NOAA's Arctic Research Program Report to AICC, December, 2008

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NOAA's Arctic Research Program contributed funding to four marine expeditions in the Arctic during the 2008 field season.

RUSALCA- The Russian American Long-term Census of the Arctic
Our intentions for RUSALCA 2008 were to carry out a full –scale multidisciplinary investigation of the state of the Bering Strait and Chukchi Sea region with the goal of monitoring climate change and its consequences. This expedition also was supposed to include the annual servicing of a suite of 8 moorings across the entire Bering Strait from the USA to Russia. NSF is a co-partner on this part of the RUSALCA program.

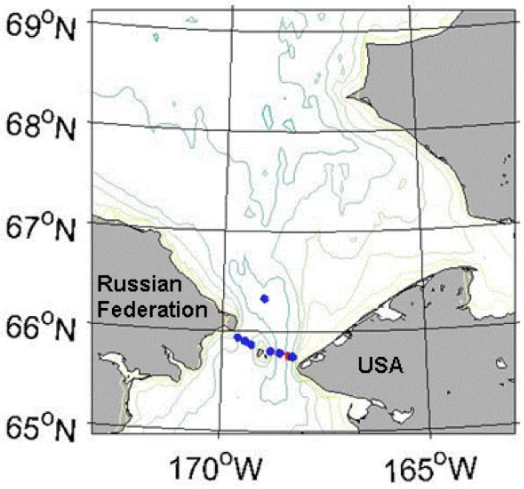
Because of the delay of funding from NOAA to our Russian logistics partners, we were unable to secure the R/V Akademik Lavrentiev for the full operation. Of particular importance, to all programs that carry out research in Russian territorial waters, vessels must be funded generally 100% up front. In the case of the Lavrentiev, a Russian geophysical company rented out the Lavrentiev for the preferred August and September time frame and we found it necessary to cancel the multi-disciplinary activities of RUSALCA in 2008.

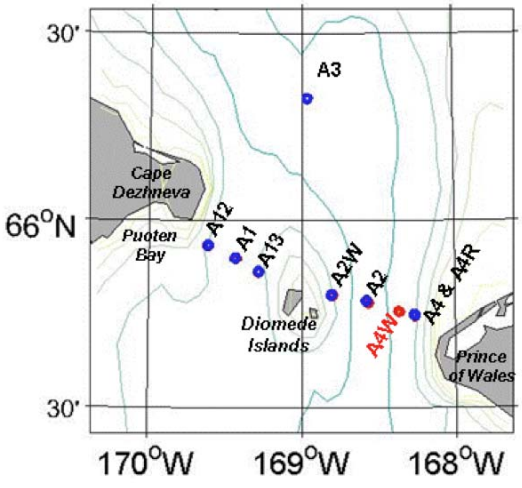
As a “rescue” operation we did secure the Lavrentiev for two weeks in October (after funding was received in Russia) to service the eight Bering Strait moorings in less than optimal wind, sea and snow state.
The cruise was, a joint project funded by NOAA, NSF, the Russian Federation Naval Hydrographic Institute, Russian Academy of Sciences Roshydromet and Group Alliance. Science was carried out by the University of Washington (UW) the University of Alaska, Fairbanks (UAF), and the Arctic and Antarctic Research Institute (AARI). (PI’s Woodgate, Weingartner, Whitledge, Golavsky, Kulakov, Bates) The moorings measure water velocity, temperature, salinity, ice motion, ice thickness (crudely) and some bio-optics.

Despite the expected bad weather and darkness, the moorings were successfully recovered and redeployed during the cruise. Unfortunately, weather prevented the taking of the related high-resolution CTD sections, although surface bucket samples were taken for salinity and nutrients at the mooring sites, and some benthic grab work was done opportunistically. Also, underway temperature and pCO2 data was collected for the Bermuda Institute of Ocean Sciences (BIOS).

RUSALCA STATIONS, BERING STRAIT

PROPOSED MOORING LOCATIONS



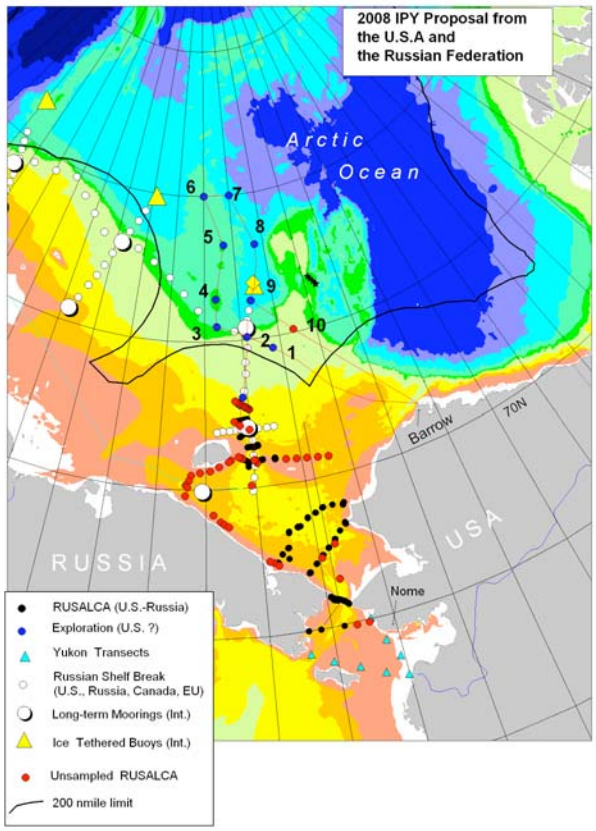


Results from the 2008 Bering Strait Observing Network can be accessed on www.arctic.noaa.gov.

2009

It is expected that we will carry out the multidisciplinary RUSALCA mission during the summer of 2009. Logistics are becoming more and more difficult because of the slowing down of US agency processing of grant funding and the growing competition for Russian ice strengthened vessels (tourism, and oil industry).

For the 2009 RUSALCA field season we are considering vessels that could be chartered out of Murmansk or Vladivostok. Additional support for the 2009 RUSALCA program will come from the Office of Ocean Exploration, NOAA



NABOS P.I. Igor Polyakov, IARC

The Arctic Research Program of the Climate Program Office has funded the NABOS program for several years.

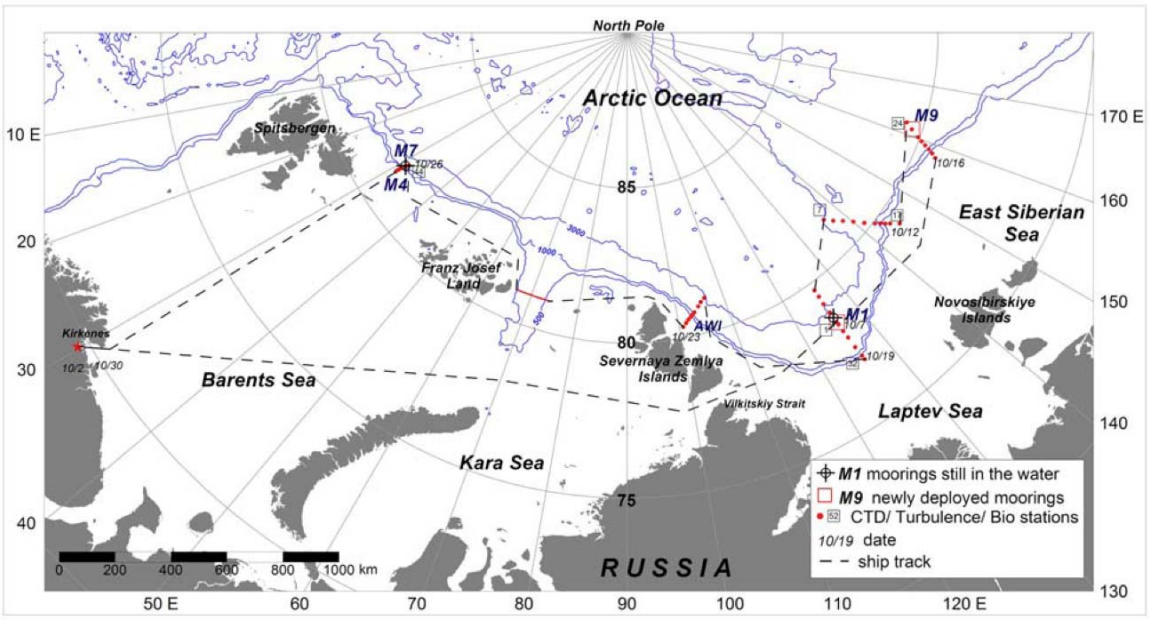
In 2008, the NABOS team was able to secure the Kapitan Dranitsyn for its annual investigation of the intruding Atlantic water into the Nansen Basin and beyond. The 2008 research cruise in the Arctic Ocean aboard

icebreaker *Kapitan Dranitsyn* was the 7th annual expedition under the aegis of NABOS (=Nansen Amundsen Basin Observations System) conducted by International Arctic Research Center (IARC) University of Alaska Fairbanks USA in partnership with Arctic and Antarctic Research Institute (AARI) St.Petersburg Russia. The main goal of the NABOS project is to provide quantitative assessment of circulation and water mass transformation along the principal pathways transporting water from the Nordic Seas to the Arctic Basin. The scope of this goal and the opportunities of extended scientific research in the Arctic, provided during NABOS expeditions, encouraged scientific institutions from US, Canada and Europe to raise funds, contribute to the cruise program and to send their personnel in the expedition, thus giving it a true multidisciplinary status. Specific feature of the 2008 NABOS cruise is that it was carried out in the beginning of the Arctic winter, when the light day was limited by 4-6 hours, the temperature was permanently below zero and the ice was growing rapidly. The information collected under these extreme conditions is very valid for understanding of the Arctic climate. However, the complexity of all field activities increased tremendously. Late arriving funding and the complexity of chartering competition forced the NABOS expedition into this October operation.

Cruise itinerary

The Icebreaker *Kapitan Dranitsyn* left Kirkenes, Norway at 6 p.m. local time on October 2, 2008 after loading/mounting the equipment and embarkation of the expedition team. The research area included Eurasian continental margin from Spitsbergen to the East Siberian Sea (Fig. 1).

Fig.1 NABOS 2008 cruise map



The operation area partly overlapped with the Russian Exclusive Economic Zone (EEZ). By the beginning of the cruise an official permission for field work within the Russian EEZ was not granted, thus restricting maneuvering options. Hence, the work started at the mooring site M1 outside the Russian EEZ. On October 7, 2008 the vessel arrived at the M1 location. An attempt to recover the mooring failed due to malfunctioning of the release. Additional attempt with the other release was not taken because of coming dusk and heavy ice conditions (see Section 3). During October 7 and 8 the northern part of transect A (5 stations) was accomplished. Operations at the transect B started late at night on October 10 and continued during the next 3 days. On October 11 the permission for operations within the Russian EEZ was received. Ten stations were occupied including 12-hour shelf station at the southernmost end of this transect. Two moorings at this transect (M8 and M3) did not respond to acoustic signals and were abandoned. The easternmost transect C, containing 8 stations, was occupied within October, 13-16. Two moorings (M10 and M9) were recovered and one mooring (M9) was deployed. During October 18-19 the southern part of the transect A was accomplished and M1 mooring was deployed. Another attempt to recover M1 mooring was not taken because of 100% ice concentration (no leads) and coming dusk. Three days, October 21-23 were spent to recover two moorings (M5 and M6) and to carry out 9 stations at the D transect northeast of Severnaya Zemlya archipelago. An attempt to pick out the shelf mooring deployed back in 2005 at 180 m depth on Severnaya Zemlya shelf was unsuccessful, although this mooring did respond after 3 years in the water. On the way to the westernmost transect E, a high resolution (20 XCTD/XBT casts) transect was taken when

crossing St. Anna Trough. Ten stations were accomplished at transect E. Triangulation of moorings M7 and M4 showed large discrepancy (several hundreds of meters) in positions of bottom releases and top transponders. This discrepancy might be caused by strong currents, which incline the wire in the upper part as was documented at M4 during 2004-2006 deployment. Both moorings were covered by kilometers-scale ice fields. Besides, instead of full light day there was only a 3 hours of twilight between the dawn and the dusk. Under these conditions it was decided to cancel recovery/deployment of these moorings. However, while taking the stations around M4, the ice situation improved dramatically and the M4 mooring was successfully recovered by 4 p.m. on October 28. Straight after this recovery Kapitan Dranitsyn started sailing to Kirkenes to stay within the cruise schedule.

Future of the NABOS cruises: Funding is uncertain for the upcoming field season.

International Siberian Shelf Studies P.I Igor Semiletov IARC

The ISSS/NOAA project carries out a Russian Arctic shelf study of the source and fate of carbon. The motivation for the ISSS-08 was to alleviate the scarcity of observational data on transport and processing of fresh water, heat, carbon, and sediment on the East Siberian Arctic Shelves (ESAS), composed of the Laptev, East-Siberian and the Russian part of Chukchi Sea, which is the most enigmatic and understudied part of the Arctic Ocean.

The ISSS-08 left Archangel'sk, Russia on August 13th and visited Kirkenes, Norway for mobilization. A complex sample and data collection program was accomplished using two vessels staffed by participants from 12 organizations in Russia, Sweden, USA, and UK.

The main vessel Yacob Smirniskyi traveled the entire length of the Siberian coast from Kirkenes to Herald Canyon, Chukchi Sea and back along the outer shelf. On September 26th, the Yacob Smirniskyi returned to Kirkenes. A second vessel, TB-0012, investigated in detail the Lena River and the eastern shallow Laptev Sea. The total number of stations was approximately two hundred. Continuous sea surface measurements, air-sea measurements/samples, and greenhouse gas flux observations were also undertaken.

At-sea findings included the discovery of several new methane seeps a documentation of Pacific inflow through Long Strait and Herald Canyon and remnants of salty and cold bottom waters on the East Siberian shelf break.

Results will be forthcoming.

Collaboration on the Xue Long

In addition to chartering vessels, NOAA has worked since 2002 to build collaborative international programs, with the exchange of scientists and platforms as well as installing equipment onboard vessels of other nations. NOAA is actively a partner in the Pacific Arctic Group. As part of this collaboration, NOAA funded scientists Rik Wanninkhov, to work with Liqi Chen and Wei-Jun Cai to outfit and operate a Surface Water pCO_2 system on the Chinese Icebreaker Xue Long.

The goals were the following:

- Train scientists from PRC in modern methods of CO_2 analysis
- Scientific Exchanges Install underway pCO_2 system on *Xue Long*
- Training of Personnel in operation of system
- Interpretation of results of expeditions to the Arctic and Antarctic

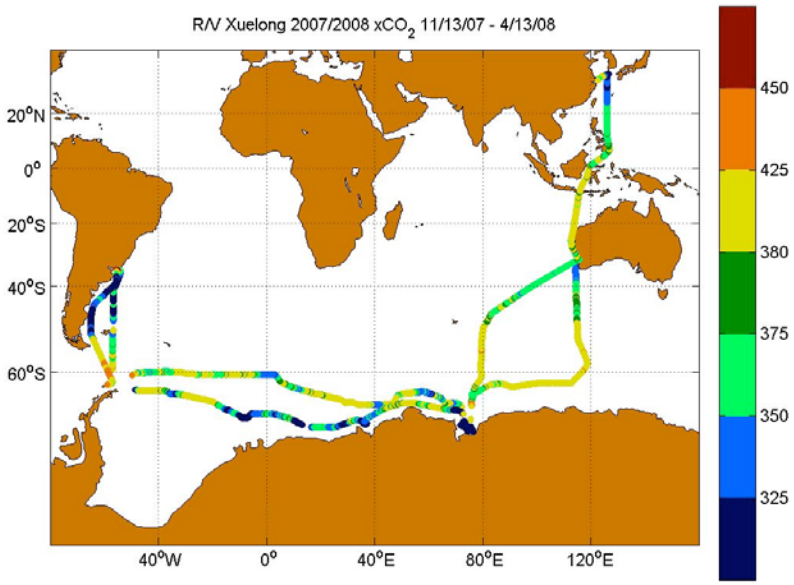
Duration: 1 February 2005 - 31 January 2008 (no cost extension to April 2009

The initial results are very encouraging.

- Successful operations took place in both the Arctic and Antarctic cruises despite several logistic challenges
- On the Antarctic cruise (Chinair 24): a large CO_2 source was detected along much of ship track except near the ice-edge and near coastal margins which are CO_2 sinks due to enhanced biological productivity
- On the 2008 Arctic cruise a very large CO_2 sink was discovered in the entire region, including under the ice up to 86°N.

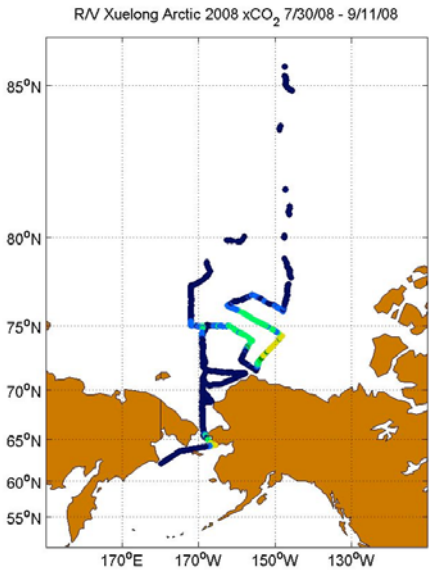
What will be the impact of an ice-free Arctic on this large sink region for CO_2?

Chinare 24 Nov. 2007- April 2008



CO_2 source > 380 ppm (yellow and red)
CO_2 sink < 380 ppm (green and blue(very large sink))

Arctic Cruise, July-September 2008



SUMMARY

NOAA anticipates further international cooperation and will continue to move forward with programs involving the implementation of the Sustained Arctic Observing Network. NOAA will build on present day success with Russian-US programs and will develop further collaboration with the members of the Pacific Arctic Group.

Difficulties in procuring vessels through the chartering process were nearly insurmountable during the field season of 2008. Timely international transfer of funds is a growing requirement because of a rapidly growing competition for vessels in the oil and tourist industries.