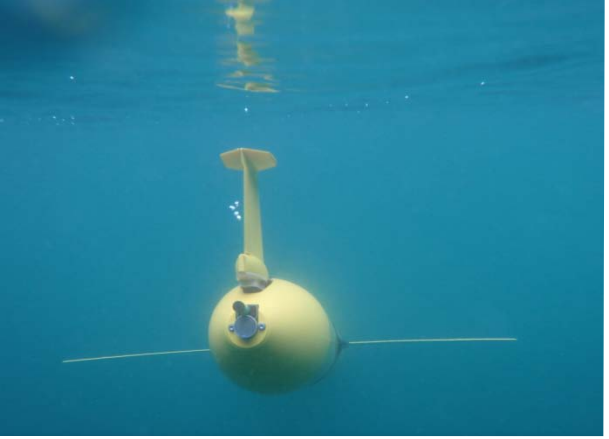
Oil in Ice: Measurement & Simulation

- Cold lab experiments & numerical modeling of oil entrainment & movement through ice
- Goal: Inform oil-spill response in coastal ice settings; improve oil-in-ice detection & modeling of ecological impacts









SFOS/UAF Autonomous Remote Technology Lab

Operates three Webb Slocum Autonomous Underwater Vehicle (AUV) gliders.

Non-propelled, autonomous, quiet, low-power, long-endurance specific AUV → up to ~ 3-month missions using lithium batteries.

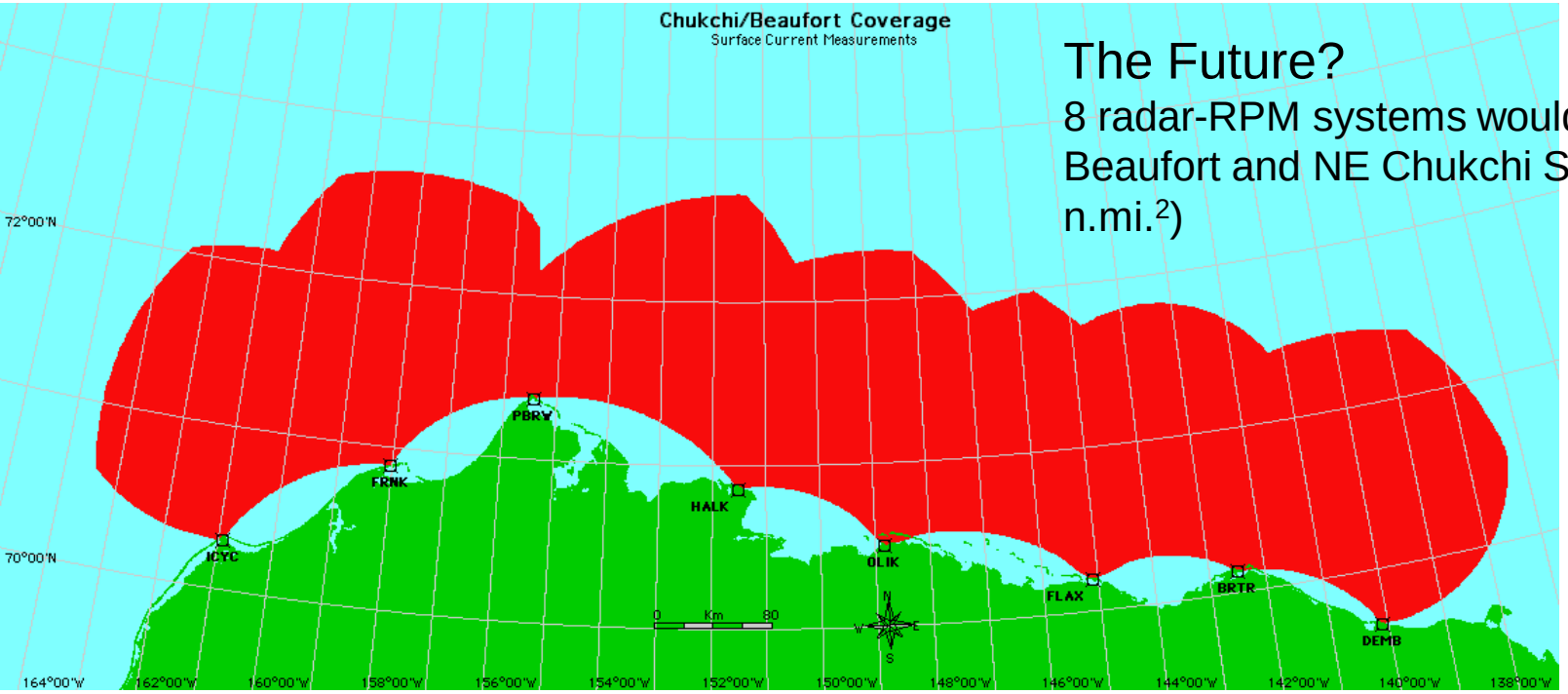
Two-way, real-time Iridium satellite communication → mission change on the fly + relay data to scientists, numerical models and decision makers.

Unique, high-resolution (vertical and horizontal) surface-to-bottom data coverage.

Coastal Alaska is not on the grid!!

We have built and tested an autonomous power system (wind, solar, & biodiesel) with Dept. of Homeland Security funding.

System: proven, flexible, portable & arctic-proof. Can support ice radars.



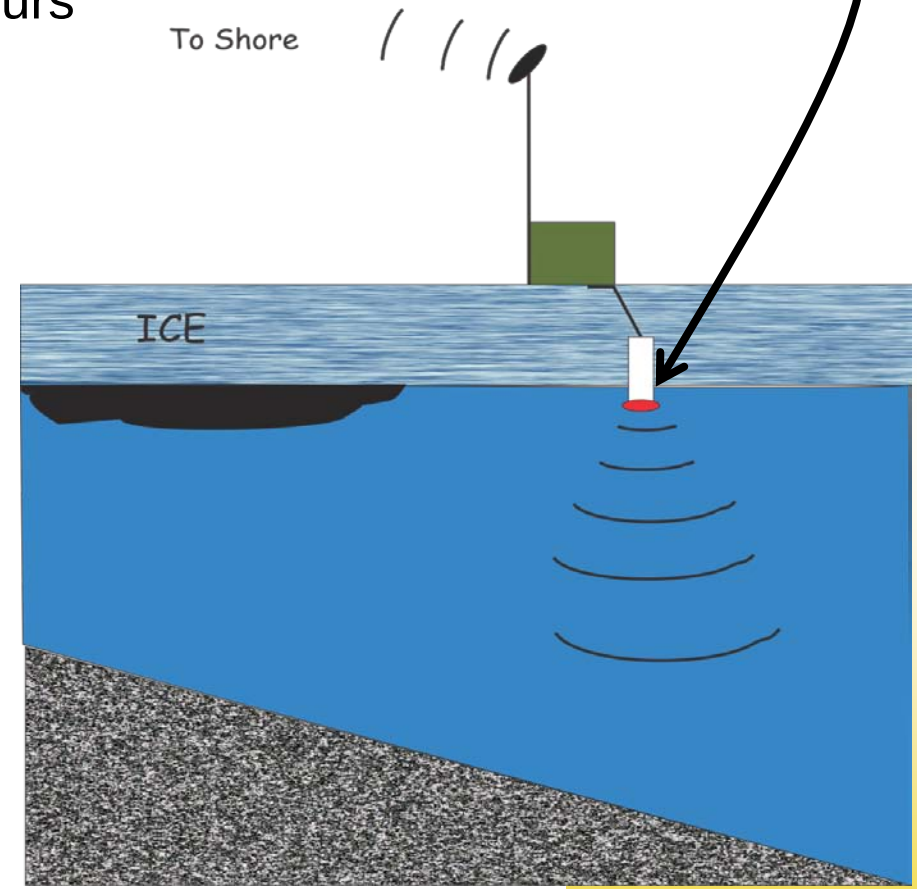
The Future?

8 radar-RPM systems would cover Beaufort and NE Chukchi Sea (40,000 n.mi.^{2})

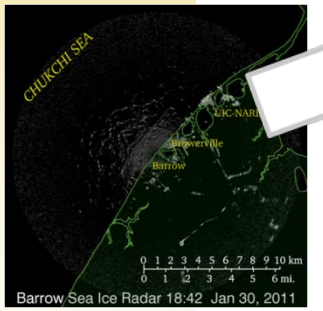
Real-Time Currents in the Landfast Ice Zone for Oil-Spill Response

Acoustic Current Meters:

- measure underice currents
- telemetering capability could be developed easily
- can be deployed in hours



Oil Trajectory Modeling in Ice-Covered Waters



Monitoring

Predicting

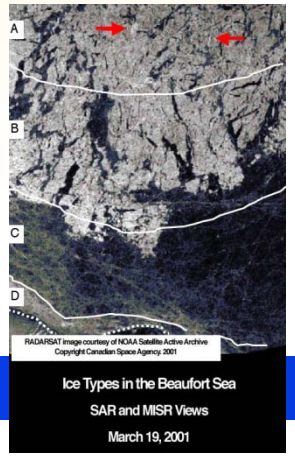
Evaluate the capability of current state-of-the-art sea-ice models to predict oil-spill trajectories

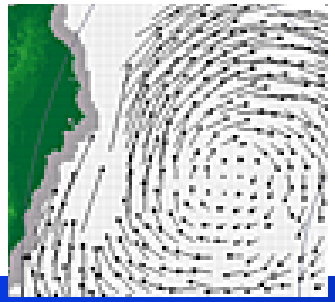
Identify key research areas to transition models to operations

Products

Daily to weekly forecasts for spill response and planning

Modeled oil-spill trajectories based on key spill scenarios for EIAs and risk assessments





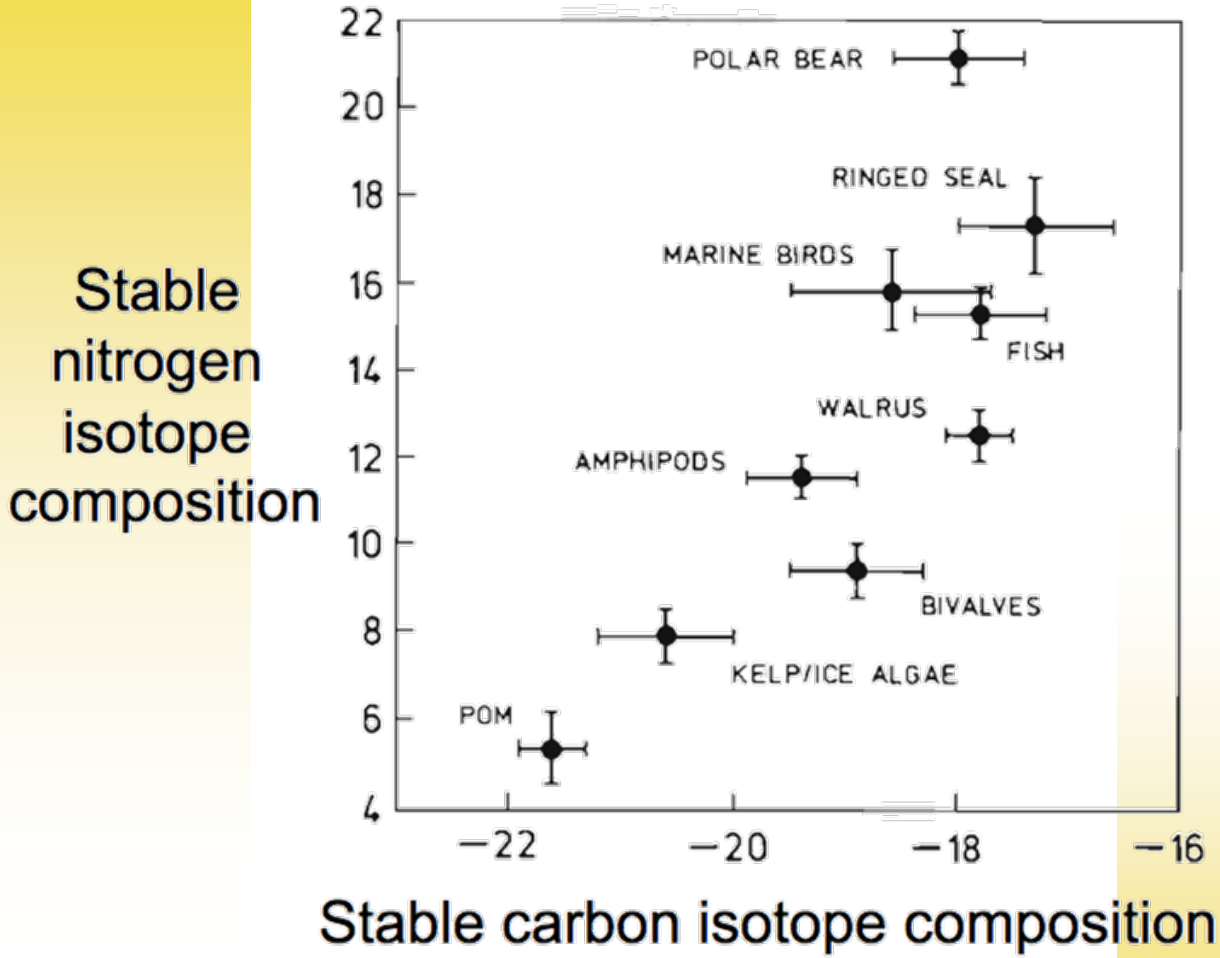
Toxicity and Biodegradation of Dispersed Oil

Capabilities:

- Test toxicity of oil to arctic marine organisms
- Measure biodegradation of oil in arctic seawater
- Assess effects of dispersants on oil toxicity and biodegradation

The Barrow Arctic Research Center, Barrow, Alaska

Baseline surveys of food webs at sites using stable isotopes: a cost effective method



Data Hobson and Welch 1992

Alaska Stable Isotope Facility

- ✓ **Characterize food webs prior to spills**
- ✓ **Use post-spill assessment to gage impact and monitor recovery**

Civil Infrastructure Needed for Spill Response and Recovery

North Slope Lacks Civil Infrastructure:

- **Inadequate spill response and recovery assets**
- **Local communities will be overwhelmed**
- **Apparent after USCG, District 17 Forward Operating Location Exercise in 2008**

"The existing infrastructure in the U.S. Arctic is insufficient to support prolonged or seasonal Coast Guard operations."

"Non-governmental berthing/messing in the U.S. Arctic is insufficient to support prolonged or seasonal Coast Guard operations"

Without the ability to deploy and operate effectively, the best technology is essentially useless!

Civil Infrastructure Needed for Spill Response and Recovery

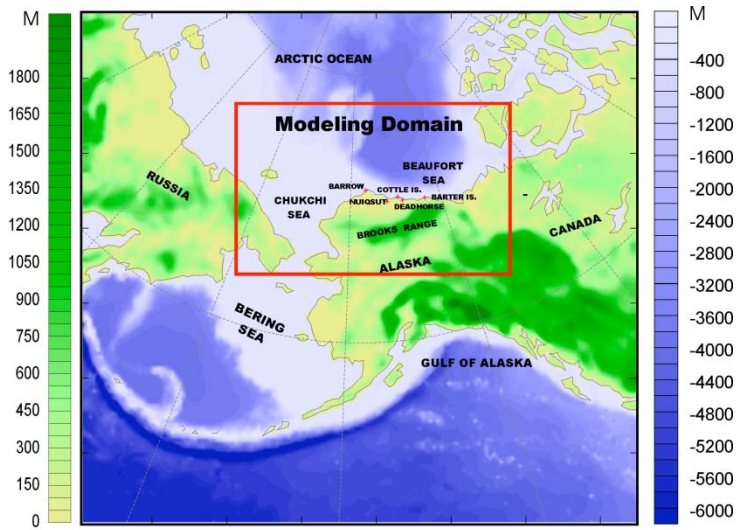
Needed Civil Infrastructure

- **Bases**
  - Staging: Pre-deployment of spill response assets
  - Operations' support
- **Moorings and Harbors – virtually non-existent**

How UAF can help

- **Provide technical assistance for:**
  - **Base Planning and Design**
  - **Harbor location and assessment**
  - **Vessel moorings in the Arctic**

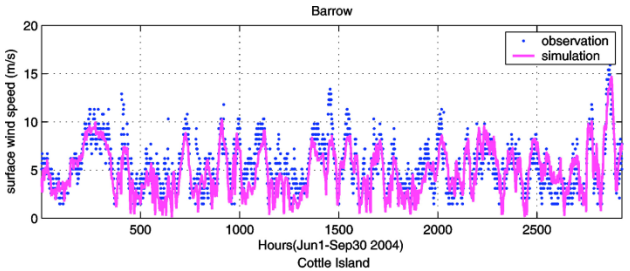
Coupled Atmosphere-Ice-Ocean Modeling

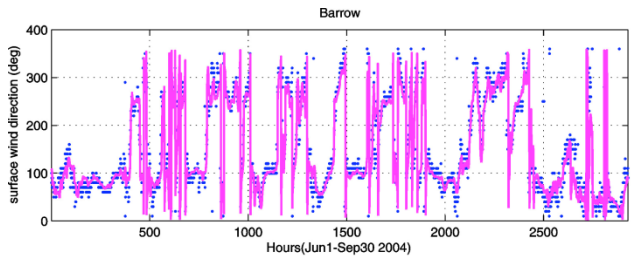


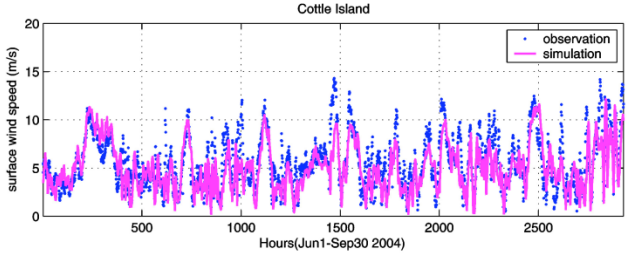
- High-resolution meteorological model developed
- Performs well year round
- Hindcasting studies underway
- Forecasting capability

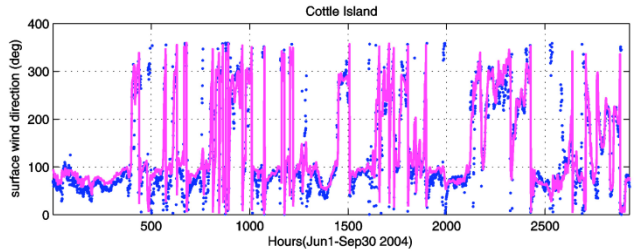
Wind Speed

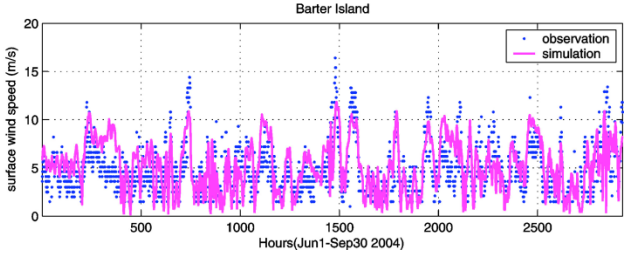
Wind Direction

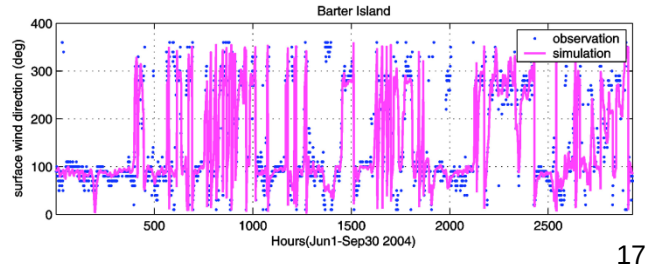












Courtesy of Zhang and Zhang; UAF International Arctic Research Center and Arctic Supercomputer Center. Supported by BOEMRE.

Summary

- UAF possesses the people, equipment, and knowledge to develop a comprehensive research program in Arctic Oil-Spill detection, mitigation, and response. We must however develop a formal structure of coordination.
- UAF is uniquely located to study and respond to oil spills.
- We need to work closely with our international collaborators to benefit from the knowledge that currently exists.