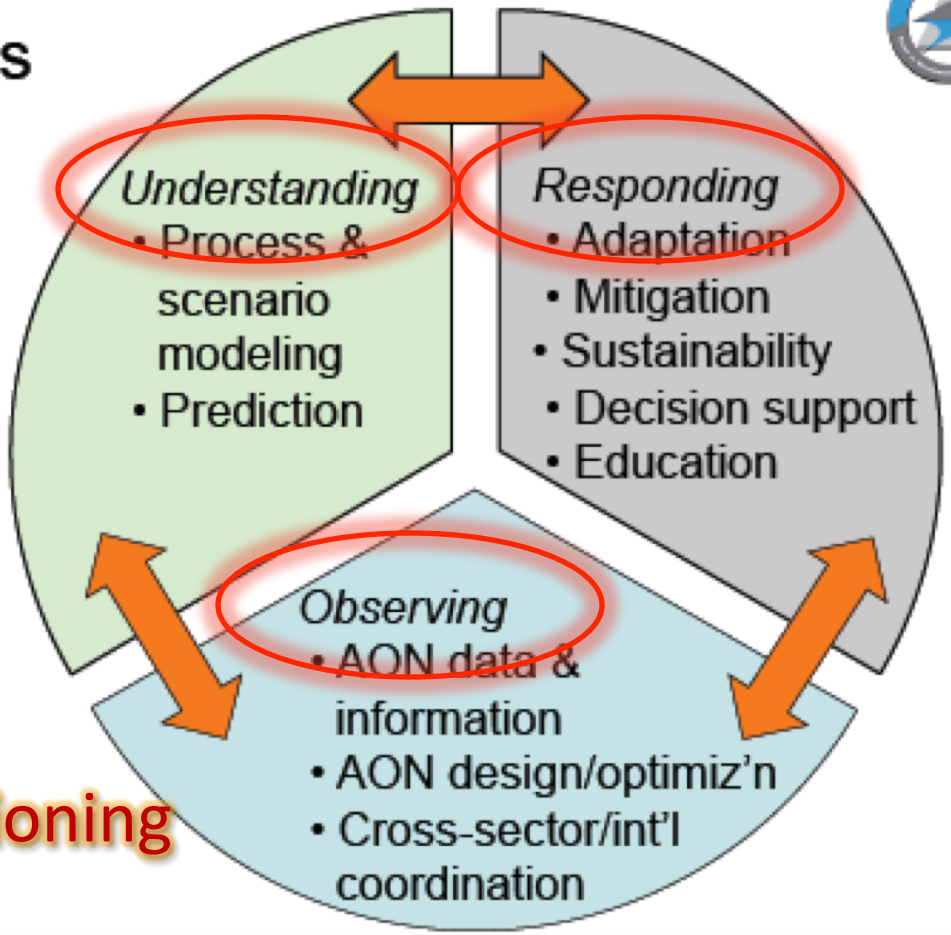
SEARCH for Sea Ice

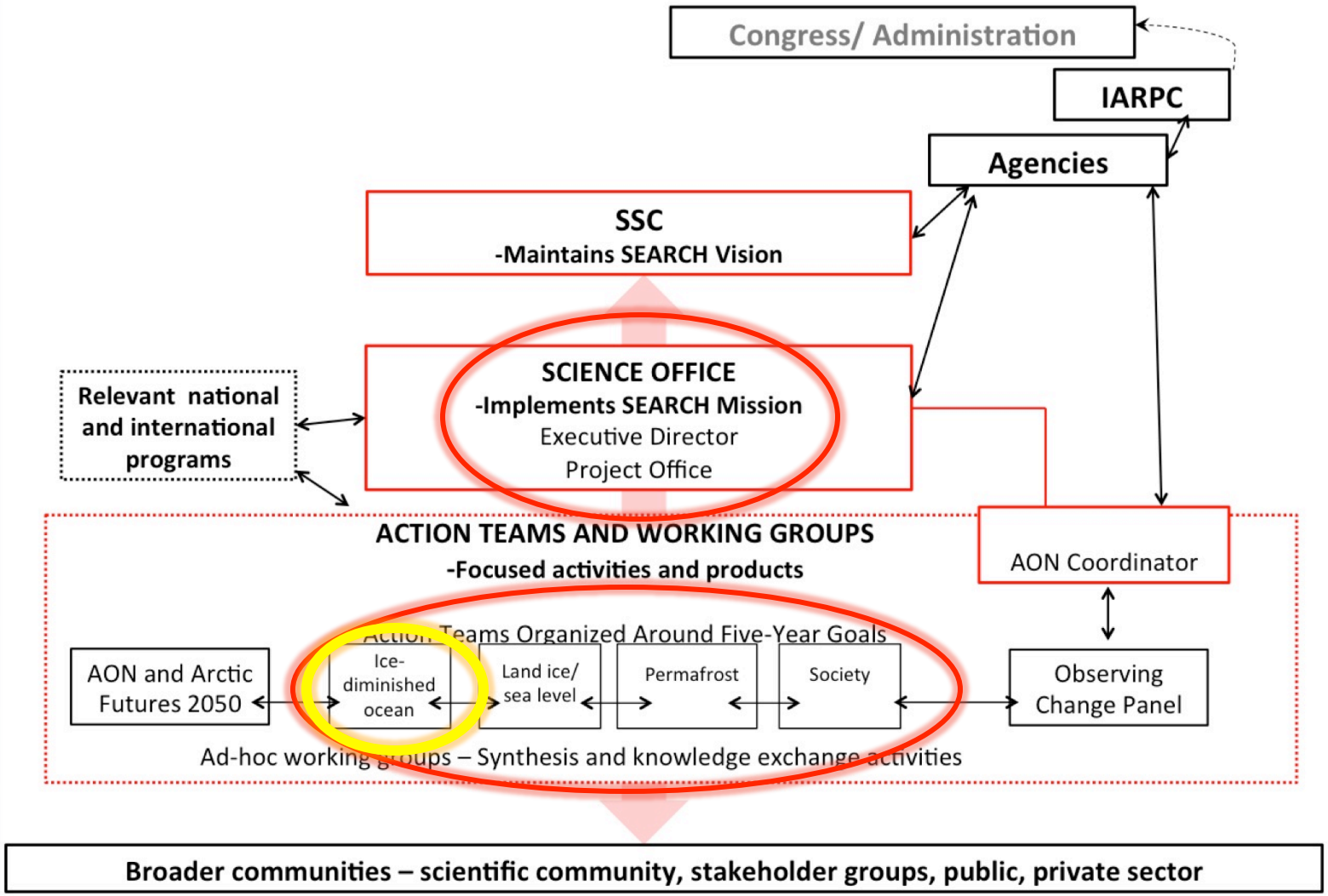
For the 5th Symposium on the Impacts of an Ice-Diminishing Arctic
16-18 July 2013

SEARCH's Tripartite Approach to Arctic Change



… is transitioning to…

A Proposed New Framework for *SEARCH**



*Under review at NSF

SEARCH's 5-year goals

1. **Document and understand how degradation of near-surface permafrost will affect Arctic and global systems**

2. **Improve predictions of future land-ice loss and impacts on sea level**

3. **Analyze societal and policy implications of Arctic environmental change**

4. **Improve understanding, advance prediction, and explore consequences of changing Arctic sea ice**

Improve understanding, advance prediction, and explore consequences of changing Arctic sea ice

- Improve the **understanding** of atmosphere, sea-ice, and ocean system interactions through a combination of enhanced observations and process-based modeling studies
- Explore the **consequences** of a seasonally ice-free Arctic Ocean across human and natural systems
- Assess how Arctic sea-ice changes interact with **mid-latitude weather** and climate
- Improve sea ice **prediction** from daily to decadal timescales

Action Team: Ice-Diminished Arctic Ocean

Action Team Co-Leaders: J. Francis and TBD (Arctic biologist/ecologist)

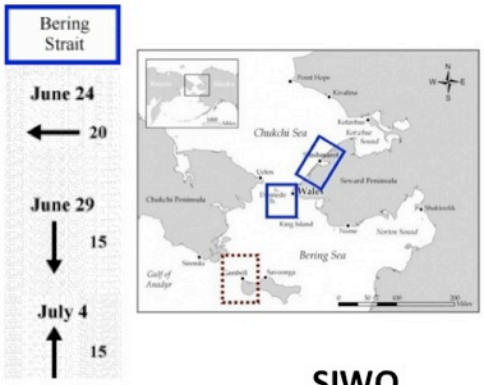
International Sea Ice Prediction Network (J. Stroeve and C. Bitz):

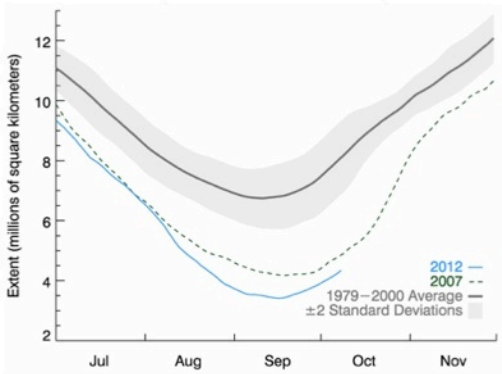
- Sea ice prediction from synoptic to interannual timescales
- Builds on SEARCH Sea Ice Outlook, Sea Ice for Walruses Outlook, and various other efforts
- Includes societal and ecological consequences
- Observations ⇔ models

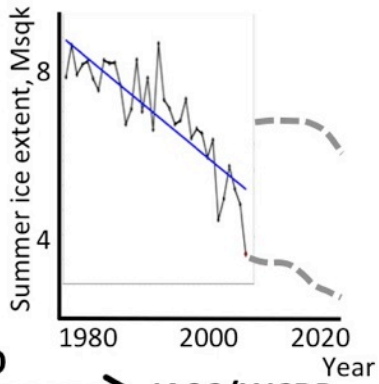
Towards a sea ice prediction network

Timescale and regional scale

Weather (1h – 20d)	Seasonal to interannual (21d – 3yr)	Decadal (>3 yr)
Local to regional	Regional to pan-Arctic	Pan-Arctic







SIWO ⟷ **SIO** ⟷ **IASC/WCRP**

This project ⟷

Network activities

Coordinate & evaluate predictions, integrate, assess & guide observations; synthesize predictions & observations; disseminate predictions & engage stakeholders

Outcomes

Scientific community
- New methods
- Improved models
- New standard datasets
- Synthesis

Agencies & Stakeholders
- Testbed to build best practices
- Defined limits of predictability
- New, improved information products
- Safer, more economical operations

Public
- Expand SIO/SIWO approach
- Accessible data & comparisons
- Engage citizen scientists

Prediction Network Goals for Modeling (UW Lead)

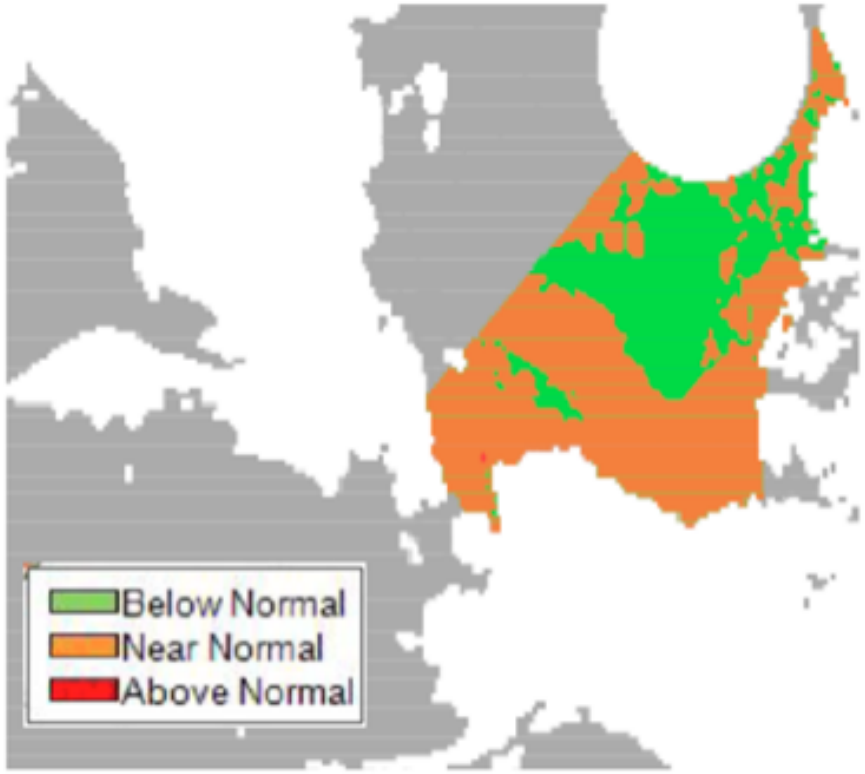
- To determine realistic expectations for predictability of Arctic sea-ice at regional and local scales. Convey these expectations to stakeholders
- To create a community of modelers -- both statistical and physical approaches
- To improve sea ice models for prediction
- To optimize observations of the Arctic system to best inform sea ice prediction
- To make sea ice forecasts that include estimates of uncertainty

Sea Ice Outlook – Regional (A. Tivy 2012)

Sea Ice Concentration Anomaly Outlook

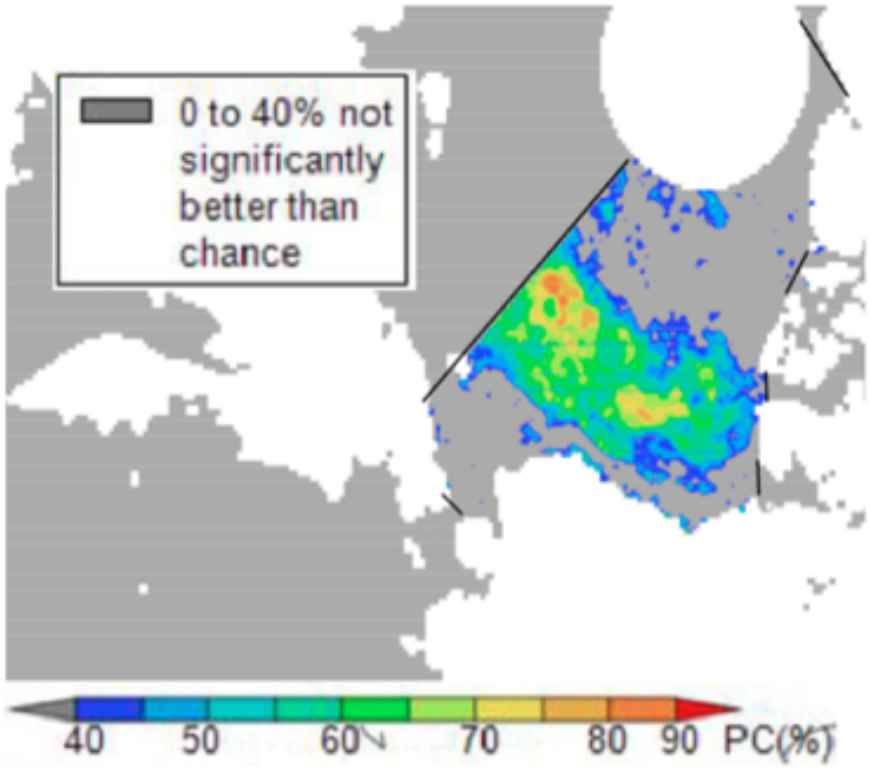
Period: September 2012 **Issued:** January 15, 2012

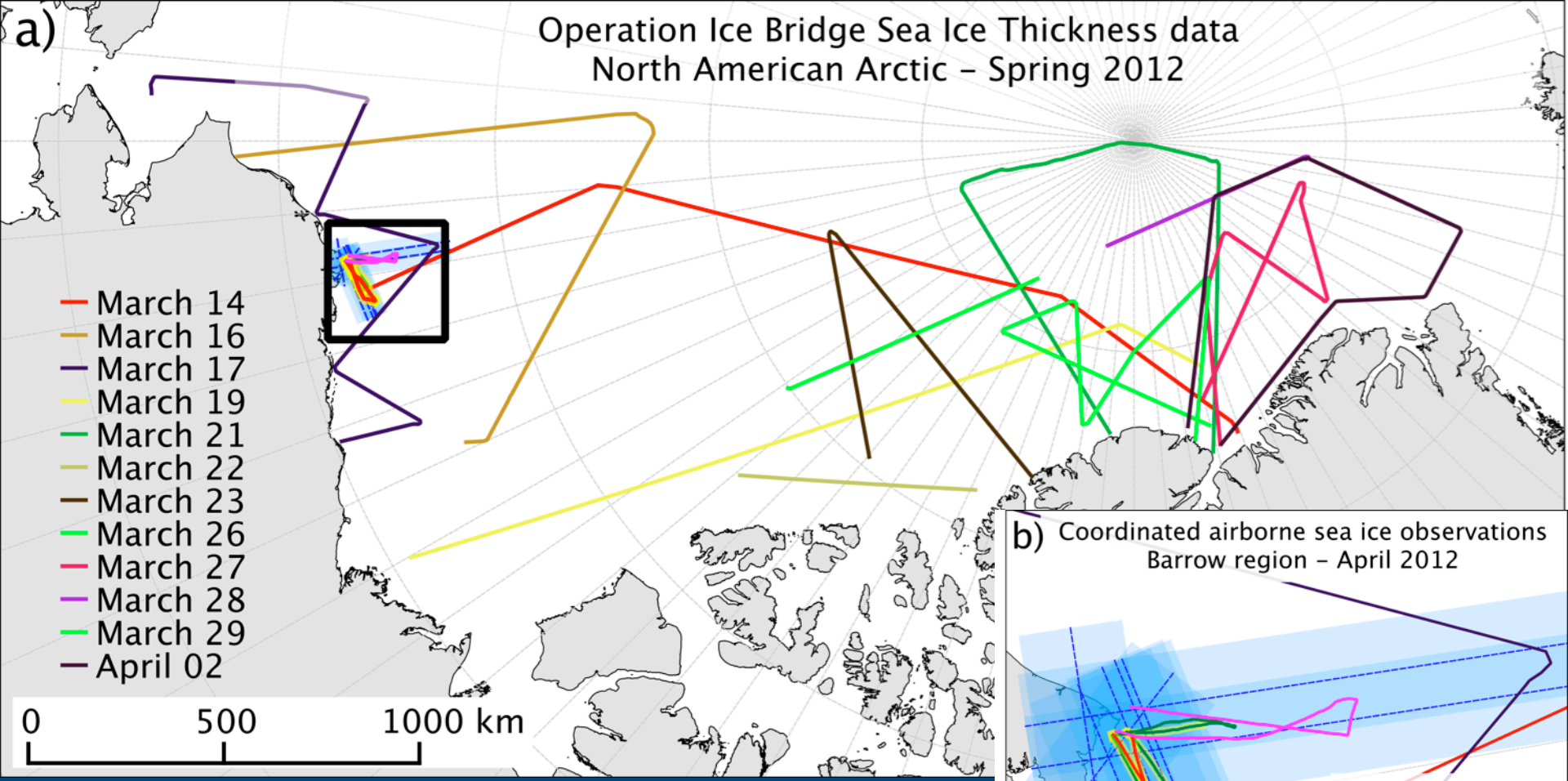
Based on 3-equiprobable categories from 1980-2011 climatology



Historical Percent Correct (1980-2011)

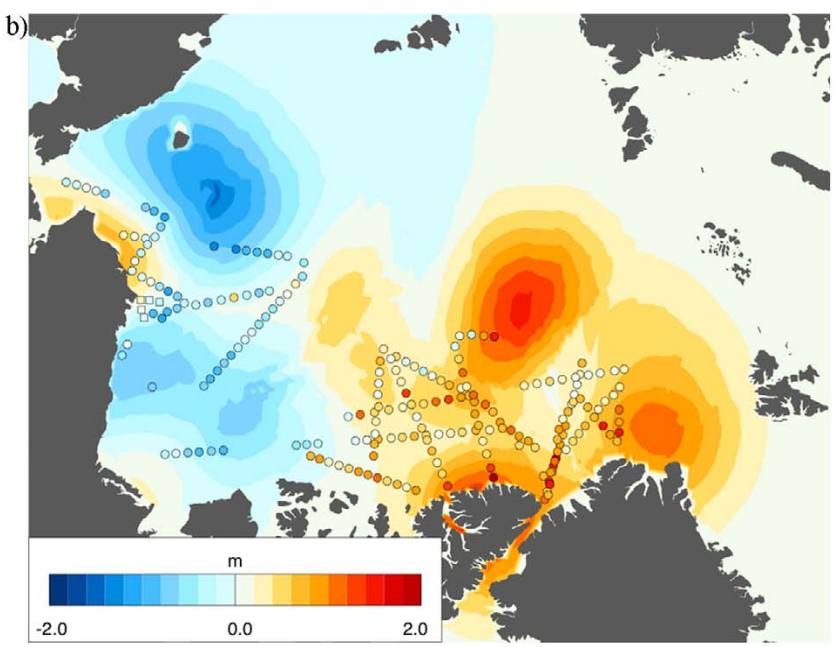
6-month sea ice concentration anomaly forecast

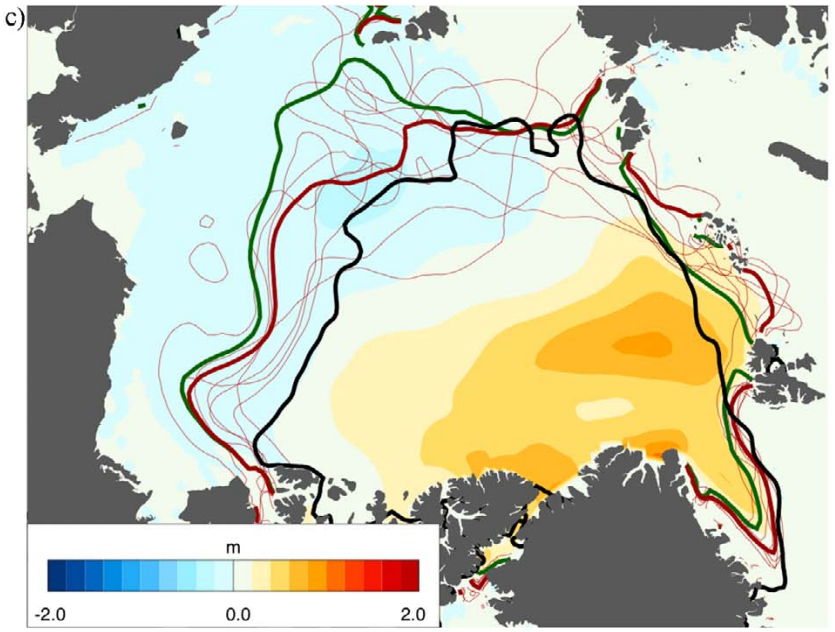




Criteria and metrics for observing system design and optimization:

- Prediction of summer sea ice extent
- Coordinated research & industry flights





Lindsay et al. (2012)

- Ensemble forecasts with PIOMAS coupled ice-ocean model
- Difference between unconstrained & thickness-initialized model run (top): anomalously thick ice in Chukchi Sea
- Difference between unconstrained (green), corrected (red) & observed (black) September ice extent

Learn more about SEARCH at *www.arcus.org/SEARCH*

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Karen Pletnikoff
Stephen Vavrus

Additional slides

Prediction Network Modeling Activities

- Organize a action teams to coordinate and evaluate seasonal-to-interannual predictions
  - Design intercomparison projects of hindcast and other experiments to improve understanding of sea ice prediction and identify model deficiencies
  - Develop skill metrics tailored to evaluate sea ice predictions in collaboration with observationists
  - Design experiments that investigate how best to initialize models
  - Design experiments that can identify and evaluate types of observations that improve prediction

Prediction Network Modeling Activities

- Organize a action teams to coordinate and evaluate seasonal-to-interannual predictions
  - Review the Sea Ice Outlooks in previous years
  - Analyze available model output and observations to determine if the last five years in the Arctic are the new normal
  - Evaluate strengths and weaknesses of different prediction approaches
  - Explore how to combine methods to improve predictions