

Pacific Arctic Region (PAR) Synthesis Effort: A Contribution of the Pacific Arctic Group (PAG) to the post-IPY Legacy

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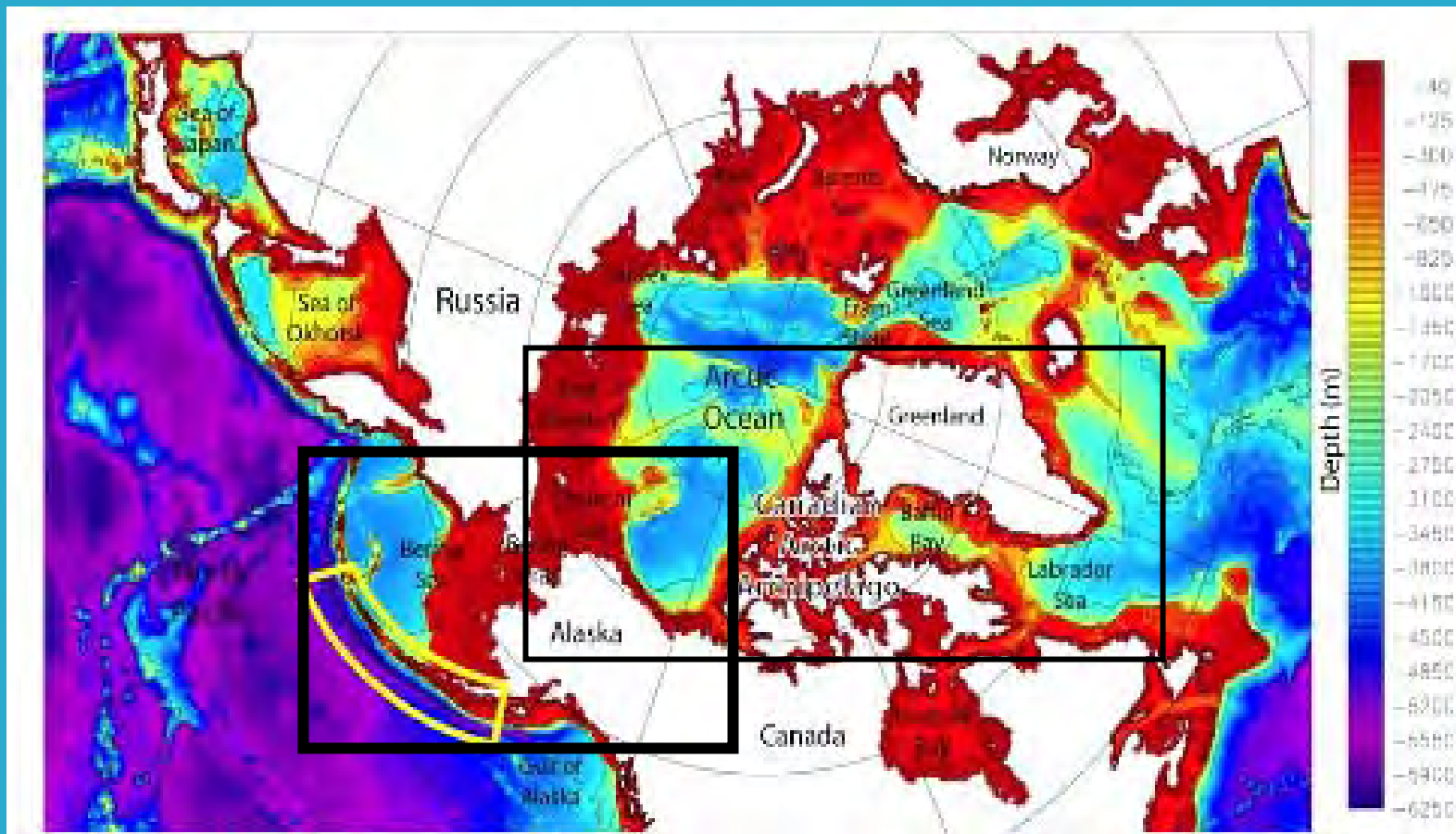
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<http://www.pagscience.com>



Synthesis Objectives

- present results from research, observation and modeling activities related to the PAG area, both retrospective and IPY efforts
- share information on current modeling activities covering the PAG synthesis area; work toward a shared modeling system
- using best available model projections, prepare hypotheses regarding the future evolution of the physics and biology of the region
- prepare scientific conclusions and recommendations to guide future PAG science activities
- specifically for the PAG region, identify critical marine components of a future Arctic Observing Network
- all fields of oceanography (physical, chemical, biological, geological), atmospheric science, and ice dynamics
- the PAG synthesis effort is endorsed by IASC, AOSB, and the ICSU IPY project office as an IPY legacy effort



[from Maslowski et al. 2007, J. Climatology]

PAG defines the “**Pacific sector**”^{*} of the Arctic as the marine area from the Northern Bering Sea into the Chukchi Sea and adjacent Seas, and extending into the deep basins of the Arctic Ocean, with model boundaries from Aleutian Island and deep Bering Sea northward to Arctic Basin

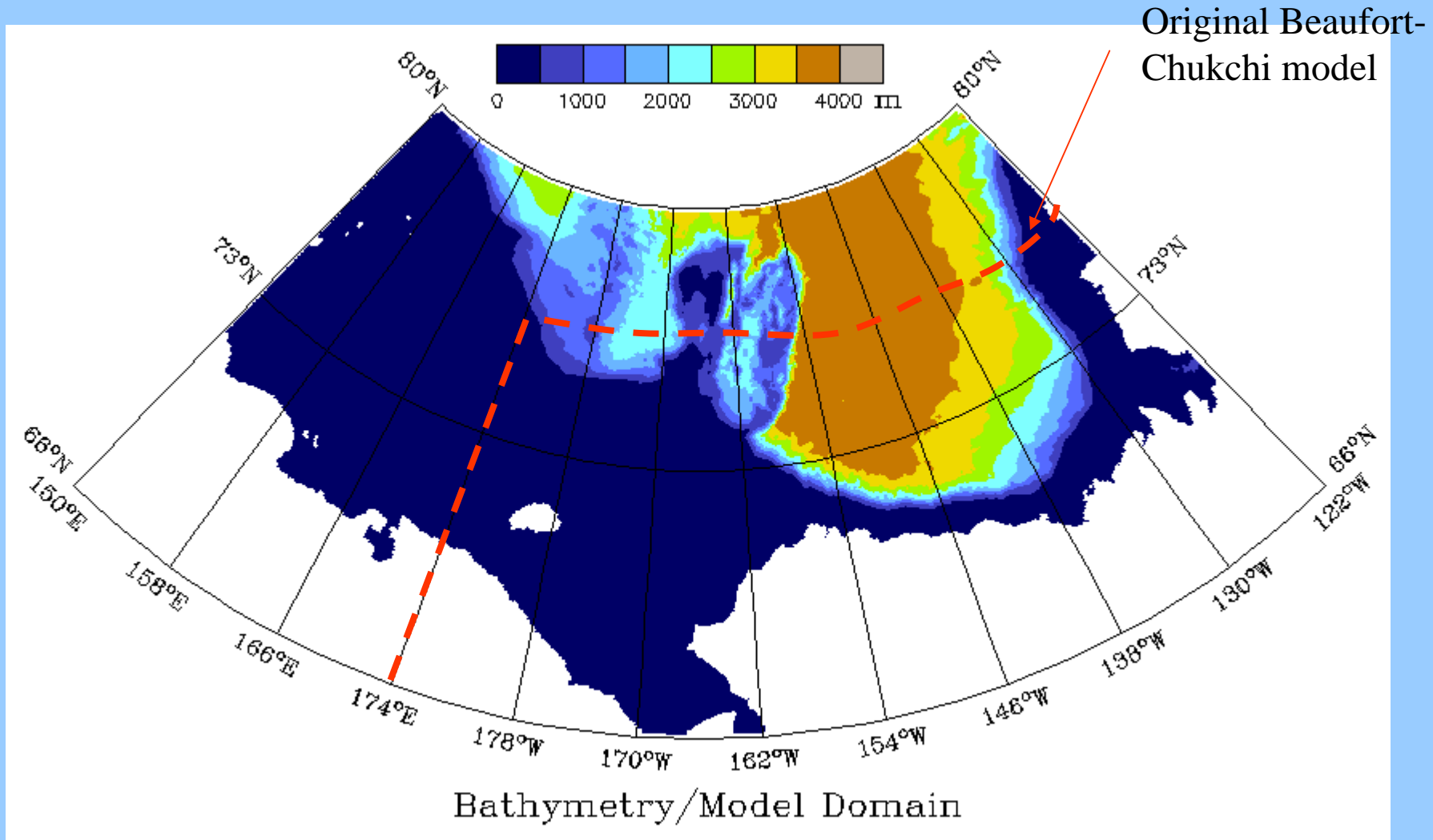
Activities Underway

- Explore linkages between modeling and observations
 - Model-Data Fusion Workshop in Sanya, China, Feb. 2007
 - Special issue Chinese Journal of Polar Science, Vol. 9, No. 2, 2008
- Biological synthesis initiated
 - Workshop in Seattle, USA, May 2009
 - EOS article and “white paper” in preparation
- Marine carbon cycle synthesis initiated

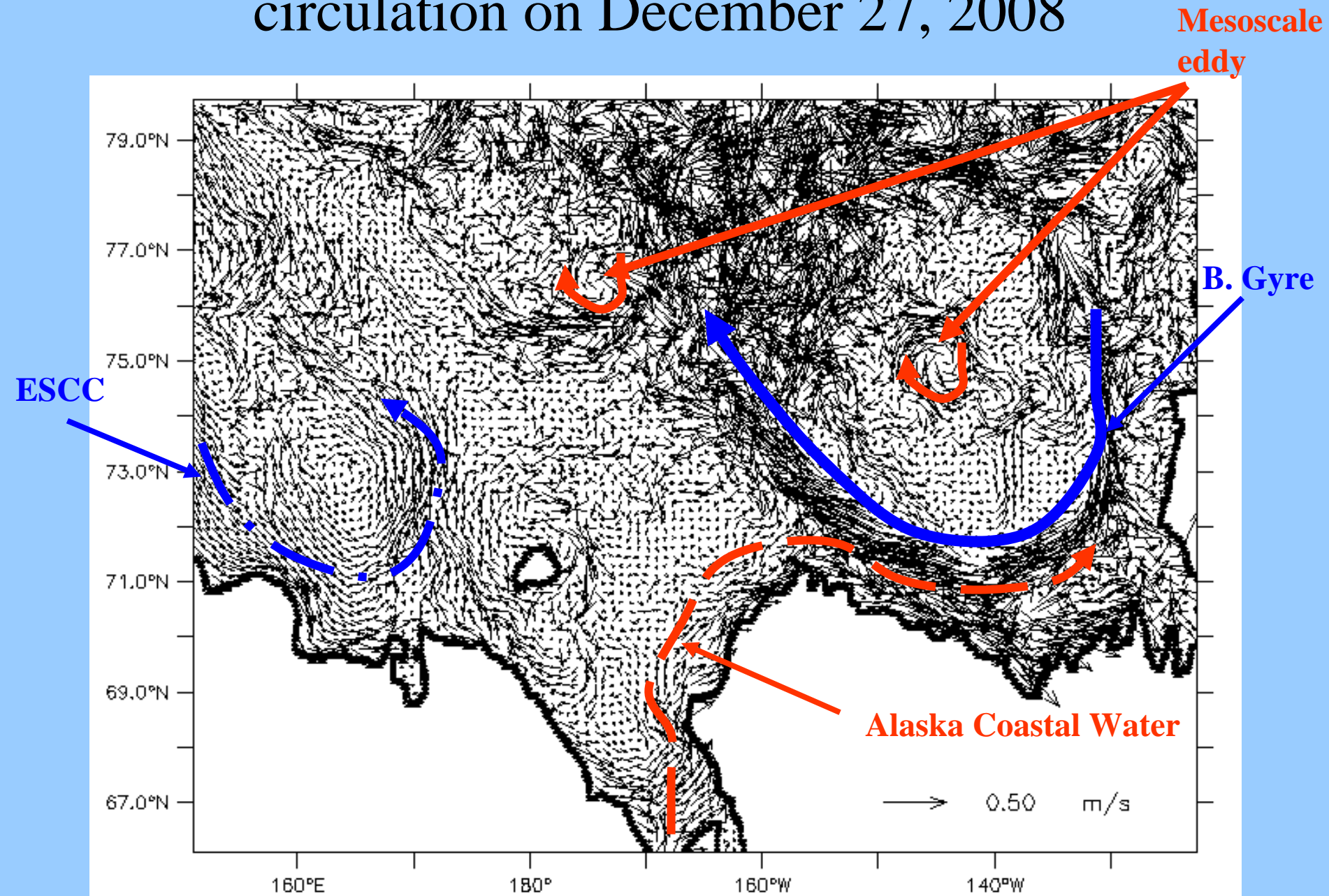
**Content of the Special Issue of Pacific Arctic Group (PAG) Model-Data Fusion
Studies in the Arctic Ocean and Subpolar Seas
Chinese Journal of Polar Science, Volume 9, Number 2, 2008. Series No. 37**

- The role of Pacific water in the dramatic retreat of arctic sea ice during summer 2007**
Zhang Jinlun, Mike Steele and Rebecca Woodgate 93
- Snow and sea ice thermodynamics in the Arctic: Model validation and sensitivity study against SHEBA data**
Cheng Bin, Timo Vihma, Zhang Zhanhai, Li Zhijun and Wu Huiding 108
- Toward development of the 4Dvar data assimilation system in the Bering Sea: reconstruction of the Mean Dynamic Ocean Topography**
Gleb Panteleev, Dmitri Nechaev, Vladimir Luchin, Phyllis Stabeno, Nikolai Maximenko and Motoyoshi Ikeda 123
- Outflow of Pacific water from the Chukchi Sea to the Arctic Ocean**
Robert S. Pickard and Greg Stossmeister 135
- A coupled multi category sea ice model and POM for Baffin Bay and the Labrador Sea**
Tang CL 149
- Modeling Arctic Ocean heat transport and warming episodes in the 20th century caused by the intruding Atlantic Water**
Wang Jia, Jin Meibing, Jun Takahashi, Tatsuo Suzuki, Igor V Polyakov, Kohei Mizobata, Moto Ikeda, Francois J. Saucier and Markus Meier 159
- Modeling seasonal variations of Ocean and Sea Ice circulation in the Beaufort and Chukchi Seas: A model data fusion study**
Wang Jia, Kohei Mizobata, Hu Haoguo, Jin Meibing, Zhang Sheng, Walter Johnson, Koji Shimada and Moto Ikeda 168
- The significance of water column nitrification in the southeastern Bering Sea**
Clara J Deal, Jin Meibing and Wang Jia 185
- Modeling the ocean circulation in the Bering Sea**
Hu Haoguo and Wang Jia 193
- Contribution of a pathway through the Arctic Ocean to the recent reduction in the ice cover**
Motoyoshi Ikeda 212
- A coupled ice ocean ecosystem model for 1D and 3D applications in the Bering and Chukchi Seas**

NOAA Expanded a Coupled Atm-Ice-Ocn Model Domain to Include Beaufort-Chukchi-East Siberian Seas with 3-4 km Resolution to Support the PAG Synthesis



Preliminary Simulation: Surface ocean circulation on December 27, 2008



Biology-sea ice retreat workshop, May 2009

- 1. How are biological processes and organisms responding now to rapid sea ice retreat and seawater warming?**
 - need for retrospective and real-time data analyses
- 2. How will biological processes change in the future, e.g the next 2-3 decades?**
 - need process studies and modeling to identify winners and loser in biological system with sea ice retreat/seawater warming; identify sentinel lower trophic level organisms (prey base) and biological processes to track over time that influence higher trophic consumers (e.g. fish, marine mammals); also use higher trophic organisms as indicators of change
- 3. What science is needed to forecast ecosystem response to sea ice retreat/seawater warming?**
 - discuss biological organisms vs. biogeochemical measurements
 - identify key trophic levels to target to evaluate change over time in an observational system
 - ocean acidification topics
 - evaluate possible step-function “tipping points” in the biological system

Workshop outcome

1. An article to EOS on the key workshop results written by workshop steering committee-abstract submitted, EOS requested **FEATURE article, deadline for submission Nov 3, 2009**
2. A brief 10 page white paper of the goals and recommendations from the workshop-**in progress, finalize fall 2009**
3. Identify authors to prepare few key overview papers in the PAR synthesis effort within PAG; **determined leads for 3 chapters: (1) regional satellite/modeling pertinent to biology, (2) lower trophics, (3) higher trophics**

Marine Carbon Cycle Synthesis

Topics with Known Lead and Contributing Authors

- Boundary Fluxes and Changing Systems
 - Major carbon pools
 - Exchanges

- Processes Internal to the Marine Carbon System in a Changing Environment
 - Transformative processes

Newly Proposed Synthesis Activities

- Synthesis of CTD and mooring data from Chukchi Sea, with assimilation of data into the modeling framework
- Identification of “core” stations and transects to develop multi-national time series – retrospective and future
- Kick-off workshops in 2010 – China and US offered to host

Planned Products

- Special journal issues and regular papers
- Special session at Ocean Sciences meeting in Portland, USA, Feb. 2010
- Session at State of Arctic conference in Miami, USA, March 2010?
- Special session at IPY conference in Oslo, Norway, June 2010
- Agreement with Springer to publish book based on PAG synthesis results, estimated for late 2011

AGU/ALSO/TOS Ocean Sciences Meeting, February 22-26, 2010, Portland, Oregon, USA (~20 abstracts submitted)

OCEANS10-IT24 Ecosystem Change in the Pacific Arctic in Relation to the Pan-Arctic System

(Grebmeier, Moore, Maslowski, Zhao)

The Pacific sector of the Arctic is currently experiencing extreme changes in sea ice extent, quality and duration, with potential long-range impacts to the Arctic marine ecosystem. The special session will focus on ecosystem status and change in the Pacific Arctic sector, including how Pacific water transiting into the Arctic is modified over the wide continental shelves, transported to the deep Arctic basin and its global connectivity to the North Atlantic Ocean. This session is international and interdisciplinary in scope, with a goal to present an array of physical, biogeochemical and biological data from past and current research projects, especially those undertaken during the International Polar Year (IPY). Because modeling is key to understanding and forecasting the Arctic system, regional and pan-Arctic models that evaluate past and ongoing physical and biogeochemical changes in the Arctic system and that project various scenarios associated with climate warming, are encouraged.

State of the Arctic session - proposed

- Focus on ecosystem status and change
 - Atmospheric and ocean forcing
 - Ecosystem response at lower and higher trophic levels
- Distributed biological observatory
 - Discuss concept
 - Solicit community input

OSLO June 8-12, 2010 Special PAG Session-CONFIRMED

Title: The Pacific Arctic Region Synthesis: A Contribution to Post-IPY Activities

Type session: Integrating

Convener:

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Session Content

The Pacific Arctic Region (PAR) is currently experiencing the largest regional changes in Arctic sea ice extent and thickness, with potential long-range changes to the Arctic ecosystem. The Pacific Arctic Group (PAG), initiated through the International Arctic Science Committee, is undertaking a PAR synthesis as a post-International Polar Year (IPY) activity. The PAR synthesis is international in nature, with a goal to synthesize an array of atmospheric, physical, biogeochemical and biological data collected during a large range of past and ongoing projects, including those initiated during IPY. These data analyses will be used to develop a variety of interdisciplinary synthesis products, including a white paper, a peer-reviewed book and possibly dedicated special issues in select journals. In addition, evaluation of data sets through biophysical coupled models and ecosystem models will be used to advance our understanding of the past and ongoing changes in the Arctic system and to investigate various scenarios projected with climate warming, including sea ice retreat, seawater warming, and ecosystem reorganization. A key outcome from the PAR synthesis activities is to develop a network for international research cooperation with a main objective of understanding the extent and impacts of the Pacific-water influence in the Arctic. This session invites presentations from both the ongoing synthesis activities as well as relevant scientific efforts in order to evaluate the status and trends of the Pacific Arctic Sector system.

Anticipated target group: disciplinary and interdisciplinary Arctic marine scientists, from physical, biogeochemical and biological oceanographers to higher trophic organism specialists, climate and ecosystem modelers