SS1.01

Prof. Knut Aagaard
University of Washington
Applied Physics Laboratory
1013 NE 40th Street
Seattle WA 98105
206-543-6698 Phone
206-616-3142 Fax
aagaard@apl.washington.edu

THE CHUKCHI-BEAUFORT SHELF/SLOPE BOUNDARY

Pickart, R.; Weingartner, T.; Woodgate, R.; Aagaard, K.

The dynamic structure of the Chukchi-Beaufort shelf and slope is determined by the variable upstream forcing of Pacific waters through Bering Strait and over the Chukchi shelf. Fall measurements show shelf bottom waters enriched in sediments, nutrients, and chlorophyll entering the upper halocline along the Chukchi shelfbreak and through Barrow Canyon. Some of this outflow contributes to a narrow, subsurface current setting eastward over the continental slope between 75-200 m depth, distributing Pacific waters around the Canada Basin margin. Several eddies with diameters of ~15 km, vertical extent of ~150 m, and core water properties identical to shelf bottom waters were found within the upper halocline over the slope. These were spawned by the slope current and will presumably propagate seaward to ventilate the interior Canada Basin.

SS1.01

Prof. Knut Aagaard
University of Washington
Applied Physics Laboratory
1013 NE 40th Street
Seattle WA 98105
206-543-6698 Phone
206-616-3142 Fax
aagaard@apl.washington.edu

THE PACIFIC INFLOW THROUGH BERING STRAIT: 1990-2002

Aagaard, K.; Woodgate, R.; Weingartner, T.

Nearly continuous measurements of the northward flow of Pacific waters through Bering Strait from 1990 onward provide a remarkable record of the variable upstream forcing of the western arctic shelves and of the Arctic Ocean halocline. Extreme warmth in the mid-1990s, accompanied by major changes in the shelf ecosystem; large and complex salinity variations that within a few months will be transmitted into the Arctic Ocean halocline; and a pronounced annual cycle in the northward flow are all hallmarks of the record from Bering Strait. These and additional measurements in the Chukchi Sea suggest that the regional salinity distribution and circulation in the Bering Sea are determining factors in the variability of the northern shelf and of the injection of Pacific water into the Arctic Ocean.

SS1.01

Dr. Carin J. Ashjian Ph.D.
Woods Hole Oceanographic Institution
Biology
Woods Hole Oceanographic Inst
WHOI DEPT 01 MS#33
Woods Hole MA 02543-0000
408-289-3457 Phone
508-457-2134 Fax
cashjian@whoi.edu

TRANSPORT OF PLANKTON AND PARTICLES BETWEEN THE CHUKCHI AND BEAUFORT SEAS

Ashjian, C. J.; Gallager, S. M.; Plourde, S.

Transport of biogenic material from Arctic shelves to the deep Arctic basin may impact significantly the biogeochemistry and ecosystem structure and function of both basin and shelf ecosystems. Plankton and particle abundance, vertical distribution, and association with hydrography and circulation were described using a self-contained Video Plankton Recorder on two cruises (spring and summer, 2002) to the Chuckchi and Beaufort Seas as part of the Shelf-Basin Interactions program. The VPR was deployed to as deep as 350 m along four transects across the shelf-basin interface. Nine categories of plankton or particles were identified, with marine snow, copepods, diatoms, and radiolarians being the most common. Concentrations of marine snow on the Chukchi Shelf appeared to be very high, as high as observed in temperate regions, with much lower concentrations over the basin. Distinct vertical patterns associated with hydrographic structure also were observed. Particle and plankton concentrations were merged with ADCP velocity records to obtain estimates of instantaneous flux (magnitude and direction). Barrow Canyon in particular is a site of high particle concentration and high flux of material between shelf and basin.

SS1.01

Dr. Nicholas R. Bates
Bermuda Biological Station For Research
17 Biological Lane
Ferry Reach GE01 Bermuda
1-441-297-1880x210 Phone
1-441-297-8143 Fax
nick@bbsr.edu

SEASONAL AND SPATIAL DISTRIBUTION OF PARTICULATE ORGANIC MATTER (POM) AND NEW PRODUCTION IN THE CHUKCHI SEA

Bates, N. R.; Hansell, D. A.; Moran, S. B.; Codispoti, L. A.; Swift, J.

As part of the Western Arctic Shelf-Basin Interactions (SBI) project, the production and fate of organic carbon and nitrogen from the Chukchi Sea shelf was investigated during a spring (May) and summer (July) cruise in 2002. Seasonal observations of suspended particulate organic carbon (POC) and nitrogen (PON) and, large particle (>53 µm) size class, indicate that there was a large accumulation of carbon and nitrogen between spring and summer in the surface mixed layer due to phytoplankton productivity (estimated from dissolved inorganic carbon). Considerable organic matter appeared to be transported from the shelf into the Arctic basin in an elevated POC and PON layer at the top of the upper halocline. Seasonal changes in the molar C:N of the POM pool reflect a significant change in the quality of material being produced and presumably exported to the sediment and from the Chukchi Sea shelf. In spring, low particulate C:N ratios (<6; i.e., N rich) were observed in nitrate-replete surface waters. By the summer, localized high particulate C:N ratios (>9; i.e., N-poor) were observed in nitrate-depleted surface waters.

SS1.01

Laura L. Belicka
Chesapeake Biological Laboratory
1 Williams Street
P.O. Box 38
Solomons MD 20688
410-326-7261 Phone
410-326-7341 Fax
belicka@cbl.umces.edu

MOLECULAR BIOMARKERS AS TRACERS OF ORGANIC CARBON CYCLING ALONG THE SHELF-BASIN BOUNDARY OF THE WESTERN ARCTIC OCEAN

Harvey, H. R.; Belicka, L. L.; Macdonald, R. W.

A suite of lipid biomarkers in particles and sediments from Arctic rivers and shelf to basin transects in the western Arctic Ocean was examined and combined with radiocarbon dating to determine the sources and exchange of organic carbon between the shelves and basins. Riverine particles contained high concentrations of a number of terrestrial biomarkers, including beta-amyrin, friedelin, and 24-ethylcholest-5-enol. Offshore particles from the chlorophyll maximum contained the polyunsaturated fatty acids 20:5 and 22:6, low concentrations of 24-ethylcholest-5-enol, and were modern based on 14C values. Particles from halocline waters contained predominantly marine signatures, but ranged in age from 300-400 years indicating the presence of an older, recalcitrant carbon pool overlain by fresh marine material sinking from the spring bloom. Basin sediments were, on average, greater than 6000 years old and contained low concentrations of algal biomarkers, suggesting that marine production provides the fuel for carbon cycling while the recalcitrant terrigenous carbon pool is slowly recycled.

SS1.01

Prof. Ronald Benner
University of South Carolina
Biological Sciences
700 Sumter Street
Columbia SC 29208
803-777-9561 Phone
803-777-4002 Fax
benner@biol.sc.edu

EXPORT OF YOUNG TERRIGENOUS DOM FROM RIVERS TO THE ARCTIC OCEAN

Benner, R.; Nelson, B.; Kaiser, K.; Amon, R.

Rivers discharge large quantities (250 Tg C/yr) of terrigenous dissolved organic matter (DOM) to the oceans. About 10% of this terrigenous DOM is discharged to the Arctic Ocean, a small basin accounting for ~1% of the global ocean volume. Soils in the drainage basins of Arctic rivers are a major global C reservoir, and the fate of this C is of growing concern as the effects of climate change become more evident in the Arctic. Herein we report natural 14C data indicating that DOM from several Eurasian and North American rivers is predominantly young and largely derived from recently-fixed C in plant litter and upper soil horizons. Concentrations of dissolved lignin phenols, unique organic tracers of terrestrial plant material, and 14C content in DOM were strongly correlated throughout the Arctic Ocean, indicating terrigenous DOM is mostly young and widely distributed in polar surface waters. It appears the old C stored in terrestrial soils and peats is not currently being mobilized as DOM in riverine discharge.

SS1.01

Dr. Bodil A. Bluhm
University of Alaska Fairbanks
School of Fisheries and Ocean Sciences
245 O'Neill
905 N. Koyukuk Rd
Fairbanks AK 99775
907 4746332 Phone
907 4747204 Fax
bluhm@ims.uaf.edu

MACROBENTHIC COMMUNITIES IN THE HIGH ARCTIC CANADA BASIN: ABUNDANCE, BIOMASS AND TROPHIC STRUCTURE

Bluhm, B. A.; Iken, K. B.; MacDonald, I. R.

Macro-infauna was sampled by collecting box cores at 6 stations in the Canada Basin at 640-3250m in Aug/Sept2002. Total abundances ranged from 100-7650 individuals/m2 with the highest concentrations in Amundsen Gulf and the lowest in the deep Canada Basin. Biomass ranged from 2-6514mg wet weight/m2 with the same geographical trend. Polychaetes and crustaceans were most abundant while polychaetes and mollusks dominated the biomass. Visual survey of macro-epifauna revealed that abundance of attachment substrata was the major factor determining community composition. Otoliths of Boreogadus saida and Arctogadus glacialis were abundant at Northwind Ridge and three 14C-dated specimens yielded calendar ages of 5605, 9120, and 13165yBP, respectively. 15N/14N isotopic signatures of benthic organisms ranged from 10-18‰ with most taxa in the 2nd and 3rd trophic level with respect to POM values (average 5‰). Distinctive herbivores and 1st order predators inhabited sea ice and upper water column (15N/14N: 5-12‰ and 6-16‰, respectively). The findings suggest that ice, pelagic and benthic systems are linked through sinking grazers and their products rather than through direct input of algal material to the benthos.

SS1.01

Ms. Elizabeth A. Carvellas M.S.
Essex Junction High School
Science
93 Wilderness Rise
Colchester VT 05446
802-863-6560 Phone
802-879-5503 Fax
bcarvellas@ejhs.k12.vt.us

REPORT FROM A TEA TEACHER ON THE 2002 SHELF-BASIN INTERACTIONS (SBI) SUMMER CRUISE

Carvellas, B. A.

Through the Teachers Experiencing Antarctica and the Arctic (TEA) program, K-12 teachers across the United States have taken part in scientific research in polar regions. The goals of the TEA program include: immerse teachers in a research experience as a component of their continuing professional development, inform teaching practices
through the research experience, and bring polar research into classrooms in engaging and innovative ways that underscore the relevance of science to society. I will provide my perspective on the scientific work I was involved in with Dr. Jackie Grebmeier of the University of Tennessee during the Summer, 2002 SBI cruise (http://sbi.utk.eedu) and how it has impacted my secondary school teaching in Essex Junction, Vermont. I will also discuss the mechanisms I used for communicating scientific information off the ship, including daily journals on the TEA website (http://tea.rice.edu/tea_carvellasfrontpage.html#calendar) and two live audio conferences held during the 40-day cruise. Finally, I will provide information on my post-cruise presentations and my work to incorporate polar science into the curriculum and the resulting impact on students from grades 4-12 and my teaching colleagues.

SS1.01

Dr. Josefino C. Comiso Ph.D.
NASA Goddard Space Flight Center
Oceans and Ice Branch
Code 971, Laboratory for Hydrospheric Processes
Greenbelt 20771
301-614-5708 Phone
301-614-5644 Fax
josefino.c.comiso@nasa.gov

VARIABILITY OF PHYTOPLANKTON BLOOMS IN THE ARCTIC AND PERIPHERAL SEAS: RELATIONSHIPS WITH SEA ICE, TEMPERATURE, CLOUDS, AND WIND

Comiso, J. C.; Cota, G. F.

Satellite data of ocean color, sea ice concentration, surface temperature, and clouds, as well as ECMWF/winds for the period 1998 to 2002 have been compiled and analyzed to quantify regional and temporal variabilities of phytoplankton blooms in the Arctic and peripheral seas and evaluate their relationships with environmental variables. Large asymmetry in phytoplankton chlorophylls is consistently observed in the Arctic basin with data in Eastern Arctic having about fivefold higher concentration than those of the Western Arctic. Monthly-average chlorophyll concentrations also show large seasonal and interannual variability with 2002 and 2001 having higher values than previous years. Environmental factors that influence phytoplankton growth were examined, and results show relatively high correlations of pigments with sea ice retreat and sea surface temperature (SST) during early and late spring periods and an apparent preference by planktons of SSTs near 277K. The correlation with clouds is significant in some areas but negligible in other areas, while the correlations with wind and its components are relatively weak. Weak stratification, upwelling of nutrients, and unpredictable effect of winds may explain unexpected observations.

SS1.01

Lee Cooper
University of Tennessee
Ecology and Evolutionary Biology
10515 Research Drive
Suite 100
Knoxville TN 37932
8659742990 Phone

lcooper1@utk.edu

TOWARDS UNDERSTANDING SHELF-BASIN INTERACTIONS: SEASONAL VARIABILITY IN THE OXYGEN ISOTOPE COMPOSITION OF ARCTIC WATERS IN CONJUNCTION WITH OTHER TRACERS

Cooper, L. W.; Benner, R.; Codispoti, L. A.; Kelly, V.; McClelland, J. W.; Peterson, B. J.; Holmes, R.; Grebmeier, J. M.

The use of stable oxygen isotope variations in Arctic water masses to study temporal mixing processes in surface waters is incompletely resolved because there has been only limited sampling outside of summer. We report here the results of several research sampling programs that are providing data on the isotopic composition of Arctic rivers (PARTNERS), shelf and deep basin regions of the Chukchi and Beaufort Seas (SBI), and flow through the northern Bering Sea and Bering Strait in late winter (Bering Strait Environmental Observatory). Combining these isotope ratio data with other variables, including terrestrial markers, nutrients, salinity, and denitrification indicators provides new insights on the timing and mechanisms of shelf-basin interaction. These findings include observations of runoff-influenced waters that remain geographically separated over-winter from brine-influenced shelf and slope waters. Apparent source differences in lignin contents of runoff components were also observed, as was subsurface ventilation as brine-injected shelf waters flowed down Barrow Canyon. In the center of Bering Strait an increasing sea ice melt signal was advected through Bering Strait in April 2003 as ice melt commenced to the south.

SS1.01

Dr. Glenn F. Cota
Old Dominion University
CCPO, OEAS
768 W 52nd St
Norfolk VA 23508
757-683-5835 Phone
-5550 Fax
cota@ccpo.odu.edu

PRIMARY PRODUCTION IN THE WESTERN ARCTIC OCEAN

Cota, G. F.

Primary production was measured on four cruises in the Chukchi-Beaufort Seas over the last decade with spring and summer cruises in 2002. Productivity is modest. The highest biomass and productivity occur in open waters on the shelf or near the shelf-break, while low values are observed in the largely ice-covered basin waters or early in the spring. Phytoplankton production is highly dependent upon biomass and integrated chlorophyll explains 88% of the variability in particulate organic carbon (POC) production. There is additional production and release of dissolved organic carbon (DOC) which can be ~30-40% of POC production. Large phytoplankton tend to dominate open water blooms, whereas in ice-covered areas small cells predominate. Property distributions confirm the patterns observed, as does ocean color imagery in open waters.

SS1.01

Mr. Matthew T. Cottrell Ph.D.
University of Delaware
College of Marine Studies
116 Smith Lab
700 Pilottown Rd
Lewes DE 19958
302 635 4383 Phone
302 645 4028 Fax
cottrell@udel.edu

THE BALANCE BETWEEN AUTOTROPHY AND HETEROTROPHY IN THE WESTERN ARCTIC OCEAN

Cottrell, M. T.; Malmstrom, R. R.; Kirchman, D. L.

The balance between autotrophy and heterotrophy is a key feature of ecosystem function that could serve as an indicator of environmental change, such as that suspected to be underway in the Arctic Ocean. Data on microbial processes in the Arctic are sparse and few studies have examined autotrophic and heterotrophic metabolism together. In order to examine the metabolic balance in the Western Arctic Ocean, we measured bacterial production, community oxygen consumption and photosynthetic oxygen production during the summer Western Arctic Shelf-Basin Interactions (SBI) process cruise of 2002. Rates of community oxygen consumption and photosynthetic oxygen production varied greatly over the sampling area, which included shelf, slope and basin environments. Low rates prevailed with substantial rates of community oxygen consumption and production in only about 30% of the samples. On average, bacteria seem to account for about 50% of community oxygen consumption, but this percentage varied greatly. The analysis of light and dark bottle oxygen experiments suggests a dynamic balance between autotrophy and heterotrophy with overall autotrophy in the SBI study area during summer.

SS1.01

Gregory A. Cutter
Old Dominion University
Ocean, Earth, and Atmospheric Sciences
4600 Elkhorn Ave
Norfolk VA 23529-0276
757-683-4929 Phone

gcutter@odu.edu

RECORDS OF BIOGENIC FLUXES IN THE WESTERN ARCTIC OCEAN OVER THE LAST 10,000 YEARS

Cutter, G. A.; Cutter, L. S.

In order to understand present day changes in the oceanographic conditions of the western Arctic Ocean shelf, one must consider past changes and likely processes controlling them. As part of a paleoceanographic reconstruction of environmental conditions in the Chukchi Sea shelf, biogenic tracers were determined in a 4 m long piston core and companion box core from 201 m depth covering the entire Holocene. These parameters included organic carbon and nitrogen, sulfur, and biogenic silica, and Cd/Ca in benthic forams as a tracer of nutrient inputs. Near the Pleistocene-Holocene transition, organic C concentrations were quite low and C/S ratios suggest very low salinities. After this presumed large melt water input, organic C and biogenic Si record large biogenic fluxes (ca. 8 ky BP). For the next 4 ky, biogenic fluxes were relatively constant, suggesting stable environmental conditions in the water column. In the last millennium, pulses of biogenic Si, and org. C and N indicate large changes in productivity; some of these are associated with nutrient inputs (as recorded by Cd/Ca in forams). In comparison to the previous 9 ky, organic carbon fluxes were highest during this period. However, in the last 300-400 y, organic fluxes decreased to the present. Processes likely controlling these biogenic fluxes will be examined.

SS1.01

Allan H. Devol
University of Washington
Oceaography
Box 355351
University of Washington
Seattle WA 98195
206-725-1352 Phone
106-685-3351 Fax
devol@u.washington.edu

OXYGEN CONSUMPTION, DENITRIFICATION AND SULFATE REDUCTION IN ARCTIC CONTINENTAL MARGIN SEDIMENTS

Devol, A. H.; Chang, B.; Christensen, J. P.

We have determined pore-water oxygen and nitrate profiles as well as sulfate reduction on four SBI, cross-margin transects in the western Arctic (Bering-Beaufort seas). At all transects oxygen penetration was less than 1 cm when the overlying water depth was less than 200 m but increased dramatically with increasing water depth to 2-3 cm at 3000 m near Barrow Canyon and 10-20 cm further west. Nitrate penetration depths were comparable to oxygen at shallow stations but became much greater at deeper stations. Diffusive oxygen and nitrate fluxes were calculated from the profiles and varied from 5.5 to 0.6 mMoles/m2/d for oxygen and 0.58 to 0.17 mMoles/m2/d for nitrate. Sulfate reduction rates varied between 2.1 and 0.01 mMoles/m2/d per day and also decreased with increasing water depth. Overall carbon oxidation rates calculated from the three electron acceptor fluxes were between 6.3 and 0.77 mMoles/m2/d. Rates Barrow Canyon sections were similar to those along the productive U.S. west coast and significantly higher than further west. Higher rates near Barrow Canyon may be due to off-shelf transport of organic matter through the Canyon.

Mr. Jeffrey S. Dixon
Naval Postgraduate School
Department of Oceanography
1 University Circle
Monterey CA 93943
(831) 656-2102 Phone

jsdixon70@hotmail.com

CIRCULATION AND PROPERTY FLUXES OVER THE CHUKCHI PLATEAU – MODEL RESULTS

Dixon, J. S.; Maslowski, W.; Okkonen, S. R.; Clement, J. L.; Walczowski, W.

Circulation in the western Arctic Ocean and over the Chukchi Plateau is not well understood. Mass and property fluxes in the region are investigated using a pan-Arctic model configured at a 1/12-degree and 45-level grid. Results for analyses are from a 23-year integration forced with realistic 1979-2001 atmospheric data. Velocity at three depth intervals, mean transports and fluxes are investigated to identify the main current pathways and directions. Variability is determined by comparison of results a decade apart. The mean velocity fields describe a cyclonic circulation pattern with increased intensity during the late 1980s and early 1990s. The meander through the Chukchi Borderland Pass is identified as the primary pathway for boundary flow across the Chukchi Plateau. The northern Chukchi Plateau is modeled as a major region of exchanges between boundary flow and the Canada Basin interior and it appears to be an area of net upward heat transport. Northward flow along the eastern side of the Northwind Ridge is identified as a mechanism for freshwater advection from the Chukchi shelves into the interior.

SS1.01

Dr. Kenneth H. Dunton
University of Texas
Marine Science Institute
750 Channel View Drive
Port Aransas TX 78373
361-749-6744 Phone
361-749-6777 Fax
dunton@utmsi.utexas.edu

ADVECTION OF CARBON ON THE WESTERN ARCTIC SHELF: IMPLICATIONS FOR BENTHIC-PELAGIC COUPLING

Dunton, K. H.; Schonberg, S. V.

This study explores trophic linkages between the benthos and associated physical and biological processes in the western Arctic. Evidence for the importance of rich Bering Sea waters on the Arctic Shelf is provided by carbon and nitrogen stable isotope signatures used to trace carbon advected onto adjacent shelves and as indicators of trophic links between pelagic and benthic components of the shelf and slope. Preliminary del 13C measurements of POM reveal that values are 2-5 ppt lower (more negative) in late summer compared to spring, especially over the shelf and basin. Based on these results and the isotopic values of ice algae, we estimate that ice algal carbon potentially contributes up to 25% of the POC pool over the Chukchi Shelf during the spring bloom. Overall, benthic organisms become more 13C depleted between the Chukchi Sea and western Beaufort, while 15N ratios remain relatively constant. These data support the hypothesis that carbon advected northeastward along the Alaskan arctic coast is assimilated by benthic consumers, but its relative importance begins to decline east of Point Barrow.

SS1.01

Dr. Rolf Gradinger
University of Alaska Fairbanks
School of Fisheries and Ocean Sciences
PO BOX 757220
Fairbanks AK 99775
9074747407 Phone

rgradinger@ims.uaf.edu

MAGNITUDE AND CONTROL OF SEA-ICE ALGAL GROWTH IN THE CHUKCHI AND BEAUFORT SEAS IN SPRING 2002

Gradinger, R. R.; Eicken, H.

We measured the biomass, diversity and activity of pack ice algae in the Chukchi and Beaufort Seas in order to assess the impact of nutrient and light availability on algal growth. Measurements included estimates of Chl a, POC, PON, stable isotopes and algal cell counts at a total of 14 stations (mainly first-year sea ice). Algal pigment concentrations were in some cases extremely high, exceeding 1 g Chl a per square meter of sea ice at two stations. As for algal pigments, POC and PON values increased exponentially towards the bottom of the ice floes with a mean C/N ratio (molar) of 16. The d13C ratio ranged between -30 and -10 per mille, exhibiting a positive correlation with POC concentration. The low ambient nutrient concentrations (nitrate and silicate) in the sea ice and photosynthetic yield data determined via PAM fluorometry point towards nutrient limitation of ice algal growth. In addition, new production and algal growth rates were estimated using exponential growth models.

SS1.01

Dr. Jackie M. Grebmeier Ph.D.
University of Tennessee
Ecology and Evolutionary Biology
10515 Research Dr., Bldg A, Suite 100
Knoxville TN 37932
865-974-2592 Phone
865-974-7896 Fax
jgrebmei@utk.edu

BENTHIC CARBON CYCLING AND NUTRIENT EXCHANGE IN THE WESTERN ARCTIC SHELF-BASIN INTERACTIONS (SBI) STUDY AREA

Grebmeier, J. M.; Cooper, L. W.; Codispoti, L. A.; Benner, R.

Benthic sediment metabolism studies initiated in 2002 in the Chukchi and Beaufort seas as part of the Western Arctic Shelf-Basin Interactions (SBI) global change program are investigating the seasonal deposition of organic carbon and its transformation. Sediment tracers, such as plant pigment, carbon content, and natural (Be-7) and artificial (Cs-137) radioisotopes are also being measured. In the spring, sediment oxygen uptake (1-17 mM m-2 d-1) and nutrient flux were highest on the Chukchi and Beaufort shelves, with rates decreasing from the shelf to the deep basin. Sediment respiration rates doubled (up to 34 mM m-2 d-1) during the summer at the shelf sites, indicating tight pelagic-benthic coupling, with rates decreasing with depth. Silicate and ammonium fluxes from the Chukchi and Beaufort shelf sediments were high, presumably due to the influence of the nutrient-rich Pacific inflow waters, with plumes of nutrients extending offshore into the Arctic Basin at halocline depths. Dissolved organic carbon was also released from sediments, with implications for both lower food chain productivity as well as carbon sequestration in this region.

SS1.01

Prof. Dennis A. Hansell Ph.D.
University of Miami
RSMAS/MAC
4600 Rickenbacker Causeway
Miami FL 33149
305-361-4078 Phone
305-361-4689 Fax
dhansell@rsmas.miami.edu

NON-CONSERVATIVE BEHAVIOR OF TERRIGENOUS DISSOLVED ORGANIC CARBON IN THE WESTERN ARCTIC OCEAN

Hansell, D. A.; Kadko, D. C.; Bates, N. R.

DOC was measured at the Chukchi/Beaufort Sea shelf break during the Shelf-Basin Interaction project. Evident from DOC/salinity relationships was a fresh water intercept indicating low terrigenous DOC (155 microM), and not the commonly high values in Arctic rivers and the Eurasian Basin (600 microM). This low intercept results from the long residence time (~20 years) of surface waters in the Beaufort Gyre, allowing significant degradation of terrigenous DOC. 228Ra/226Ra indicated the surface gyre water had an age of 13 years since being over the shelf. With this age and terrigenous DOC decrease (450 microM), a terrigenous DOC decay constant of 0.104 year-1 and a half life of 6.66 years results. In contrast, in the Eurasian Basin, where the freshwater DOC intercept is high, surface waters have a much shorter residence time. Terrigenous DOC transferred from the Eurasian shelves into the Eurasian Basin via the Trans Polar Drift apparently has insufficient time to significantly degrade before being exported out of the Arctic Ocean. The different ocean pathways of Arctic rivers draining North America and Eurasia impart different fates for terrigenous DOC.

SS1.01

Dr. David C. Kadko
University of Miami-RSMAS
MAC
4600 Rickenbacler Causeway
Miami FL 33149
305 361 4721 Phone

dkadko@rsmas.miami.edu

EVALUATION OF SHELF-BASIN INTERACTION IN THE WESTERN ARCTIC BY USE OF SHORT-LIVED RADIUM ISOTOPES; EVIDENCE OF THE IMPORTANCE OF JETS AND EDDIES

Kadko, D. C.; Muench, R.

Rapid shelf-basin exchange in the western Arctic was evaluated by use of the first ever measurement of the short-lived 224Ra (3.64 d half-life) in this region. Radium-224, generated in shelf sediment by decay of its parent 228Th, subsequently diffuses into the overlying water. There, the 224Ra (in excess of the parent) is transported to the extent that its decay-time allows thus providing a measure of short-timescale transport. During the 2002 SBI program, excess 224Ra was measured over the shelf but extended less than 20km beyond the shelf-break. Similarly, the 228Ra/226Ra ratio dropped rapidly across the shelf-break. Bering Strait inflow is constrained by the earth's rotation to follow local isobaths and does not easily move into deeper water. Possible mechanisms that can generate cross-shelf currents that break the topographic constraint to follow isobaths, and thereby transport water (and associated properties) off the shelves include meandering jets and eddies. Evidence of a jet was found during the ICEX project in April 2003 when excess 224Ra measured over 200 km from any shelf source corresponded to a high velocity feature (measured by ADCP) within the upper 300m of the ocean.

SS1.01

Prof. David L. Kirchman Ph.D.
University of Delaware
College of Marine Studies
700 Pilottown Road
Lewes DE 19958
302-645-4375 Phone
302-645-4028 Fax
kirchman@cms.udel.edu

BIOMASS, PRODUCTION AND COMMUNITY STRUCTURE OF HETEROTROPHIC BACTERIA IN THE WESTERN ARCTIC

Kirchman, D. L.; Cottrell, M. T.; Malmstrom, R. R.; Cota, G. F.

Heterotrophic prokaryotes are often large components of biomass and carbon fluxes in many oceans, but they may be less important in the Arctic Ocean because of perennially low water temperatures. We examined the biomass (abundance and cell size), production, and community structure of prokaryotic communities in spring and summer 2002 as part of the Western Arctic Shelf-Basin Interactions (SBI) project. Bacteria appear to dominate these communities, according to results from fluorescence in situ hybridization (FISH) with oligonucleotide probes; the general bacterial probe usually recognized >75% of total cells. The bacterial communities were mainly composed of Cytophaga-like bacteria and alpha-proteobacteria. The alpha-proteobacterial subgroup, SAR11, which was originally discovered in the Sargasso Sea, made up as much as 50% of total prokaryotic abundance. Total prokaryotic biomass was nearly half of phytoplankton biomass (estimated from chlorophyll concentrations). Bacterial production relative to primary production was very low (about 4%) in spring (May-June), but increased to levels observed in other oceans (about 10%) in summer (July-August). Except for spring, the activity and even the structure of bacterial communities are remarkably similar to other oceanic systems.

SS1.01

James A. Moore
UCAR/Joint Offcie for Science Support
P. O. Box 3000
Boulder CO 80307-3000
303-497-8635 Phone
303-497-8987 Fax
jmoore@ucar.edu

DATA MANAGEMENT SUPPORT TO THE WESTERN ARCTIC SHELF BASIN INTERACTIONS (SBI) PROJECT

Moore, J. A.; Stossmeister, G. J.; Roberts, S. D.; Dirks, R. A.

The UCAR Joint Office for Science Support (JOSS) provides data management support to the SBI Project. By working with the investigators since the project began, we have been able to establish useful data and documentation guidelines that streamline the exchange and integration of datasets among SBI scientists. JOSS provides support for real-time data collection and exchange during SBI cruises by customizing and implementing the SBI In-Field Data Catalog. The system is operated aboard ship and offers real-time ship track mapping display capabilities, station event logging and an easy
way to submit and share scientist logs and preliminary data from the cruises. Data are relayed via satellite to an SBI "mirrored" catalog running in Boulder, CO for access by the larger community and public. JOSS has produced high-resolution bathymetric maps, GIS-based cruise comparison databases and customized satellite products to aid in project analysis and synthesis tasks. Information on the status of SBI Phase 2 datasets will be provided. The authors will summarize the cruises to date using the GIS MapServer tool and describe future data management activities.

SS1.01

Dr. Bradley Moran
University of Rhode Island
Graduate School of Oceanography
South Ferry Road
Narragansett RI 02882-1197
(401) 874-6530 Phone
(401) 874-6811 Fax
moran@gso.uri.edu

POC EXPORT IN THE WESTERN ARCTIC OCEAN

Moran, S. B.; Kelly, R. P.; Cota, G. F.; Smith, J. N.; Nelson, R. P.; Mulsow, S.; Povinec, P.

The magnitude and variability (spatial and seasonal) of POC exported from the upper waters of the Chukchi-Beaufort Seas during the SBI-II 2002 field program was quantified using measurements of Th-234/U-238 disequilibrium and large particle (>53 μm) POC/Th-234 ratios. Large volume (200-1000 L) water samples were collected from 36 stations and 184 depths during May-June and July-August. Results are characterized by: 1) enhanced particle export in the shelf and slope waters; 2) higher particle export in the southeast sections near Barrow Canyon (West of Hanna Shoal), and; 3) a marked increase in particle export at all stations during the summer. POC export fluxes at 50 m were calculated using a 1-D steady-state model and multiplying the Th-234 deficit by the large particle POC/Th-234 ratio. POC fluxes exhibit a marked seasonal and spatial variability, averaging 1.8 ± 2.3 mmol m-2 d-1 (0.031-5.7 mmol m-2 d-1) in spring and 10.6 ± 9.3 mmol m-2 d-1 (0.56-39 mmol m-2 d-1) in summer. Export fluxes represent 13 ± 15% and 32 ± 24% of primary production in spring and summer, respectively.

SS1.01

Dr. Frank Nilsen
The University Centre on Svalbard (UNIS)
Arctic Geophysics
P. O. Box 156
Longyearbyen 9171 Norway
+47 79023338 Phone
+47 79023301 Fax
frank@unis.no

AN INVESTIGATION OF THE MESOSCALE EDDY DYNAMICS ALONG THE WEST SPITSBERGEN SLOPE

Nilsen, F.

The slope along West Spitsbergen is identified as a wave-guide, trapping energy within the slope geometry and trapping energy along the slope. The northward flowing West Spitsbegen Current (WSC) is trapped along the slope and is the largest heat source from the ambient oceans to the Polar Ocean. The Atlantic Water of WSC losses approximately three times as much heat (1050 W/m2) laterally to the surrounding below 100 meters depth than directly to the atmosphere on its path along the West Spitbergen slope. In summer and fall 2002 the shelf areas along West Spitsbergen were flooded with Atlantic Water, and hence, the heat content on the shelf and in the fjord systems increased and influenced the ice growth the following year. This also influenced the local ecosystems since the usually Arctic type fjords were transformed into Atlantic ecosystems. Current time series across the slope at 79-degree north, collected between September 1997 and September 1999, are used in order to quantify the eddy dynamics and to characterize the instability processes responsible for water mass exchanges across the temperature-salinity front between the slope and the shelf areas.

SS1.01

Christopher Osburn
US Naval Research Laboratory
Marine Biogeochemistry
Code 6114
4555 Overlook Ave SW
Washington DC 20375
202-767-1700 Phone
202-404-8515 Fax
cosburn@ccs.nrl.navy.mil

TRANSPORT AND PHOTOCHEMICAL DEGRADATION OF CHROMOPHORIC DISSOLVED ORGANIC MATTER IN THE MACKENZIE RIVER-DELTA SYSTEM

Osburn, C. L.; O'Sullivan, D. W.; Vincent, W. F.

Western Arctic shelves are dynamic regions of the coastal ocean where riverine discharge of chromophoric dissolved organic matter (CDOM) mixes with saline marine waters; the biogeochemical implications for this freshwater-saltwater transition zone (FSTZ) are not clear. We are examining the flux and photoreactivity of CDOM into the Beaufort Sea in an effort to understand the biogeochemical implications for heterotrophic communities of terrigenous C loading into Arctic shelves. Based on an initial transect of the Mackenzie River and Delta in 2002, we have calculated upper constraints on the photochemical degradation of DOM transported from the Mackenzie River through the FSTZ in the Mackenzie Delta to the Beaufort Sea. We observed a sharp decline in CDOM across the FSTZ and we have measured a DOM photooxidation rate in the Mackenzie River at 13 uM C per day. While sun angle is lower at polar latitudes than at temperate latitudes, the photoreactivity of Mackenzie River CDOM appears to be much higher than temperate rivers, suggesting that photochemical reactions may play a major role in modifying riverine DOM during transport to the Arctic shelf.

SS1.01

Dr. Evelyn Sherr
Oregon State University
COAS
104 Ocean Admin Bldg
Corvallis OR 97331-5503
541-737-4369 Phone
541-737-2064 Fax
sherre@coas.oregonstate.edu

SBI - MICROZOOPLANKTON AS HERBIVORES AND AS FOOD FOR MESOZOOPLANKTON IN ARCTIC OCEAN FOOD WEBS

Sherr, E.; Sherr, B.; Ashjian, C.; Campbell, R.; Plourde, S.

During the 2002 field year of the Shelf-Basin Interactions (SBI) project, we carried out both dilution assay experiments to evaluate microzooplankton grazing rates, and mesozooplankton grazing experiments to determine relative grazing of copepods on phytoplankton and on heterotrophic protists. Based on changes in chlorophyll-a concentration as a proxy for change in phytoplankton biomass, 2 out of 6 dilution experiments in spring, and 6 of 12 experiments in summer, showed significant rates of microzooplankton herbivory, primarily at slope and basin stations. We independently analyzed change in phytoplankton stocks in the dilution experiments via flow cytometric (FCM) enumeration of small (less than 5 micron) and large (greater than 5 micron) phytoplankton size classes. In some experiments, FCM data indicated differential grazing losses for smaller-sized versus larger-sized cells. FCM and inverted microscopy analyses made for the mesozooplankton grazing experiments showed that, in general, copepods appeared to be consuming large phytoplankton cells and heterotrophic protists, but not small phytoplankton cells. Microzooplankton accounted for up to 100% (average of 29%) of total carbon biomass ingested by copepods.

SS1.01

Dr. Philippe D. Tortell
University of British Columbia
Earth and Ocean Sciences / Botany
6270 University Blvd.
Vancouver BC V6T 1Z4 Canada
604-822-4728 Phone
604-822-6091 Fax
ptortell@eos.ubc.ca

REAL-TIME MEASUREMENT OF TRACE GAS CONCENTRATIONS IN THE EASTERN BERING SEA VIA MEMBRANE INLET MASS SPECTROMETRY

Tortell, P. D.

Marine microorganisms influence global climate through the production and consumption of various trace gases in the upper ocean. In highly dynamic marine ecosystems such as the Bering Sea, trace gases exhibit large spatial and temporal concentration gradients across multiple biological and chemical fronts. High frequency sampling is therefore necessary to fully capture the gas dynamics in these waters, yet such intensive monitoring is often difficult using current methods based on discrete sample collection. Here I describe a new mass spectrometer-based method for underway, real-time measurements of CO2, O2, and dimethylsulfide (DMS), and present results from a series of cross-shelf transects in the Eastern Bering Sea. Trace gas concentrations exhibited a high degree of spatial variability across the sampling transects. The most significant changes occurred across the slope/shelf transition where enhanced biological productivity resulted in a sharp drop in CO2 concentrations and a significant increase O2 levels. In contrast, surface water DMS concentrations did not generally correlate with total phytoplankton biomass or productivity, but rather showed significant variations associated with physical fronts that may have affected phytoplankton community composition.

SS1.01

William J. Williams
University of British Columbia
Department of Earth and Ocean Sciences
6339 Stores Road
Vancouver BC V6T 1Z4 Canada
2503636343 Phone

WilliamsBi@pac.dfo-mpo.gc.ca

SHELF-BREAK EXCHANGE PROCESSES AT A WIDE ARCTIC CANYON: MACKENZIE CANYON, BEAUFORT SEA

Williams, W. J.; Carmack, E. C.; Aagaard, K.; MacDonald, R. W.; Woodgate, R.; Ingram, R. G.

Shelf-break exchange processes in the Arctic are critical to the development of the upper halocline and to the flux of deep water onto the shelves. MacKenzie canyon, in the Beaufort Sea shelf near 70N 137W, is hypothesised to be a site of enhanced shelf-break exchange. This canyon runs northward from the coast to the shelf-break where it is approximately 60km wide and 400m deep. Dynamically the canyon is wide, being at least twice the baroclinic Rossby radius. Enhanced upwelling has been found in this canyon and is expected due to adjustment of stratified alongshelf flow crossing the canyon. We show CTD data and current meter, temperature and salinity data from moorings deployed within and on either side of MacKenzie Canyon at various times during 1991 to 1996. The present analysis focuses on describing flow patterns due to the wind-stress and its modification in the presence of sea ice. Upwelling events and the possibility of this canyon acting as a conduit for deep nutrient rich water to the Canadian Shelf are also discussed.