HIGHLIGHTS FROM RUSALCA 2004-2014

KOREA PAG MEETING 2013

RUSSIAN-AMERICAN LONG-TERM CENSUS OF THE ARCTIC

Aleksey Ostrovskiy, Group Alliance, Russia, Russian Federation Oversight for RUSALCA
Kathleen Crane, Arctic Research Program, CPO NOAA, USA U.S. Oversight for RUSALCA

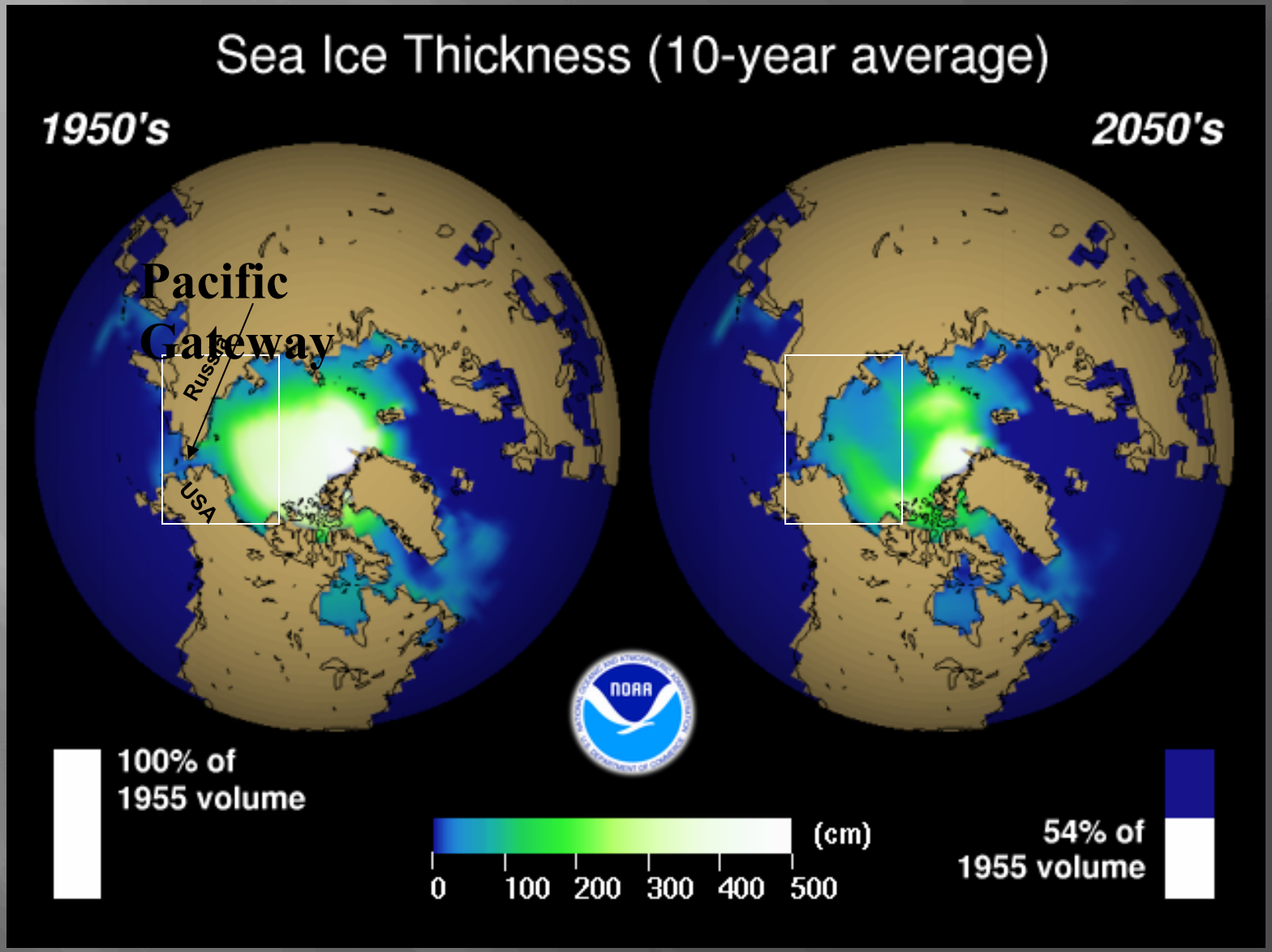
ISSUE: How to Improve Russian - U.S. ocean and polar Region collaboration

Bringing overarching guidance back into Russian-U.S. scientific collaboration was and is a worthy goal.

Vice-Admiral Lautenbacher(NOAA) and Vice-President Laverov (RAS) sign the Memorandum of Understanding between NOAA and the Russian Academy of Sciences, December, 2003 (World Oceans and Polar Regions Studies).

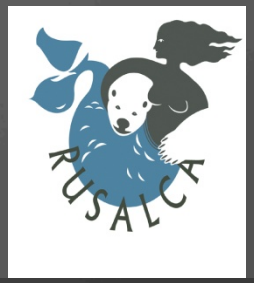
A major outgrowth of this MOU was the creation of the Russian, American Long-term Census of the Arctic (RUSALCA)

RUSALCA is now a piece of the Medvedev-Obama Commission on the Environment



RUSALCA IS LOCATED IN THE PACIFIC ARCTIC

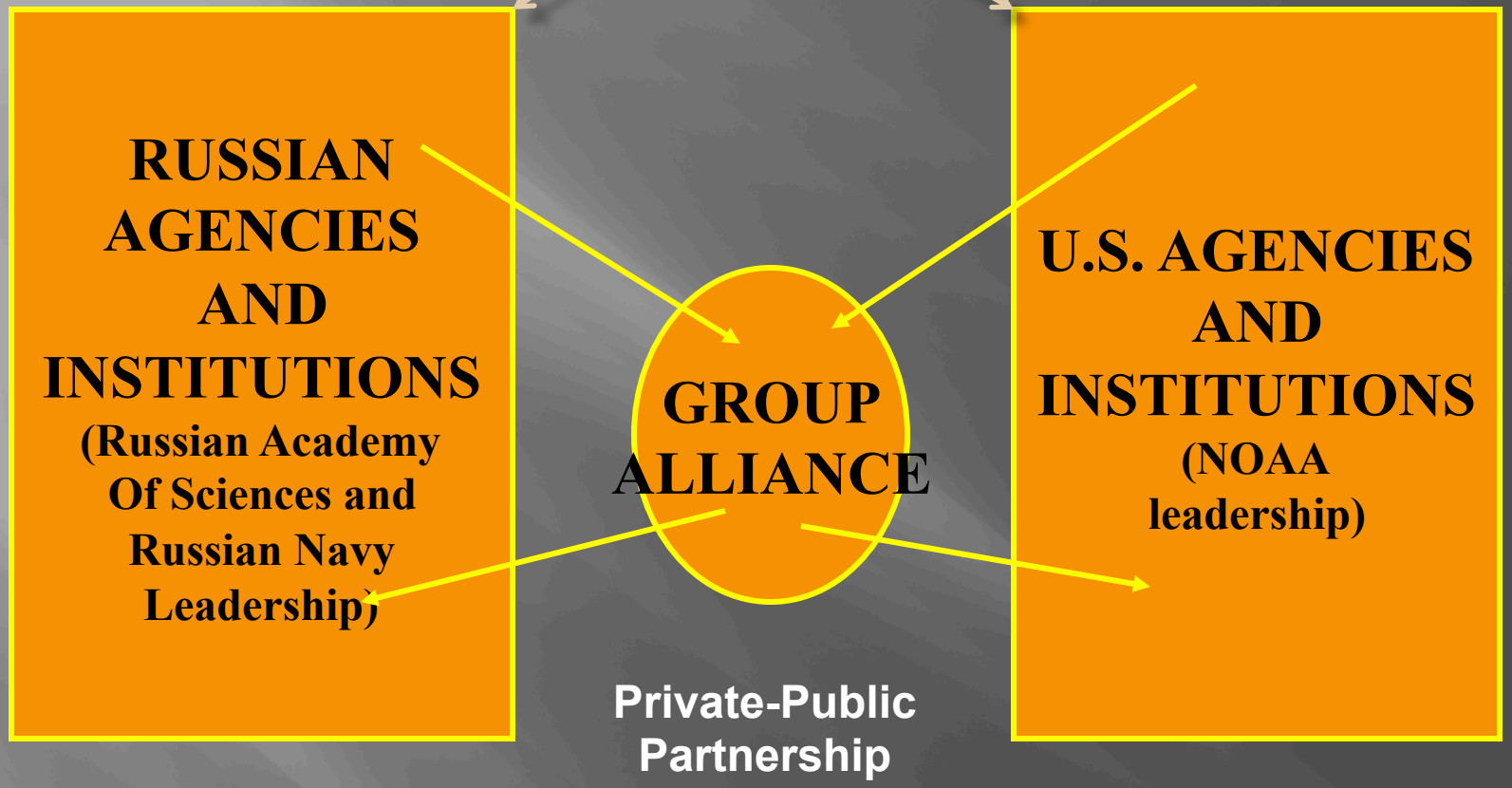
RUSALCA'S GOALS



1. Take observations Where Arctic sea ice reduction is a maximum
2. Monitor fresh water, heat, nutrient fluxes and transport pathways through the Pacific Gateway.
3. Monitor ecosystem indicators of climate change.
4. Model and forecast changes in ecosystems and Arctic wide physical systems that impact global climate and ecosystem stability.
5. Improve Russian-U.S. Arctic science relations
6. Explore the unknown Arctic

RUSSIAN FEDERATION AND US SCIENCE AND TECHNOLOGY AGREEMENT

MOU ON WORLD OCEANS AND POLAR REGION STUDIES



HOW RUSALCA IS ORGANIZED

RUSALCA Russian Government Partners

- Russian Academy of Sciences
  - Shirshov Institute of Oceanology
  - Zoological Institute
  - Institute of Microbiology
  - Pacific Oceanological Institute
- Roshydromet
  - AARI
  - FEHRI
- Ministry of Defense
  - Russian Federation Navy
  - GNINGI
- Ministry of Natural Resources
  - VNIIOkeangeologia
- Ministry of Sciences
- Foreign Ministry

RUSALCA U.S. PARTNERS

- NOAA (CPO, OER, NMFS)
- NSF- Bering Strait Moorings
- Department of the Interior
- Department of State
- More (?)

Structure of the Shipboard Operations

- ROSHYDROMET: Captain, Crew, Scientists
- RUSSIAN FEDERATION NAVY: Chief of Expedition
- RUSALCA MISSION COORDINATORS :
  - K. Crane, USA A. Ostrovskiy, Russia
- CHIEF SCIENTISTS: Terry Whitledge, UAF.
- VESSEL OPERATORS: Heritage Expeditions NZ

SCIENTIFIC PARTY

- > 50 Scientists have been funded by their own funding agencies
- Russians - to the Russian Academy of Sciences
- US - to NOAA's, Arctic Research Program , Ocean Exploration and NSF

- Most teams have both Russian and American partners **The teams are**:
  - Ocean Acidification,
  - Benthic and Epibenthic Census and Processes,
  - Census of Zooplankton
  - Biodiversity of Fish and Assessment
  - Nutrients and Productivity
  - Physical and Chemical Oceanography (Bering Strait Fluxes)
  - Paleooceanography, geology and seafloor-ocean fluxes
  - Seafloor permafrost stability
  - Methane
  - Census of Marine Mammals

RUSALCA TIME LINE

2003 Signed Memorandum of Understanding, Russian Academy and NOAA

2004 Khromov Expedition Bering-Chukchi Seas

- **Census of Marine Life, Ecosystem changes in conditions of sea ice in the Chukchi Sea**
- **Began the Bering Strait monitoring of fluxes into the Arctic (heat, salt, nutrients and marine mammals)**

2005-2008 retrieval of mooring data

2009 Khromov Expedition: Bering Strait to the Yermak Plateau Climate and Ecosystem Changes from the loss of sea ice cover.

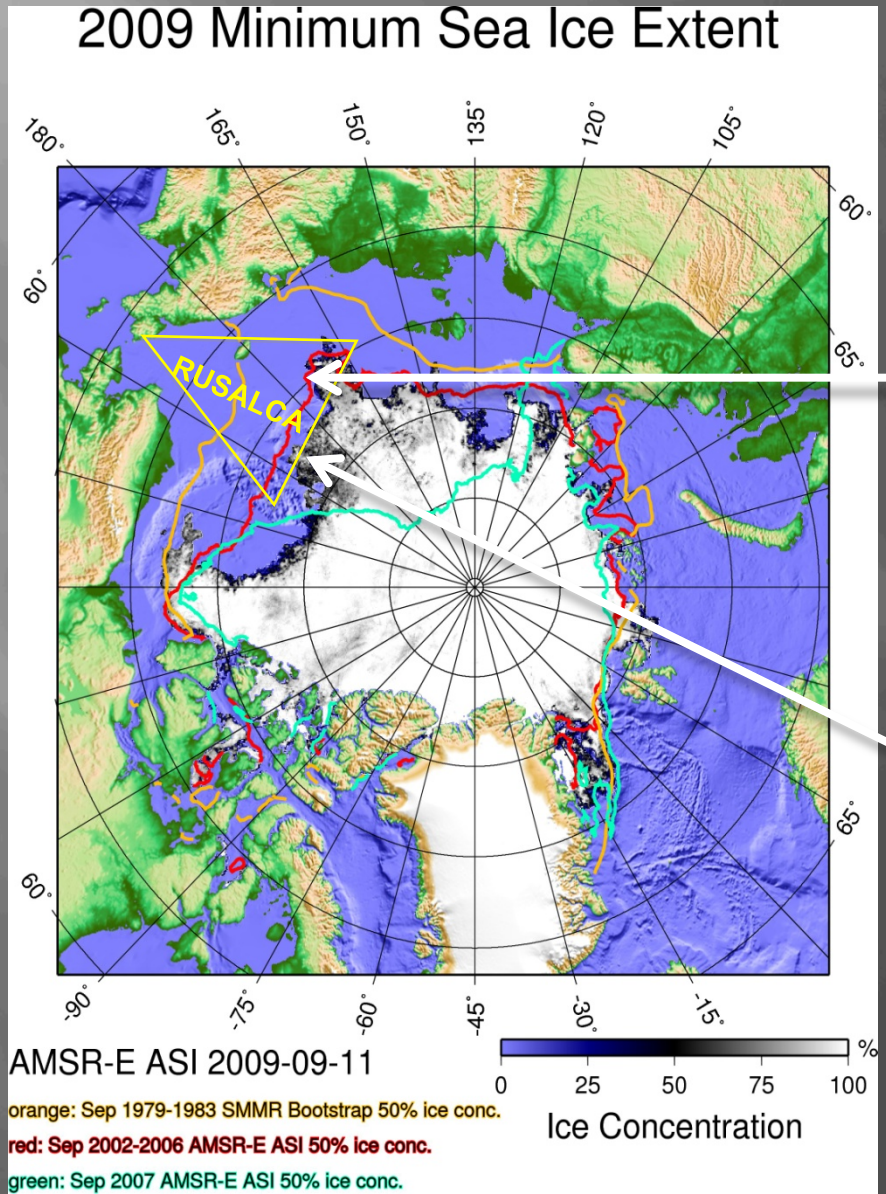
2010 Bering Strait Moorings and extensive mapping of the Siberian Current

2011 Bering Strait Moorings

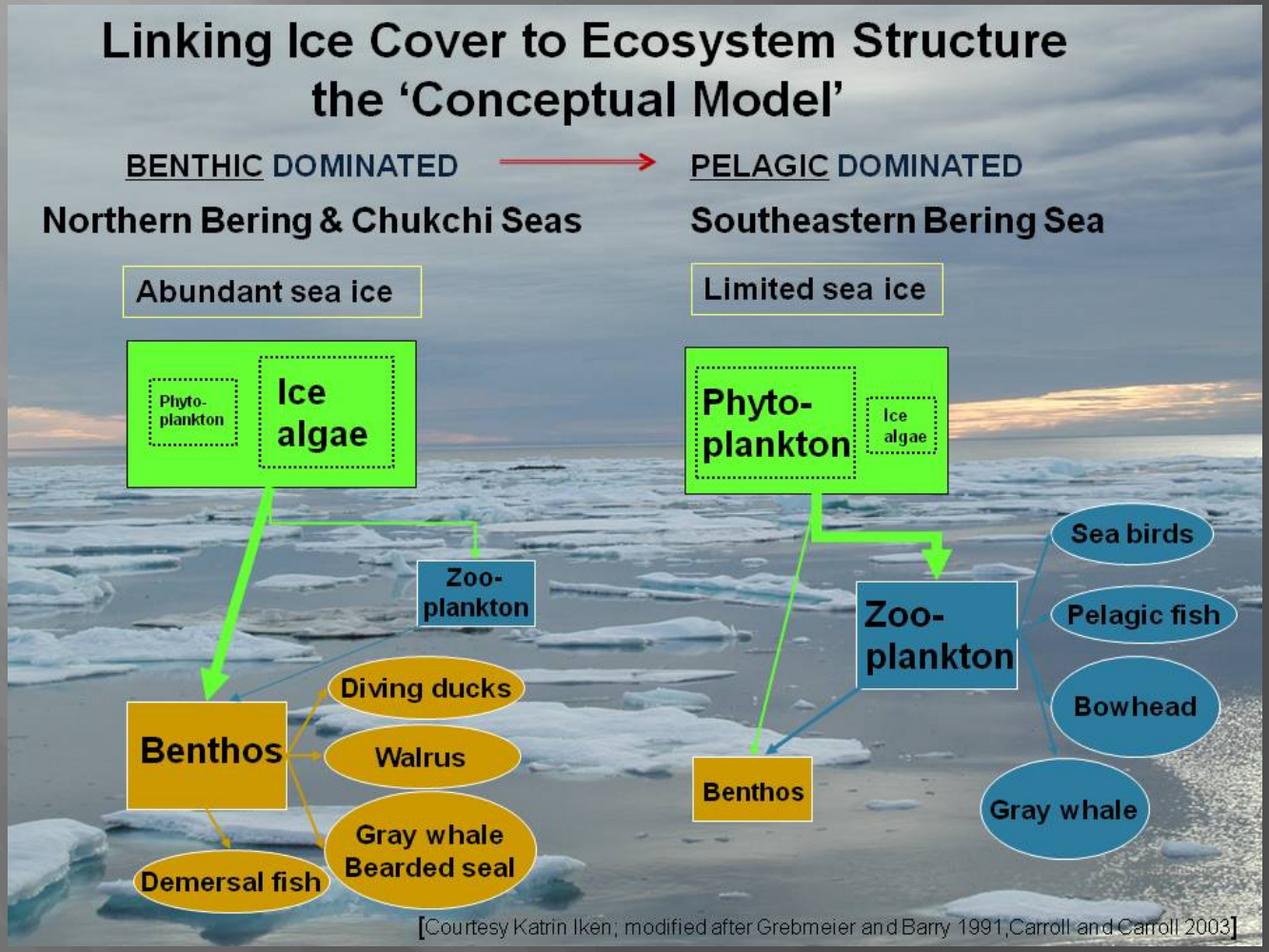
2012 Ecosystem Ocean Expedition (Bering Strait to the Makharov Basin)

2013 Data synthesis

Recent Changes in the Arctic Ocean Sea Ice Cover, 2009: RUSALCA Region of Study



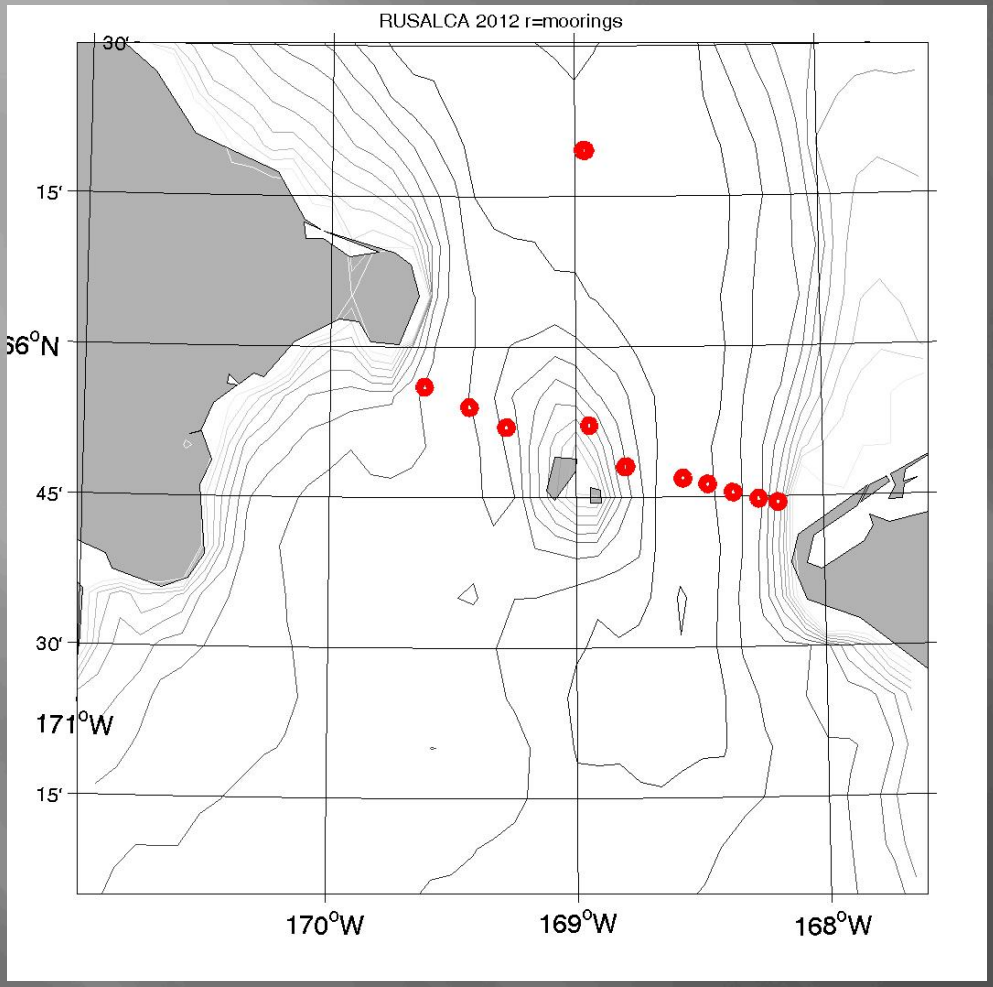
Loss of Sea Ice and Ecosystem Changes (RUSALCA)



Present Day

Future?

RUSALCA 2012 - Khromov

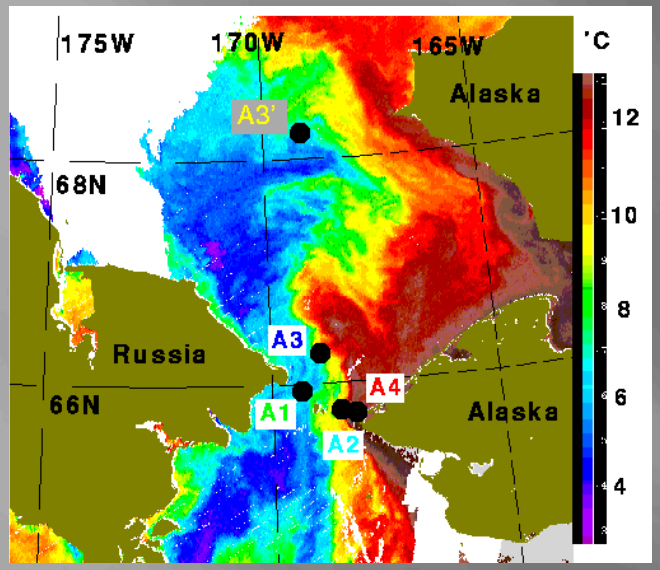


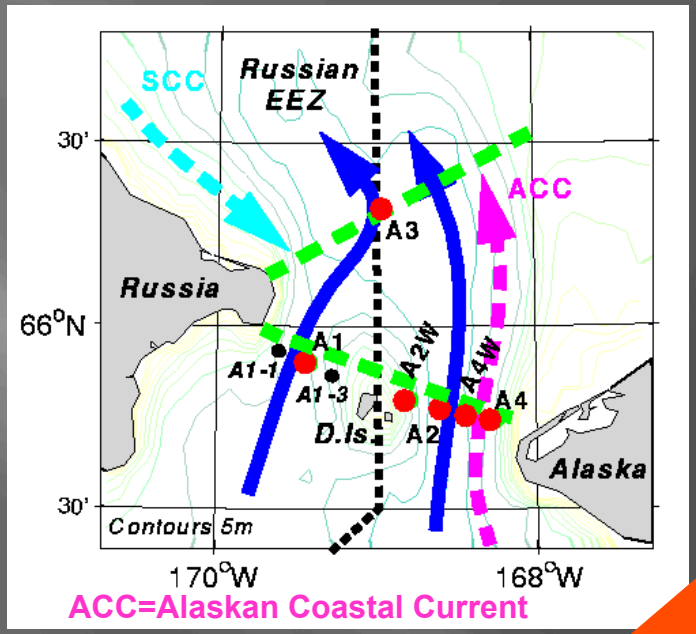
10th – 22nd July 2012
Nome to Nome
(including on and off load)

11 moorings to recover (3 likely by dragging)

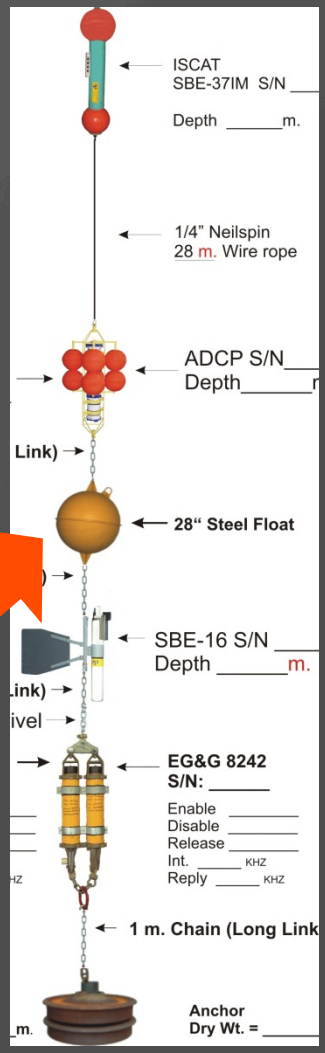
8 moorings to deploy
- Including BPG, Nutrients, Whale, pCO2

Bering Strait Moorings





ACC=Alaskan Coastal Current



Your instrument here!!!!

Since 2007

(International Polar Year)

8 moorings with upper and lower sensors

RUSSIAN AND us SIDES LINKED

With

- Nutrient sensors –

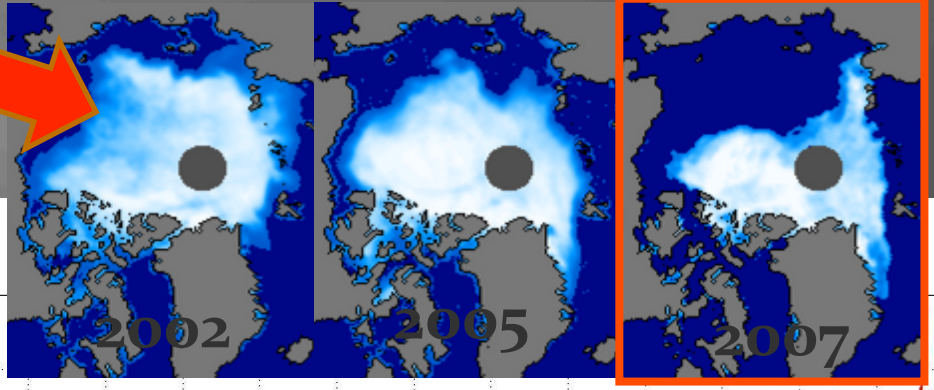
- Whale Recorders –

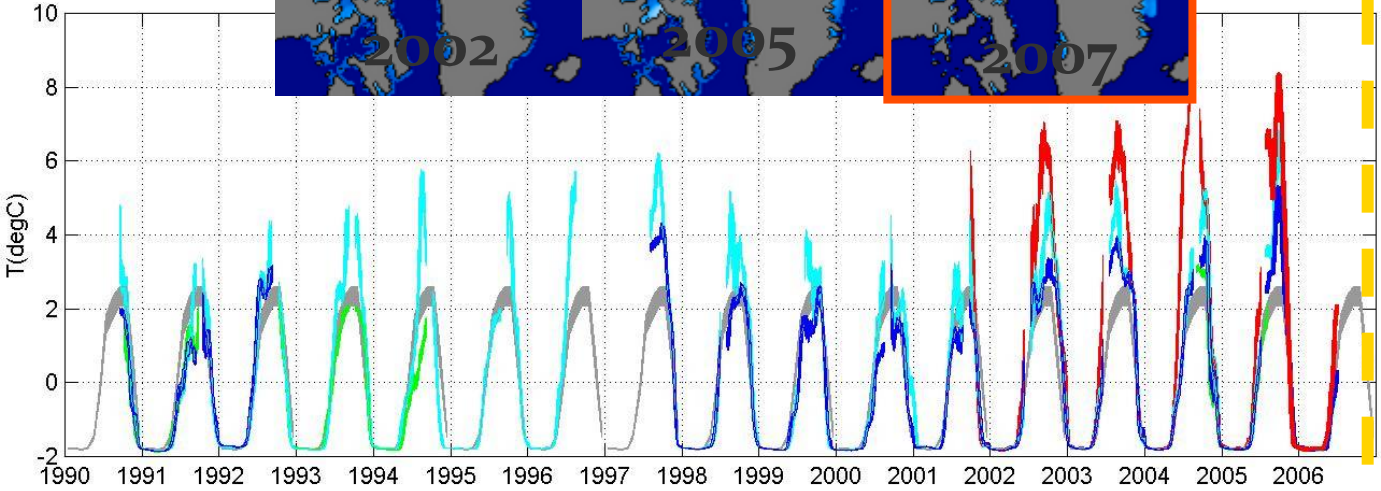
-pH and pCO2 sensors –

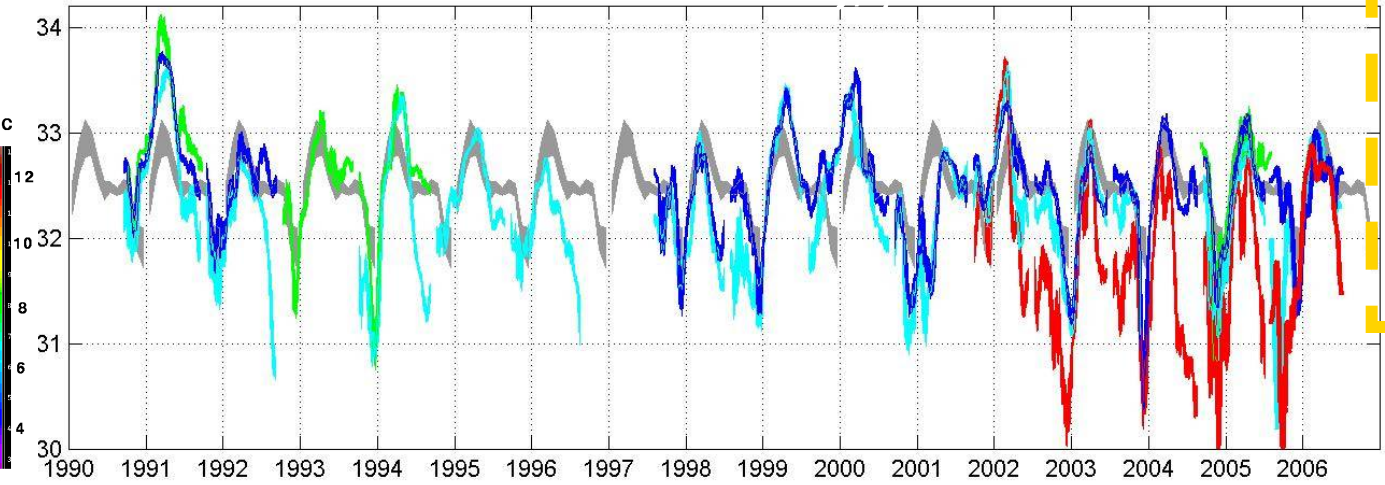
Annual CTD sections- mapping fluxes of Heat, Salt, nutrients into the Arctic

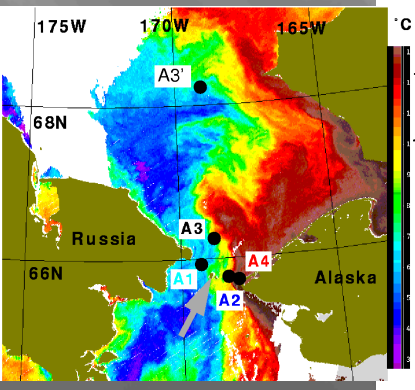
Bering Strait properties from 1990 to present

warmer and fresher water



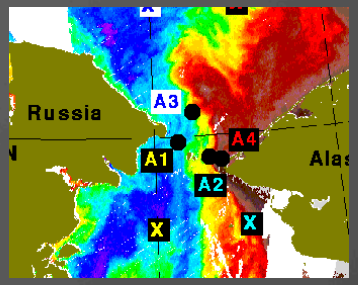


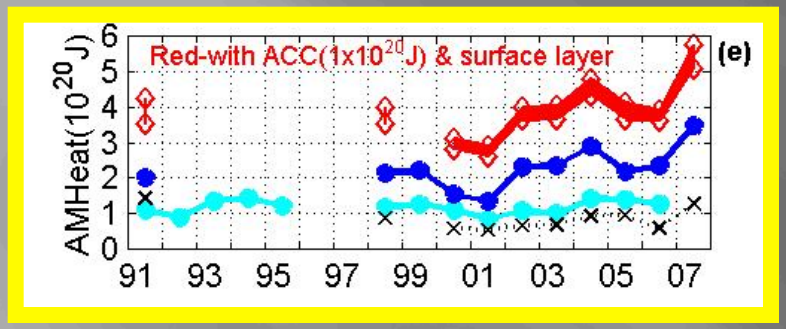




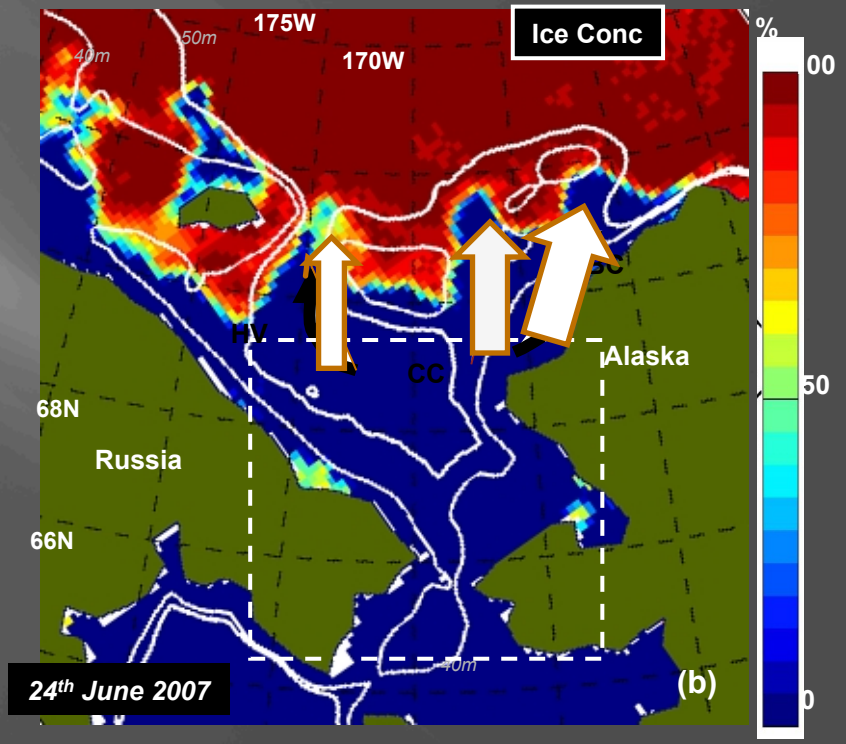
Bering Strait Heat Flux

Woodgate et al, 2010





Heat flux relative to -1.9deg C, Errors ~ 0.1 Sv, 10^{20}J



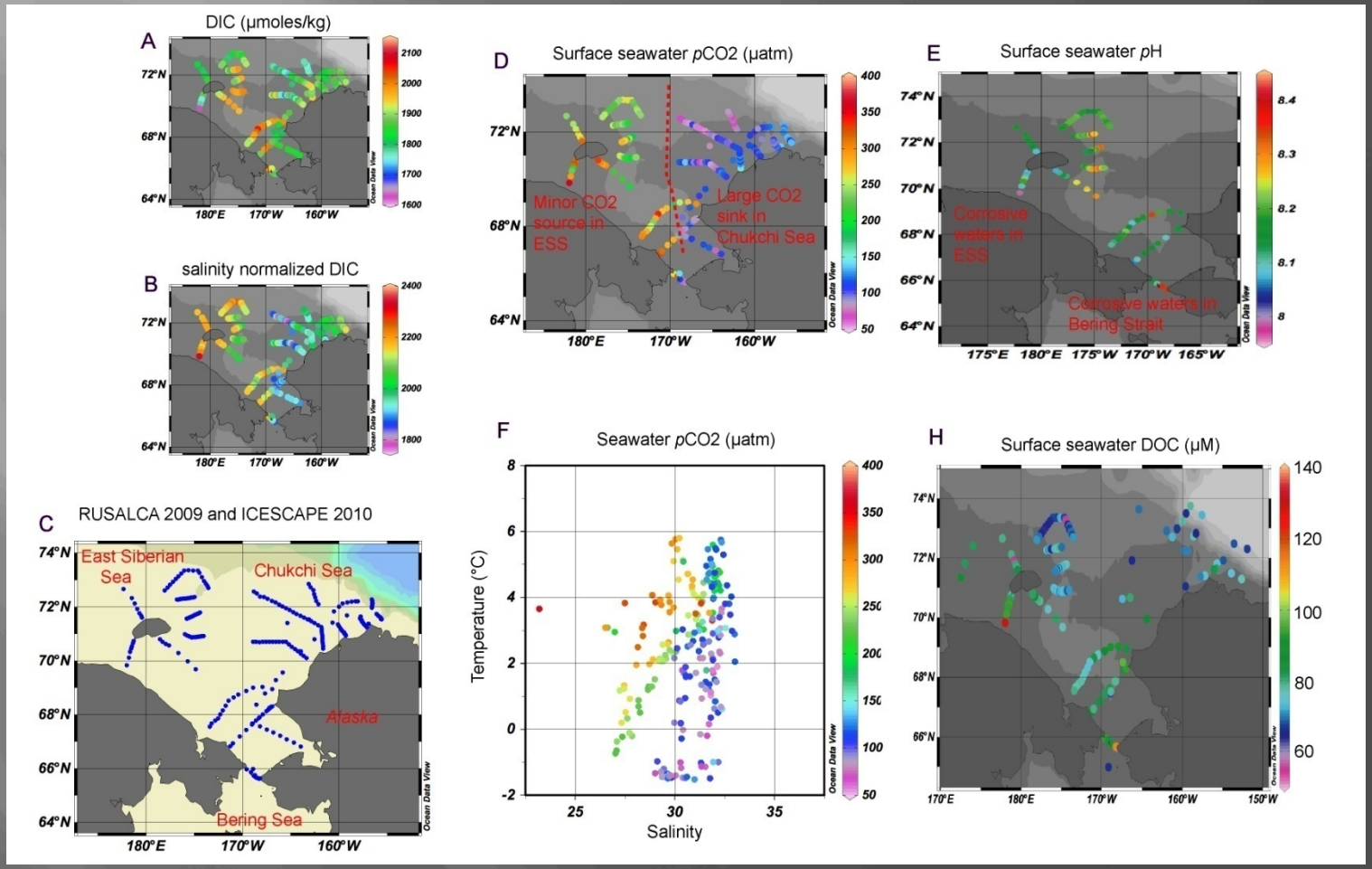
Acts as a trigger for sea-ice melt

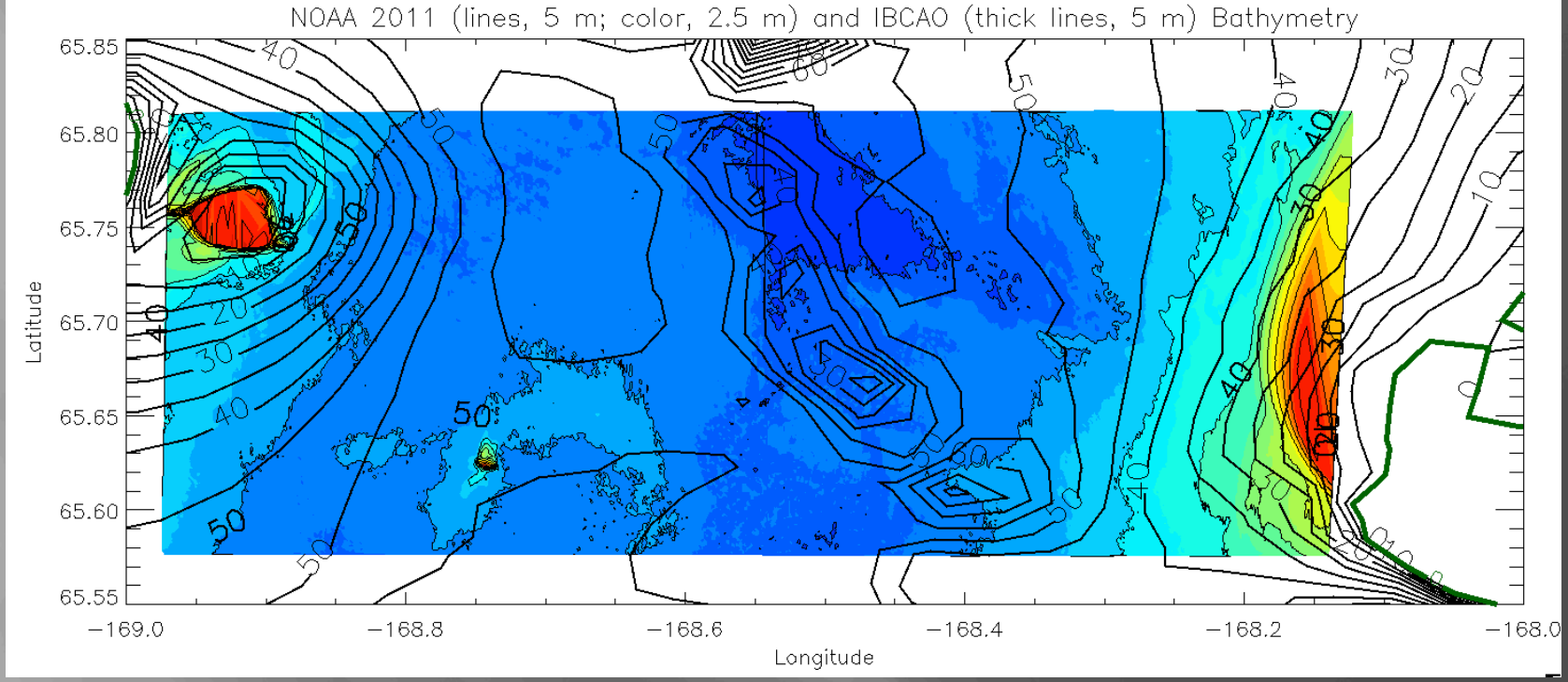
Large enough to be significant in the Arctic

- - greater than solar input to Chukchi

- 1/3rd of Fram Strait heat

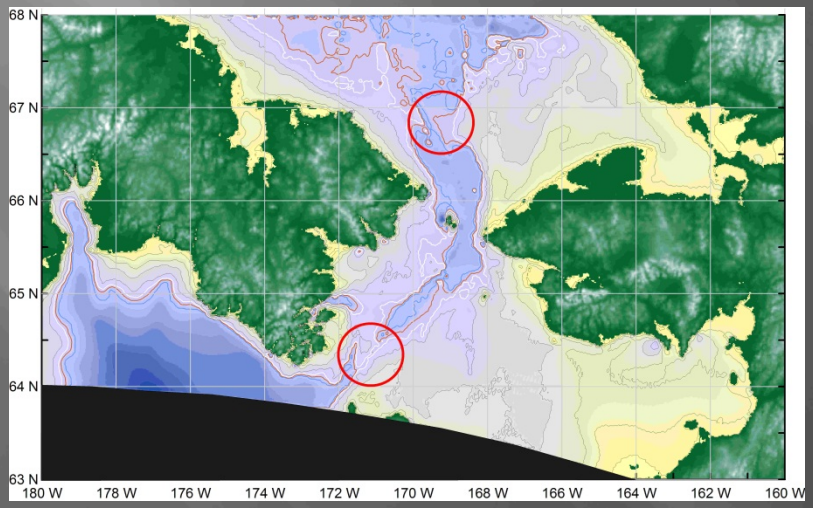
Ocean Acidification Research via RUSALCA and Icescape

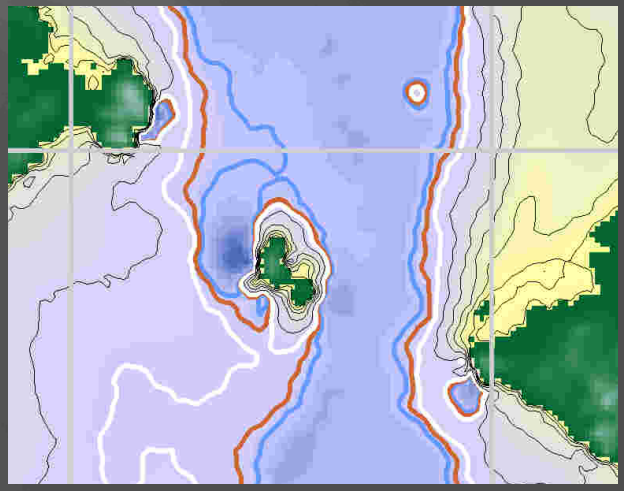




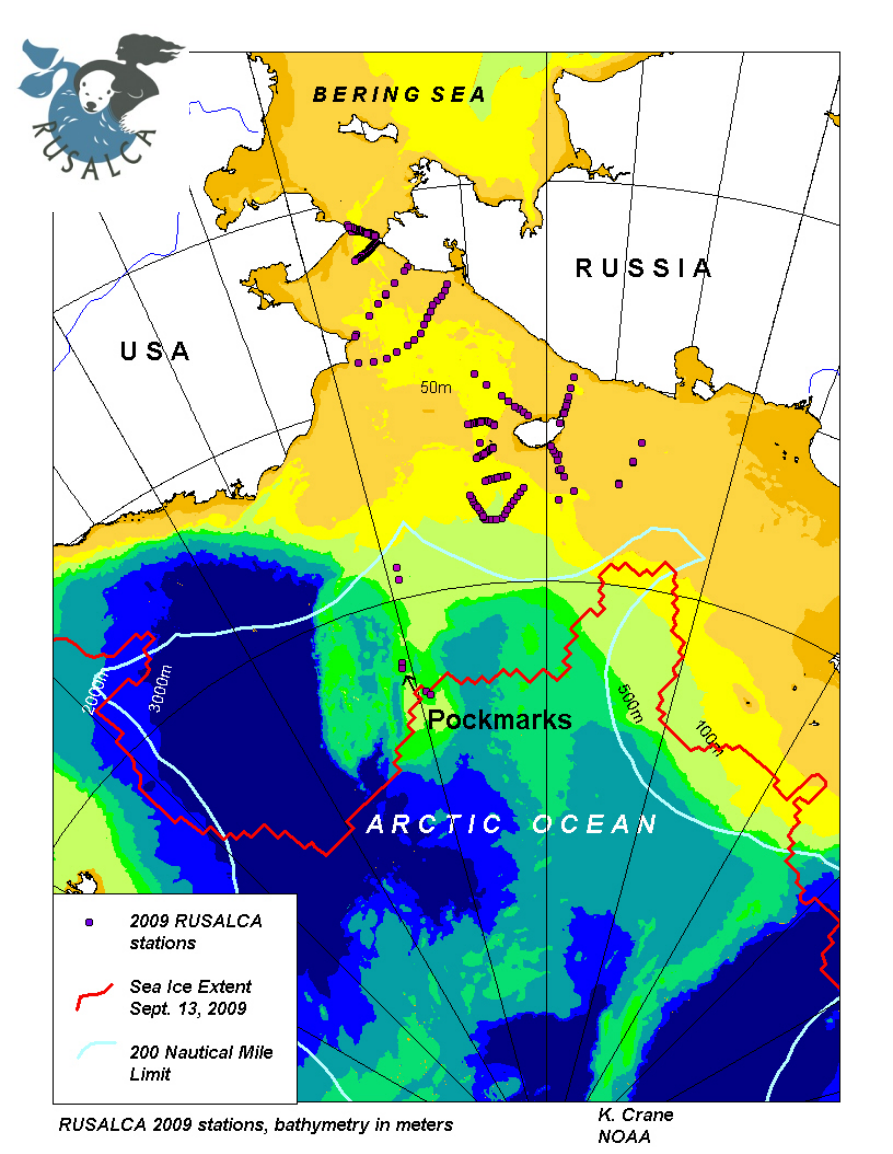
Above: Comparison of IBCAO with NOAA 2011 Bathymetry data from Kathy Crane. Plot by Ron Lindsay

Below: As per Melling et al 2008, IBCAO (??) map of the strait





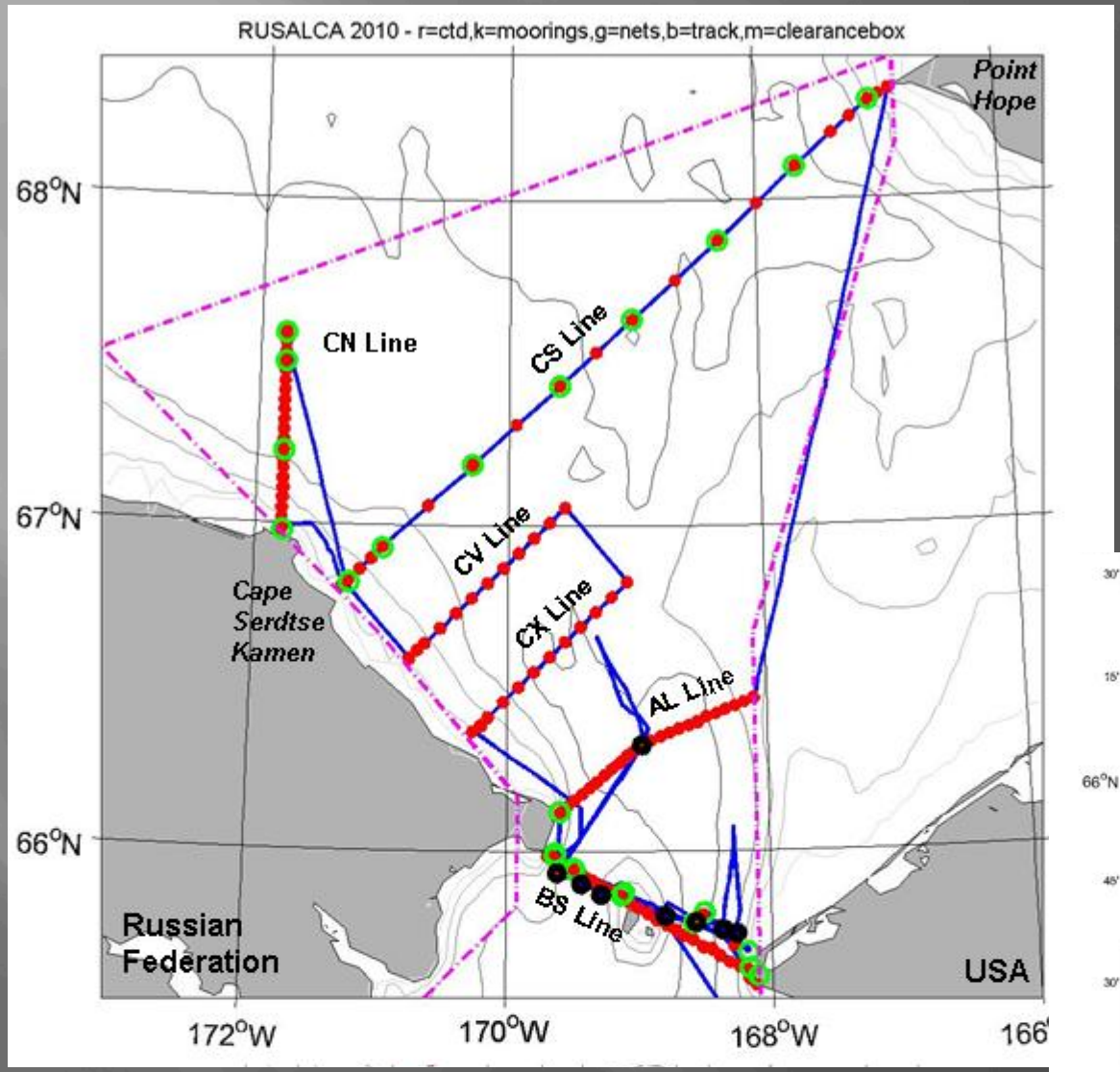
2009 STATION LOCATIONS



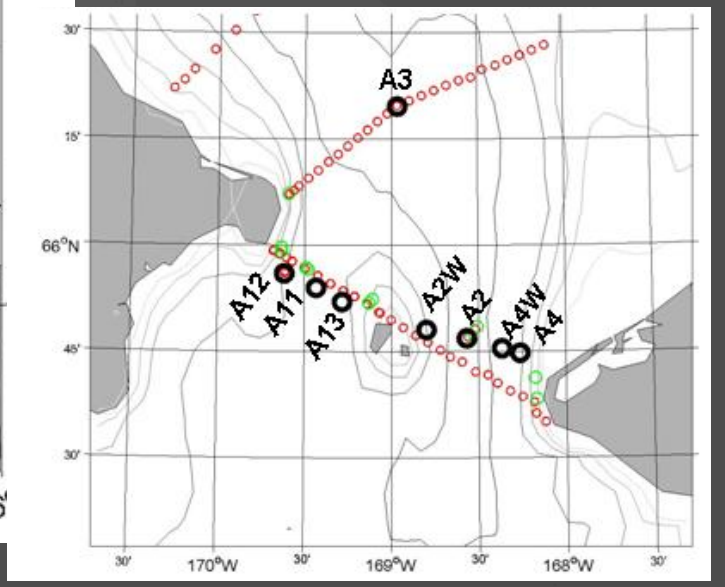
Photos Courtesy of A. Ostrovskiy

RUSALCA 2010

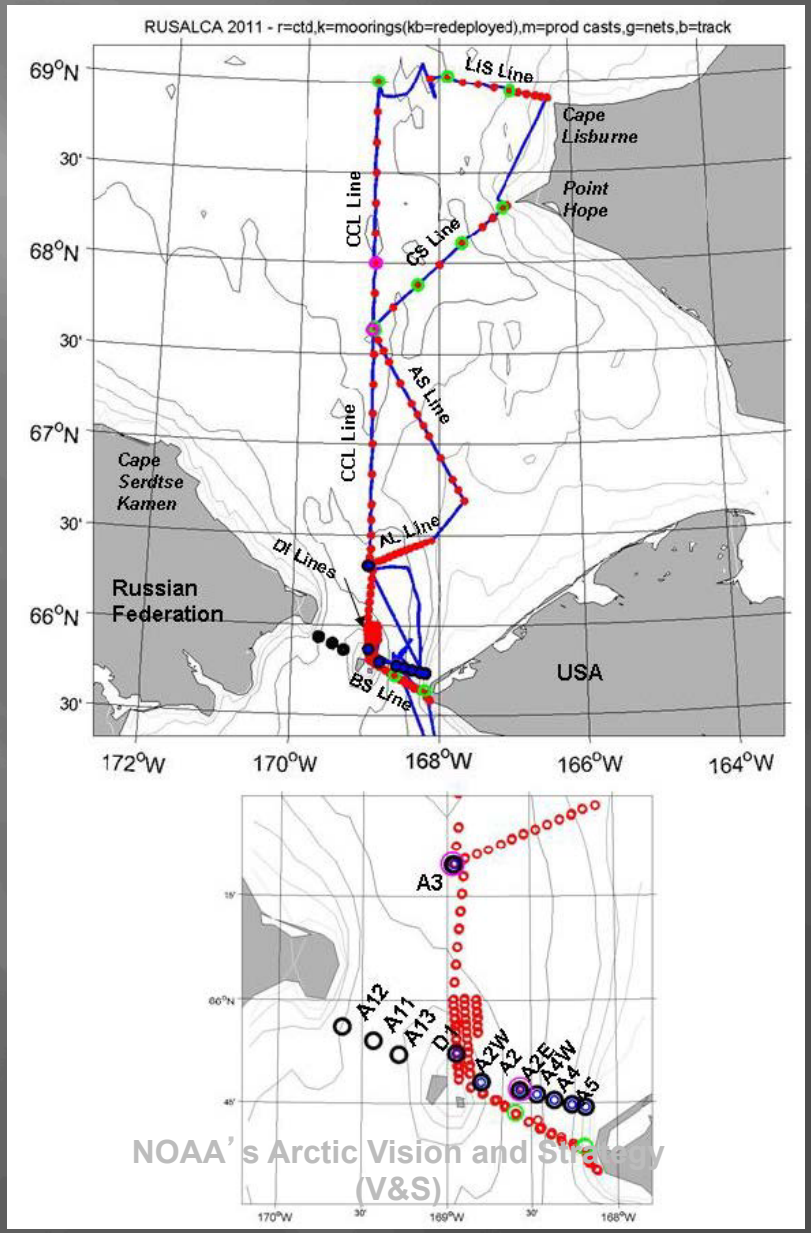
31st July – 11th Aug 2010
Nome to Nome



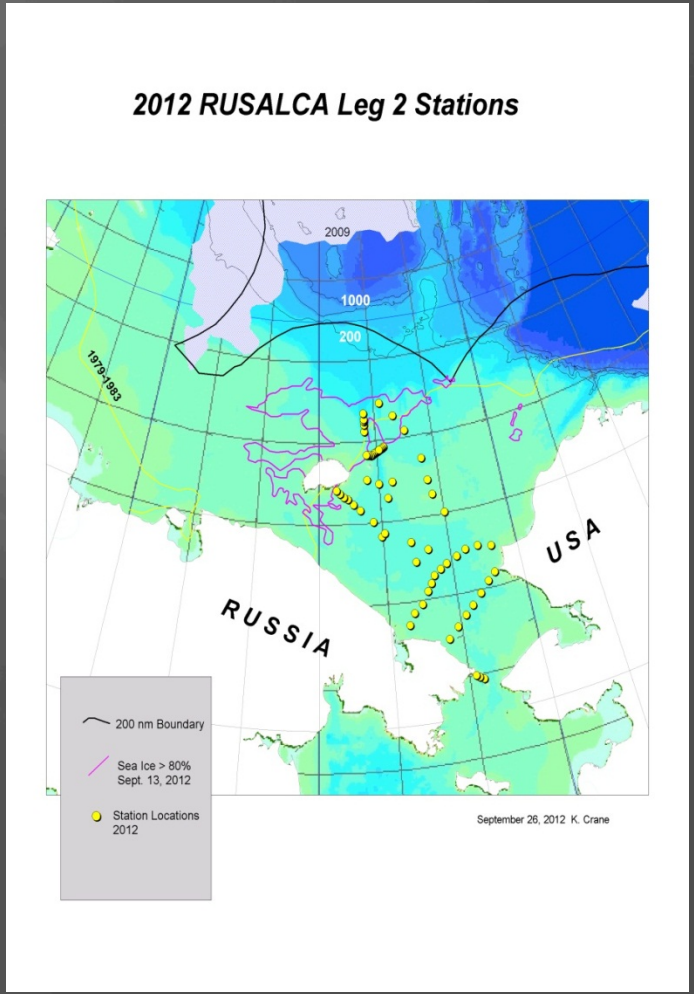
Mauve = clearance box
Blue = ship track
Black dots = moorings
Red dots = CTDS
Green dots = nets
+ 4 Primary productivity stations



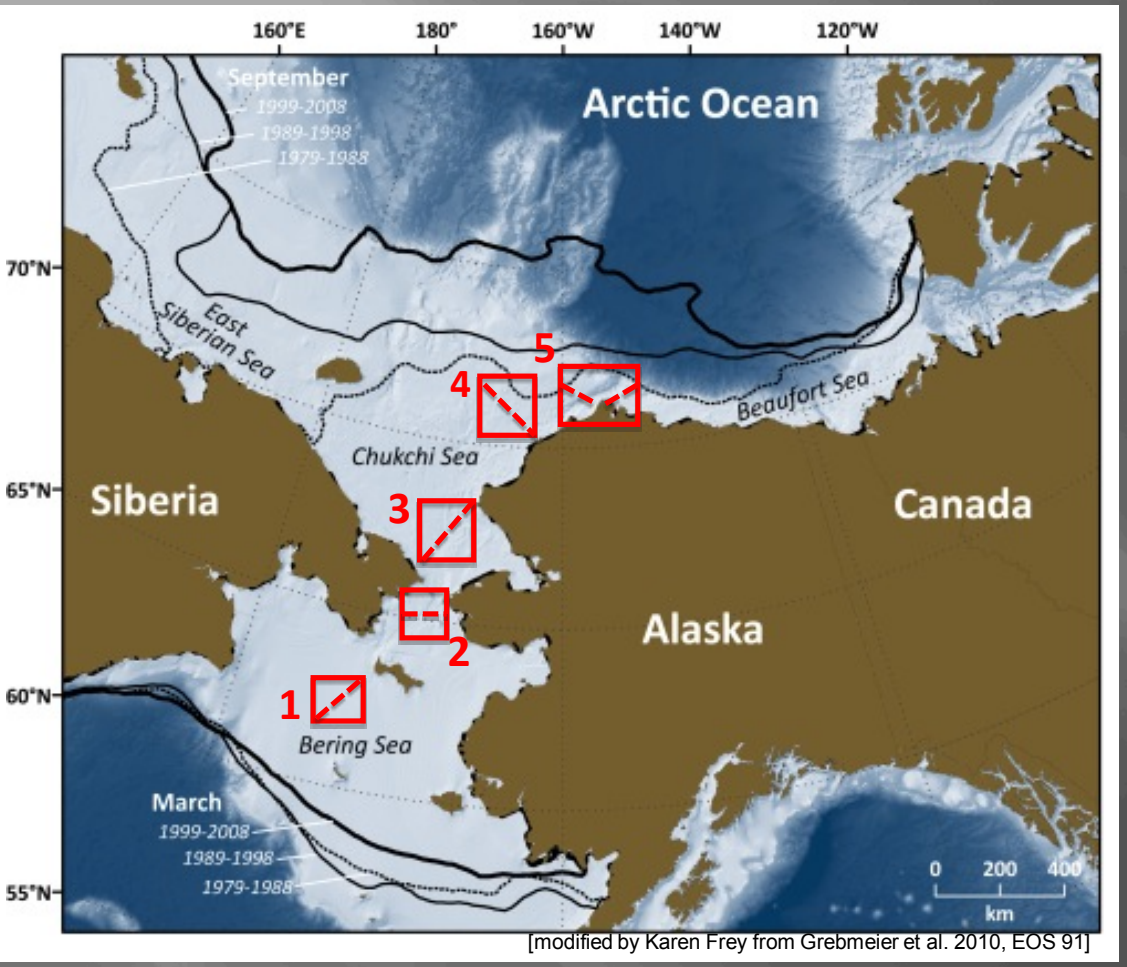
2011 Restrictions



RUSALCA 2012 Leg-2 stations



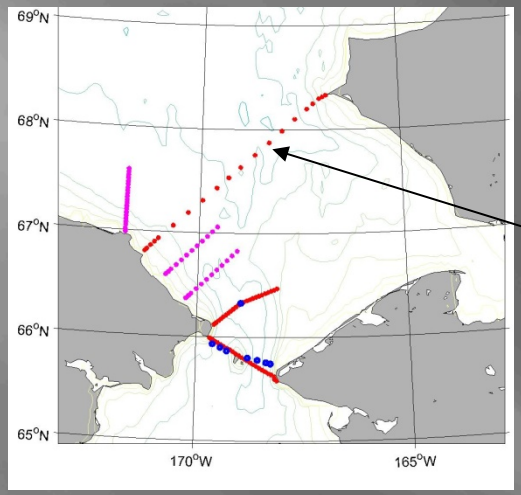
Linking Physics & Biology: the Distributed Biological Observatory (DBOs) Concept



[modified by Karen Frey from Grebmeier et al. 2010, EOS 91]

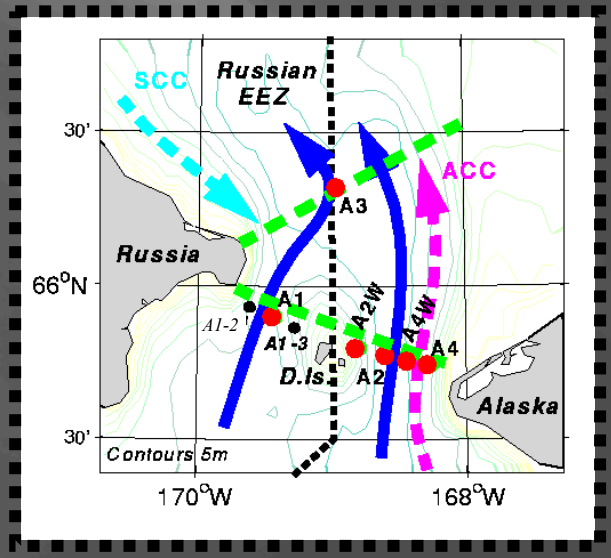
- The DBO will focus on five regional "hotspot" locations along a latitudinal gradient
- DBO regions exhibit high productivity, biodiversity, and overall rates of change
- The DBO will serve as a *change detection array* for the identification and consistent monitoring of biophysical responses

Bering Strait Mooring to be deployed in 2014

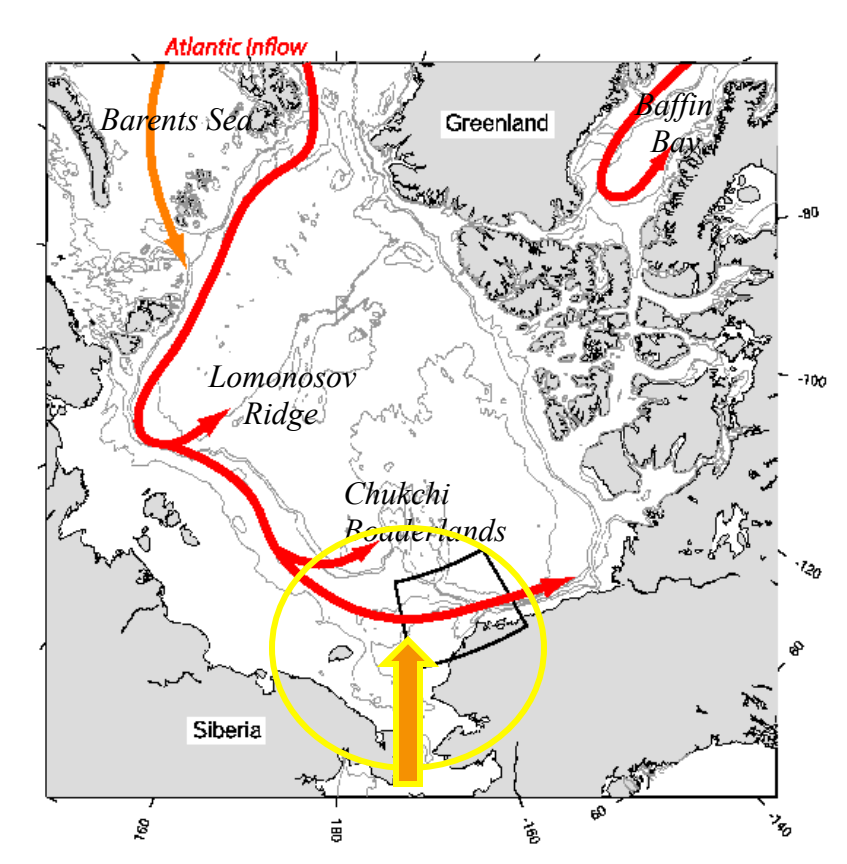


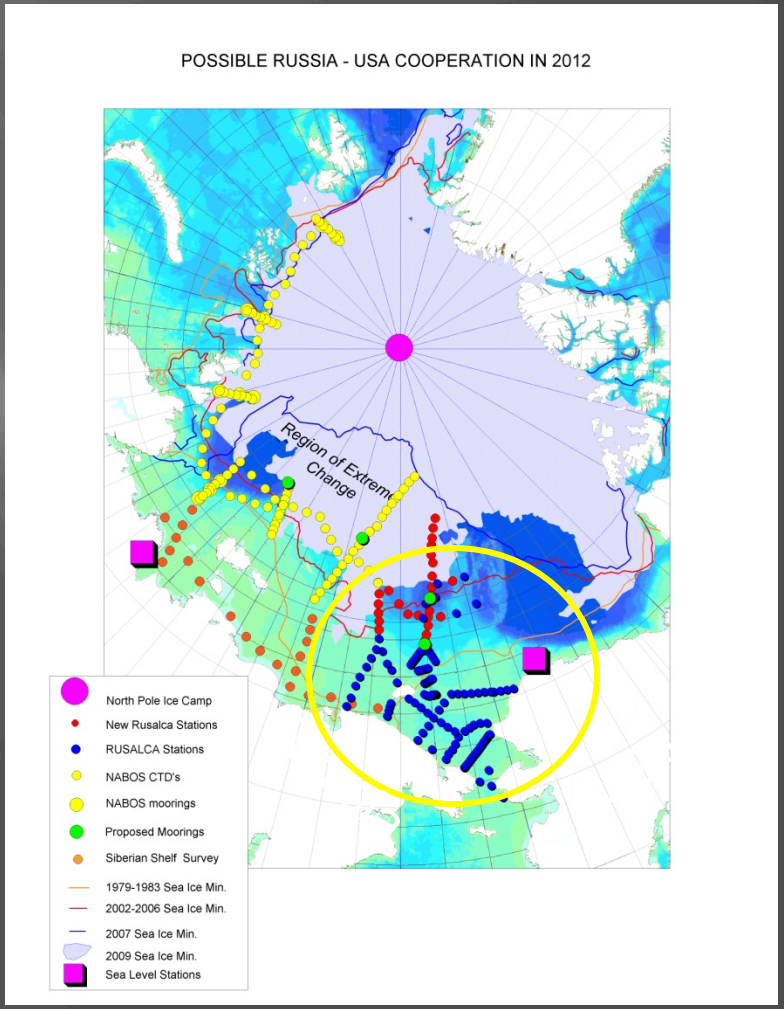
Schematic of Bering Strait region showing topography contoured at 10m intervals.
- Red (small) dots mark primary CTD locations The most northerly line is DBO Line 3.
. Magenta (small) dots mark possible extra lines
- Blue (larger) dots mark mooring locations prior to 2012

Detail of Bering Strait Region, schematically marking:
- major currents
(SCC = Siberian Coastal Current; ACC = Alaskan Coastal Current) - mooring locations – black and red dots. Red (larger) dots indicate moorings with upper layer temperature-salinity sensors - A1, A3, A2W, A2, A4W, and A4. Black (smaller) dots indicate conventional moorings – A1-2 and A1-3.
D.Is. = Diomede Islands



FUTURE ARCTIC RESEARCH GOALS:
Role of Atlantic Water and Pacific Water on the Transport of Heat and Biota into the Pacific Arctic (RUSALCA Region)





Future RUSALCA observing 2012-2020

2nd Decade RUSALCA, PAG and others !

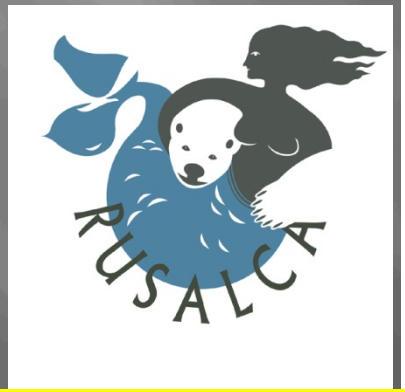
Considerations for 2014-2019 sampling

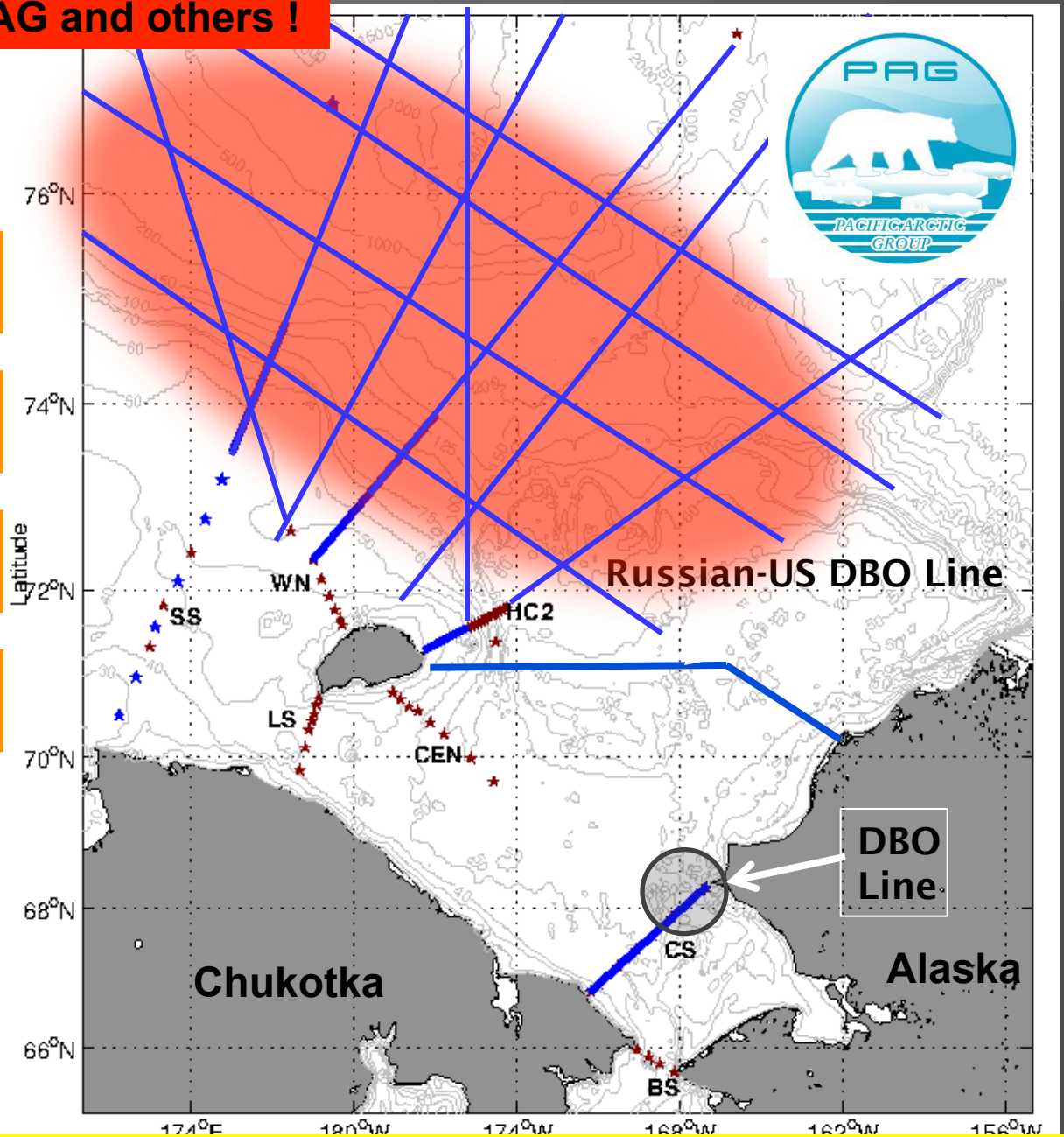
2 U.S. Russian DBO lines

10 Repeat hydrography,

Ecosystem and Methane

RUSALCA + Korea, China, Japan, Canada, Germany, Sweden?





Proposed 2015-2010 synoptic surveys: YOUR ADVICE and PARTICIPATION WANTED!!

ISSUES

- US Coast Guard requirements
- Russian Border Guard requirements
- Russian territorial and EEZ waters permissions
- US Deemed Exports constraints
- Data transfer via the Russian Navy
- RUSALCA subject to US-Russia diplomatic relations
- Use of Russian Federation vessel

SUCCESSES

- Enhanced scientist-scientist cooperation
- Enhanced government to government relations
- Russian-USA (Chukotka-Alaska relations)
- U.S.-Russian Federation Presidential Commission on Climate
- Enhanced agency to agency collaboration within Russia
- Enhanced agency to agency collaboration in the USA
- Arctic Council recognition: CBMP sentinel sites

POSSIBLE JOINT RUSALCA EXPEDITION

1. USA, RUSSIA, KOREA, CHINA, JAPAN
2. RV "POFESSOR KHROMOV" (+ "ARAON"?)
3. Russian EEZ access AG LLC, NAVY
4. 2015 or 2016
5. Have to move fast.
6. Vessel reservation - 2 years
7. Permission application - 1 year
8. Prepayment for the Vessel operator of New Zealand - 1 year needed

RUSALCA Sponsors and Scientists

RUSALCA CONFERENCE
SAINT PETERSBURG
MAY 21-23, 2013

RUSALCA CONFERENCE HAWAII, USA FEBRUARY 21-22, 2014

WELLCOME!