Cruise report

FS Poseidon cruise 290

from St.Johns, Canada to Reykjavik, Island
June 6 to June 24, 2002
Chief scientist: Dr. Jürgen Holfort

Introduction

The cruise Poseidon 290 was a continuation of the work done in the EC- project VEINS (Variability of exchanges in the Northern Seas), where eighteen countries contributed to field work and modeling of the transport fluctuations through the major ocean passages between the Arctic Ocean and the Northern North Atlantic. This cruise focussed on the fluxes and the changes in the properties of water masses in the area from the Denmark Strait to the southern tip of Greenland. It is a repeat of of several cruises conducted since 1997 (Meteor M39/5 in 1997, M45/4 in 1999 and M50/3 in 2001; Valdivia 173 in 1998; Poseidon 263 in 2000).

Research program

The ideas about the composition of the Denmark Strait Overflow Water (DSOW) have changed considerably within the last couple of years. This changing view did also arise due to the long term measurements within the VEINS program. Some of these measurements were also done on previous cruises with FS Meteor. Actually the overflow is related to the waters of the western boundary currents of the Nordic Seas. This results in arctic, polar and atlantic contributions to the Denmark Strait Overflow. The present concept consists of equal contributions of Arctic Intermediate Waters, Arctic Ocean Deep Waters and recirculated Atlantic Water in the composition of overflow waters.

Of course this composition can change with time. On longer temporal scales the atmospheric forcing changes, and the formation of water masses depends also on this forcing. The predominant signal of these changes is the North Atlantic Oscillation. The exact nature of the relationship between changes in atmospheric forcing and changes in the composition and strength of the overflow is still unclear and a subject of our investigations. But recently a coherence was found between inter-annual temperature changes of the DSOW at 64°N, changes in the temperature in the Greenland Sea and also with changes in the Atlantic Waters in the West-Spitsbergen Current.

For several years now hydrographic sections were taken regularly along the East Greenland continental slope south of Denmark Strait. Several moorings are deployed along one of these sections at about 64°N. This mooring line consists of 6 moorings with current meters, one inverted echo sounder and one bottom mounted ADCP. This field work is a cooperative effort of institutions from Germany, Iceland, Finland and Great Britain.

The Poseidon cruise 290 aims at repeating those standard sections and to recover and redeploy the moorings.

Participants

The cruise was coordinated from the Institut für Meereskunde der Universität Hamburg, other participating organizations were CEFAS Lowestoft and Proudman laboratories.

Name	Speciality	Institute
Holfort, Jürgen	Chief scientist	IfM Hamburg
Hargreaves, Geoffrey	Moorings	POL
Read, John	Moorings	CEFAS
Verch, Norbert	Oceanography	IfM Hamburg
Drübbisch, Ulrich	Moorings	IfM Hamburg
Hochbaum, Ute	Student, Oceanography	IfM Hamburg

Hacker, Filip	Student, Oceanography	IfM Hamburg
Janout, Markus	Student, Oceanography	IfM Hamburg
Heyen, Söhnke	Student, Oceanography	IfM Hamburg
Trumm, Florian	Student, Oceanography	IfM Hamburg

Cruise narrative

The scientific crew embarked FS Poseidon June 6 in the morning. After stowing the last equipment, FS Poseidon left St. Johns, Canada on June 6, 2002 around midday. The ship steamed for several days across the Labrador Sea to reach the actual research region at the southern tip of Greenland. During this Labrador Sea transect two CTD stations were taken and four APEX floats were deployed.

The main CTD work started on June 10 at section 6. During VEINS the sections were given numbers from 1 starting in the north till 6 for the southernmost section and we will keep this denomination. Section 6 corresponds also to the western part of WOCE section A1E. The planned westernmost CTD profile could not be taken due to ice conditions. Along the section a detour had to be taken between the third and fourth profile due to an extended ice field. Seals were observed on this ice fields and some smaller whales were sighted nearby.
After this section the ship headed towards section 3. The day time was used to recover the moorings on June 13 and to deploy the ADCP mooring on June 14, five moorings on June 15 and the last three moorings on June 16. The time in between moorings was used for the CTD work of section 3 together with some stations nearby.
After finishing the mooring work at section 3, the ship headed, in somewhat rougher weather towards section 4. After some CTD sections in the night, with a sighting of a sperm whale, FS Poseidon arrived at the first tube mooring position, located on the east Greenland shelf. The local weather was quite favorable, especially compared with the rougher weather encountered some hours earlier just 30 or 40 miles towards the east. The mooring position was in open water at a distance of about 3 nautical miles from the ice edge, but this meant, that the second tube mooring was about 6 miles within the ice and it would therefore be impossible to recover with FS Poseidon. Tube mooring 3 had no acoustic release and had to be dredged. This was successful on the first try. The mooring engaged when we believed had passed over it and had not found it. The further recover also gave no problems, even with the tube measuring 40m and an available deck length of about 30m. While reworking the mooring for later redeployment, the day was spent around the mooring position doing some CTD work and contemplating Greenland, the ice edge and a larger iceberg with a height of about 50m above sea level, which was grounded nearby. In the evening the tube mooring was redeployed and the CTD work on section 4 was continued, with nice blue sky at its end, but with a quite large swell. The weather continued being very fine during the following CTD work on the eastern end of section 3 and on sections 2 and 1. As the swell decreased and the sea was very calm, sightings of different kind of whales increased and seals were also spotted. On the 20th of June two whales appeared just meters away from the ship during a CTD station. Due to the good sea and weather conditions work on the last hydrographic sections proceeded rapidly and FS Poseidon arrived Reykjavik on June 23 in the evening, which marked the end of the cruise.

CTD work

During the cruise a total of 76 CTD stations were taken in the Irminger Sea, using a Seabird 9-CTD with a 24 Bottle Rosette sampler. A spare CTD with a 12 bottle Rosette was on board, but was not used. The CTD used was the SBE-2 from the Institut für Meereskunde Kiel, the Rosette was from GO, but with a Seabird bottle releaser. Only 12 bottles were attached to the rosette.
In calm weather the CTD was lowered to 2m and after the pump started and salinity was stable, lowered with a speed of 0.5 m/s, which was increased to 1 m/s at a depth of about 150 to 200m. In rougher weather the CTD was first lowered to 10m and after the starting of the pump heaved up to 2m to start the actual profile.
The bottom contact switch did not work, but as the CTD was equipped (after the two test stations in the Labrador Sea) with an altimeter, the profiles could be taken till just above the ground (distance of 5-10m). As was known from previous cruises, the altimeter signal is poor for pressures above about 2000dbar at the regular lowering speeds of 1 m/s. For safety therefore the lowering speed was decreased to 0.5 m/s 100m above ground. During just one single station (390) the CTD had contact with the bottom. Inspection of the data showed no influence on the sensors.
After sections 6 a Chelsea transmissometer was attached to the CTD. This sensor was calibrated in 1994 and the data, expressed in percent, was used without further calibration. No problems were noted for this sensor.
The calibration of the pressure sensor dated June 29, 2000 and from the temperature sensor October 21,2000.
The comparison with the reversing thermometers (on just one bottle) showed no discernible drift, just an offset

of 4dbar in pressure and 0.01 in temperature. But as the calibration of the used mercury thermometers dated back to 1999 the offset is most probably from a shifted calibration of the thermometers. The newly calibrated electronic reversing SIS thermometers and pressure sensors did not arrive on time in St. Johns due to delayed baggage transportation.
The conductivity calibration dated October 31, 2000. Up to 5 water samples per station were taken and analyzed with a Guildline Autosal salinometer (8400H). Standard water of batch 140 was used to calibrate the salinometer. The first on board analyses showed no drift or linear or higher order term with respect to time, pressure, temperature or conductivity itself. The constant offset was 0.004 mS/cm in conductivity or 0.005 in salinity, with the CTD values being too low.

Some problems with the cable arouse when doing CTD work in heavier swell. The outer mantle was twisted off just above the CTD and some meters had to be cut off several times. As the rosette (with CTD) is not symmetrical, especially with only 12 bottles attached to one side, it rotates on its way through the water. This rotation could be one reason for the cable damage, but it did not help to arrange the 12 bottles more symmetrically on the 24-bottle rosette. Inspection of the data from stations with and without cable damage under similar environmental conditions revealed, that the mean heave-velocity was about 0.1 to 0.2 m/s higher on the stations with cable damage. Due to the tighter cable the ship movement was transmitted more directly onto the CTD resulting in larger deviations around the mean heave-velocity, with maximum up-speeds of 1.8 m/s. As cable damage was not seen after decreasing the heave speed (in addition the swell decreased), we therefore believe to have identified the problem.

Mooring work

The mooring work consisted of two parts, the first along section 3 and the second at the western end of section 4. Along section 3 it was planned to recover and redeploy eight moorings and deploy one additional mooring. Seven of them were short line moorings with a maximum length of 350m equipped with up to 4 Aanderaa current meters and 1 microcat on two of them. The eighth was a bottom mounted inverted echo sounder (IES). The additional mooring was a bottom mounted acoustic doppler current meter (ADCP). On the shelf at the western end of section 4 it was planned to recover and redeploy two *tube* moorings. These consist mainly of a 40m long plastic tube with a diameter of 22 cm, which should protect the three microcats in the inside from damage by drifting ice. A simple, schematic overview of the design of each mooring is given in Table m1? and dates and positions of recovery and deployment can be found in the station list.

Except from one tube mooring, which could not be reached due to ice conditions, all moorings were recovered and redeployed without problems. All releasers responded and could be triggered to release the mooring without major problems. The single mooring designed to be dredged was recovered on the first attempt. All instruments seem to have worked properly with the exception of the microcat on mooring UK1, which did not record any data. On deployment the ADCP and IES moorings were tracked acoustically until they landed on the sea floor.

The new type of tube mooring, which was recovered for the first time on this cruise, with a reduced diameter, lighter plastic flotation instead of glass spheres and a simplified connection between the 5m long tube elements did not break into 2 pieces during the one year of deployment, could be handeld much easier and be easily redeployed after some minor work.

Further measurements

Data from the ship mounted ADCP and thermosalinigraph were recorded as standard measurements. The ship also collects some atmospheric data, which are transmitted directly to the German weather service (DWD). A total of 6 APEX floats were launched on behalf of W. Zenk from Kiel.

First results

On all section the DSOW can be identified by a temperature and salinity minimum at the bottom. On its way from the Denmark Strait to the south, the main core descends from a depth of about 1000-2000dbar at section 1 to about 2300-2700dbar at section 6. On the same distance the measured minimum potential temperature increases from 0.5°C to 1.1°C and the salinity from 34.74 to 34.86. A signal of higher beam attenuation (lower transmission) can also be found, as the DSOW flows over the bottom and probably re-suspends or keeps material in suspension.

Very cold and low saline water on the East Greenland shelf is Polar Water, which flows southward within the East Greenland current. Other discernible water masses are the Labrador Sea Deep Water (e.g. mid-depths at section 6) and the warm waters of the Irminger current (e.g. the upper eastern part of section 1).

As the cruise is part of a long term measurement project (as a part of the VEINS and now ASOF program) we are especially interested in the changes in hydrographic parameters in time. The comparision with previous cruises reveals, that the T-S characteristics of the DSOW are similar to the ones of 1997 in the densest parts (sigma-2=37.21) and to 1999 in the density range sigma-2 37.05 to 37.15.

Temperature and conductivity were recorded with a microcat deployed in the DSOW mooring G1. Changes in temperature and salinity are not as pronounced as at mooring UK1 two years ago. A period similar to the low salinity and temperature seen two years ago is not present in this years record. Or such signal did not exist or it does not reach the depth of mooring G1, located further offshore then UK1. The analysis of most of the current meters will begin after the cruise.

Compared to the tube mooring recovered last year, the actual tube had a smaller diameter, therefore the drag is smaller. With the change in design we also hoped, that the instrument would not tilt under the effects of currents as much as the old design. The time series shows, that this also seems to be the case, although spectral analysis of the pressure at the upper instrument showed peaks at the tidal frequencies as before, showing that the mooring responds with depth changes to the tidal currents .

Acknowledgment

Sincere thanks goes to the crew of the RV Poseidon for highly professional assistance, and to the authorities of Greenland and Island for the research permission.

Figures

Fig. 1: Station positions

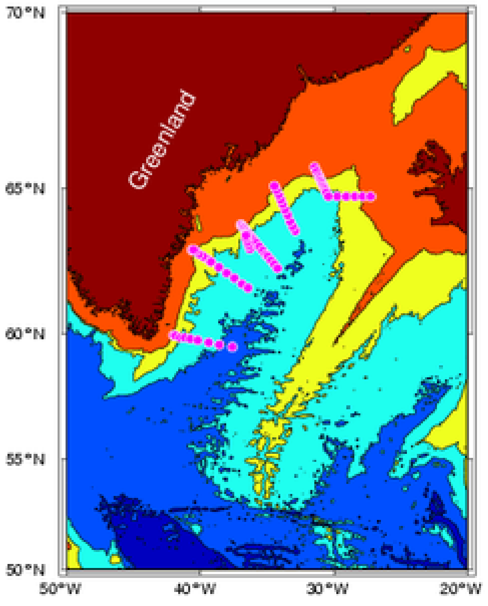


Fig.2: Potential temperature and salinity along section 6, as a function of pressure and as a function of pressure distance from the deepest measurement.

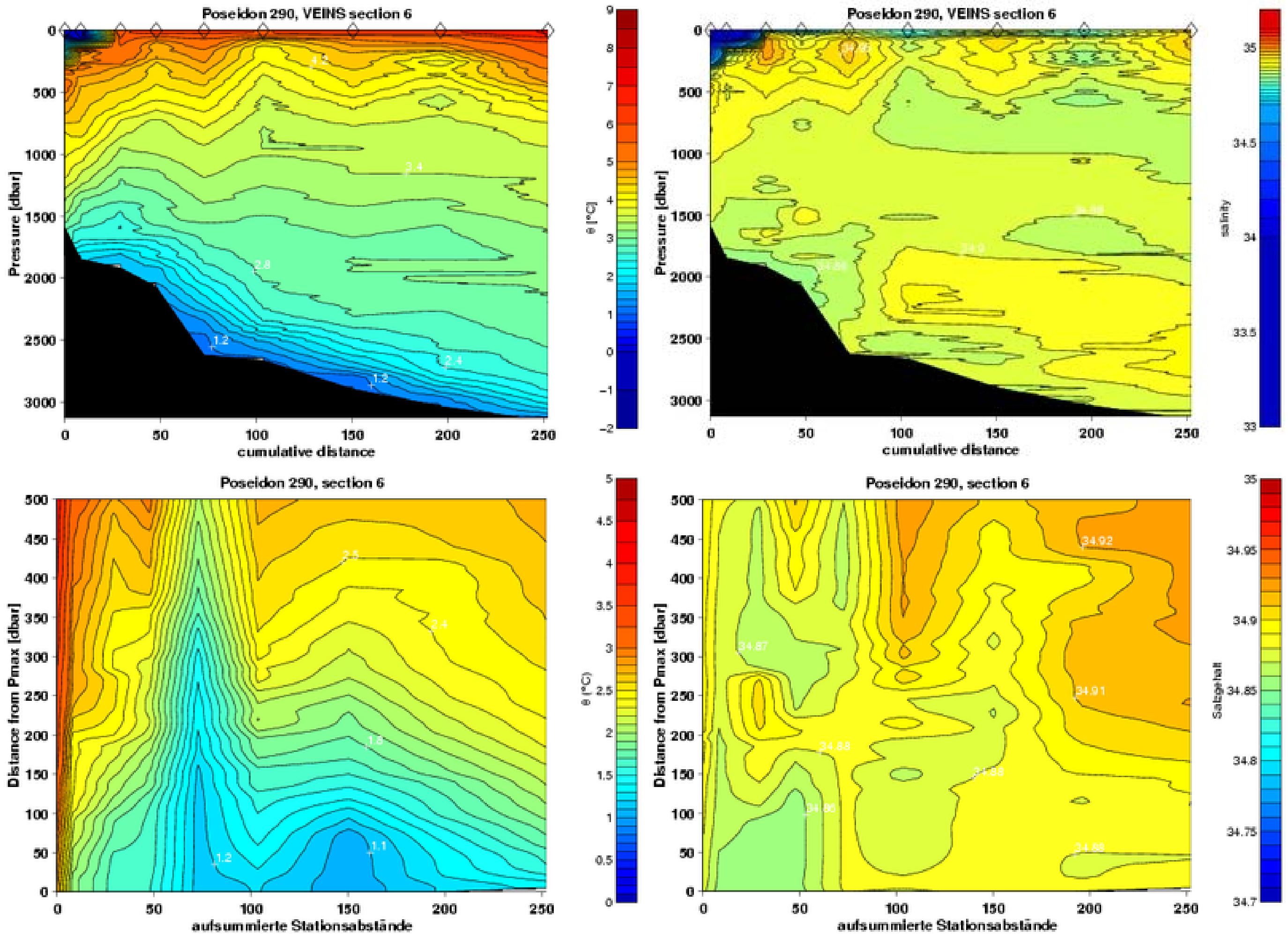
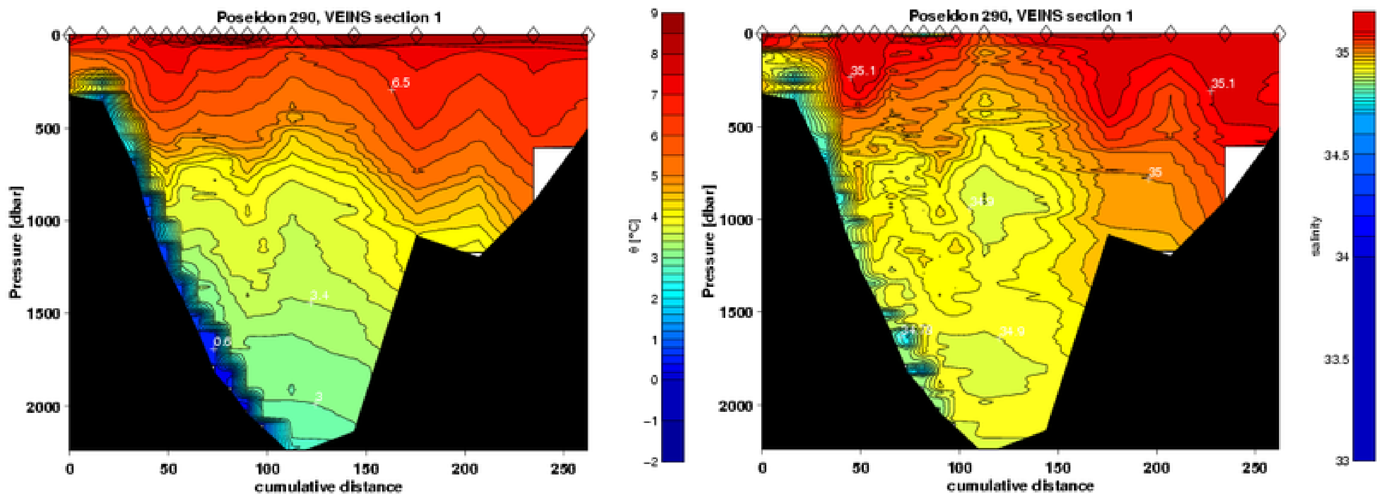


Fig.3: Potential temperature and salinity along section 1 as a function of pressure and as a function of pressure distance from the deepest measurement.



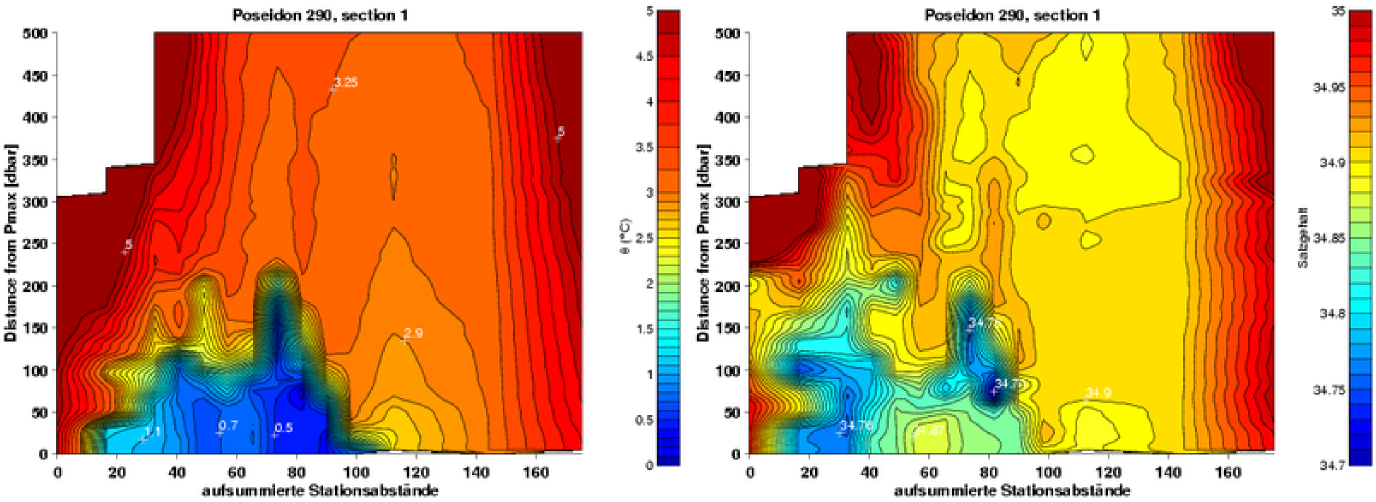


Fig. 4: Time series of temperature and salinity at mooring G1 near the bottom.

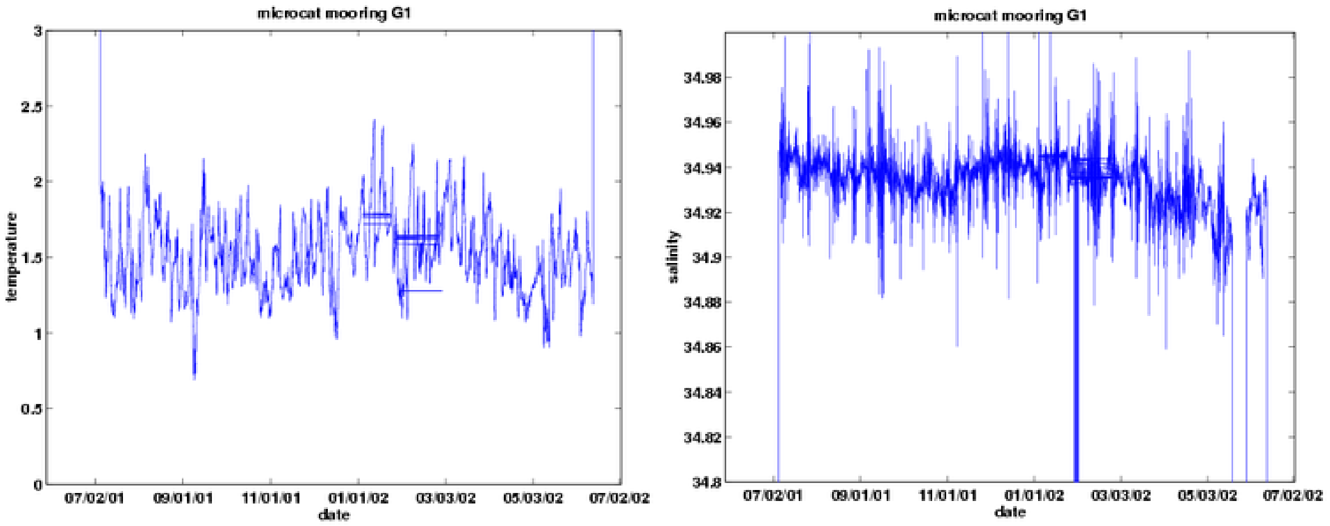


Fig. 5: Time series of pressure and temperature of the upper instrument of the tube mooring.

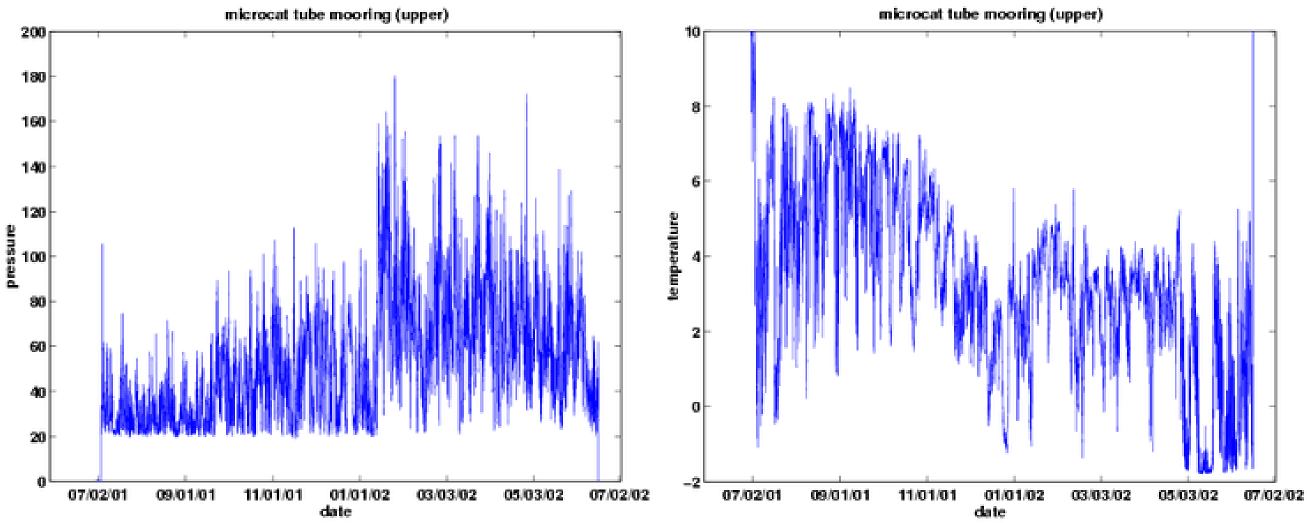


Fig. 6: Mean Theta-S diagramms of combined section 3+4 for different years.

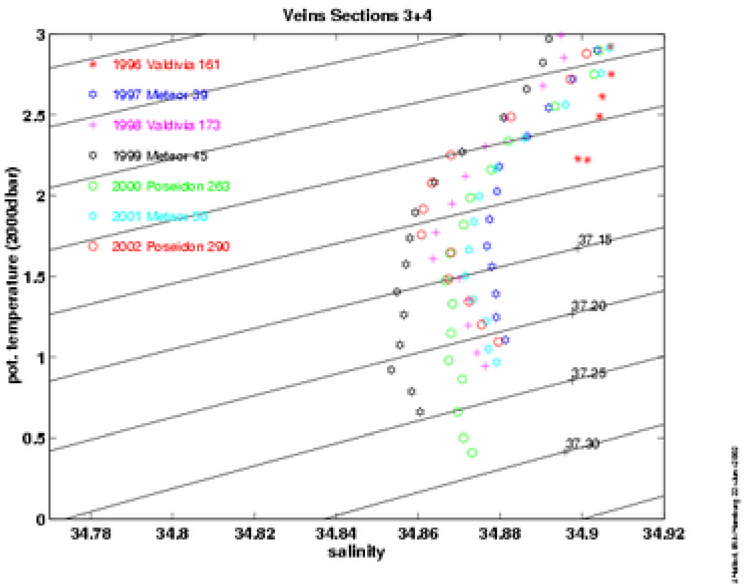
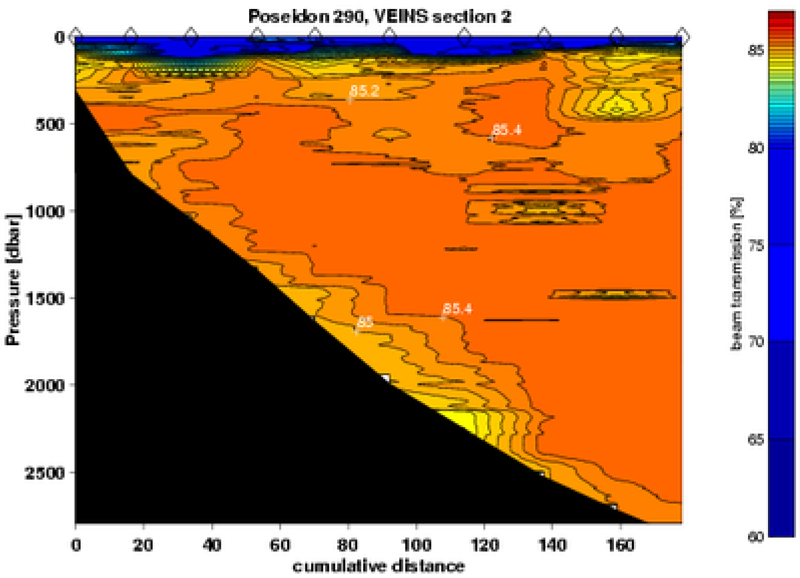


Fig. 7: Beam transmission at section 2.



Station List

EXPO-CODE	Section Name	Stat. No.	Cast No.	Cast Type	Date mmddyy	Time UTC	Code	Position Latitude	Position Longitude	Code	Bottom depth	Meter Wheel	Max Press.	Bottom Dist.	Comments
06POS290		335	01	FLOAD	060802	0104	BE	52 05.03 N	49 10.04 W	GPS					APEX 611
06POS290		336	01	ROS/CTD	060802	2012	BE	54 22.76 N	47 29.72 W	GPS	3723				
06POS290		336	01	ROS/CTD	060802	2108	BO	54 22.83 N	47 30.05 W	GPS	3727	3639	3684		Test Station
06POS290		336	01	ROS/CTD	060802	2216	EN	54 23.37 N	47 30.09 W	GPS					
06POS290		336	02	FLOAD	060802	2224	BE	54 23.54 N	47 30.24 W	GPS					APEX 610
06POS290		337	01	ROS/CTD	060902	1004	BE	55 59.43 N	46 01.35 W	GPS	3375				
06POS290		337	01	ROS/CTD	060902	1100	BO	55 57.53 N	46 01.83 W	GPS					Test Station
06POS290		337	01	ROS/CTD	060902	1207	EN	55 57.74 N	46 02.81 W	GPS					
06POS290		337	02	FLOAD	060902	1215	EN	55 57.92 N	46 03.16 W	GPS					APEX 609
06POS290		338	01	FLOAD	061002	0600	EN	58 17.55 N	43 18.09 W	GPS					APEX 548
06POS290	VEINS-6	339	01	ROS/CTD	061002	1815	BE	59 57.35 N	42 01.22 W	GPS	1570				
06POS290	VEINS-6	339	01	ROS/CTD	061002	1844	BO	59 57.21 N	42 01.79 W	GPS	1584	1610	1610	5	
06POS290	VEINS-6	339	01	ROS/CTD	061002	1915	EN	59 55.21 N	42 02.08 W	GPS	1537				
06POS290	VEINS-6	340	01	ROS/CTD	061002	1957	BE	59 56.04 N	41 52.85 W	GPS	1821				
06POS290	VEINS-6	340	01	ROS/CTD	061002	2032	BO	59 55.38 N	41 52.56 W	GPS	1816	1793	1811	8	
06POS290	VEINS-6	340	01	ROS/CTD	061002	2103	EN	59 54.80 N	41 53.64 W	GPS	1816				
06POS290	VEINS-6	341	01	ROS/CTD	061102	0156	BE	59 51.90 N	41 32.04 W	GPS	1890				
06POS290	VEINS-6	341	01	ROS/CTD	061102	0228	BO					1863	1873		

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06POS290	VEINS-6	342	01	ROS/CTD	061102	0428	BE	59 51.97 N	41 11.95 W	GPS	2040				
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06POS290	VEINS-6	343	01	ROS/CTD	061102	0823	BO	59 49.15 N	40 45.53 W	GPS	2582	2594	2602	6	
06POS290	VEINS-6	343	01	ROS/CTD	061102	0917	EN	59 49.27 N	40 45.52 W	GPS					
06POS290	VEINS-6	344	01	ROS/CTD	061102	1103	BE	59 46.05 N	40 13.16 W	GPS	2620				
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APEX 612															
06POS290	VEINS-3	348	01	MOR	060502	0659	BE	63 06.62 N	35 32.37 W	GPS					Recovery fo
mooring G2-2001															
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06POS290	VEINS-3	349	01	MOR	060502	0939	BE	63 16.64 N	35 53.47 W	GPS					Recovery fo
mooring UK2-2001															
06POS290	VEINS-3	349	01	MOR	060502	1023	EN	63 16.94 N	35 57.83 W	GPS					
06POS290	VEINS-3	350	01	MOR	060502	1116	BE	63 21.47 N	36 04.79 W	GPS					Recovery fo
mooring G1-2001															
06POS290	VEINS-3	350	01	MOR	060502	1159	EN	63 21.78 N	36 04.30 W	GPS					

06POS290	VEINS-3	351	01	MOR	060502	1304	BE	63 28.41 N	36 18.45 W	GPS					Recovery fo
mooring UK1/IES-2001															
06POS290	VEINS-3	351	01	MOR	060502	1347	EN	63 28.58 N	36 19.50 W	GPS					
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mooring UK1-2001															
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mooring F2-2001															
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mooring F1-2001															
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mooring O1-2001															
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06POS290	VEINS-3	357	01	ROS/CTD	061302	2231	BO	63 47.46 N	36 53.45 W	GPS	342			7	
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06POS290	VEINS-3	363	01	ROS/CTD	061402	0739	BE	63 30.04 N	36 20.08 W	GPS	1938				
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06POS290	VEINS-3	363	01	ROS/CTD	061402	0841	EN	63 29.94 N	36 21.10 W	GPS	1922				
06POS290		364	01	ROS/CTD	061402	0922	BE	63 32.15 N	36 28.42 W	GPS	1832				
06POS290		364	01	ROS/CTD	061402	0953	BO	63 31.97 N	36 28.67 W	GPS	1838	1827	1826	6	
06POS290		364	01	ROS/CTD	061402	1025	EN	63 31.76 N	36 28.82 W	GPS	1845				
06POS290	VEINS-3	364	02	MOR	061402	1157	BE	63 32.07 N	36 28.44 W	GPS					Deployment fo mooring UK/ADCP
06POS290	VEINS-3	365	01	ROS/CTD	061402	1245	BE	63 25.97 N	36 12.97 W	GPS	2096				
06POS290	VEINS-3	365	01	ROS/CTD	061402	1322	BO	63 25.76 N	36 12.65 W	GPS	2104	2109	2109	10	
06POS290	VEINS-3	365	01	ROS/CTD	061402	1421	EN	63 25.40 N	36 12.11 W	GPS	2116				
06POS290	VEINS-3	366	01	ROS/CTD	061402	1455	BE	63 21.85 N	36 06.52 W	GPS	2197				
06POS290	VEINS-3	366	01	ROS/CTD	061402	1531	BO	63 21.81 N	36 06.43 W	GPS	2196	2195	2209	7	
06POS290	VEINS-3	366	01	ROS/CTD	061402	1622	EN	63 21.80 N	36 06.43 W	GPS	2198				
06POS290	VEINS-3	367	01	ROS/CTD	061402	1702	BE	63 18.10 N	35 58.23 W	GPS	2302				
06POS290	VEINS-3	367	01	ROS/CTD	061402	1737	BO	63 18.17 N	35 58.27 W	GPS	2300	2311	2308	10	
06POS290	VEINS-3	367	01	ROS/CTD	061402	1838	EN	63 18.15 N	35 58.20 W	GPS	2301				
06POS290	VEINS-3	368	01	ROS/CTD	061402	1920	BE	63 13.94 N	35 49.86 W	GPS	2415				
06POS290	VEINS-3	368	01	ROS/CTD	061402	1957	BO	63 13.97 N	35 50.05 W	GPS	2416	2413	2433		
06POS290	VEINS-3	368	01	ROS/CTD	061402	2044	EN	63 14.01 N	35 50.36 W	GPS	2413				
06POS290	VEINS-3	369	01	ROS/CTD	061402	2159	BE	63 06.09 N	35 35.50 W	GPS	2588				
06POS290	VEINS-3	369	01	ROS/CTD	061402	2241	BO	63 06.20 N	35 35.02 W	GPS	2598	2576	2596	6	
06POS290	VEINS-3	369	01	ROS/CTD	061402	2331	EN	63 06.24 N	35 34.47 W	GPS	2590				

06POS290	VEINS-3	370	01	ROS/CTD	061502	0047	BE	62 58.04 N	35 20.00 W	GPS	2672				
06POS290	VEINS-3	370	01	ROS/CTD	061502	0131	BO	62 58.09 N	35 19.95 W	GPS	2672	2663	2690	10	
06POS290	VEINS-3	370	01	ROS/CTD	061502	0232	EN	62 58.06 N	35 19.83 W	GPS	2672				
06POS290	VEINS-3	371	01	ROS/CTD	061502	0348	BE	62 49.97 N	35 07.14 W	GPS	2747				
06POS290	VEINS-3	371	01	ROS/CTD	061502	0432	BO	62 50.02 N	35 06.91 W	GPS	2746	2720	2733	15	
06POS290	VEINS-3	371	01	ROS/CTD	061502	0546	EN	62 50.23 N	35 06.79 W	GPS	2746				
06POS290	VEINS-3	372	01	MOR	061502	0951	BE	63 06.90 N	35 32.70 W	GPS					Deployment fo mooring G2-2002
06POS290	VEINS-3	372	01	MOR	061502	1014	EN	63 06.89 N	35 32.51 W	GPS					
06POS290	VEINS-3	373	01	MOR	061502	1157	BE	63 16.52 N	35 52.50 W	GPS					Deployment fo mooring UK2-2002
06POS290	VEINS-3	373	01	MOR	061502	1214	EN	63 16.75 N	35 52.35 W	GPS					
06POS290	VEINS-3	374	01	MOR	061502	1320	BE	63 21.52 N	36 04.84 W	GPS					Deployment fo mooring G1-2002
06POS290	VEINS-3	374	01	MOR	061502	1345	EN	63 21.94 N	36 04.45 W	GPS					
06POS290	VEINS-3	375	01	MOR	061502	1456	BE	63 28.54 N	36 18.22 W	GPS					Deployment fo mooring UK1-2002
06POS290	VEINS-3	375	01	MOR	061502	1516	EN	63 28.84 N	36 17.97 W	GPS					
06POS290	VEINS-3	376	01	MOR	061502	1559	BE	63 28.58 N	36 17.37 W	GPS					Deployment fo mooring UK-IES-2002
06POS290	VEINS-3	376	01	MOR	061502	1014	EN	63 06.89 N	35 32.51 W	GPS					
06POS290		377	01	ROS/CTD	061502	1937	BE	63 01.47 N	36 17.86 W	GPS	2555				
06POS290		377	01	ROS/CTD	061502	2019	BO	63 01.31 N	36 17.56 W	GPS	2550	2535	2543	10	
06POS290		377	01	ROS/CTD	061502	2110	EN	63 01.31 N	36 17.34 W	GPS	2550				
06POS290		378	01	ROS/CTD	061502	2218	BE	63 08.47 N	36 24.22 W	GPS	2438				
06POS290		378	01	ROS/CTD	061502	2300	BO	63 08.43 N	36 24.93 W	GPS	2435	2435	2438	9	
06POS290		378	01	ROS/CTD	061502	2352	EN	63 08.19 N	36 25.18 W	GPS	2435				
06POS290		379	01	ROS/CTD	061602	0104	BE	63 15.64 N	36 29.99 W	GPS	2309				
06POS290		379	01	ROS/CTD	061602	0147	BO	63 15.45 N	36 30.00 W	GPS	2309	2288	2316	12	
06POS290		379	01	ROS/CTD	061602	0241	EN	63 15.08 N	36 29.58 W	GPS	2309				

06POS290		380	01	ROS/CTD	061602	0400	BE	63 22.80 N	36 36.01 W	GPS	2141				
06POS290		380	01	ROS/CTD	061602	0435	BO	63 22.71 N	36 36.07 W	GPS	2144	2122	2139	13	
06POS290		380	01	ROS/CTD	061602	0528	EN	63 22.55 N	36 35.83 W	GPS					
06POS290		381	01	ROS/CTD	061602	0625	BE	63 28.76 N	36 36.04 W	GPS	1992				
06POS290		381	01	ROS/CTD	061602	0658	BO	63 28.70 N	36 36.04 W	GPS	1981	1961	1983	9	
06POS290		381	01	ROS/CTD	061602	0731	EN	63 28.62 N	36 35.82 W	GPS	1994				
06POS290	VEINS-3	382	01	MOR	061602	0910	BE	63 32.92 N	36 30.54 W	GPS					Deployment fo mooring F2-2002
06POS290	VEINS-3	382	01	MOR	061602	0933	EN	63 33.16 N	36 30.09 W	GPS					
06POS290	VEINS-3	383	01	MOR	061602	1049	BE	63 38.05 N	36 48.22 W	GPS					Deployment fo mooring F1-2002
06POS290	VEINS-3	383	01	MOR	061602	1111	EN	63 38.16 N	36 47.58 W	GPS					
06POS290	VEINS-3	384	01	MOR	061602	1146	BE	63 38.93 N	36 54.75 W	GPS					Deployment fo mooring O1-2002
06POS290	VEINS-3	384	01	MOR	061602	1157	EN	63 38.96 N	36 54.64 W	GPS					
06POS290	VEINS-4	385	01	ROS/CTD	061602	2100	BE	62 35.22 N	39 13.39 W	GPS	2022				
06POS290	VEINS-4	385	01	ROS/CTD	061602	2135	BO	62 35.19 N	39 13.06 W	GPS	2027	2001	2001	8	
06POS290	VEINS-4	385	01	ROS/CTD	061602	2203	EN	62 35.23 N	39 12.91 W	GPS	2027				
06POS290	VEINS-4	386	01	ROS/CTD	061602	2330	BE	62 40.61 N	39 31.08 W	GPS	1950				
06POS290	VEINS-4	386	01	ROS/CTD	061702	0001	BO	62 40.66 N	39 30.71 W	GPS	1939	1924	1928	9	
06POS290	VEINS-4	386	01	ROS/CTD	061702	0033	EN	62 40.64 N	39 30.97 W	GPS	1938				
06POS290	VEINS-4	387	01	ROS/CTD	061702	0201	BE	62 46.52 N	39 49.52 W	GPS	1940				
06POS290	VEINS-4	387	01	ROS/CTD	061702	0231	BO	62 46.15 N	39 49.10 W	GPS	1945	1921	1931	15	
06POS290	VEINS-4	387	01	ROS/CTD	061702	0316	EN	62 45.74 N	39 48.32 W	GPS	1940				
06POS290	VEINS-4	388	01	ROS/CTD	061702	0438	BE	62 51.02 N	40 07.64 W	GPS	1657				
06POS290	VEINS-4	388	01	ROS/CTD	061702	0508	BO	62 50.89 N	40 07.48 W	GPS	1665	1635	1648	10	
06POS290	VEINS-4	388	01	ROS/CTD	061702	0548	EN	62 50.36 N	40 07.25 W	GPS	1676				
06POS290	VEINS-4	389	01	ROS/CTD	061702	0709	BE	62 57.34 N	40 22.09 W	GPS	255				
06POS290	VEINS-4	389	01	ROS/CTD	061702	0718	BO	62 57.31 N	40 22.22 W	GPS	262	250	253	8	
06POS290	VEINS-4	389	01	ROS/CTD	061702	0725	EN	62 57.29 N	40 22.28 W	GPS	266				

06POS290	VEINS-4	390	01	MOR	061702	0900	BE	62 59.65 N	40 32.56 W	GPS	303			
Recovery Tube04														
06POS290	VEINS-4	390	01	MOR	061702	1140	EN	63 00.39 N	40 32.85 W	GPS	303			
06POS290	VEINS-4	391	01	ROS/CTD	061702	1308	BE	62 59.38 N	40 38.61 W	GPS	473			
06POS290	VEINS-4	391	01	ROS/CTD	061702	1319	BO	62 59.27 N	40 38.66 W	GPS	493	472	474	16
06POS290	VEINS-4	391	01	ROS/CTD	061702	1333	EN	62 59.18 N	40 38.70 W	GPS	498			
06POS290	VEINS-4	392	01	ROS/CTD	061702	1431	BE	63 00.11 N	40 32.64 W	GPS	301			
06POS290	VEINS-4	392	01	ROS/CTD	061702	1438	BO	63 00.00 N	40 32.66 W	GPS	311	305	302	10
06POS290	VEINS-4	392	01	ROS/CTD	061702	1445	EN	62 59.87 N	40 32.70 W	GPS	317			
06POS290	VEINS-4	393	01	MOR	061702	1908	BE	63 00.12 N	40 34.47 W	GPS	303			
Deployment Tube04														
06POS290	VEINS-4	393	01	MOR	061702	2007	BE	63 00.20 N	40 32.51 W	GPS	303			
06POS290	VEINS-4	394	01	ROS/CTD	061802	0110	BE	62 35.24 N	39 13.27 W	GPS	2023			
06POS290	VEINS-4	394	01	ROS/CTD	061802	0142	BO	62 35.08 N	39 13.13 W	GPS	2026	1997	2015	12
06POS290	VEINS-4	394	01	ROS/CTD	061802	0229	EN	62 34.90 N	39 12.42 W	GPS	2034			
06POS290	VEINS-4	395	01	ROS/CTD	061802	0444	BE	62 24.03 N	38 38.03 W	GPS	2274			
06POS290	VEINS-4	395	01	ROS/CTD	061802	0523	BO	62 23.88 N	38 37.82 W	GPS	2271	2248	2283	10
06POS290	VEINS-4	395	01	ROS/CTD	061802	0619	EN	62 23.67 N	38 37.68 W	GPS	2271			
06POS290	VEINS-4	396	01	ROS/CTD	061802	0845	BE	62 12.09 N	38 02.89 W	GPS	2492			
06POS290	VEINS-4	396	01	ROS/CTD	061802	0931	BO	62 12.04 N	38 02.72 W	GPS	2492	2455	2481	10
06POS290	VEINS-4	396	01	ROS/CTD	061802	1020	EN	62 11.97 N	38 02.32 W	GPS	2510			
06POS290	VEINS-4	397	01	ROS/CTD	061802	1242	BE	62 01.43 N	37 27.95 W	GPS	2557			
06POS290	VEINS-4	397	01	ROS/CTD	061802	1326	BO	62 01.46 N	37 27.51 W	GPS		2518	2512	30
06POS290	VEINS-4	397	01	ROS/CTD	061802	1427	EN	62 01.29 N	37 26.69 W	GPS				
06POS290	VEINS-4	398	01	ROS/CTD	061802	1648	BE	61 49.02 N	36 53.61 W	GPS	2680			
06POS290	VEINS-4	398	01	ROS/CTD	061802	1740	BO	61 48.88 N	36 52.64 W	GPS	2680	2674	2672	
06POS290	VEINS-4	398	01	ROS/CTD	061802	1844	EN	61 48.82 N	36 51.65 W	GPS	2681			
06POS290	VEINS-4	399	01	ROS/CTD	061802	2028	BE	61 40.55 N	36 26.81 W	GPS	2722			
06POS290	VEINS-4	399	01	ROS/CTD	061802	2113	BO	61 40.49 N	36 26.25 W	GPS	2764	2751	2750	10
06POS290	VEINS-4	399	01	ROS/CTD	061802	2204	EN	61 40.61 N	36 25.38 W	GPS				

06POS290	VEINS-3	400	01	ROS/CTD	061902	1003	BE	62 46.15 N	34 57.78 W	GPS	2765			
06POS290	VEINS-3	400	01	ROS/CTD	061902	1051	BO	62 46.42 N	34 66.63 W	GPS	2764	2754	2727	
06POS290	VEINS-3	400	01	ROS/CTD	061902	1145	EN	62 46.72 N	34 55.79 W	GPS	2760			
06POS290	VEINS-3	401	01	ROS/CTD	061902	1324	BE	62 38.18 N	34 42.42 W	GPS	2803			
06POS290	VEINS-3	401	01	ROS/CTD	061902	1411	BO	62 38.09 N	34 42.35 W	GPS	2802	2768	2805	10
06POS290	VEINS-3	401	01	ROS/CTD	061902	1520	EN	62 37.89 N	34 42.07 W	GPS	2802			
06POS290	VEINS-3	401	02	FLOAD	061902	1527	EN	62 38.02 N	34 41.72 W	GPS	2802			
APEX														
06POS290	VEINS-3	402	01	ROS/CTD	061902	1641	BE	62 30.02 N	34 27.96 W	GPS	2837			
06POS290	VEINS-3	402	01	ROS/CTD	061902	1726	BO	62 29.85 N	34 27.46 W	GPS	2840	2817	2849	11
06POS290	VEINS-3	402	01	ROS/CTD	061902	1838	EN	62 29.74 N	34 26.82 W	GPS	2839			
06POS290	VEINS-3	403	01	ROS/CTD	061902	1950	BE	62 21.73 N	34 13.37 W	GPS	2873			
06POS290	VEINS-3	403	01	ROS/CTD	061902	2034	BO	62 21.74 N	34 12.14 W	GPS	2876	2880	2887	15
06POS290	VEINS-3	403	01	ROS/CTD	061902	2130	EN	62 21.72 N	34 10.58 W	GPS	2880			
06POS290	VEINS-2	404	01	ROS/CTD	062002	0733	BE	63 38.05 N	32 53.93 W	GPS	2783			
06POS290	VEINS-2	404	01	ROS/CTD	062002	0823	BO	63 38.31 N	32 53.21 W	GPS	2781	2751	2791	15
06POS290	VEINS-2	404	01	ROS/CTD	062002	0929	EN	63 38.52 N	32 52.45 W	GPS	2780			
06POS290	VEINS-2	405	01	ROS/CTD	062002	1043	BE	63 47.00 N	33 05.95 W	GPS	2672			
06POS290	VEINS-2	405	01	ROS/CTD	062002	1136	BO	63 47.43 N	33 05.25 W	GPS	2668	2641	2681	10
06POS290	VEINS-2	405	01	ROS/CTD	062002	1239	EN	63 47.94 N	33 04.62 W	GPS	2662			
06POS290	VEINS-2	406	01	ROS/CTD	062002	1359	BE	63 57.09 N	33 18.04 W	GPS	2486			
06POS290	VEINS-2	406	01	ROS/CTD	062002	1439	BO	63 57.14 N	33 17.80 W	GPS	2484	2449	2487	10
06POS290	VEINS-2	406	01	ROS/CTD	062002	1542	EN	63 57.17 N	33 17.57 W	GPS	2485			
06POS290	VEINS-2	407	01	ROS/CTD	062002	1710	BE	64 08.96 N	33 27.78 W	GPS	2240			
06POS290	VEINS-2	407	01	ROS/CTD	062002	1746	BO	64 09.06 N	33 28.41 W	GPS	2238	2211	2240	9
06POS290	VEINS-2	407	01	ROS/CTD	062002	1843	EN	64 09.21 N	33 29.32 W	GPS	2228			
06POS290	VEINS-2	408	01	ROS/CTD	062002	2001	BE	64 19.66 N	33 40.50 W	GPS	1936			
06POS290	VEINS-2	408	01	ROS/CTD	062002	2034	BO	64 19.84 N	33 41.33 W	GPS	1929	1914	1929	7
06POS290	VEINS-2	408	01	ROS/CTD	062002	2119	EN	64 19.69 N	33 41.75 W	GPS	1929			
06POS290	VEINS-2	409	01	ROS/CTD	062002	2230	BE	64 30.50 N	33 50.89 W	GPS	1612			

06POS290	VEINS-2	409	01	ROS/CTD	062002	2302	BO	64 30.69 N	33 50.47 W	GPS	1610	1575	1601	9
06POS290	VEINS-2	409	01	ROS/CTD	062002	2342	EN	64 30.60 N	33 50.16 W	GPS	1612			
06POS290	VEINS-2	410	01	ROS/CTD	062102	0043	BE	64 39.01 N	33 58.97 W	GPS	1318			
06POS290	VEINS-2	410	01	ROS/CTD	062102	0107	BO	64 38.98 N	33 58.51 W	GPS	1324	1302	1310	12
06POS290	VEINS-2	410	01	ROS/CTD	062102	0138	EN	64 38.94 N	33 58.81 W	GPS	1324			
06POS290	VEINS-2	411	01	ROS/CTD	062102	0254	BE	64 48.65 N	34 08.24 W	GPS	1031			
06POS290	VEINS-2	411	01	ROS/CTD	062102	0311	BO	64 48.62 N	34 08.48 W	GPS	1030	1006	1015	11
06POS290	VEINS-2	411	01	ROS/CTD	062102	0336	EN	64 48.62 N	34 08.90 W	GPS	1030			
06POS290	VEINS-2	412	01	ROS/CTD	062102	0442	BE	64 57.03 N	34 19.17 W	GPS	781			
06POS290	VEINS-2	412	01	ROS/CTD	062102	0456	BO	64 57.12 N	34 19.38 W	GPS	777	757	767	9
06POS290	VEINS-2	412	01	ROS/CTD	062102	0513	EN	64 57.09 N	34 19.38 W	GPS	779			
06POS290	VEINS-2	413	01	ROS/CTD	062102	0612	BE	65 05.02 N	34 28.08 W	GPS	307			
06POS290	VEINS-2	413	01	ROS/CTD	062102	0621	BO	65 05.04 N	34 27.65 W	GPS	308	300	300	10
06POS290	VEINS-2	413	01	ROS/CTD	062102	0627	EN	65 05.04 N	34 27.83 W	GPS	309			
06POS290	VEINS-1	414	01	ROS/CTD	062102	1524	BE	65 39.96 N	31 26.96 W	GPS	320			
06POS290	VEINS-1	414	01	ROS/CTD	062102	1533	BO	65 39.86 N	31 27.15 W	GPS	322	306	312	10
06POS290	VEINS-1	414	01	ROS/CTD	062102	1547	EN	65 39.71 N	31 27.26 W	GPS	323			
06POS290	VEINS-1	415	01	ROS/CTD	062102	1652	BE	65 31.79 N	31 18.16 W	GPS	354			
06POS290	VEINS-1	415	01	ROS/CTD	062102	1700	BO	65 31.65 N	31 18.71 W	GPS	359	344	349	9
06POS290	VEINS-1	415	01	ROS/CTD	062102	1708	EN	65 31.60 N	31 19.16 W	GPS	362			
06POS290	VEINS-1	416	01	ROS/CTD	062102	1813	BE	65 23.95 N	31 09.00 W	GPS	756			
06POS290	VEINS-1	416	01	ROS/CTD	062102	1826	BO	65 24.05 N	31 09.04 W	GPS	752	730	737	11
06POS290	VEINS-1	416	01	ROS/CTD	062102	1840	EN	65 24.25 N	31 09.02 W	GPS	738			
06POS290	VEINS-1	417	01	ROS/CTD	062102	1915	BE	65 19.97 N	31 04.31 W	GPS	979			
06POS290	VEINS-1	417	01	ROS/CTD	062102	1935	BO	65 19.76 N	31 03.87 W	GPS	993	987	970	11
06POS290	VEINS-1	417	01	ROS/CTD	062102	1959	EN	65 19.48 N	31 03.51 W	GPS	1005			
06POS290	VEINS-1	418	01	ROS/CTD	062102	2029	BE	65 15.90 N	30 57.85 W	GPS	1213			
06POS290	VEINS-1	418	01	ROS/CTD	062102	2050	BO	65 15.69 N	30 59.90 W	GPS	1220	1207	1211	8
06POS290	VEINS-1	418	01	ROS/CTD	062102	2118	EN	65 15.46 N	31 00.07 W	GPS	1234			
06POS290	VEINS-1	419	01	ROS/CTD	062102	2146	BE	65 12.06 N	30 55.95 W	GPS	1400			

06POS290	VEINS-1	419	01	ROS/CTD	062102	2216	BO	65 11.87 N	30 56.53 W	GPS	1412	1399	1397	7
06POS290	VEINS-1	419	01	ROS/CTD	062102	2250	EN	65 11.73 N	30 57.11 W	GPS	1420			
06POS290	VEINS-1	420	01	ROS/CTD	062102	2323	BE	65 07.92 N	30 51.09 W	GPS	1595			
06POS290	VEINS-1	420	01	ROS/CTD	062102	2357	BO	65 07.87 N	30 51.92 W	GPS	1597	1579	1588	7
06POS290	VEINS-1	420	01	ROS/CTD	062202	0035	EN	65 07.81 N	30 52.87 W	GPS	1604			
06POS290	VEINS-1	421	01	ROS/CTD	062202	0112	BE	65 04.01 N	30 46.86 W	GPS	1789			
06POS290	VEINS-1	421	01	ROS/CTD	062202	0139	BO	65 04.21 N	30 47.77 W	GPS	1776	1766	1773	10
06POS290	VEINS-1	421	01	ROS/CTD	062202	0218	EN	65 04.31 N	30 48.73 W	GPS	1760			
06POS290	VEINS-1	422	01	ROS/CTD	062202	0301	BE	65 00.00 N	30 42.39 W	GPS	1895			
06POS290	VEINS-1	422	01	ROS/CTD	062202	0329	BO	65 00.25 N	30 42.39 W	GPS	1893	1895	1890	9
06POS290	VEINS-1	422	01	ROS/CTD	062202	0405	EN	65 00.43 N	30 44.03 W	GPS	1894			
06POS290	VEINS-1	423	01	ROS/CTD	062202	0450	BE	64 55.94 N	30 37.51 W	GPS	2013			
06POS290	VEINS-1	423	01	ROS/CTD	062202	0519	BO	64 55.81 N	30 38.48 W	GPS	2014	2006	2011	9
06POS290	VEINS-1	423	01	ROS/CTD	062202	0606	EN	64 55.79 N	30 39.97 W	GPS	2016			
06POS290	VEINS-1	424	01	ROS/CTD	062202	0644	BE	64 51.94 N	30 33.05 W	GPS	2091			
06POS290	VEINS-1	424	01	ROS/CTD	062202	0721	BO	64 51.99 N	30 34.29 W	GPS	2096	2108	2092	8
06POS290	VEINS-1	424	01	ROS/CTD	062202	0812	EN	64 52.21 N	30 35.82 W	GPS	2108			
06POS290	VEINS-1	425	01	ROS/CTD	062202	0914	BE	64 45.11 N	30 25.00 W	GPS	2231			
06POS290	VEINS-1	425	01	ROS/CTD	062202	0955	BO	64 44.90 N	30 25.64 W	GPS	2235	2215	2234	10
06POS290	VEINS-1	425	01	ROS/CTD	062202	1044	EN	64 44.76 N	30 26.58 W	GPS	2238			
06POS290	VEINS-1	426	01	ROS/CTD	062202	1242	BE	64 45.03 N	29 45.00 W	GPS	2106			
06POS290	VEINS-1	426	01	ROS/CTD	062202	1313	BO	64 45.07 N	29 45.10 W	GPS	2114	2095	2127	14
06POS290	VEINS-1	426	01	ROS/CTD	062202	1351	EN	64 45.13 N	29 45.19 W	GPS	2125			
06POS290	VEINS-1	427	01	ROS/CTD	062202	1544	BE	64 44.93 N	29 05.05 W	GPS	1068			
06POS290	VEINS-1	427	01	ROS/CTD	062202	1602	BO	64 45.09 N	29 05.04 W	GPS	1067	1047	1054	15
06POS290	VEINS-1	427	01	ROS/CTD	062202	1624	EN	64 45.13 N	29 05.07 W	GPS	1068			
06POS290	VEINS-1	428	01	ROS/CTD	062202	1816	BE	64 44.95 N	28 24.90 W	GPS	1163			
06POS290	VEINS-1	428	01	ROS/CTD	062202	1838	BO	64 44.91 N	28 25.63 W	GPS	1179	1173	1169	8
06POS290	VEINS-1	428	01	ROS/CTD	062202	1903	EN	64 44.87 N	28 26.42 W	GPS	1182			
06POS290	VEINS-1	429	01	ROS/CTD	062202	2044	BE	64 44.84 N	27 50.26 W	GPS	892			

06POS290	VEINS-1	429	01	ROS/CTD	062202	2104	BO	64 44.77	N	27 50.73	W	GPS	918	900	903	8
06POS290	VEINS-1	429	01	ROS/CTD	062202	2122	EN	64 44.75	N	27 51.12	W	GPS	945			
06POS290	VEINS-1	430	01	ROS/CTD	062202	2258	BE	64 44.92	N	27 15.24	W	GPS	498			
06POS290	VEINS-1	430	01	ROS/CTD	062202	2312	BO	64 44.78	N	27 15.10	W	GPS	500	486	491	8
06POS290	VEINS-1	430	01	ROS/CTD	062202	2323	EN	64 44.65	N	27 15.06	W	GPS	502			