

Pacific Arctic Group (PAG)

Climate Line Workshop

Sung-Ho Kang

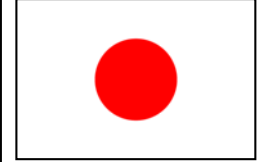
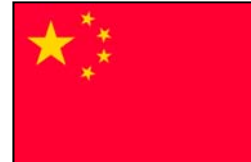
Division of Polar Ocean Sciences, Korea Polar Research Institute (KOPRI),
Incheon, Republic of Korea

Welcome and Introduction

21-22 April 2015

Tokyo, Japan

<http://pag.arcticportal.org/>





Pacific Arctic Group, PMEL, Seattle, October 28-29, 2014

Photo credit: Aleksey Ostrovskiy

THE PACIFIC ARCTIC GROUP (PAG) MEETING

October 28-29, 2014
Seattle, Washington

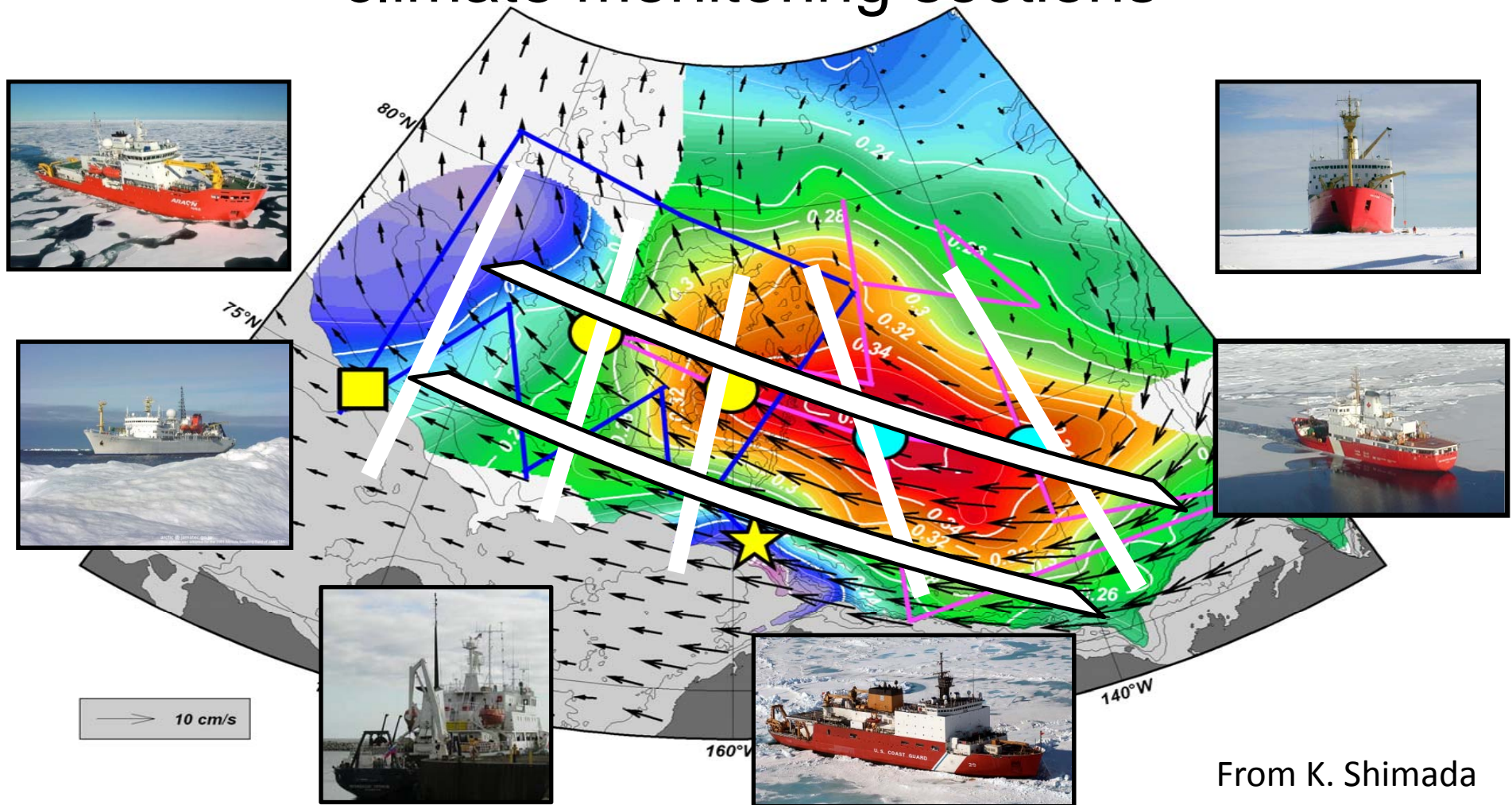
Citation: Grebmeier, J.M, A. Bayard, L.S. Guy, and J. Lee (eds). 2015. The Pacific Arctic Group (PAG) Fall 2014 Meeting Report. CBL/UMCES, 24 pp.

*Meeting
Minutes*

Meeting report
available and
presentations available
on the PAG website:

<http://pag.arcticportal.org/>

Proposed international Pacific Arctic climate monitoring sections



From K. Shimada

Background color: dynamic height at 100dbar relative to 800dbar from Mirai and Louis S. St-Laurent 2008 cruises (Oceanic Beaufort Gyre)

Black vectors: average sea ice motion vectors for Nov. 2007- Apr. 2008 (Sea Ice Beaufort Gyre)

Symbols: Mooring array in 2012-2013 (TUMSAT/KOPRI/NIPR & WHOI)

- The Pacific Arctic region would be important in identifying the ocean circulation that is affecting the receding ice in the Arctic (i.e. center of action on sea ice reduction).
- The recent increases in scientific studies have improved our understanding of this region; however, there is a gap in the northeastern Siberian region where a link between international projects would be extremely useful for understanding overall system change.
- The workshop will focus on the joint activities in relation to developing an international “Pacific Climate Line” north of the Chukchi Sea extending from the Makharov Basin in the West to the Canada Basin in the East.



Proposed Steps

- Abstract submitted for ICARP III conference in Toyama, Japan
- A “Letter of Intent” to be developed among interested countries/program managers to layout the proposed roles of the participants
- Presentations for ICARP III to provide scientific rationale and updates on plans
- Workshop in Tokyo (hosted by TUMSAT) prior to Toyama meeting to fine tune presentations and plans



PAG ICARP III Activities

- The nations of the Pacific Arctic Group are proposing **to carry out a series of repeat observations in the Arctic Ocean, north of the Chukchi Sea extending from the Makharov Basin in the West to the Canada Basin in the East.**
- This region has undergone **the most extreme loss of sea ice extent and thickness within the Arctic Ocean and yet is very poorly observed.** We propose to study the **evolution, structure, variability, and heat transport of Atlantic Water in this region and its interaction with northward flowing warm Pacific Water from the Chukchi Sea,** which accelerates the positive ice/ocean albedo feedback cycle, leading to rapid loss of summer sea ice.
- We also propose to carry out **a census of the ecosystem in this region** which is likely in rapid transition due to the extreme physical changes.
- **Repeat observational transects and time-series records from moorings** will be planned to reveal year-round the interplay between the amount of heat that is being lost into the atmosphere from this part of the Pacific Arctic Ocean, the enhanced mixing of both surface and intermediate waters in response to increased storms, increased ocean absorption of solar radiation and the consequent impacts on the changing weather and climate of the Northern Hemisphere.
- The observing period will also incorporate atmospheric observations **to support the WMO's Year of Polar Prediction (YOPP).**
- We propose **to coordinate this work with the vessels of our respective countries** from 2015-2020, which will provide a unique suite of synoptically collected data made available **for joint analysis, assessment, and modeling/data assimilation via the mechanisms already set up within the Pacific Arctic Group.**

B2: Current and Future Observing Strategies for Understanding the Evolving Arctic Climate and Ecological System

April 28, 2015 (Tuesday), Room 203

10:45-12:15

Chair: Leif Anderson, Terry Callaghan

10:45-11:03	B02-O11	ARCTIC OCEAN BOUNDARY ARRAY: CORNERSTONE OF ARCTIC MONITORING S. Bacon*, T. Tsubouchi, Y. Aksenov
11:03-11:21	B02-O12	THE DISTRIBUTED BIOLOGICAL OBSERVATORY: A LATITUDINAL DETECTION ARRAY FOR TRACKING ECOSYSTEM CHANGE IN THE PACIFIC ARCTIC J. M. Grebmeier*, L. W. Cooper, K. E. Frey, T. Kikuchi, S. E. Moore, S. Vagle
11:21-11:39	B02-O13	THE PACIFIC ARCTIC GROUP CLIMATE OBSERVING SYSTEM: AN INTERNATIONAL EFFORT TO UNDERSTAND THE CAUSES AND CONSEQUENCES OF SEA ICE LOSS IN THE 'HOT SPOT' OF THE ARCTIC OCEAN K. H. Cho, J. He, S. H. Kang, J. H. Kim, H. Melling, A. Ostrovskiy, G. Panteleev, R. Pickart, I. Polyakov, K. Shimada, T. Uttal, W. Williams, H. Yamaguchi, J. Zhao, J. Wang, K. Crane
11:39-11:57	B02-O14	YEAR-LONG, DAILY-SCALE ECOSYSTEM OBSERVATIONS UNDER PERENNIAL ICE COVER IN THE ARCTIC OCEAN S. Laney*, J. Toole, R. Krishfield, M. L. Timmermans
11:57-12:15	B02-O15	SIZONET: MULTI-PURPOSE, MULTI-PLATFORM OBSERVATIONS TO INFORM RESPONSES TO AN ARCTIC SEA ICE COVER IN TRANSFORMATION H. Eicken*, A. R. Mahoney, D. O. Dammann, J. Jones, S. Hendricks, Y. Fukamachi, K. I. Ohshima, C. Haas, S. Gerland, A. Makshtas



Pacific Arctic Group (PAG) Climate Line Workshop

April 21-22 2015

Venue: Tokyo University of Marine Science and Technology (TUMSAT, Shinagawa Campus)

Tues. April 21, 2015	Wed. April 22, 2015
1300 - transport hotel to TUMSAT	0730 and 0800 transport hotel to TUMSAT
1330 - 1540 Afternoon 1	0830 - 0930 Morning 1
1540 - 1625 Coffee break & Poster session	0930 - 1100 Morning 2
1630 - 1750 Afternoon 2	1100 End of meeting; transport to Toyama
1800 ~ Dinner (no-host dinner)	

Day 1 (21 April 2015)

Introduction and Welcome (Sung-Ho Kang)

Brief introduction of PAG Climate Line and meeting agenda (Sung-Ho Kang, Chair)

13:30-14:20 Major institutions (10min each)

Kathy Crane (NOAA)

Joo-Hong Kim (KOPRI)

Takashi Kikuchi (JAMSTEC)

Jianfeng He (PRIC) or Jinping Zhao (OUC)

Bill Williams (DFO)



14:20-15:40 Physical oceanography and sea ice dynamics (15min each)

[Chair: Koji Shimada]

Hajime Yamaguchi (Univ. Tokyo)

Vladimir Ivanov (AARI)

Kyoung Ho Cho (KOPRI)

Jinping Zhao (Ocean Univ. China)

Bill Williams (DFO)

15:40-16:25 Coffee break & Poster session

16:30-17:50 Biogeochemical Oceanography and Ecosystem (15min each)

[Chair: Kathy Crane]

Eun Jin Yang/Jin Young Jung (KOPRI)

Naomi Harada (JAMSTEC)

Carin Ashjian (WHOI)

Lee Cooper (UMCES)

Jacqueline Grebmeier (UMCES)

18:00~ Dinner



Day 2 (22 April 2015)

8:30-9:30 Atmosphere and sea ice (15min each)

[Chair: Joo-Hong Kim]

Jun Inoue (NIPR)

Taneil Uttal (NOAA) – presentation by Kathy Crane

Joo-Hong Kim (KOPRI)

9:30-11:00 Discussions (Kathy Crane, Takashi Kikuchi, Joo-Hong Kim, Jinping Zhao)

11:00 End of workshop; move to Toyama



Suggested Approach to Implementation

- Segment the domain into smaller units consistent with PAG countries' interests and capabilities
- Build on existing activities
- Coordinate logistics and science to the maximum extent possible



Potential Outcomes

- Advancement in scientific knowledge, with direct application to:
 - Improved regional weather and sea ice forecasts
 - Improved hemispheric weather and climate models and forecasts
 - Improved regional ecosystem understanding in area outside of national jurisdiction to guide future international ecosystem protection efforts

Overview of PAG

- The Pacific Arctic Group (PAG) is a consortium of institutes and individuals having a Pacific perspective on Arctic science
- PAG serves as a Pacific Arctic regional partnership to plan, coordinate, and collaborate on science activities
- The four PAG principal science themes are climate, contaminants, human dimensions and structure and function of Arctic ecosystems
- The PAG membership is led by an Executive Committee consisting of a Chair, two Vice Chairs, and the Project leads from ongoing PAG activities from Canada, China, Japan, Korea, Russia, USA.



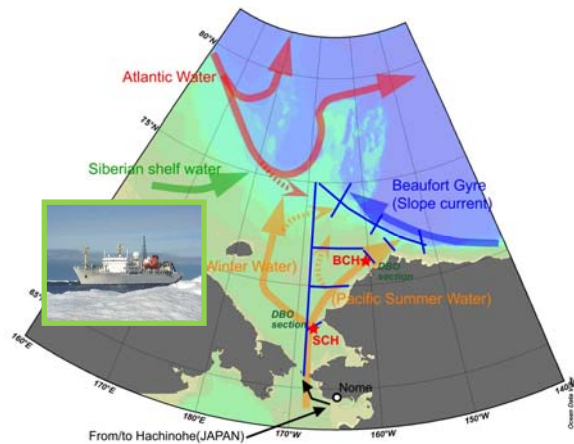
Examples of current PAG activities

- Sharing information on **annual field activities** in the Pacific Arctic region
- **Continued development and implementation of long-term monitoring activity such as the Distributed Biological Observatory (DBO)** - environmental and biological sampling at stations on transect lines located along a latitudinal gradient extending from the northern Bering Sea to the Barrow Arch, and new regions
- **Undertake a Pacific Arctic regional, multidisciplinary synthesis of scientific findings** in the marine region relevant to ongoing scientific objectives at the core of the PAG
- **Project development and sampling in the Chukchi Borderland and Canada Basin region** to investigate climate, oceanography, air-sea ice interactions, physical oceanography, and modeling

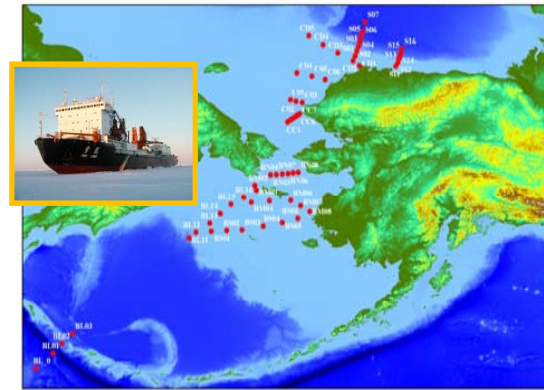


2010-14 PAG research cruises in Pacific Arctic Region

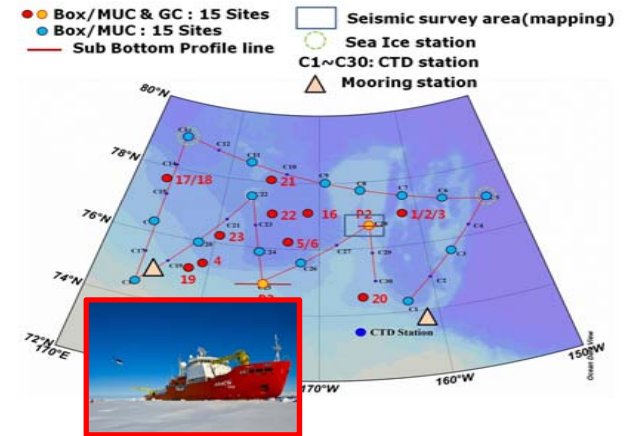
Japan: RV Mirai



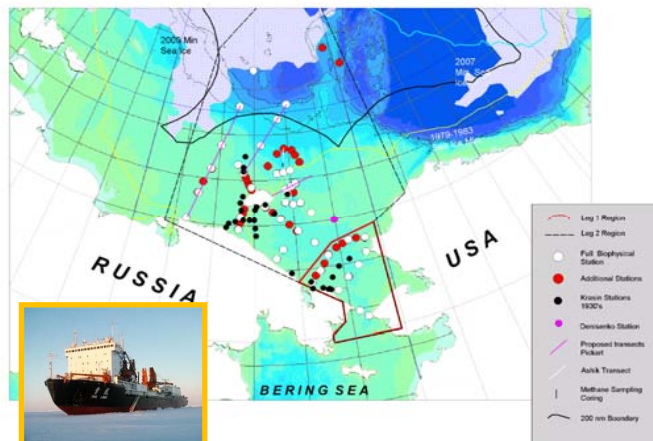
China: RV Xuelong



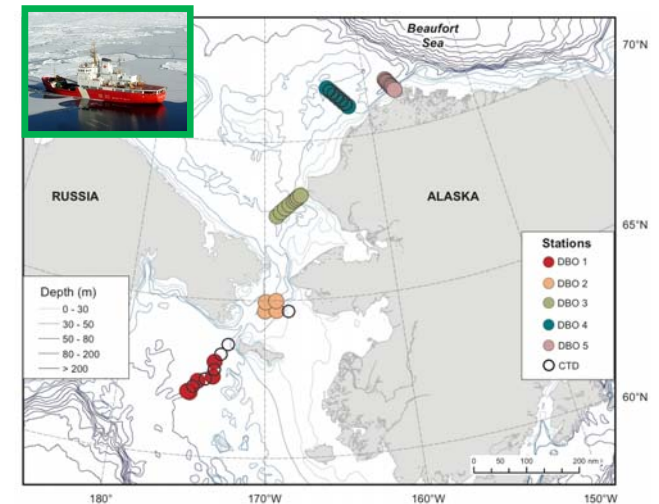
Korea: RV Araon



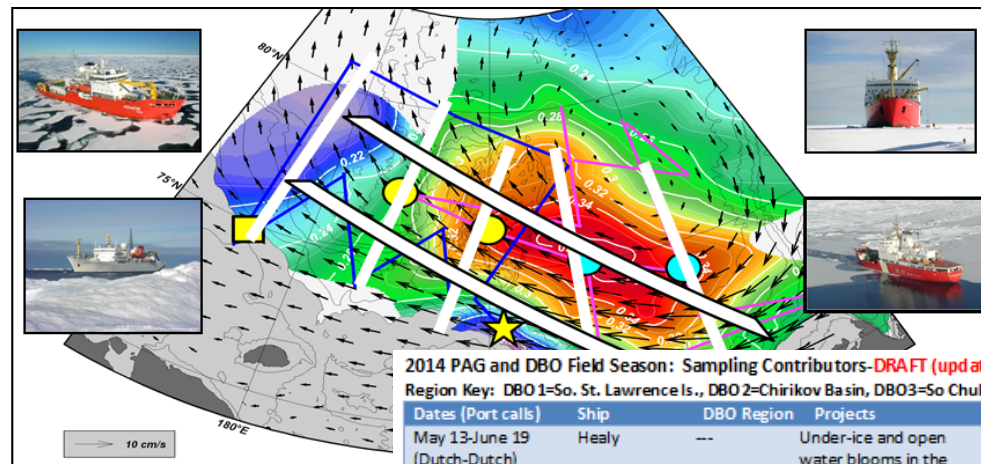
Russia-USA: RV Khromov



Canada-USA: CCGS Sir Wilfrid Laurier (DBO 1-5 and RV Westward Wind DBO4)



Sharing information on annual field activities

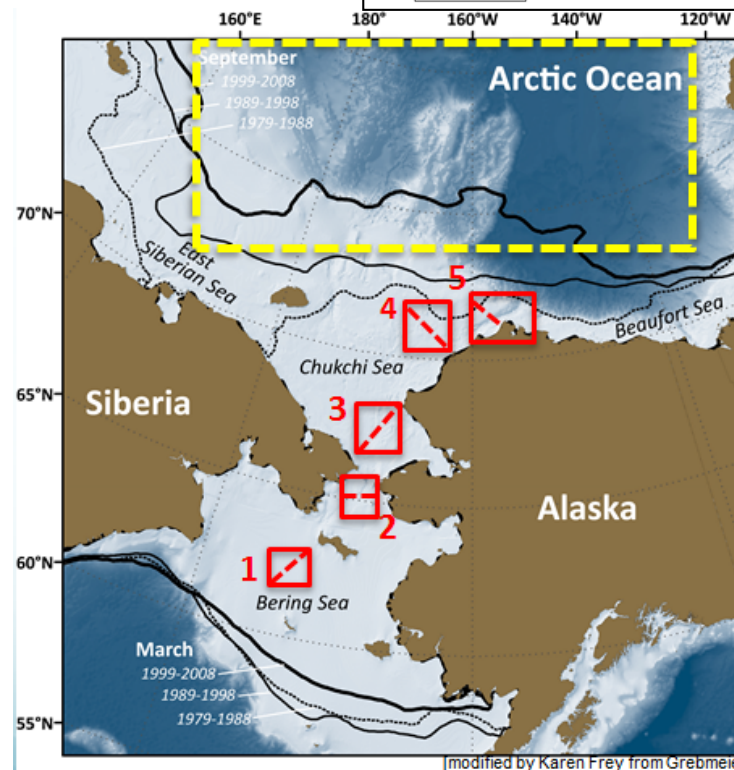


2014 PAG and DBO Field Season: Sampling Contributors-DRAFT (updates pending PAG meeting April 2014)

Region Key: DBO 1=So. St. Lawrence Is., DBO 2=Chirikov Basin, DBO3=So Chukchi Sea, DBO4=NE Chukchi Sea, DBO5=Barrow Canyon.

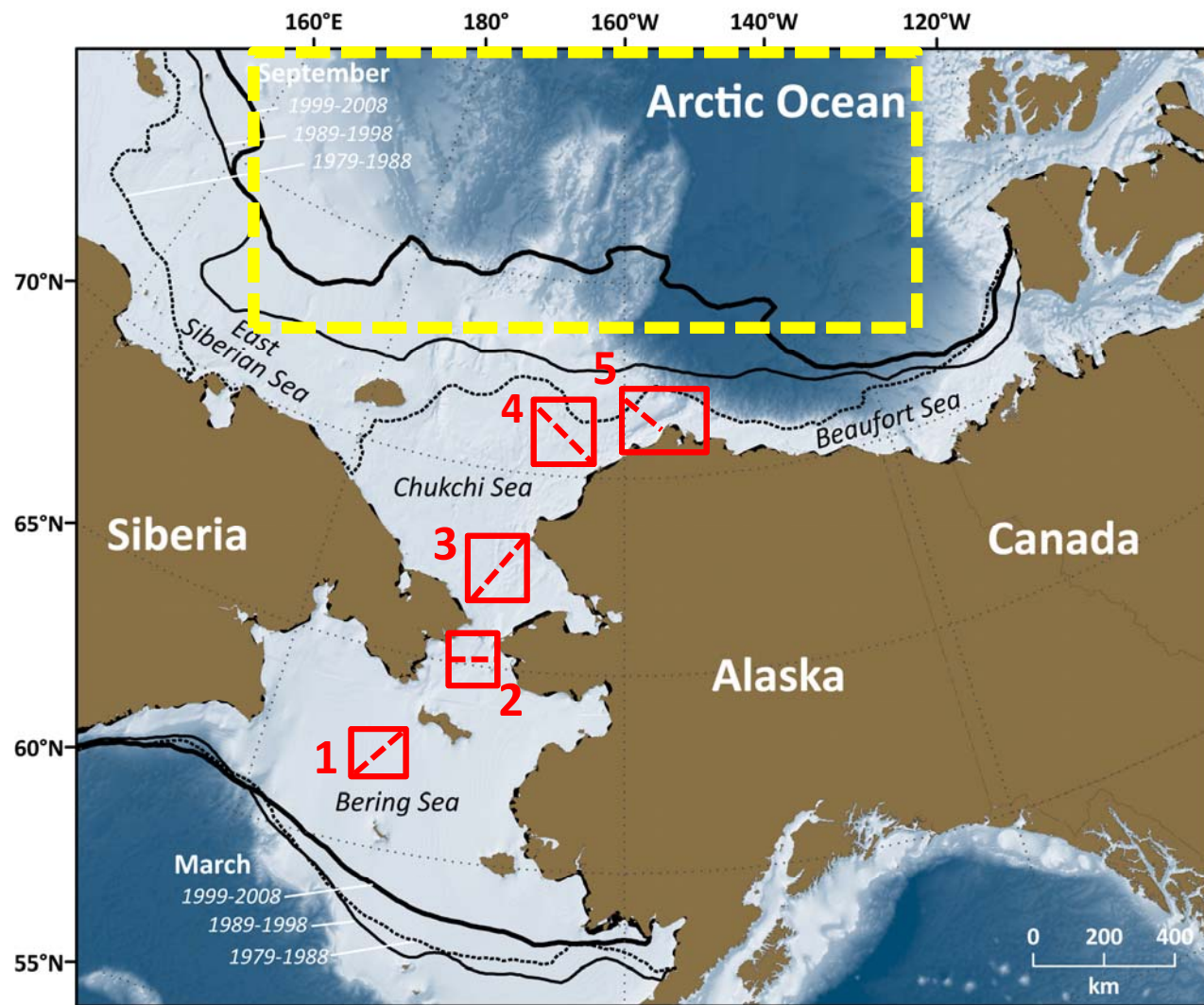
Dates (Port calls)	Ship	DBO Region	Projects	PAG contact	Chief Scientist
May 13-June 19 (Dutch-Dutch)	Healy	---	Under-ice and open water blooms in the Chukchi Sea	Robert Pickart rpickart@whoi.edu	Kevin Arrigo arrigo@stanford.edu
July 3 (Nome-Nome)	Norseman II	3	Bering Strait Mooring Project/AON?	Rebecca Woodgate woodgate@apl.washington.edu	Rebecca Woodgate woodgate@apl.washington.edu
July (Anadyr-Anadyr)	Khromov	3	RUSALCA Bering Strait mooring	Kathy.Crane@noaa.gov Phyllis.Stabeno@noaa.gov	Kathy.Crane@noaa.gov
July 4-25 (Victoria, BC-Barrow)	Sir Wilfrid Laurier	1,2,3,4,5; + moorings at 1, 3	C30/DBO, plus JAMSTEC DBO moorings	Jackie Grebmeier jgrebmei@umces.edu ; Takashi Kikuchi takashik@jamstec.go.jp	Svein Vagle Svein.Vagle@dfo-mpo.gc.ca
July 11-Sept 24 (Shanghai-return)	Xuelong	(1-2 partial), 3,5	Chinese Arctic Research Expedition	Jianfeng He	
July 4-29-August 15 (Dutch-Barrow)	Healy	5 (TBD)	AON	Robert Pickart rpickart@whoi.edu	Robert Pickart rpickart@whoi.edu
August-Sept (Nome-Nome)	Araon	3	Korean Expedition (KOPRI)	Sung-Ho Kang shkang@kopri.re.kr	Sung-Ho Kang shkang@kopri.re.kr
August-Sept (Barrow-Barrow)	Annika Marie	5	AON	Carin Ashjian cashjian@whoi.edu	Carin Ashjian cashjian@whoi.edu
August-Sept	Aquila?	1,3, 5	ARCWEST	Jeff.Napp@noaa.gov Sue.Moore@noaa.gov	Catherine Berchok@noaa.gov Phyllis.Stabeno@noaa.gov
August-October	Westward Wind	4	CSESP	Tom Weingartner weingart@ims.uaf.edu	Bob Day bday@abrinc.com John Burns jbumssn@gci.net
August-September	Bristol or Alaska Explorer	1 and/or 2	Arctic Eis	Ed.Farley@noaa.gov	Franz Mueter mueter@alaska.edu
September-October	Mirai	3,5	JAMSTEC	Takashi Kikuchi takashik@jamstec.go.jp	Shigeto Nishino nishinos@jamstec.go.jp
September-Oct	Louis S St-Laurent	-	JOIS	Bill Williams Bill.Williams@dfo-mpo.gc.ca	Bill Williams Bill.Williams@dfo-mpo.gc.ca

Projects Key: AON=US Arctic Observing Network; ARCWEST = Arctic Whale Ecology Study; COMIDA=Chukchi Offshore Monitoring in Drilling Area; CSESP=Chukchi Sea Environmental Studies Program; C30=Canada's Three Oceans; JAMSTEC= Japan Agency for Marine-Earth Science and Technology; KOPRI = Korea Polar Research Institute.



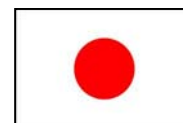
(modified by Karen Frey from Grebmeier)

Continued development and implementation of long-term monitoring activity - the Distributed Biological Observatory (DBO)



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

- DBO sites (red boxes) are **regional “hotspot”** transect lines and stations located along a latitudinal gradient
- DBO sites are considered to exhibit **high productivity, biodiversity, and overall rates of change**
- DBO sites will serve **as a change detection array for the identification and consistent monitoring of biophysical responses**
- Sites occupied by **national and international entities with shared data plan**



Supporting Comments

- Arctic ocean is vigorous and links to climate changes (K. Shimada, PAG, October 2014)
 - Upper ocean heat content a major factor in sea ice loss and regrowth (e.g., much sea ice loss in 2007/2008 from ocean heat)
 - Positive feedbacks on sea ice loss exist from altered atmospheric circulation and increased ocean heat
 - Ocean heat enters from atmosphere, Pacific inflow and possibly Atlantic water
- Opportunity to decipher how the changing atmosphere, ice, ocean, ecosystem and benthic flux system is altering in response to increasing heat flux from the northward flowing Pacific Water, the eastward flowing Atlantic Water, enhanced mixing of surface waters, and increased solar radiation (reaching ocean surface) (K. Crane, NOAA call for proposals 2014)

- - Main objectives of the session to:
 - (1) introduce and discuss new research focus areas that would be appropriate for joint and/or coordinated efforts by PAG participants,
 - (2) confirm the identity of potential participants and coordinators for each focus area, and .

- Points to consider included:
 - 1. What is the overarching rationale of the proposed activities?
 - 2. What are the specific outcomes of the proposed activities?
 - 3. Should testable hypotheses be stated to guide activities?
 - 4. Should specific space-time coordinates for stations and moorings be defined in advance?

Complex system requires careful planning

- Complexity of system requires climate system approach to ship-based work (i.e., atmosphere-ice-ocean)
- Review existing data, employ OSSEs and perform new analyses to fine tune observing plans
- A companion chemistry-biology focus would allow understanding of the ecological response to the changing physical state

Planning for New PAG Climate Observations

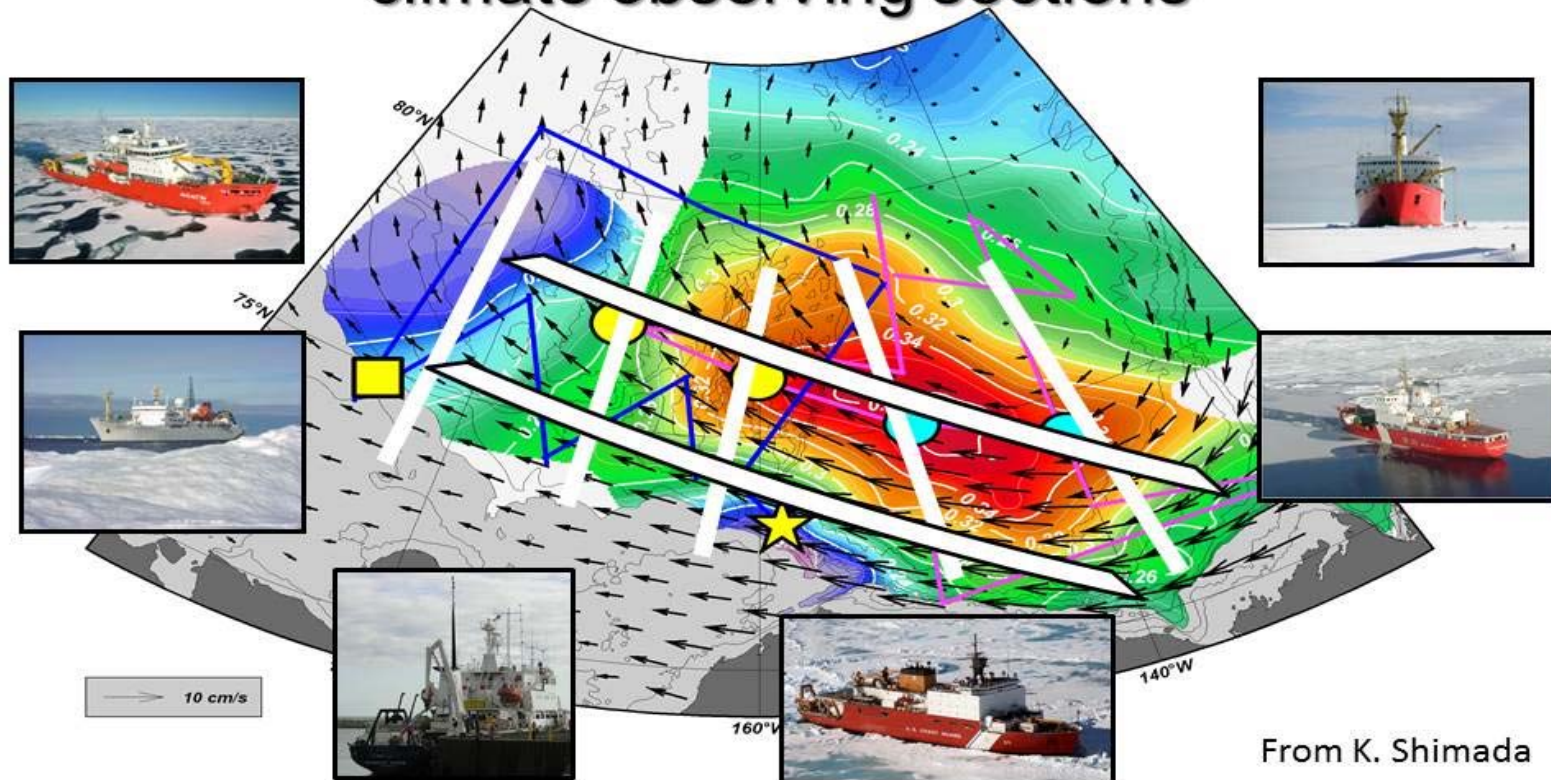
October 31, 2014

Seattle, Washington USA



PAG ICARP III Observatory

Proposed international Pacific Arctic climate observing sections



From K. Shimada

Background color: dynamic height at 100dbar relative to 800dbar from Mirai and Louis S. St-Laurent 2008 cruises (Oceanic Beaufort Gyre)

Black vectors: average sea ice motion vectors for Nov. 2007- Apr. 2008 (Sea Ice Beaufort Gyre)

Symbols: Mooring array in 2012-2013 (TUMSAT/KOPRI/NIPR & WHOI)

PAG ICARP III Contribution

- **PAG works with a pan-Arctic perspective to promote synergies across the Arctic Ocean.**
- **PAG recognizes the value of the ICARP III as a means to identify and prioritize overarching Arctic science issues, and to improve international coordination of research agendas.**
- **PAG's ICARP III contribution as data sharing and publications from results of the Distributed Biological Observatory (DBO) and continued development and implementation of the project.**
- **PAG can provide a valuable dataset for ongoing research and development of cooperative synthesis in the Pacific and Atlantic marine sector.**
- **European research activity can complement PAG studies with its research in the Atlantic side of the Arctic.**