BERING STRAIT MOORING CRUISE REPORT - RUSALCA 2009 LEG 1

Russian Research Vessel Professor Khromov (also called Spirit of Enderby)

Nome, 23rd August 2009 – Nome, 2nd September 2009

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(Photo by Aleksey Ostrovskiy)

(Photo by R Woodgate)

Expedition Leader: *Vladimir Bakhmutov, State Research Navigational Hydrographical Institute, RF.*
Science Coordinators: *Kathleen Crane, NOAA, USA; Mikhail Zhdanov, Group Alliance, Russia (RF) and Aleksey Ostrovsky, Group Alliance, Russia.*
US Expedition Leader: *Terry Whitledge, University of Alaska, Fairbanks (UAF), USA*
Chief Scientist: *Rebecca Woodgate, University of Washington (UW), USA.*
Science Liaison at Sea: *Kevin Wood, NOAA/UW, USA.*

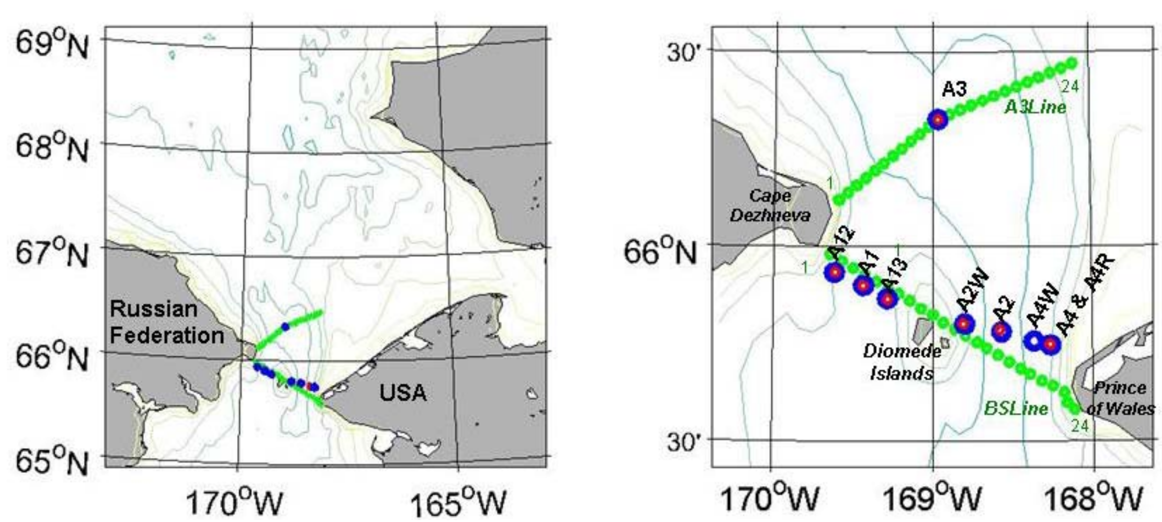
As part of the joint US-Russian RUSALCA (Russian US Long-term Census of the Arctic Ocean) Program, a team of US and Russian scientists undertook two oceanographic cruises in August/September 2009 on board the Russian vessel 'Khromov', operated by Heritage Expeditions (under the name of Spirit of Enderby). This report concerns the first of these cruises, Leg 1, in August 2009.

The major objective of the Leg 1 cruise was mooring work in the Bering Strait region, i.e., the recovery and redeployment of 8 moorings, a joint project by the University of Washington (UW), the University of Alaska, Fairbanks (UAF), and the Arctic and Antarctic Research Institute (AARI). The US portion of the mooring recoveries are supported by an NSF-OPP IPY grant (PIs: Woodgate, Weingartner, Whitledge and Lindsay). The US portion of the mooring deployments are supported by a NOAA-RUSALCA grant (PIs: Woodgate, Weingartner, Whitledge and Lindsay). The moorings measure water velocity, temperature, salinity, ice motion, ice thickness (crudely) and some bio-optics.

Although the start of the cruise was delayed by a day due to bad weather in Nome (and the off-load was delayed by 2 days, again for bad weather), the majority of the cruise goals were met, viz., recovery and redeployment of the 8 moorings, and the occupation of 2 high resolution CTD lines, one in the Bering Strait proper and one just north of the strait (see map below). These sections were also sampled for nutrients, chlorophyll and other water properties. For details of the water measurements and of opportunistic benthic grab work done at various locations during the cruise, please contact the US Expedition Leader, Terry Whitledge. Cruise time was also used to set-up equipment for Leg 2 RUSALCA. This included a CTD water sampler, run by Marshall Swartz of the Woods Hole Oceanographic Institution (WHOI). For details for the CTD set up and explicit parameters of the CTD, see the Leg 2 cruise report.

The Leg 1 cruise was scheduled to on-load in Nome on 22nd August 2009, with the ship docking on 21st or early 22nd August. However strong south winds and the ensuing high seas prevented the ship coming into Nome until early on the 23rd August 2009. An efficient on-load allowed us to sail on the evening of the 23rd August, and arrive on site in the strait on the afternoon of the 24th August. Fair weather and the long daylight of this time of year greatly expedited our operations for the next 6 days, during which we completed the mooring operations and 2 high resolution CTD lines. On the morning of the 30th August, we concluded the CTD operations for this leg to allow for further testing/set up of Leg 2 equipment and steamed for Nome, in anticipation of possibly getting dock space on 31st August. Although we were off Nome from early on 31st August, strong south winds on 31st August and winds/swell on 1st Sept prevented us coming to dock until early on 2nd September. Offload of the mooring equipment was complete by about midday, allowing for an afternoon on-load of Leg 2.

RUSALCA 2009 LEG 1 - MAP OF STATIONS



Map of the Bering Strait region (left) and detail of the strait (right) showing Khromov RUSALCA 2009 Leg 1 CTD sites (small green dots) and mooring locations for the eight moorings recovered in 2009 (A12-08, A11-08, A13-08, A2W-08, A2-08, A4-08, A4R-08, and A3-08) and the eight moorings deployed in 2009 (A12-09, A11-09, A13-09, A3-09, A2W-09, A2-09, A4W-09, A4-09, and A3-09). Blue dots with red center indicate a site of recovery and deployment. Blue dot (A4W) indicates deployment only. Depth contours are every 10m from the International Bathymetric Chart of the Arctic Ocean [Jakobsson et al., 2000].

RUSALCA 2009 LEG 1 CRUISE PARTICIPANTS

- US

1. Terry Whitedge (M), UAF, USA – *US Expedition Leader, nutrients, moored nutrient sampler*
2. Kathleen Crane (F), NOAA – *Program Manager, NOAA;*
3. Kevin Wood (M), NOAA/UW – *Science Liaison*
4. Rebecca Woodgate (F), UW – *US Chief Scientist, Moorings, UW Mooring lead*
5. Wendy Ermold (F), UW – *Moorings*
6. David Leech (M), UAF – *Moorings, UAF Mooring lead*
7. Kevin Taylor (M), UAF – *Moorings*
8. Dan Naber (M), UAF – *Mooring, moored nutrient sampler, nutrients*
9. Mike Kong (M), UAF – *UAF graduate student, nutrients, mooring assistance*
10. Marshall Swartz (M), WHOI – *CTD*
11. Jeff Jones (M), Reuters, Canada – *Media*

- Russian (directly part of RUSALCA 2009 Leg 1mooring work)

12. Vladimir Bakhmutov (M), State Research Navigational Hydro. Institute, RF – *Expedition Leader*
13. Aleksey Ostrovskiy (M), Group Alliance – *Liaison and translator*
14. Elena Bondareva (F), Arctic and Antarctic Research Institute (AARI), RF – *Moorings*

- Other Russian Scientists:

Alex Savvichev, Boris Smirnov, Alexey Sazonov, Natalia Chernova, Evgeny Vekhov, Iouri Pashchenko, Konstanin Kramchanin, Alexander Kolesnik, Stanislav Denisenko, Petr Strelkov, Daria Petrova, Elizaveta Ershova, Elena Zakharova, Alexey Sherbinin, Valentina Pimenova, Sergey Yarosh, Dmitry Korshunov, Alexander Bosin, Valentina Pimenova.

RUSALCA 2009 LEG 1 CRUISE SCHEDULE

Tuesday 18th Aug 2009	*UW mooring team (Woodgate, Johnson, Stewart) arrive Nome*
Wednesday 19th Aug 2009	*UW mooring team (Ermold) arrive Nome, prep mooring gear*
Thursday 20th Aug 2009	*prep mooring gear*
Friday 21st Aug 2009	*prep mooring gear, other scientists arrive, on-load meeting with agent*
Saturday 22nd Aug 2009	*prep mooring gear, waiting for weather*
Sunday 23rd Aug 2009	*Khromov docks ~8am, customs & USCG inspection, onload, sail 8:30pm*
Monday 24th Aug 2009	*(Johnson and Stewart return to Seattle)* *arrive A11 ~ 3pm, recover A11-08, A12-08, A13-08, download iscats*
Tuesday 25th Aug 2009	*Recover A2W-08, A2-08, A4R-08, A4-08 by lunchtime (1pm),* *Steam to A3, Recover A3-08 (by dragging) just before dinner (7:30pm)* *Continue downloads*
Wednesday 26th Aug 2009	*Deploy A3-09, A2-09, A4-09, and A4W-09* *Download SBEs*
Thursday 27th Aug 2009	*Deploy A2W-09, A13-09, A11-09, A12-08,* *Download ADCPs*
Friday 28th Aug 2009	*Run BStrait CTD line with mud (10am-6am, 45min per station with transit)* *Finish Russian downloads*
Saturday 29th Aug 2009	*Run A3L CTD line (noon – 6am), Fix CTD salinity problem (see below)* *Transfer of Russian Mooring Data, finish US downloads*
Sunday 30th Aug 2009	*Run for Nome, packing. Stewart arrives Nome to assist offload.*
Monday 31st Aug 2009	*Off Nome, waiting for weather to dock.*
Tuesday 1st Sep 2009	*Off Nome, waiting for weather to dock.*
Wednesday 2nd Sep 2009	*Dock ~ 9am, offload by noon, air cargo by 4pm, UW team leave Nome.*
Thursday 3rd Sep 2009	*Return to Seattle*

Total: 9.5 days at sea

BACKGROUND TO MOORING AND CTD PROGRAM

Moorings: The moorings serviced on this cruise are part of a multi-year time-series (started in 1990) of measurements of the flow through the Bering Strait. This flow acts as a drain for the Bering Sea shelf, dominates the Chukchi Sea, influences the Arctic Ocean, and can be traced across the Arctic Ocean to the Fram Strait and beyond. The long-term monitoring of the inflow into the Arctic Ocean via the Bering Strait is important for understanding climatic change both locally and in the Arctic. Data from 2001 to 2004 suggest that heat and freshwater fluxes are increasing through the strait [*Woodgate et al.*, 2006]. The work completed this summer should tell us if this is a continuing trend.

An overview of the Bering Strait mooring work (including access to mooring and CTD data) is available at http://psc.apl.washington.edu/BeringStrait.html.

Eight moorings were recovered on this cruise. These moorings (three in Russian waters – A11-08, A12-08, A13-08; five in US waters – A2W-08, A2-08, A4R-08, A4-08, A3-08) were deployed in another joint US-Russian cruise supported by NSF-OPP (*Woodgate, Weingartner, Whitledge, Lindsay, NSF-OPP-ARC-0632154*) with ship-time from the NOAA-led RUSALCA (Russian-American Long-term Census of the Arctic, http://www.arctic.noaa.gov/aro/russian-american/) program. This same NSF grant, an International Polar Year (IPY) project, funded the 2009 recoveries described here and data work up.

Eight moorings were deployed on this cruise under funding from NOAA-RUSALCA. These moorings (three in Russian waters – A11-09, A12-09, A13-09; five in US waters – A2W-09, A2-09, A4W-09, A4-09, A3-09) are almost entirely direct replacements of the recoveries, with one exception - site A4W, which was deployed on this cruise, was not deployed in 2008. (Note A4R-08 and A4-08 were at essentially the same position, and only 1 mooring was placed at this location in 2009.) To correct for a gradual shift of mooring positions over the last years, A11-09, A12-09, A13-09 and A2-09 were placed at their design positions established in the RUSALCA agreement started in 2004.

This is the 3rd year of the highest resolution array ever deployed in the Bering Strait (see map above). Three moorings were deployed across the western (Russian) channel of the strait (from west to east - A12-09, A11-09, A13-09). Four moorings were deployed across the eastern (US) channel of the strait (from west to east - A2W-09, A2-09, A4W-09, A4-09). A final 8th mooring (A3-09) was deployed ca. 35 nm north of the strait at a site proposed as a "climate" site, hypothesized to measure a useful average of the flow through both channels [*Woodgate et al.*, 2007]. Testing this hypothesis is one of the main aims of this work. All moorings (recovered and deployed) measure water velocity, temperature and salinity near bottom (as per historic measurements). Additionally, 6 of the 8 moorings (i.e., all eastern channel moorings, the climate site mooring A3, and the mooring central in the western channel, A11) also carried upward-looking ADCPs (measuring water velocity in 1-2 m bins up to the surface, ice motion, and medium quality ice-thickness) and ISCATS (upper level temperature-salinity-pressure sensors in a trawl resistant housing designed to survive impact by ice keels). Bottom pressure gauges were also deployed on the moorings at the edges of the eastern channel (A2W-09 and A4-09). Two moorings (A2-09, central eastern channel; and A12-09, western part of western channel) also carried ISUS nitrate sensors. For a full instrument listing, see the table below.

This coverage should allow us to assess year-round stratification in the strait and also to study the the physics of the Alaskan Coastal Current, a warm, fresh current present seasonally in the eastern channel, and suggested to be a major part of the heat and freshwater fluxes [*Woodgate and Aagaard*, 2005; *Woodgate et al.*, 2006]. The current meters and ADCPs (which give an estimate of ice thickness and ice motion) allow the quantification of the movement of ice and water through the strait. The nutrient sampler, the transmissometer and fluorometer time-series measurements should advance our understanding of the biological systems in the region.

CTD: The moorings are usually supported by annual CTD sections, with water samples for nutrients. This year, two high resolution CTD sections were run – one across the Bering Strait (BSL), and one through mooring site A3 (A3L line) – using the WHOI CTD setup, described in the cruise report for Leg 2. The third proposed line (CSL line) is due to be run on RUSALCA Leg 2.

International links: Maintaining the time-series measurements in Bering is important to several national and international programs, e.g., the Arctic Observing Network (AON) started as part of the International Polar Year (IPY) effort; NSF's Freshwater Initiative (FWI) and Arctic Model Intercomparison Project (AOMIP), and the international Arctic SubArctic Ocean Fluxes (ASOF) program. The mooring work also supports regional studies in the area, by providing key boundary conditions for the Chukchi Shelf/Beaufort Sea region; a measure of integrated change in the Bering Sea, and an indicator of the role of Pacific Waters in the Arctic Ocean. Furthermore, the Bering Strait inflow may play a role in Arctic Ocean ice retreat and variability (especially in the freshwater flux) is considered important for the Atlantic overturning circulation and possibly world climate [*Woodgate et al.*, 2005].

MOORING OPERATIONS DURING RUSALCA 2009 LEG 1 KHROMOV CRUISE

Much of the efficiency of this mooring cruise is attributable to the excellent weather and long daylight available by doing the cruise in August. That said, although there was a 6-day weather window which allowed us to service the moorings and complete the CTD lines, both on-load and off-load were delayed by weather preventing docking in Nome, losing a total of 3 days of ship-time. This reinforces our standard conclusion that at any time of year, it is essential to include several weather days in the cruise planning.

For mooring recoveries, acoustics were done from the aft lab on the main deck, with the hydrophone deployed just forward of the aft starboard A-frame. Once released, the ship brought the floating mooring along the starboard side where it was hooked with a detachable hook on a long pole. Grapples were used to hold the mooring for hooking. Also a top-float catching noose (a ~ 2 m of chain suspended from 2 hand-held lines, thrown over the top float) was used to hold moorings for hooking. Once hooked, line was tied off to the hook of the starboard crane and lifted aboard. As soon as possible the Iscat was recovered by hand as the rest of the mooring was being lifted. Many moorings could be brought aboard with 1 pick, but as necessary a stopper line was used on the aft-starboard rail. Although there was a learning curve to bringing the mooring along side and hooking the mooring with the detachable hook, once the method was established, it could work very time-efficiently, and thus we chose not to deploy a small boat to capture the top of the mooring. Once recovered, moorings were cleaned and rinsed with freshwater by hand. (Preliminary attempts were unsuccessful in connecting the electric power washer to the ship's water and electric supplies, however, since biofouling was very light this year, no more strenuous efforts were pursued.)

Deployments were done off the aft-deck, using the ship's trawl wire and stern A-frame for lifting, with the ship steaming slowly (1.5 knots) into the wind, and the mooring being deployed anchor last from the aft deck. As the weather was good and the moorings were short, this operation did not require stopper points on the aft deck, although tag lines were used on the picking of the anchor.

Overall, mooring operations went exceptionally smoothly. A few points are noteworthy:

1) One mooring, A3-08, required dragging, possibly due to a starfish on the release hook. Other moorings previously with release issues due to biofouling had been painted with antifouling. This proved effective. A3-09 was redeployed without antifouling but with extra floatation and with a spring on the release hook of the mooring. Other US moorings were redeployed with anti-fouling. **Prepare for dragging on all Bering Strait mooring cruises. Use Antifouling measures on releases.**

2) Mooring A2W-08 confirmed release but did not surface for 8 minutes. The suspicion is that this was hung-up on the bottom pressure gauge, possibly held by the plastic wrap used to inhibit biofouling on the pressure gauge, although A4-08 exhibited no problems in this regard. However, the plastic wrap solution was abandoned for the redeployments. The rubber piping connecting the gauge to the anchor was loosened as in previous years. **Be prepared for a delay in the mooring surfacing.**

3) Other (non-Bering Strait) cruises this year experienced significant release problems. UW uses dual releases on all moorings, pairing new releases with old. This year, all the new releases were used for recoveries and all functioned without hitch.

4) Biofouling was remarkably light this year. Discussions with Peter Strelkov (who took samples of biofouling from the moorings) suggest this is due to the late timing of the deployments. In previous years, barnacle larvae may establish themselves on the moorings before winter. In particularly warm years, there may be 2 seasons of this per year. A CD was made of all mooring fouling pictures since 2003, which shows substantial interannual variability. **Investigate.**

5) Of the 5 Iscats deployed in 2008, 2 of the upper layer sensors were lost (those on A11-08 and A3-08) in mid Feb 2009 and early March 2009. In both cases, loggers returned good data up to the time of loss. The remained 3 iscats gave good data all year round. **This yields the first ever year-round record of stratification in the eastern channel of the Bering Strait.** (Although 1 logger experienced logging problems, the data was successfully recovered from the microcat itself. The problematic logger had significant corrosion on the pins of the tether connected to the logger. This may be responsible for logger battery being low voltage on recovery.) The 2008 deployments were targeted at 17-18m depth, and the losses were not from the shallowest deployments. Thus 17-18m was taken as the target depth for the iscats for 2009 also. It is perhaps a coincidence that both of the lost iscats were on the ADCPs deployed in syntactic foam floats. Note that downloading of the iscats via the modem takes around 8 hours each. Also, in preparation, issues were found with the memory battery of the logger failing to connect. **Investigate logger issues.**

6) The 2008 deployments experienced problems with weak chain. No further problems were encountered on recovery.

7) During this cruise, all deck operations were assisted by Russian personnel from RosHydroMet. We are extremely grateful for their expert assistance, which greatly facilitated operations. Particular thanks go to Alexey Sherbinin, who twice used a grappling hook to catch a mooring that had evaded the hooking technique.

Very preliminary analysis of the mooring data show very good data return from all instrumentation, with the exception of the ISUS on A12-08, which returned no data, likely due to a fault in the battery cable. Preliminary plots are given below.

The data show the **usual large annual cycle in temperature and salinity.** Many of the usual features are present, i.e. high variability in autumn, generally with freshening and cooling; salting (at the freezing point) in the winter; freshening and warming in the spring [*Woodgate et al.*, 2005].

As usual A4R (sampling the Alaskan Coastal Current) is warmer and fresher than the rest of the strait. Yet, it seems that this mooring showed less Iscat-SBE salinity difference than last year. It needs to be investigated if this reflects a change in the ACC or the fact that the recent iscat was deployed around 17m compared to 14.5m in the first year.

Very **unusually, all salinity sensors at A4R show a strong freshening in midwinter**, around mid March. This freshening turns up also at A2 (to a lesser extent), but is only weakly present at A2W at depth. A possibly related mid March freshening is seen at A3 at depth (by this time, the A3 iscat was lost). This curious phenomenon (at a time when we expect salinities to be increasing due to ice formation) requires more investigation.

Very preliminary comparisons suggest that **2008 and 2009 are cold years compared to 2007**. Also, interestingly, **A3 maximum salinities in these 2008-2009 deployments are ~ 0.5 psu fresher than in the previous year**. Does this relate to a significant freshening in the strait?

Velocity data also show the typical high correlation both across the strait and in the vertical. As in previous years, the ACC is present in the eastern channel as evidenced by seasonal velocity shear. As in previous recent years, southward flow events are rare.

The flow through the strait is believed to be driven by a sea-level difference between the Pacific and the Arctic, which drives a flow northwards towards the Arctic. Local winds (usually southward in the annual mean) tend to oppose this flow and may reverse it on timescales of days [*Woodgate et al.*, 2005b]. However, the recovered data suggest that reversals have been unusually uncommon this summer, as other recent data. Since the variability of northward fluxes of heat and freshwater are dominantly dependent on the variability of the volume transport [*Woodgate et al.*, 2006], this may imply further increases in this fluxes, with possible implications for the Arctic and beyond.

Details of mooring positions and instrumentation are given below, along with schematics of the moorings, photos of the mooring fouling, and preliminary plots of the data.

CTD AND WATER SAMPLING DURING RUSALCA 2009 LEG 1 KHROMOV CRUISE

Two high resolution CTD lines were completed during the cruise, using the WHOI Seabird CTD system with water sampling rosette. The CTD was deployed through the aft A-frame, and bottles were fired at regular depths.

Unprocessed data should be treated with some caution. The first cast (BSL-1) was taken without the instrument soaking at depth. Anomalous salinity signals suggested that air had not been sufficiently purged from the system, and subsequent to this cast, all CTD casts started with soaking the CTD at 10m depth until the pumps came on. However, as the lines progressed, this problem reemerged, although it was not fully recognized until late in the A3L line (A3L Line, also possibly named AL Line in some CTD documentation), since it was initially (erroneously) considered to be a problem with the sharp temperature gradients in the vertical. Yo-yo-ing part of one cast confirmed that temperature was not the culprit, and further investigation showed the small hole that vented air from the CTD piping was blocked. This resulted in the pump pumping air rather than water, and thus the time lag between the temperature and conductivity sensors was not as expected, resulting in anomalous salinity signals. Once the vent hole was cleaned (secondary sensors cleaned on consecutive casts) the anomalous salinity signals disappeared. The upcasts did not experience this issue, presumably since once the CTD had descended to depth all the air was finally purged from the system.

On data processing, be prepared to use upcasts instead of downcasts.

During operation, be alert to this problem, and prepared to clean the vent frequently.

Since the CTD operations were taken by WHOI, who had other priorities on this leg of the cruise, calibrated CTD data are not available for this report. However, impressions gained during CTDing suggest that in the Bering Strait line, only the first cast (BSL-01) appeared to sample the Siberian Coastal water. **Add extra stations at the Russian Coast.**

Water samples were taken for a variety of parameters, including nutrients. For details please see the cruise report for the second leg, or contact Terry Whitledge.

RUSALCA 2009 LEG 1 BERING STRAIT MOORING POSITIONS AND INSTRUMENTATION

ID	LATITUDE (N) (WGS-84)	LONGITUDE (W) (WGS-84)	WATER DEPTH /m (corrected)	INST.
09 Recoveries				
- Russian EEZ				
A11-08	65 54.033	169 26.174	52	ISCAT, ADCP, SBE37
A12-08	65 56.060	169 36.738	51	ISUS, SBE/TF, RCM9
A13-08	65 51.897	169 16.907	50	AARI, RCM9, SBE37
- US EEZ				
A2W-08	65 48.124	168 48.371	53	ISCAT, ADCP, SBE16, BPG
A2-08	65 47.195	168 34.691	56	ISCAT, ADCP, SBE/TF, ISUS
A4R-08	65 44.946	168 15.964	50	ISCAT, ADCP, SBE16
A4-08	65 44.882	168 15.761	50	SBE16, BPG
A3-08	66 19.595	168 57.875	58	ISCAT, ADCP, SBE37

ID	LATITUDE (N) (WGS-84)	LONGITUDE (W) (WGS-84)	WATER DEPTH /m (corrected)	INST.
09 Deployments				
- Russian EEZ				
A11-09	65 54.002	169 25.984	52	ISCAT, ADCP, SBE37
A12-09	65 55.993	169 37.005	51	ISUS, SBE/TF, RCM9
A13-09	65 52.006	169 16.987	51	AARI, RCM9T, SBE37
- US EEZ				
A2W-09	65 48.062	168 47.957	54	ISCAT, ADCP, SBE16, WR, BPG
A2-09	65 46.870	168 34.044	57	ISCAT, ADCP, SBE/TF, ISUS
A4W-09	65 45.424	168 21.937	56	ISCAT, ADCP, SBE16
A4-09	65 44.762	168 15.746	50	ISCAT, ADCP, SBE16, BPG
A3-09	66 19.601	168 57.928	58	ISCAT, ADCP, SBE37, WR

AARI = AARI Current meter and CTD
ADCP = RDI Acoustic Doppler Current Profiler
BPG=Seabird Bottom Pressure Gauge
ISCAT = near-surface Seabird TS sensor in trawl resistant housing, with near-bottom data logger
ISUS= Nutrient Analyzer WR=Whale Recorder
RCM9= Aanderaa Acoustic Recording Current Meter
RCM9T = Aanderaa Acoustic Recording Current Meter with Turbidity
SBE/TF = Seabird CTD recorder with transmissometer and fluorometer
SBE16 = Seabird CTD recorder SBE37 = Seabird Microcat CTD recorder

RUSALCA 2009 LEG 1 TARGET CTD POSITIONS (For actual, see Leg 2 report)

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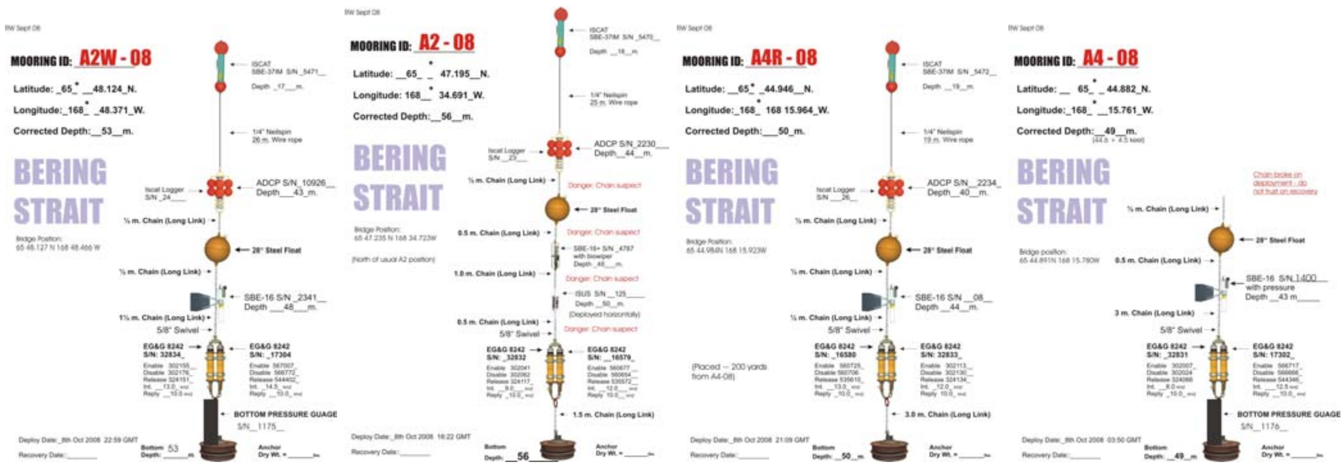
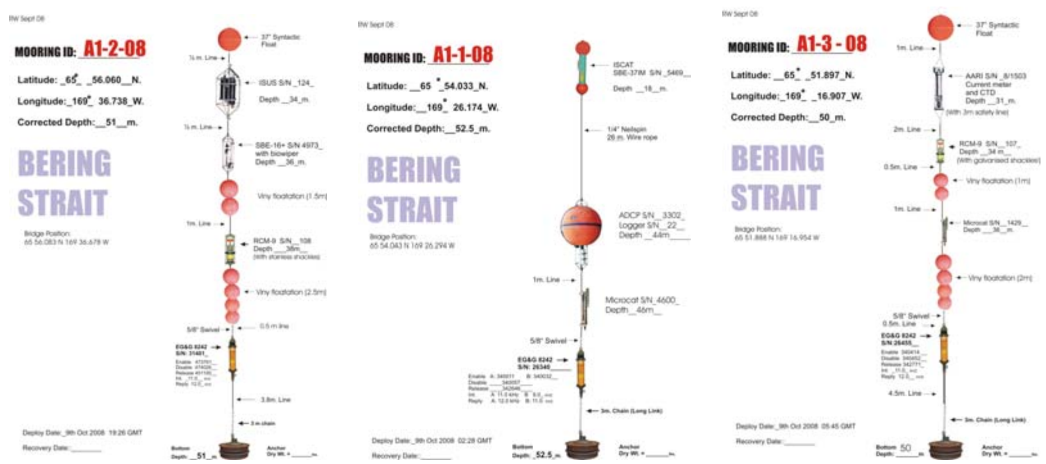
%===== Bering Strait Line
% - 24 stations just north of the Bering Strait
% Lat (N) Long (W)   Lat (N)     Long (W)       Station
%                    deg  min    deg   min    Num     Name
  65.980  169.643   65  58.81   169  38.56    %1     %BS1
  65.963  169.571   65  57.75   169  34.24    %2     %BS2
  65.945  169.498   65  56.71   169  29.87    %3     %BS3
  65.927  169.425   65  55.65   169  25.52    %4     %BS4
  65.910  169.352   65  54.59   169  21.11    %5     %BS5
  65.892  169.280   65  53.55   169  16.77    %6     %BS6
  65.880  169.214   65  52.78   169  12.83    %7     %BS7
  65.862  169.142   65  51.72   169   8.49    %8     %BS8
  65.841  169.072   65  50.47   169   4.31    %9     %BS9
  65.825  169.000   65  49.50   169   0.00    %10    %BS10
  65.805  168.933   65  48.31   168  55.96    %11    %BS11
  65.788  168.860   65  47.26   168  51.62    %12    %BS12
  65.772  168.794   65  46.33   168  47.64    %13    %BS13
  65.755  168.721   65  45.28   168  43.29    %14    %BS14
  65.739  168.663   65  44.35   168  39.80    %15    %BS15
  65.722  168.591   65  43.29   168  35.46    %16    %BS16
  65.704  168.521   65  42.23   168  31.28    %17    %BS17
  65.686  168.449   65  41.18   168  26.94    %18    %BS18
  65.672  168.391   65  40.35   168  23.44    %19    %BS19
  65.655  168.318   65  39.29   168  19.09    %20    %BS20
  65.642  168.250   65  38.53   168  14.97    %21    %BS21
  65.625  168.177   65  37.48   168  10.63    %22    %BS22
  65.599  168.161   65  35.96   168   9.66    %23    %BS23
  65.582  168.117   65  34.91   168   7.00    %24    %BS24
%
%=====  A3L line
% - 24 stations heading Southwest-northeast through mooring site A3
%  Lat (N)  Long (W)     Lat (N)     Long (W)          Station
%                      deg     min    deg     min        Num     Name
   66.1190  169.5931   66    7.1400  169   35.5850    %25    %AL1
   66.1380  169.5362   66    8.2800  169   32.1700    %26    %AL2
   66.1570  169.4793   66    9.4200  169   28.7550    %27    %AL3
   66.1760  169.4223   66   10.5600  169   25.3400    %28    %AL4
   66.1950  169.3654   66   11.7000  169   21.9250    %29    %AL5
   66.2140  169.3085   66   12.8400  169   18.5100    %30    %AL6
   66.2330  169.2516   66   13.9800  169   15.0950    %31    %AL7
   66.2520  169.1947   66   15.1200  169   11.6800    %32    %AL8
   66.2710  169.1378   66   16.2600  169    8.2650    %33    %AL9
   66.2900  169.0808   66   17.4000  169    4.8500    %34    %AL10
   66.3090  169.0239   66   18.5400  169    1.4350    %35    %AL11
   66.3280  168.9670   66   19.6800  168   58.0200    %36    %AL12
   66.3398  168.8952   66   20.3867  168   53.7092    %37    %AL13
   66.3516  168.8233   66   21.0933  168   49.3983    %38    %AL14
   66.3633  168.7515   66   21.8000  168   45.0875    %39    %AL15
   66.3751  168.6796   66   22.5067  168   40.7767    %40    %AL16
   66.3869  168.6078   66   23.2133  168   36.4658    %41    %AL17
   66.3987  168.5359   66   23.9200  168   32.1550    %42    %AL18
   66.4104  168.4641   66   24.6267  168   27.8442    %43    %AL19
   66.4222  168.3922   66   25.3333  168   23.5333    %44    %AL20
   66.4340  168.3204   66   26.0400  168   19.2225    %45    %AL21
   66.4458  168.2485   66   26.7467  168   14.9117    %46    %AL22
   66.4576  168.1767   66   27.4533  168   10.6008    %47    %AL23
   66.4693  168.1048   66   28.1600  168    6.2900    %48    %AL24
```

RUSALCA 2009 LEG 1 SCHEMATICS OF MOORING RECOVERIES

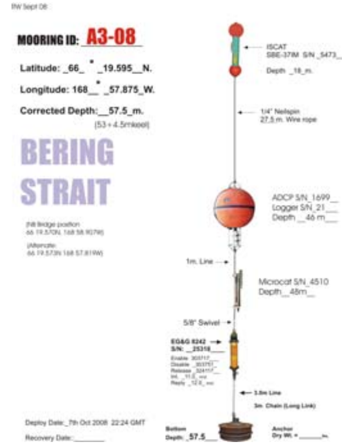
= in the eastern channel of the Bering Strait



= in the western channel of the Bering Strait

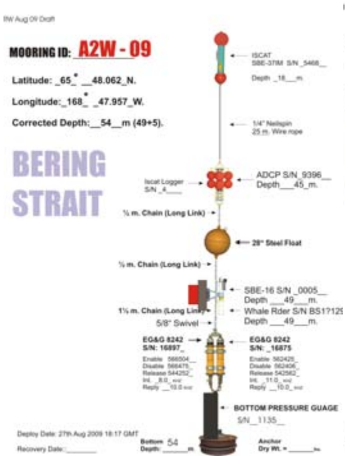


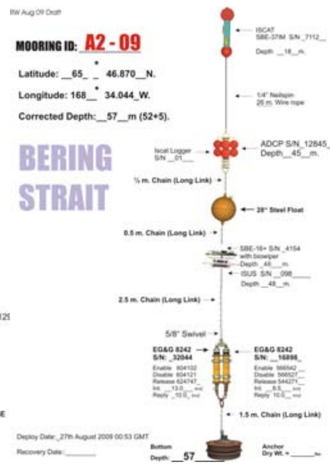
= at the climate site, ~ 60km north of the Strait

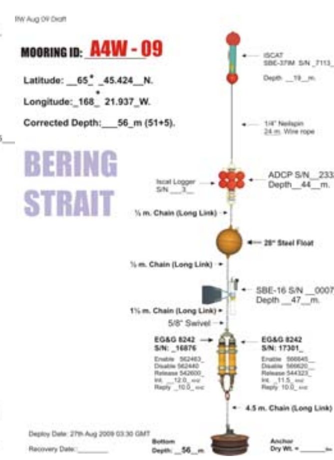


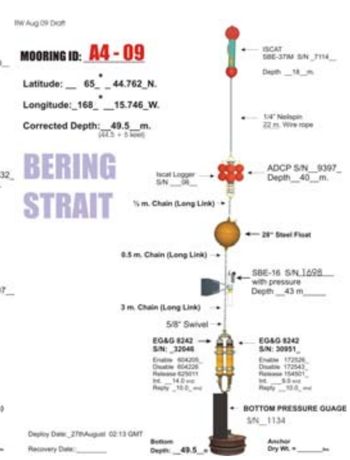
RUSALCA 2009 LEG 1 SCHEMATICS OF MOORING DEPLOYMENTS

= in the eastern channel of the Bering Strait

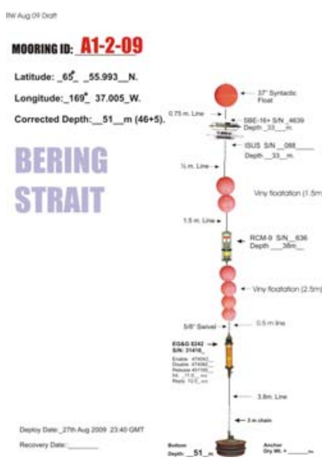


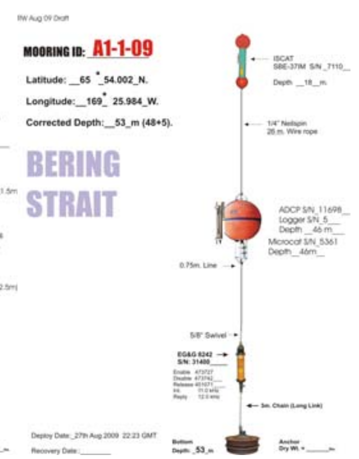


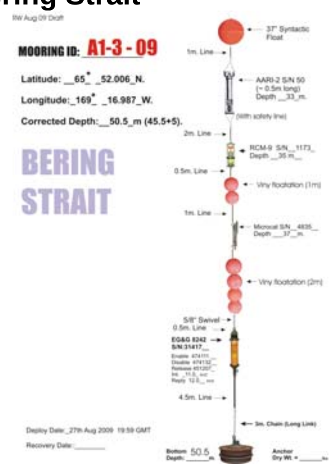




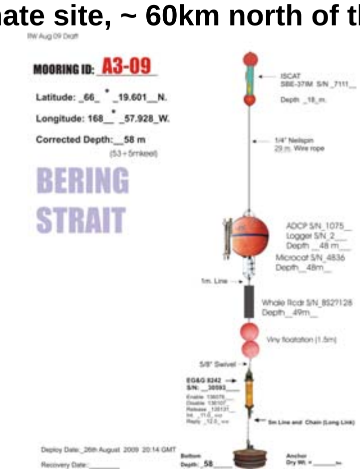
= in the western channel of the Bering Strait





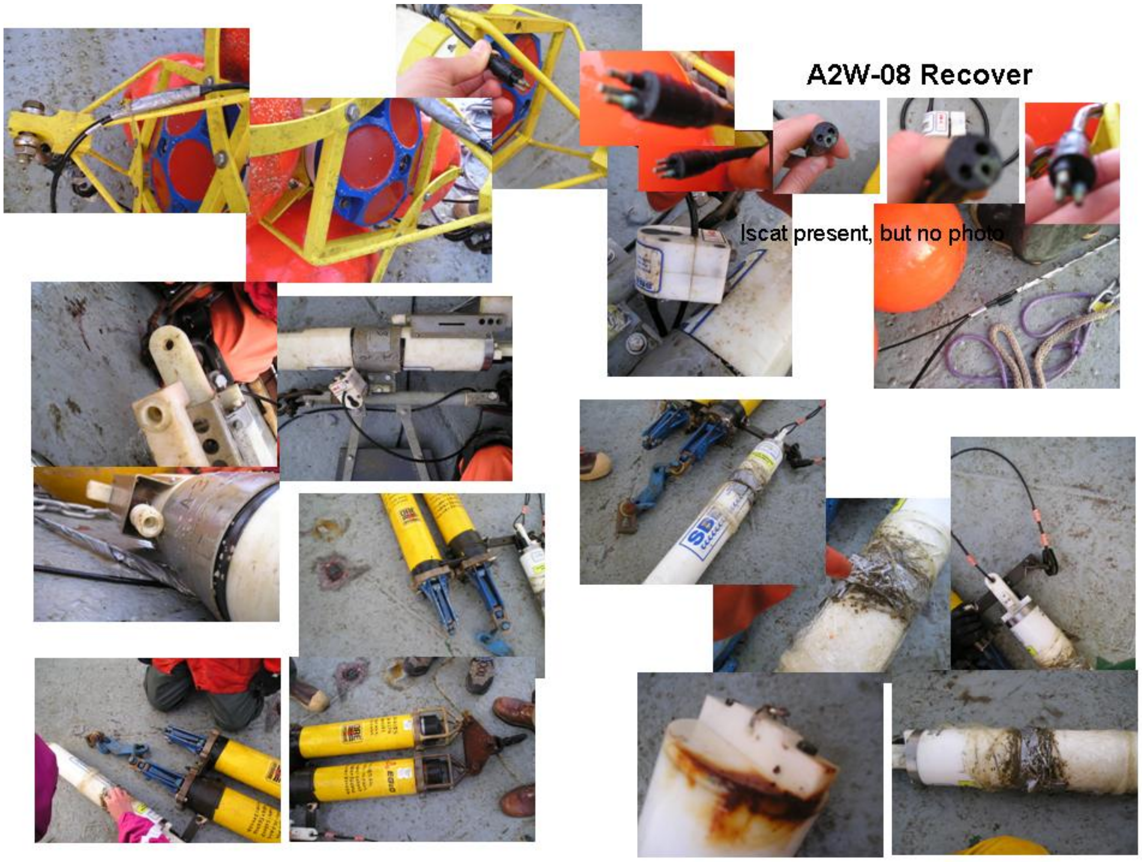


= at the climate site, ~ 60km north of the Strait

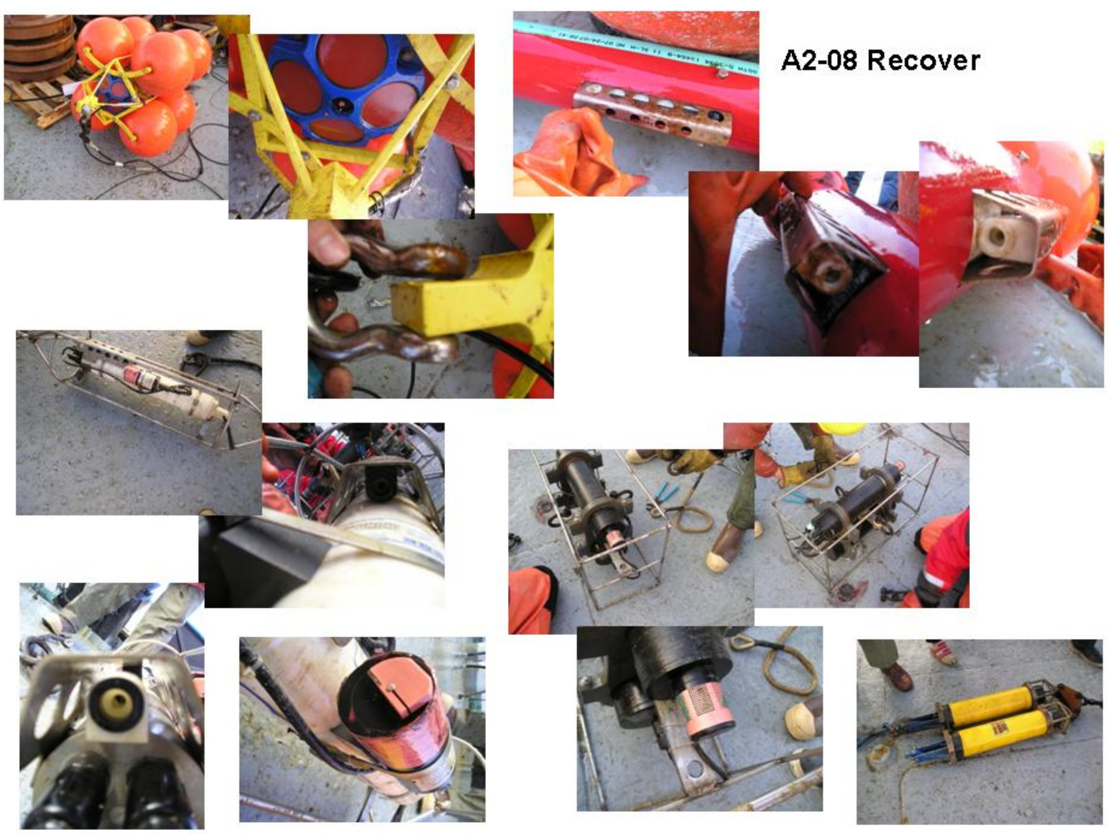


RUSALCA 2009 LEG 1 RECOVERY PHOTOS

A2W-08 Recover



A2-08 Recover



RUSALCA 2009 LEG 1 RECOVERY PHOTOS (continued)

A4-08 Recover

A4R-08 Recover

RUSALCA 2009 LEG 1 RECOVERY PHOTOS (continued)

A13-08 Recover

A11-08 Recover

RUSALCA 2009 LEG 1 RECOVERY PHOTOS (continued)

A12-08 Recover







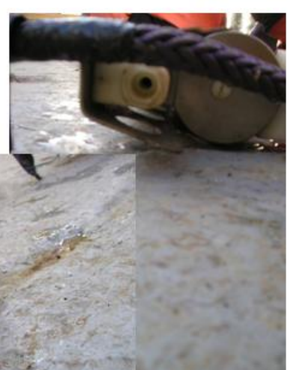






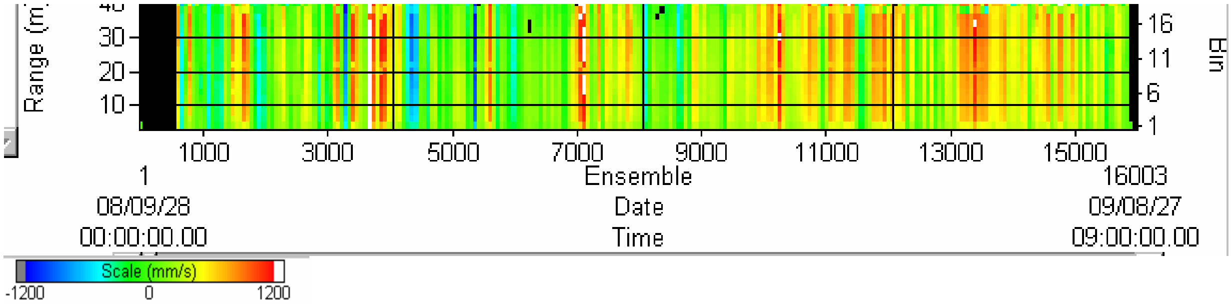

A3-08 Recover



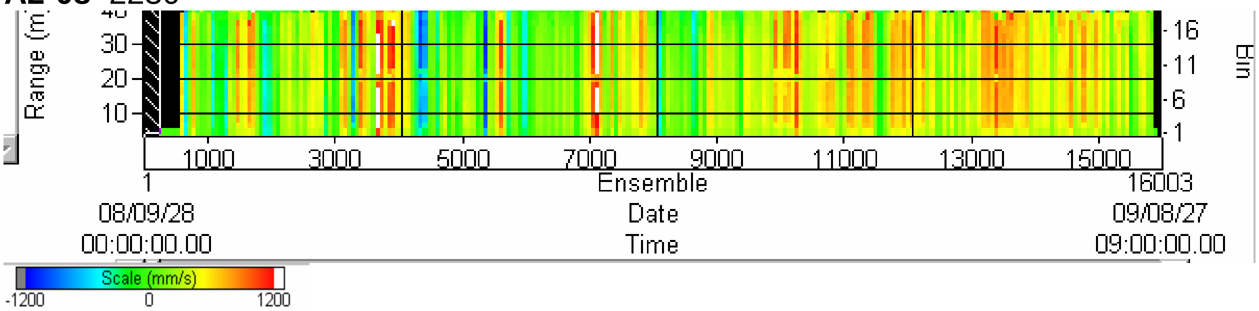



RUSALCA 2009 PRELIMINARY ADCP RESULTS

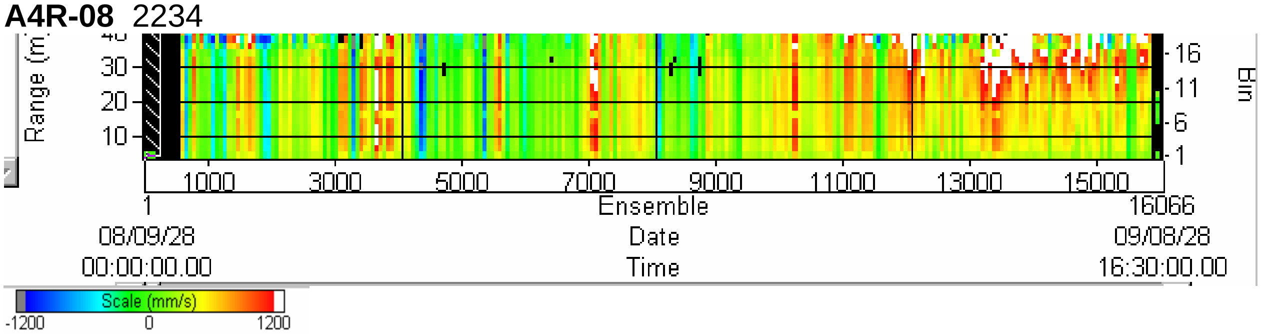
A2W-08 10926



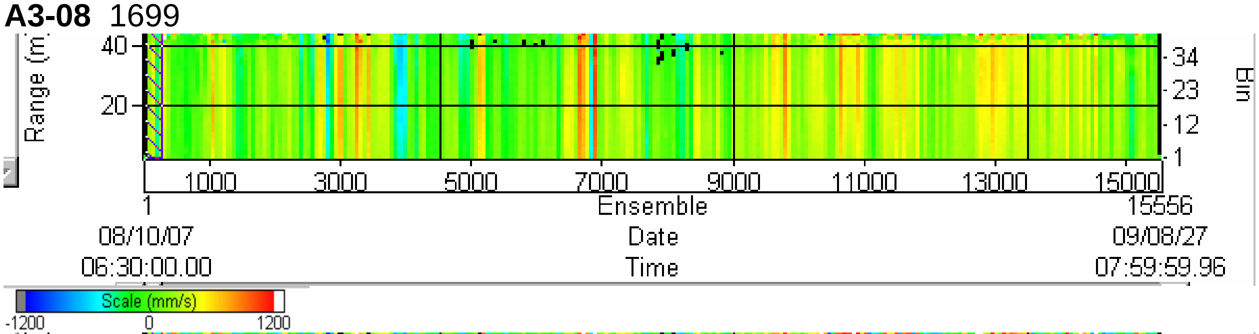
A2-08 2230

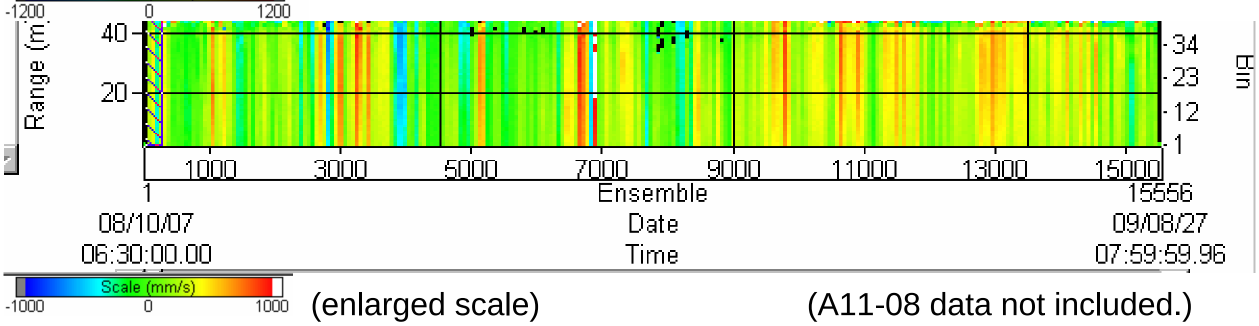


A4R-08 2234



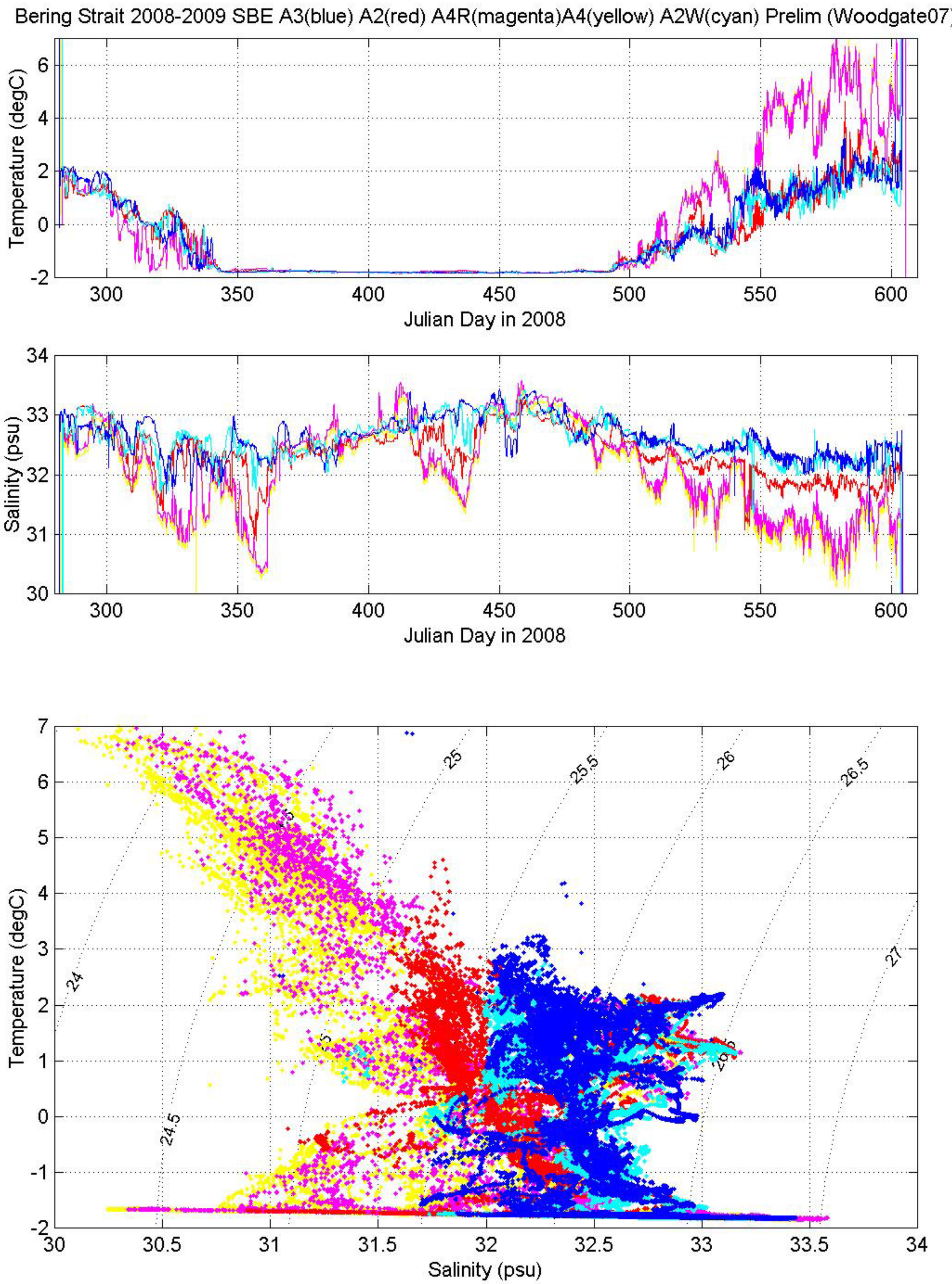
A3-08 1699





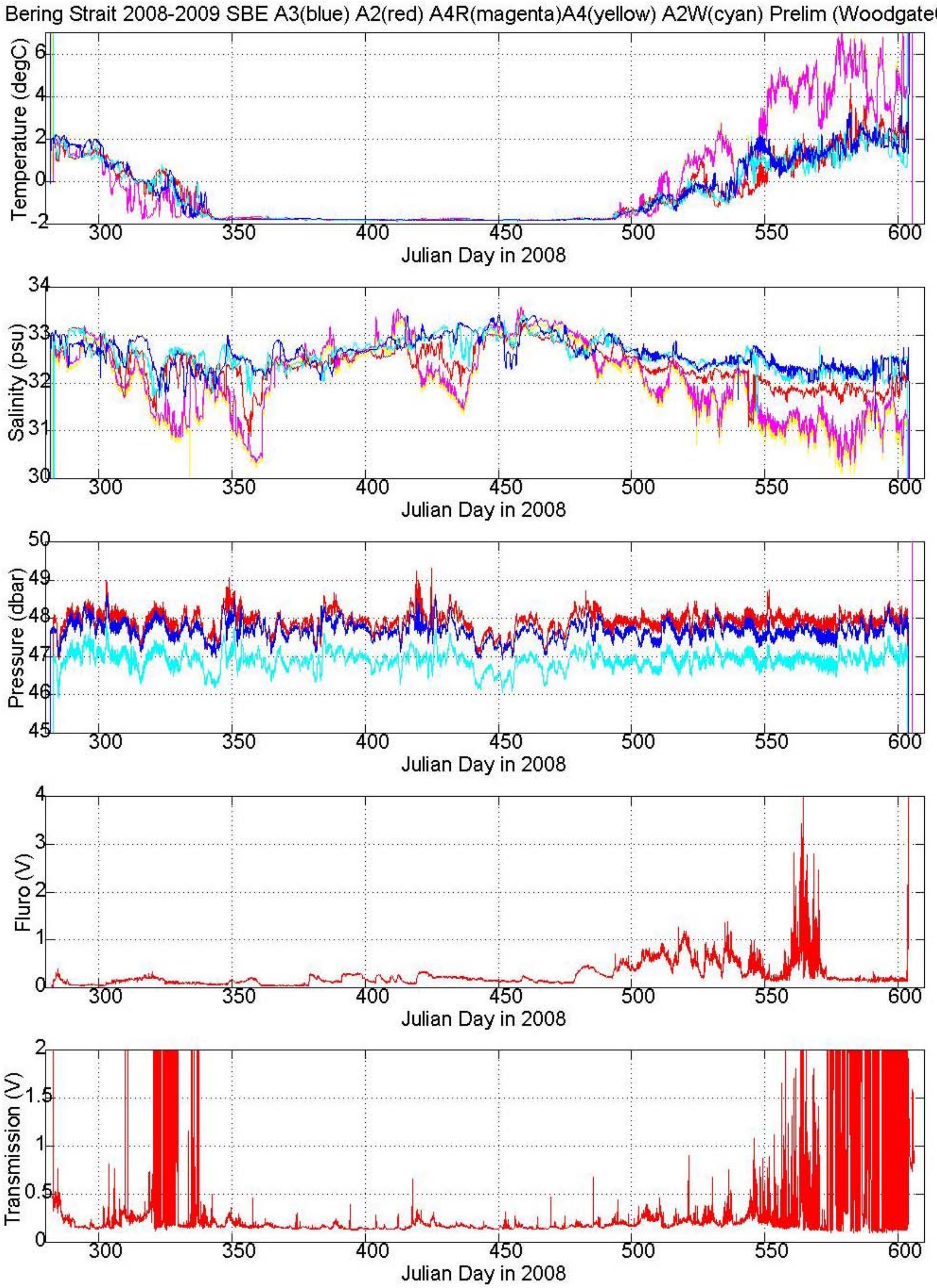
(enlarged scale) (A11-08 data not included.)

RUSALCA 2009 PRELIMINARY SEACAT RESULTS



(A11-08, A12-08, A13-08 data not included.)

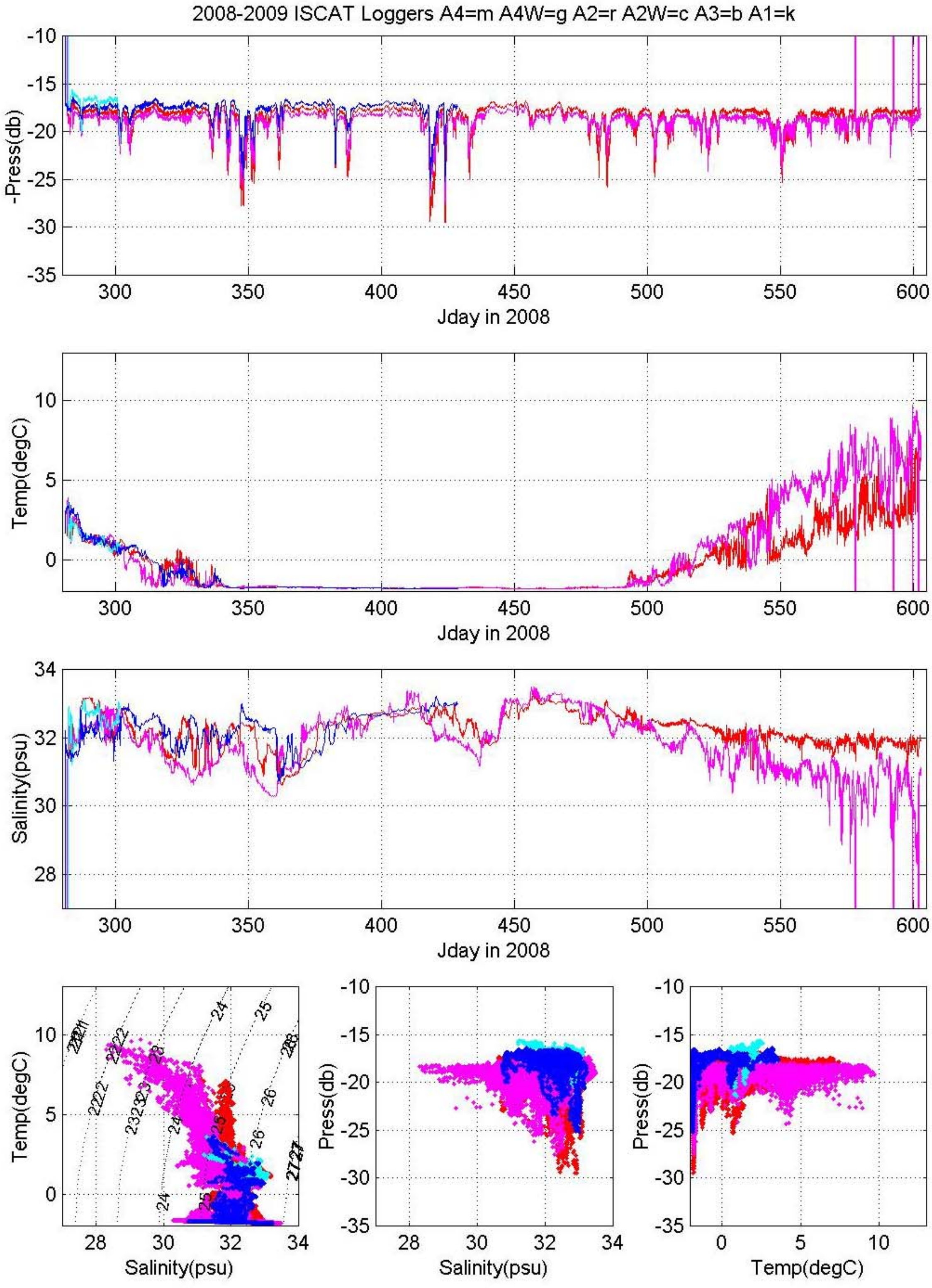
RUSALCA 2009 PRELIMINARY SEACAT RESULTS (continued)



(A11-08, A12-08, A13-08 data not included.)

RUSALCA 2009 PRELIMINARY ISCAT RESULTS

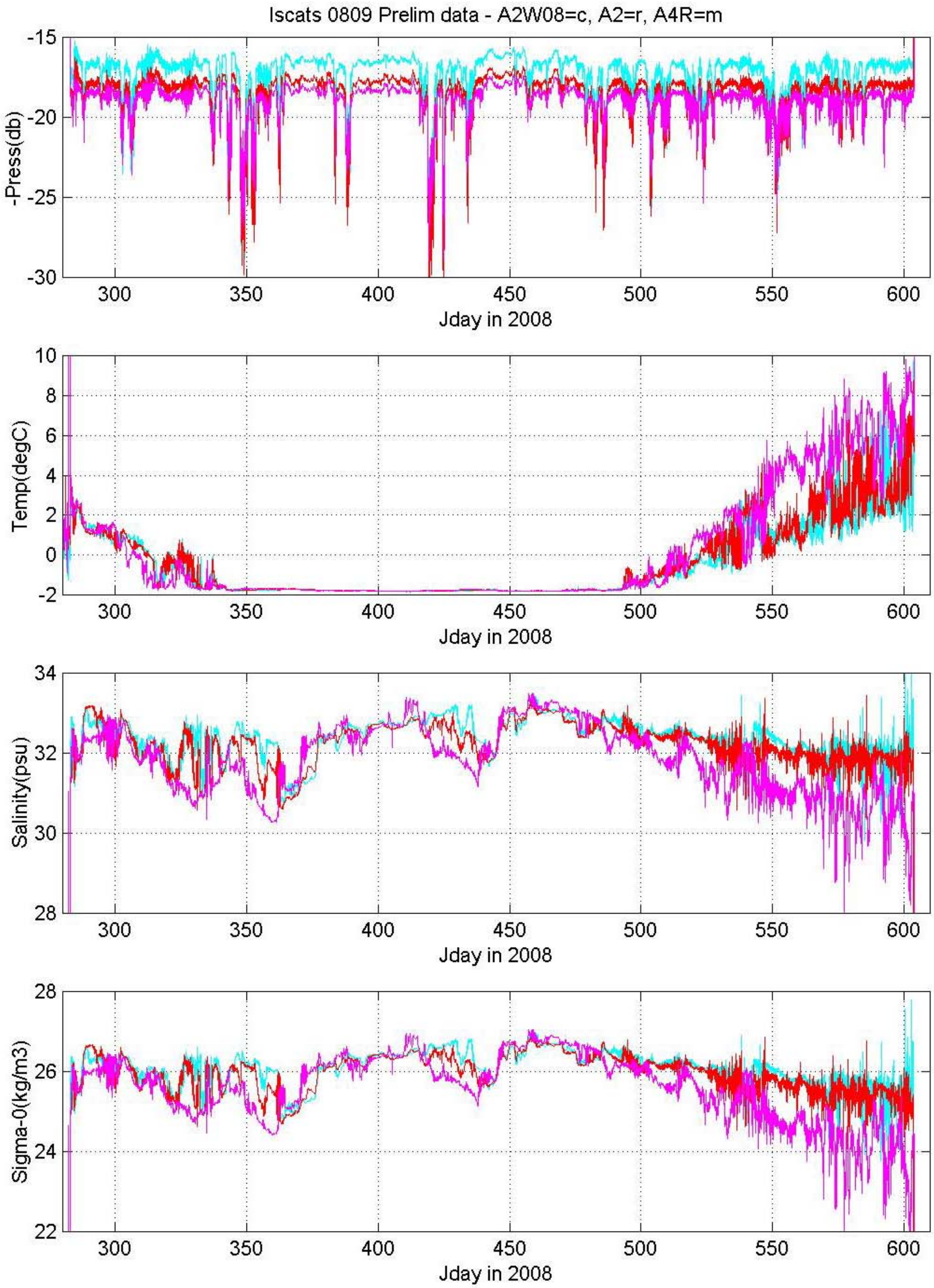
All Logger data



(A11-08 data not included.)

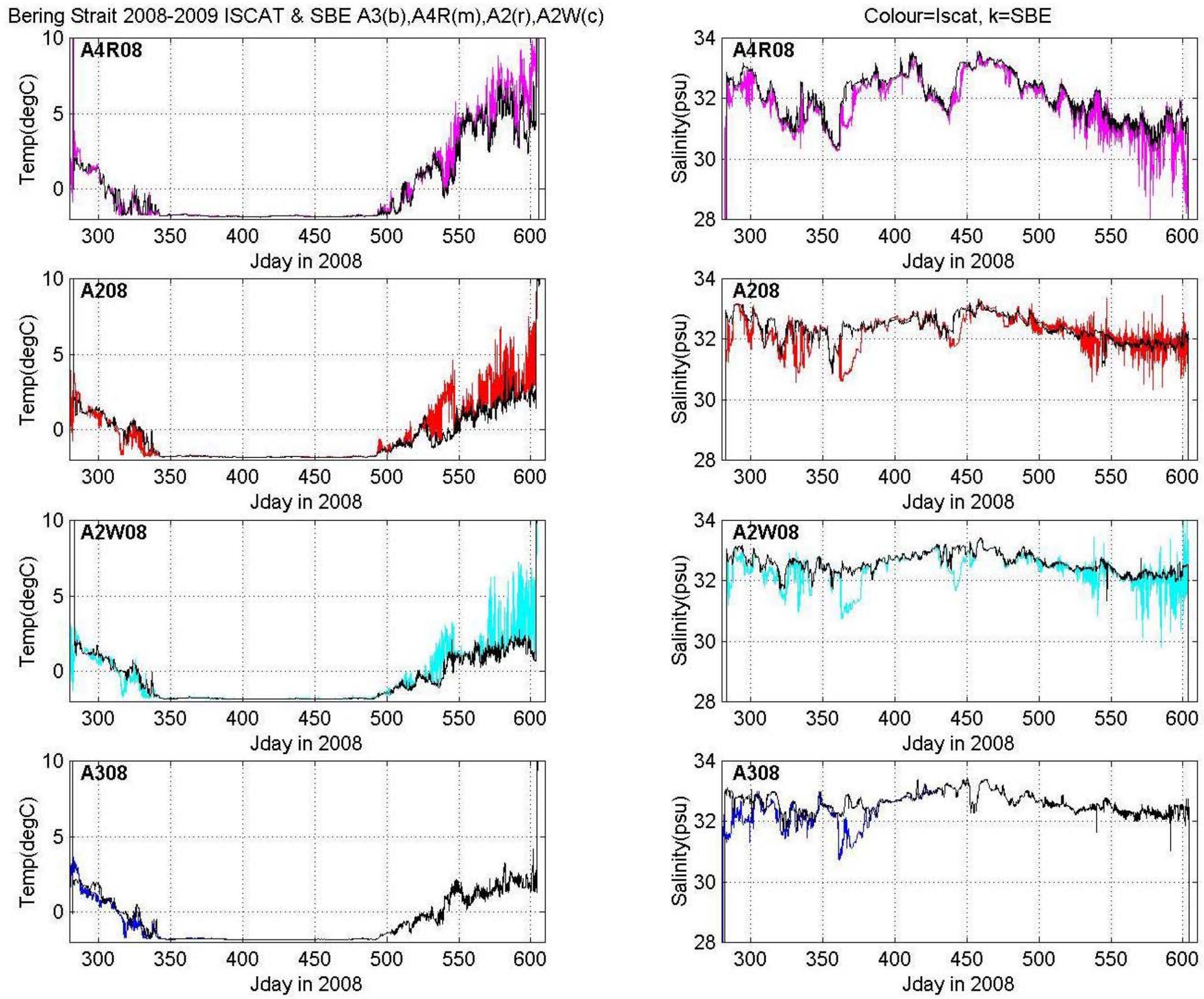
RUSALCA 2009 PRELIMINARY ISCAT RESULTS (continued)

All recovered Microcat (within the top iscat float) data



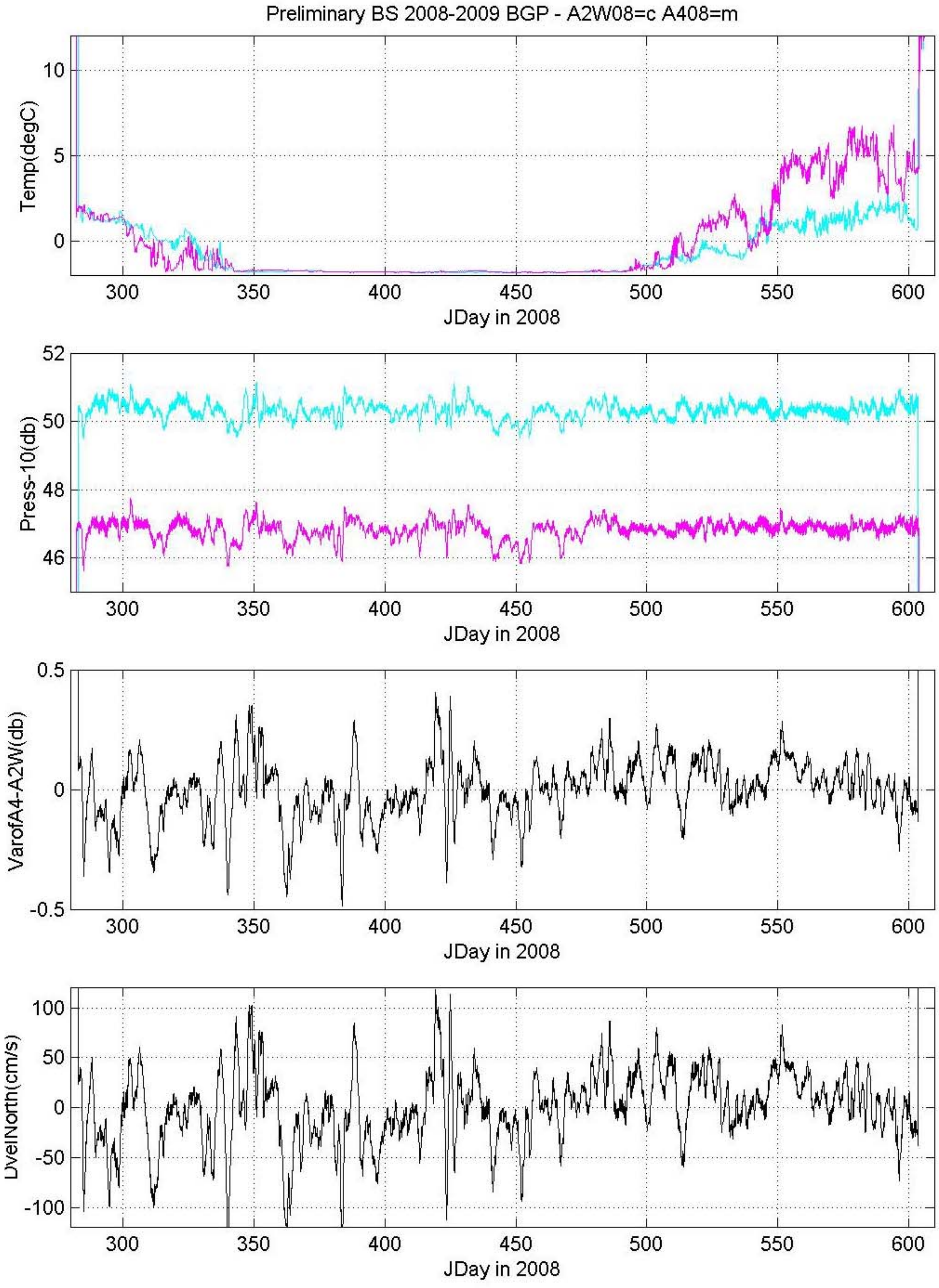
(A11-08 data not included.)

RUSALCA 2009 PRELIMINARY ISCAT – SBE COMPARISON



(A11-08 data not included.)

RUSALCA 2009 PRELIMINARY PRESSURE GAUGE RESULTS



RUSALCA 2009 LEG 1 RUSSIAN DOCUMENTS FOR TRANSFER OF 2008-2009 BERING STRAIT MOORING DATA (from A11-08, A12-08 and A13-08), AND FOR 2009 MOORING DEPLOYMENTS (A11-09, A12-09 and A13-09)

А К Т

передачи первичных данных измерений с приборов, установленных на американских автономных буйковых станциях А1-1-08, А1-2-08, А1-3-08 в территориальном море Российской Федерации в Беринговом проливе в период с 9 октября 2008 г. по 25 августа 2009 г.

«29» августа 2009 г. Берингов пролив

В Соответствии с Разрешением Федерального агентства по науке и инновациям от 26 июня 2009 года № 72 заявителем морских научных исследований – ОАО «ГНИНГИ» – на борту НИС «Профессор Хромов» был произведен съем информации на CD с иностранных приборов как указано ниже:

АБС **А1-1-08**

1) Акустический доплеровский профилограф течений ADCP «Sentinel», модель WHS300-I, с/н 3302BT.

2) Датчик проводимости и температуры SBE-37SM MicroCAT (с/н 4600).

3) Устройство записи данных ISCAT Logger (с/н 22).

АБС **А1-2-08**

1) Датчик нитратов Satlantic's ISUS, с/н 124 – датчик неисправен с момента постановки, данные не получены.

2) CTD-зонд SBE-16plus, с/н 4973 с комбинированным датчиком ECO Combination Meter, с/н FLNTUS-489.

4) Акустический измеритель течения RCM9 MKII, с/н 108.

АБС **А1-3-08**

1) Датчик проводимости-температуры SBE-37SMP MicroCAT, с/н 1429.

2) Акустический измеритель течения RCM9 MKII (с/н 107).

Файлы данных скопированы на носители информации ОАО «ГНИНГИ»:

1). A1108_3302.000
2). A1108_3302post.txt
3). A1108_simlogger22.dat
4). A1108_4600.asc
5). A1208_RCM108.asc
6). A1208_4973.hex
7). A1208_4973.pre.cnv
8). RCM9 LW SN 108.pdf
9). A1308_1429.asc
10). A1308_RCM107.asc
11). RCM9 LW SN 107.pdf

Данные скопированы в пяти экземплярах. После копирования информации первичные данные удалены из модулей памяти приборов и с компьютеров, использованных для съема и передачи данных.

Начальник экспедиции	[signature]	В.Бахмутов
NOAA oversight	[signature]	K.Crane
Представитель компании «Группа Альянс»	[signature]	А.Островский
RUSALCA Coordinator	[signature]	T.Whitledge
Chief Scientist	[signature]	R.Woodgate
Представитель ААНИИ	[signature]	Е.Бондарева

А К Т
постановки автономной буйковой станции АБС-1 (А1-1-09)

«29» августа 2009 г. Берингов пролив

В Соответствии с Разрешением Федерального агентства по науке и инновациям от 26 июня 2009 года № 72, заявитель морских научных исследований – ОАО «ГНИНГИ» – с борта НИС «Профессор Хромов» установил автономную буйковую станцию АБС-1 (А1-1-09) в следующей комплектации:

1) Акустический доплеровский профилограф течений ADCP «Sentinel» модель WHS300-I, серийный номер 11698;

2) Датчик проводимости-температуры «SBE-37SM MicroCAT» (серийный номер 5361);

3) Система измерений проводимости, температуры, давления с возможностью уклонения от воздействия льда ISCAT, в которую входят датчик измерения проводимости-температуры SBE 37-IM (серийный номер 7110), индуктивное соединительное устройство SBE Inductive Cable Coupler, модем SBE ICC и записывающее устройство ISCAT Logger (серийный номер 05);

4) Гидроакустический ответчик-размыкатель модель 8242XS (серийный номер 31400).

Дата постановки (МСК): 28 августа 2009 года.
Время постановки (МСК): 02.23.
Координаты постановки: 65°54,002′ N 169°25,984′ W (WGS-84 - корма)
65°53,996′ N 169°26,075′ W (СК-42 - мостик)
Глубина постановки: 53 м.
Высота станции над поверхностью дна: 35 м.

Приложение: схема постановки на 01 листе

Начальник экспедиции ____________ В.Бахмутов

NOAA oversight ____________ K.Crane

Представитель компании «Группа Альянс» ____________ А.Островский

RUSALCA Coordinator ____________ T.Whitledge

Chief Scientist ____________ R.Woodgate

Капитан судна ____________ А.Дьяченко

А К Т
постановки автономной буйковой станции АБС-2 (А1-2-09)

«29» августа 2009 г. Берингов пролив

В Соответствии с Разрешением Федерального агентства по науке и инновациям от 26 июня 2009 года № 72, заявитель морских научных исследований – ОАО «ГНИНГИ» – с борта НИС «Профессор Хромов» установил автономную буйковую станцию АБС-2 (А1-2-09) в следующей комплектации:

1) Датчик нитратов Satlantic's ISUS (серийный номер 088);
2) CTD зонд SBE-16plus (серийный номер 4639);
3) Акустический измеритель течения RCM9 LW (серийный номер 636);
4) Гидроакустический ответчик-размыкатель модель 8242XS (серийный номер 31416).

Дата постановки (МСК): 28 августа 2009 года.
Время постановки (МСК): 03.40.
Координаты постановки: 65°55,993′ N 169°37,005′ W (WGS-84 - корма)
65°56,020′ N 169°37,008′ W (СК-42 - мостик)
Глубина постановки: 51 м.
Высота станции над поверхностью дна: 18 м.

Приложение: схема постановки на 01 листе

Начальник экспедиции ____________ В.Бахмутов

NOAA oversight ____________ K.Crane

Представитель компании «Группа Альянс» ____________ А.Островский

RUSALCA Coordinator ____________ T.Whitledge

Chief Scientist ____________ R.Woodgate

Капитан судна ____________ А.Дьяченко

А К Т
постановки автономной буйковой станции АБС-3 (А1-3-09)

«29» августа 2009 г. Берингов пролив

В Соответствии с Разрешением Федерального агентства по науке и инновациям от 26 июня 2009 года № 72, заявитель морских научных исследований – ОАО «ГНИНГИ» – с борта НИС «Профессор Хромов» установил автономную буйковую станцию АБС-3 (А1-3-09) в следующей комплектации:

1) Измеритель течений «Вектор-2» (серийный номер 50);
2) Датчик проводимости-температуры «SBE-37SM MicroCAT» (серийный номер 4835);
3) Акустический измеритель течения RCM9 (серийный номер 1173);
4) Гидроакустический ответчик-размыкатель модель 8242XS (серийный номер 31417).

Дата постановки (МСК): 28 августа 2009 года.
Время постановки (МСК): 00.00.
Координаты постановки: 65°52,006′ N 169°16,987′ W (WGS-84 - корма)
65°51,982′ N 169°17,038′ W (СК-42 - мостик)
Глубина постановки: 50,5 м.
Высота станции над поверхностью дна: 21 м.

Приложение: схема постановки на 01 листе

Начальник экспедиции ____________ В.Бахмутов

NOAA oversight ____________ K.Crane

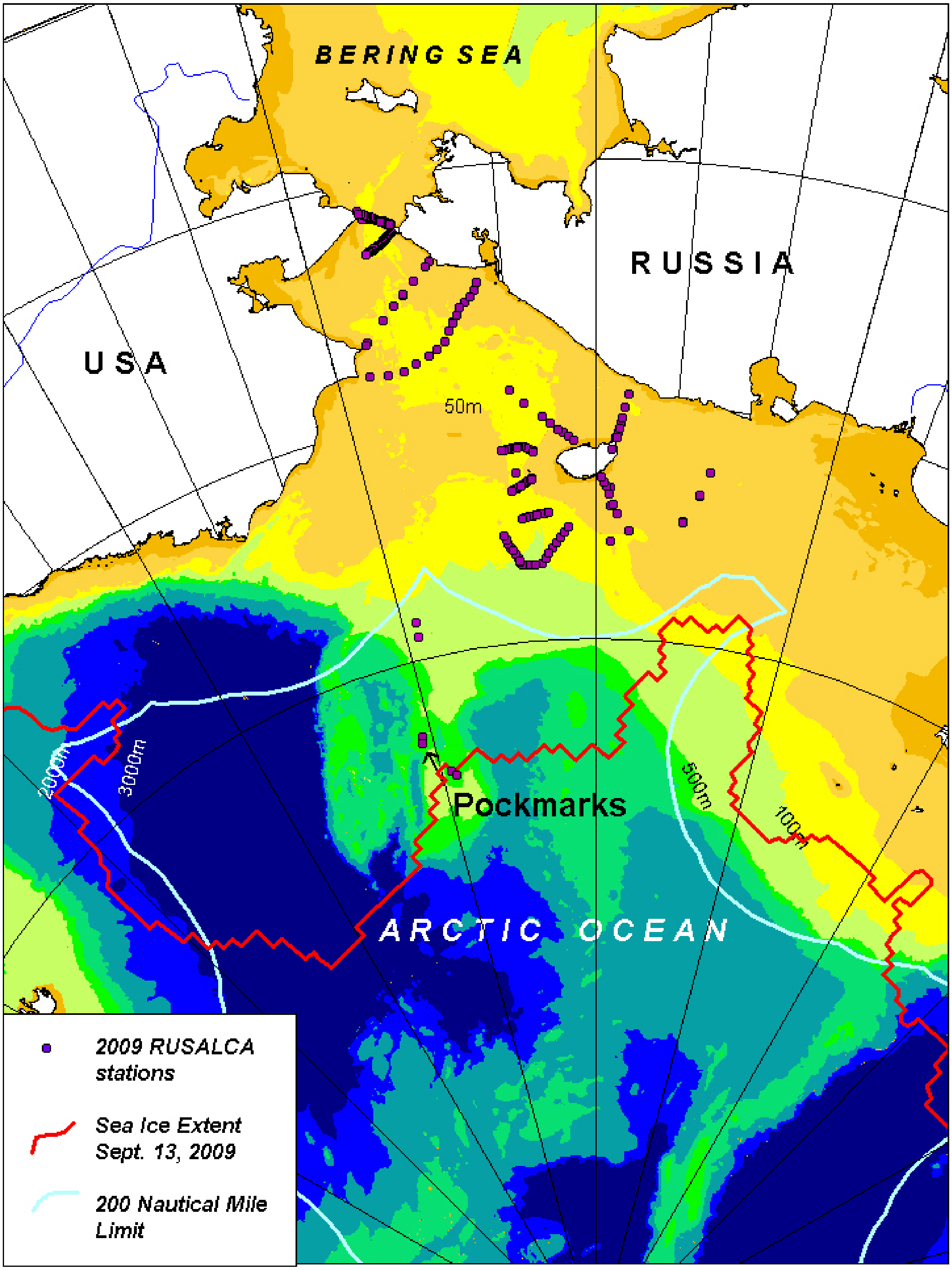
Представитель компании «Группа Альянс» ____________ А.Островский

RUSALCA Coordinator ____________ T.Whitledge

Chief Scientist ____________ R.Woodgate

Капитан судна ____________ А.Дьяченко

RUSALCA 2009 MAP OF STATIONS FROM LEG 1 AND LEG 2
(from Kathy Crane)



RUSALCA 2009 stations, bathymetry in meters

K. Crane
NOAA

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