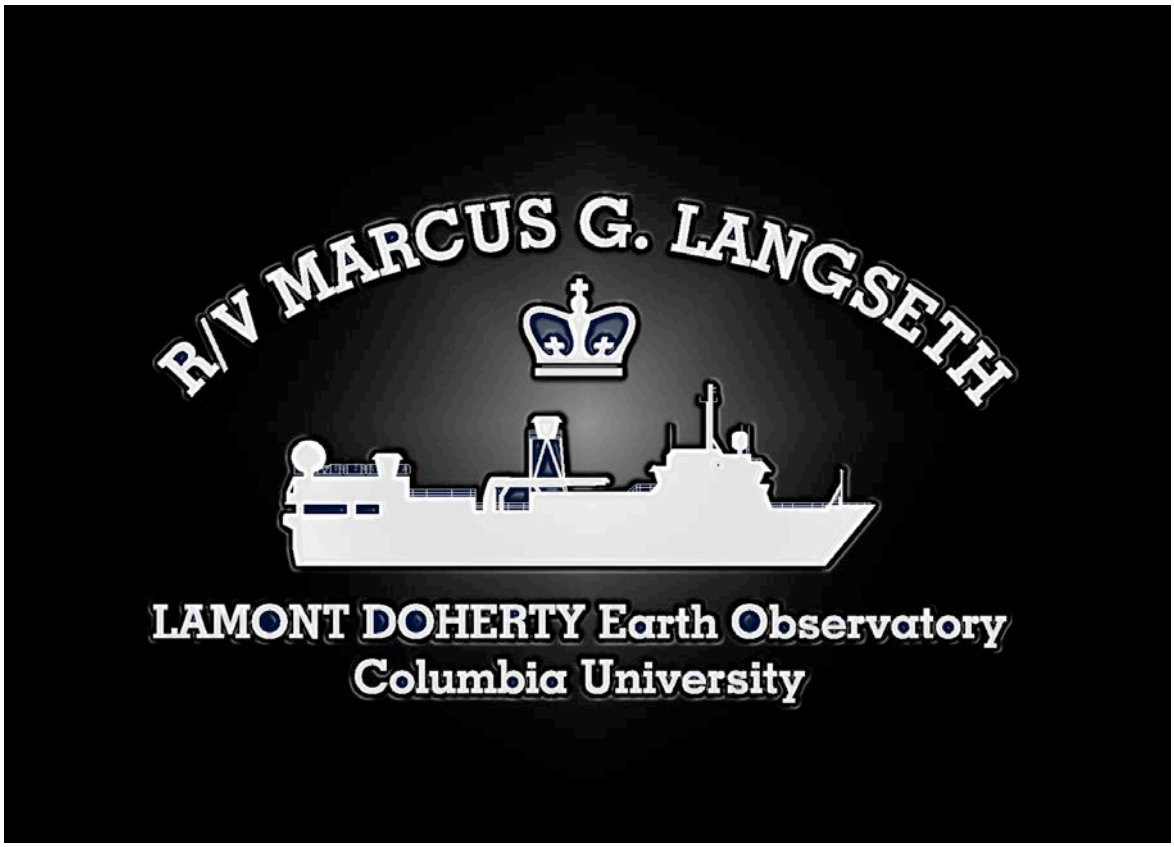
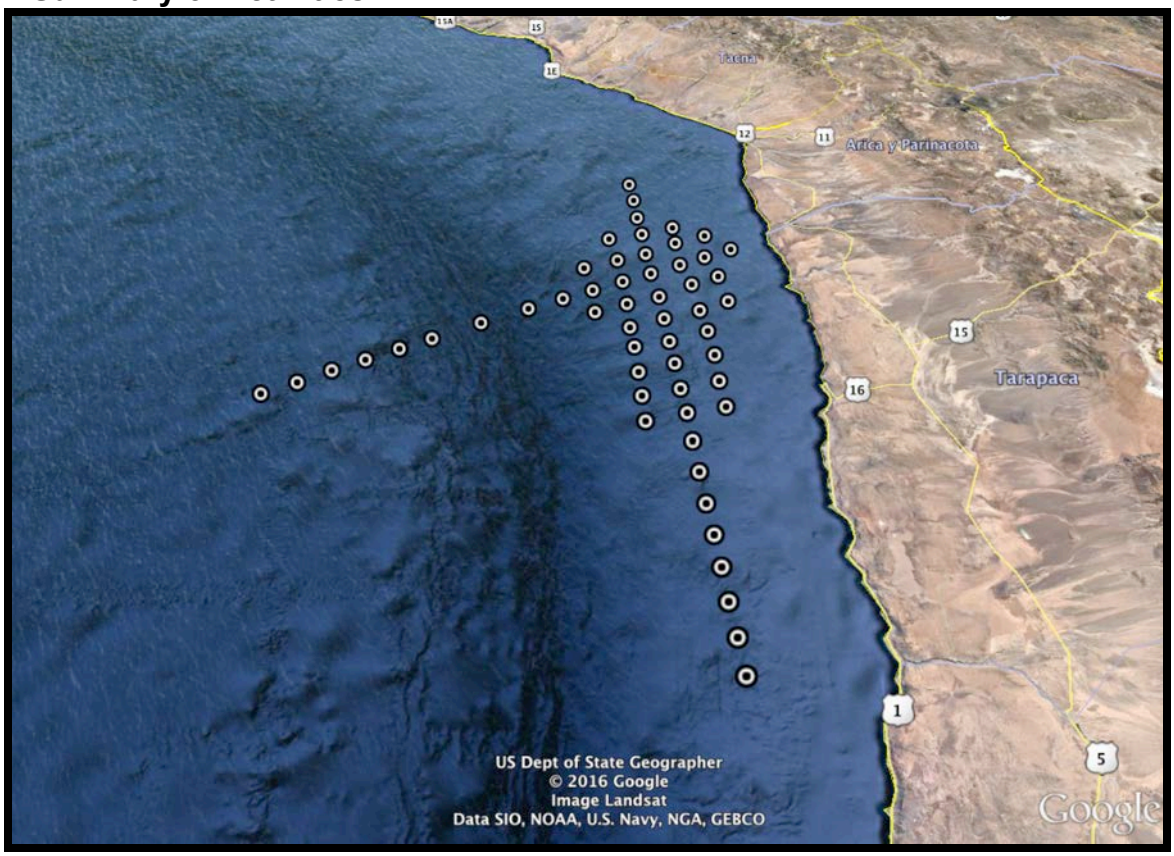
Cruise: MGL1610 Trehu
IRIS Network Code: XW
Purpose: Deploy and Recover 50 Scripps SP-OBS (+1)
Vessel: R/V Marcus G. Langseth
Port: Arica, Chile
Master/Captain: Mark Landow
Chief Scientist: Anne Trehu
Science Officer (LDEO): Robert Steinhaus
SIO OBS Technicians: Mark Gibaud, Ernest Aaron
SIO ResTech: Josh Manger
Cruise Dates: (10/23/16 – 12/09/16)



A Total Piece of Ship

I. Summary of Activities



MGL1610 Operations
OBS deployment locations provided by Anne Trehu, plotted with GoogleEarth.

II. Instrumentation

Scripps OBS – 50 Glass SP-OBS
GEOMAR OBS – 19 Syntactic OBS

III. Areas of Concern

Time is a concern as the GEOMAR group has 14 OBS to recover, recondition and redeploy plus an additional 5 OBS to deploy new.

IV. Ships Equipment and Condition

It's the Langseth. They have new hull mounted transducers for us to test out and hopefully they will solve the communications issues that have plagued us in the past. Cautious optimism.

V. Journal of Events in Chronological Order

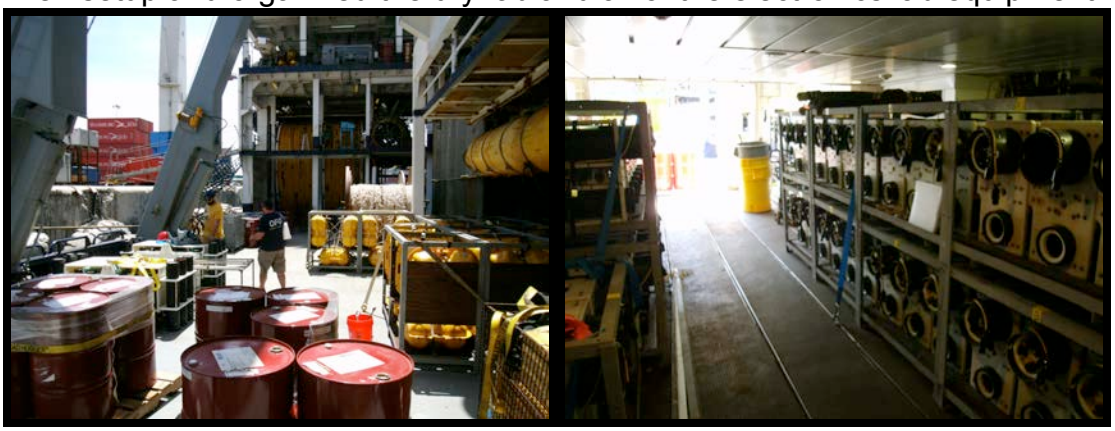
All times and dates in this report are UTC unless otherwise noted as local time.

1. Loading & Setup

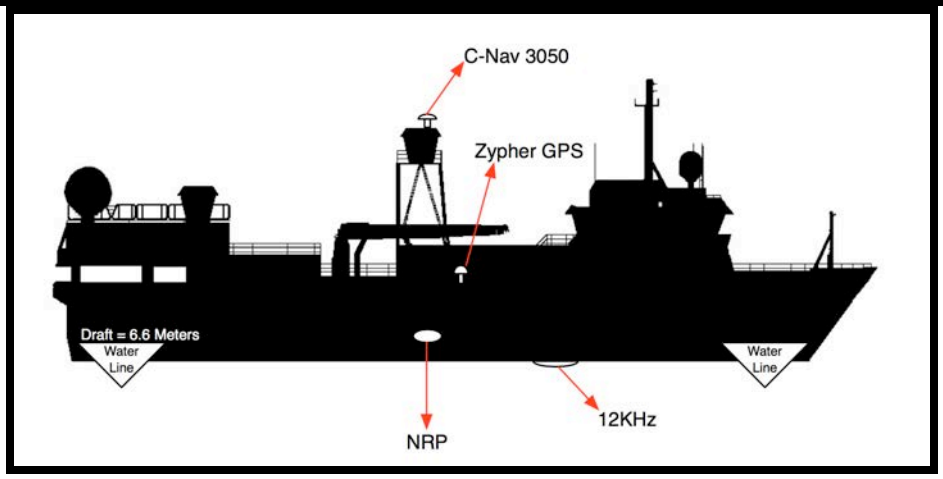
10/22/16 08:00 Arica Local (MOB day 1)

This morning we moved onto the Langseth and spent the day setting up all of our lab equipment, as well as relocating the floats and securing other deck items for departure on Sunday the 23rd.

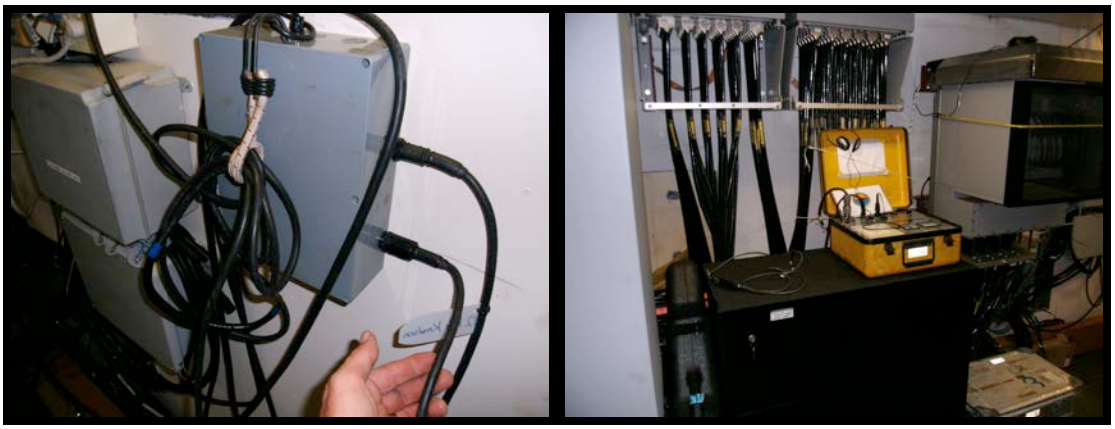
Mark and Josh handled the brunt of the deck equipment relocation and securing while I setup and organized the dry-lab and all of the electronics lab equipment.



The Zyfer GPS setup was routine and it locked in (TFOM4) within 10-minutes.



The acoustic station was very easy to setup now that we can plug our dunking transducer cables directly into the 12kHz junction box. Bottom bounces at the dock and a few random disable codes proved that the new hull-mounted transducers were making noise. Soon enough we'll see how they perform at sea.



2. Transit

10/23/16 16:30 Local

We have about 5-hours to the shallow water acoustic rosette test site where we will perform a 2000 meter cast in ~2200 meters of water and then deploy our first OBS at site SS20. We actually have the first ten sites in a row.

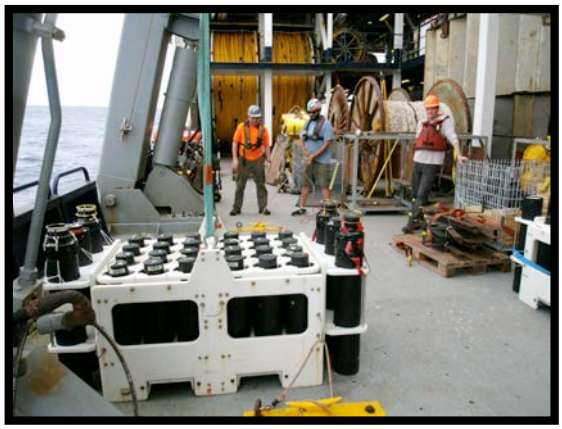
3. Rosette Acoustic Testing

2016:298:01:50:00

We just deployed the acoustic rosette and asked the ship to payout to 2000M depth. At this depth we were able to talk very easily and receive clear responses from the 26 acoustic units of the first rosette test. We will perform the second acoustic rosette test in a day or two at a depth of 4K meters.

2016:299:14:33:00

For the 4K acoustic rosette testing we helped the German OBS group secure their five untested releases into our modified rosette frame. This act eliminated the necessity of a third rosette cast. This second acoustic rosette cast went much as the 2K acoustic rosette test. We had very clear returns form all but one malfunctioning acoustic unit (#110), which was either not responding, or was responding, but on a different frequency. We've seen this before- bumping the exposed dipswitches, which govern the response frequency value, will cause a response frequency shift. The Germans had good acoustic returns for all five of their releases.



4. Scripps OBS Deployments

The rate of the initial deployments and the fact that I'm only up for a portion of these deployments on my 12-hour work shift makes it impractical for me to try and speak to every OBS site, as I often do. Instead, I will highlight the challenges and accomplishments that take place throughout this cruise, comprised of details that I personally deem noteworthy.

2016:298:18:00:00

To maintain consistency with the logger checkout procedures we began by deploying all of the new (BUG) electronics first. We managed to deploy all 27 of them within 4-days. As luck would have it, the only BUG logger that gave us significant issue was the very first one to be randomly brought into the dry lab for setup, which was BS16-012 (13010). Remaining calm about the fact that the GUI and command prompt weren't communicating with the logger, but we had good COM port attachments, as well as a green light on the BUG module indicating power from the USB connection, we set the logger aside and brought in a second one to validate the problem as logger, or a setup/config issue. The second BUG logger communicated during the setup procedure exactly as we had expected, which proved that the issue was somewhere in the first logger. I performed a basic inspection of the dysfunctional logger module (13037), but couldn't find anything physically out of place, so I swapped the entire module out with our complete spare module (14006). I also moved the CF card over to the replacement module. It (logger BS16-012) with module 14006 then worked fine.

2016:302:17:30:00 (14:30 Local)

We are at a GEOMAR station with their Sonardyne transducer deployed and they are having success retrieving data from the OBS array. While on station we have see no less than eight whales breaching all around the ship, two dolphin, one sea turtle and one pinniped (seal). Needless to say, we will likely have a lot of shutdowns during the active seismic shooting portion of this cruise.

2016:303:10:00:00
We have deployed the last Scripps SP-OBS. All of the setup and deployment operations went very well, with only minor challenges along the way that were documented on the checkout sheets and in this report under the Notable Stuff section. The German OBS group has one more recovery and two more stations to deploy, and then we will begin the active seismic work, if the whales allow.

5. GEOMAR Long-Term Stations

2016:302:07:00:00
GEOMAR has about ten semi-permanent OBS stations deployed in this area. They use an acoustic modem to retrieve data from these OBS about once a year, until they require recovery and repowering. They have a massive multi transducer head that weighs about 400-pounds which was lowered by the CTD wire to about 70-meters depth. Initially they could only talk to the OBS, but not receive data. The ship actually killed the engines to make it super quiet for their dunking transducer operation, and now they are receiving a partial data stream. The GEOMAR group is fortunate that the seas are dead calm, or we wouldn't have the option of shutting down the engines. They estimate that it will take them about an hour to complete a data download of about 4MB. Seriously, we are spending 10-hours collecting 4MB of data from 10-GEOMAR stations, so 40MB at best. Could this be worth the cost of ship time? Currently they aren't having success because they cannot maintain constant connection.

2016:302:18:30:00
The Germans have been successful retrieving data from the GEOMAR array. It's a slow process, but we have seriously calm seas and with the main engines off they are getting data to stream in to their dunking transducer. We should be back to OBS deployments in another 5-hours.

2016:303:10:00:00
Site SS04
This was the 50th Scripps OBS deployment and the end of the stations for this experiment. All of these setup and deployment operations went very well and we finished ahead of schedule, as is usual.

2016:307:07:34:00
Site SS21A, 4400 Meters
This was a redeployment station of SS21. We did this for Anne Trehu, with permission from Dr. Babcock, so that we could get a glimpse of the data, which might help Anne fine-tune the streamers later in the cruise. It will also be a very good opportunity for Mark and I to go through the processing of a BUG logger dataset using Sean's newly streamlined program. We chose to setup our spare logger, which is a 4x4, to replace the recovered BUG logger.

The recovery was a very routine operation, as we used our standard techniques with tagging and retrieval. On the deck, as I unplugged the logger sensor cables,

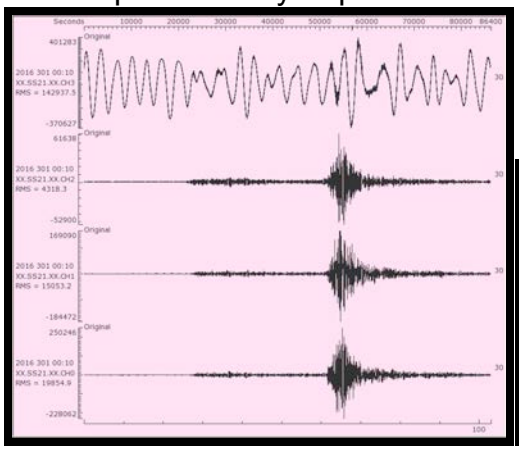
I believe that the hydrophone boot was loose as I pulled it free. I cannot be certain until I process the data, but it came off the logger easier than I was expecting and it was off before I could notice if it was backed away from the bulkhead. The good news is that the locking sleeve was most certainly screwed all the way on, so maybe it slid back as I pulled back on the sleeve.

6. Scripps OBS Recoveries
Site SS21, 4423 Meters (SIO Recovery 0 of 50)
2016:307:05:00:00

We recovered this end-of-line OBS station and redeployed the OBS with our spare logger, naming the new site SS21A (noted in deployments).

The acoustic communications were phenomenal. It is the clearest acoustic comms that I have personally experienced while working on this vessel.

Update for SS21
After processing the data to Mseed I discovered that all channels recorded as we'd hoped. The hydrophone cable was installed securely from the beginning.



Site SS21, JD:301- Chilean Earthquake of 10/27/16

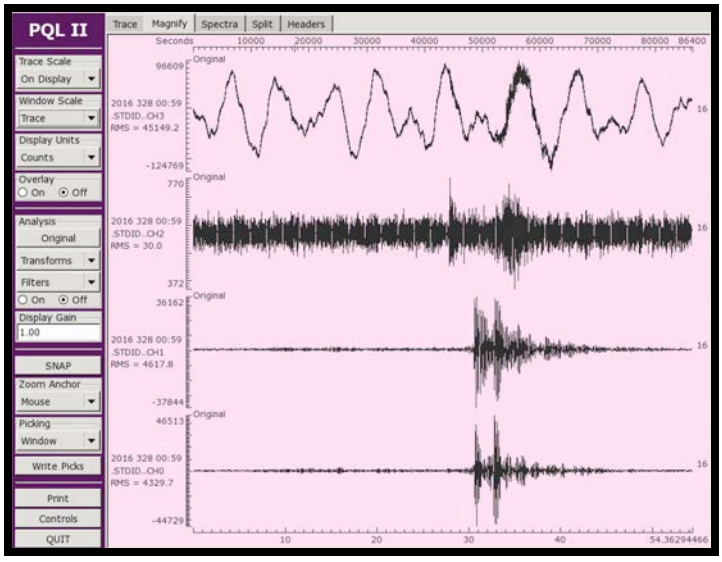
Below is a screenshot of JD:300, which is very early in the SS21 data, there is a strange shift on CH2-Z that I cannot explain. We will redeploy this OBS with our spare logger that happens to be a 4x4 and we'll see if it reappears.

About an hour ago I processed SS21 to Mseed and then created Segy from the shotlogs provided by the Langseth folks. Anne says that the data from SS21 looks fantastic. She said that it's very clean and she could see about 80 kilometers out and that the hydrophone data looks great. I hope this trend continues.

Site SS04, 1827 Meters (SIO Recovery 1 of 50)
2016:334:07:30:00
The recovery was routine, although the radio failed to enable and the strobe was visibly weak. We have red taped these NovaTech's for inspection.

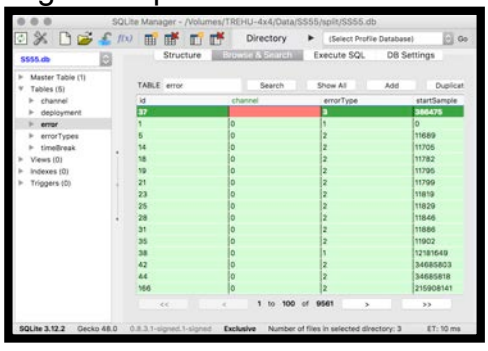
Site SS08, 1641 Meters (SIO Recovery 7 of 50)
2016:335:13:00:00
This instrument has a bad hydrophone dataset. The geophone recorded a great deal of 6.5Hz noise as well, but that's most likely unrelated to the hydrophone issue.

Site SS68, 3772 Meters (SIO Recovery 5 of 50)
2016:335:08:00:00
This was the fifth Scripps OBS recovery site. So far all is going fine. We are calculating a rise rate of about 45-meters/min and the data collected has been about 9-gigs thus far and growing. The recovery efforts are going well, although the mates are still figuring out how to get the OBS close enough for a forward tag hook, but I'm sure they will get it straight.



JD328 CH2 (Z) Possible Issue

Site SS55, 4261 Meters (SIO Recovery 10 of 50)
2016:336:00:00:00
This Logger (SP73) was running PPM at recovery. The OBS clock time was also inaccurate. This logger reset at some point during the experiment and there was a timing glitch.



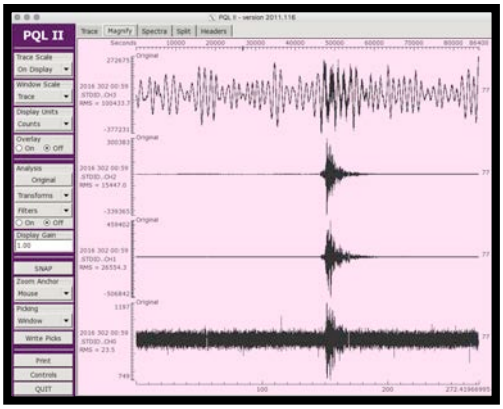
At recovery:
Real GPS Time = 2016:336:00:36:00
OBS Time = 2016:335:04:52:54
Clock Drift = 0.1347731

Data processing update (SS55):
There was one error that forced me to process this dataset manually. The solution was to delete the error line, update timeBreaks and then process miniseed.

Site SS57, 1179 Meters (SIO Recovery 15 of 50)
2016:336:09:30:00
This OBS acoustic (#60) has a 5-min burn cycle. Enable command was sent approximately 2000-meters from the station as we approached. Acoustic returns were very clear and the approaching slant ranges were 3941, 3871 and decreasing as expected. At 06:30:47 the Burn2 command was accepted and a distinct double ping was heard just before the acoustic unit kicked out of the burn cycle almost five minutes later. I wasn't expecting a 5-min burn, so I chose to immediately send a second Burn2 and see if it truly was a 5-min burn cycle for AC #60. After confirming the 5-min cycle I sent a few slant ranges that all returned 1650, 1648, 1649 consistently. We were holding station just under 1K from the site coordinates, so it looked like we were still on the bottom. I sent a third Burn2 command and informed the bridge to move over the drop coordinates and explained that if the OBS was released during the first burn attempt it would surface very near 07:00 hours. Once the third burn cycle ended I attempted to receive a few slant ranges. They were all slightly over 1400 meters, which made me question the accuracy of our station coordinates, the true location of our OBS (if it was possibly dragged away), or the accuracy of the returns we were receiving from acoustic #60. While considering this, the OBS surfaced at 07:00 and thus had been released during the first burn attempt. It surfaced only a few hundred meters from the ship, off of its port side, so the location coordinates were accurate, as was the OBS position on the seafloor. I cannot explain the inaccuracy of the returns recorded from AC #60.

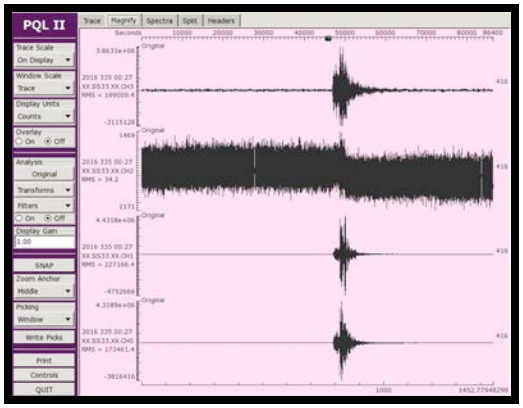
Site SS11, 2100 Meters (SIO Recovery 16 of 50)
2016:336:12:00:00
The release command was sent at 08:17 and a clear double-ping was heard at 08:22. The OBS surfaced with a radio chirp at 09:01. If the depth was recorded correctly we calculate a rise rate of about 55-meters/min. Every other site has been 44-meters/min. I'm not sure what could be different here. The depth was confirmed by multibeam.

Site SS59, 3248 Meters (SIO Recovery 11 of 50)
2016:336:02:30:00
Channel 0-X looks much noisier that the other geophone channels. It's possible that it could have been sitting at an angle. The counts greatly differ from Y-Z too.

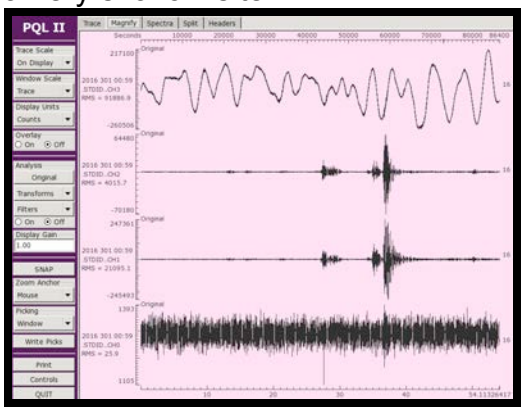


Site SS45, 729 Meters (SIO Recovery 25 of 50)
2016:337:15:00:00
The logger timing is very poor for this station. The time TAG is (2016:337:15:16:26.9228389) and I was using the new 4x4-Zyfer-GUI, which gave me a displayed drift of +26.9228389 seconds.

Site SS33, 775 Meters (SIO Recovery 27 of 50)
2016:337:18:00:00
CH2-Z looks bad.

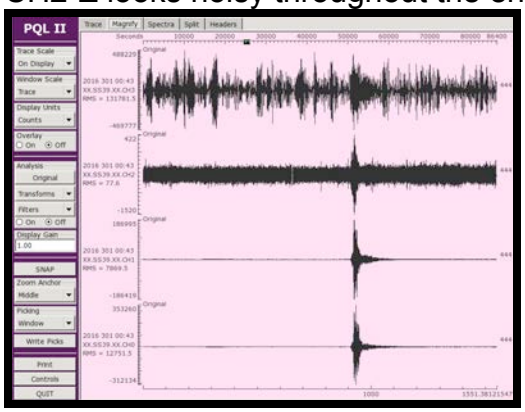


Site SS32, 760 Meters (SIO Recovery 28 of 50)
2016:337:19:00:00
CH0-X looks like junk to me. The hydrophone looked a bit noisy too, but this was a very shallow site.



Site SS20, 1525 Meters (SIO Recovery 33 of 50)
2016:338:06:00:00
Logger BS16-012 has a Start UTC discrepancy between the paperwork and what the HKLog provided during processing. I used the HKLog Start UTC.
Written Start UTC = 2016:297:18:42:00
HKLog Start UTC = 2016:297:19:11:00
This was the first deployment and the logger module 13037 was not working, so I swapped it out for the spare logger module 14006, which seemed to work fine.

Site SS39, 2412 Meters (SIO Recovery 40 of 50)
2016:338:20:00:00
CH2-Z looks noisy throughout the entire dataset.



Site SS29, 5244 Meters (SIO Recovery 44 of 50)
2016:339:16:00:00
This recovery was uneventful, as were all of my previous recoveries. We have the technique for easy and safe deck operations dialed in and the seas have been less than three meters throughout the duration of the cruise. The last six Scripps OBS will stay on the seafloor while we head out to the westernmost point and the guns are deployed for one last time. Anne wants a set of data from this particular offset for just these six OBS, which comprise the tip of the westernmost array being sites SS21A, SS22, SS23, SS24, SS25 and SS26.

Site SS21A, 4400 Meters (SIO Recovery 45 of 50)
2016:341:00:00:00
This data looks great. I could not find the strange shift on the vertical channel (CH2-Z) as was present on the previous deployment (SS21), but with a different logger (BS16-001). I did not look at every day, but I did look through several days worth of miniseed day files.

Site SS26, 4564 (SIO Recovery 50 of 50)
2016:341:12:00:00
This was the final recovery of the cruise.

7. Data Processing

Site	Logger	Type	AC	Geophone	Frame	Depth	Deployment Comment	Gigs	CH0-X	CH1-Y	CH2-Z	CH3	Recovery Comment	Rec-Order
SS20	BS16-012	BUG	90	OBS10GP50	F104	1525	Moduel 13037 Swap Out	10.40	Y	Y	Y	Y	Start UTC Discrepancy	33
SS19	BS16-023	BUG	69	OBS10GP63	F41	1580		10.40	Y	Y	Y	Y		34
SS18	BS16-010	BUG	50	OBS10GP66	F66	1520		10.30	Y	Y	Y	Y		35
SS37	BS16-011	BUG	99	OBS10GP25	F51	1049	Lost Flag	10.20	Y	Y	Y	Y		32
SS41	BS16-024	BUG	71	OBS10GP23	F26	934		10.20	Y	Y	Y	Y		31
SS34	BS16-007	BUG	87	OBS10GP53	F115	735		10.20	Y	Y	Y	Y		26
SS33	BS16-005	BUG	14	OBS10GP43	F42	775		10.30	Y	Y	N	Y	CH2-Z Looks Bad	27
SS40	BS16-028	BUG	108	OBS10GP34	F114	870		10.10	Y	Y	Y	Y		30
SS17	BS16-014	BUG	105	OBS15GP06	F98	980		10.20	Y	Y	Y	Y		36
SS36	BS16-021	BUG	115	OBS10GP20	F46	1697		10.20	Y	Y	Y	Y		37
SS35	BS16-022	BUG	73	OBS10GP28	F35	3153		10.20	Y	Y	Y	Y		38
SS29	BS16-020	BUG	58	OBS10GP24	F27	5244		10.40	Y	Y	Y	Y		44
SS26	BS16-016	BUG	38	OBS10GP21	F109	4564	Rough Bottom	10.80	Y	Y	Y	Y		50
SS25	BS16-026	BUG	55	OBS10GP54	2000-09	4555		10.90	Y	Y	Y	Y		49
SS24	BS16-015	BUG	23	OBS10GP48	F48	3330		10.80	Y	Y	Y	Y		48
SS23	BS16-009	BUG	40	OBS10GP60	F59	2853		10.70	Y	Y	Y	Y		47
SS22	BS16-006	BUG	78	OBS10GP15	2000-53	4158	Bad PC TAG	10.70	Y	Y	Y	Y		46
SS21	BS16-001	BUG	80	OBS10GP33	F58	4423	Early Recovery	2.03	Y	Y	Y	Y	Logger Swap - SS21A	0
SS51	BS16-002	BUG	34	OBS10GP14	F113	3995		9.68	Y	Y	Y	Y		17
SS52	BS16-017	BUG	47	OBS10GP03	F24	2729		9.60	Y	Y	Y	Y		19
SS48	BS16-004	BUG	102	OBS10GP07	F52	2689		9.55	Y	Y	Y	Y		18
SS43	BS16-025	BUG	19	OBS10GP44	F25	3070		10.00	Y	Y	Y	Y		42
SS42	BS16-027	BUG	103	OBS10GP55	F111	4142		10.00	Y	Y	Y	Y		43
SS30	BS16-019	BUG	96	OBS10GP46	F39	4221		10.64	Y	Y	Y	Y		41
SS38	BS16-018	BUG	24	OBS10GP31	F40	3634		9.08	Y	Y	Y	Y		39
SS39	BS16-013	BUG	3	OBS10GP09	F60	2412		9.81	Y	Y	Y	Y	CH2-Z Looks Noisy	40
SS16	BS16-003	BUG	72	OBS15GP02	F34	1430	GUI Freeze @ ZR	9.56	Y	Y	Y	Y		29
SS32	SP65	4x4	28	OBS10GP02	F78	772		10.36	N	Y	Y	Y	CH0-X Looks Bad	28
SS45	SP78	4x4	32	OBS15GP07	F60	729		10.26	Y	Y	Y	Y	Very Large Drift	25
SS50	SP126	4x4	146	OBS10GP45	F117	998		10.14	Y	Y	Y	Y		23
SS49	SP86	4x4	150	OBS15GP03	F63	1303		10.14	Y	Y	Y	Y		24
SS54	SP92	4x4	61	OBS10GP72	F43	1177	Broke Vac-Port - Fixed	10.08	Y	Y	Y	Y		22
SS53	SP95	4x4	97	OBS10GP70	F105	1236		10.03	Y	Y	Y	Y		21
SS12	SP67	4x4	30	OBS10GP40	F107	1383		9.98	Y	Y	Y	Y		20
SS11	SP93	4x4	2	OBS10GP42	F37	2100		9.81	Y	Y	Y	Y		16
SS57	SP71	4x4	60	OBS10GP32	F68	1179		9.82	Y	Y	Y	Y		15
SS58	SP85	4x4	67	OBS10GP49	F39	1150		9.80	Y	Y	Y	Y		14
SS60	SP38	4x4	111	OBS13GP410	F118	1071		9.75	Y	Y	Y	Y		13
SS10	SP17	4x4	123	OBS15GP09	F57	2112	3x Sync Required	9.71	Y	Y	Y	Y		12
SS59	SP124	4x4	41	OBS10GP51	F54	3277		9.64	Y	Y	Y	Y	CH0-X Looks Peculiar	11
SS55	SP73	4x4	88	OBS15GP04	F65	4261		9.59	Y	Y	Y	Y	TimeBreak Error - Fixed	10
SS67	SP61	4x4	31	OBS10GP73	F33	4063		9.55	Y	Y	Y	Y		9
SS64	SP20	4x4	85	OBS10GP65	F49	884		9.42	Y	Y	Y	Y		8
SS08	SP75	4x4	77	OBS10GP30	F100	1641		9.39	Y	Y	Y	N	CH3-HYD Looks Bad	7
SS61	SP94	4x4	27	OBS10GP409	F101	2436		9.34	Y	Y	Y	Y		6
SS68	SP57	4x4	98	OBS10GP12	F47	3772		9.30	Y	Y	Y	Y	CH2-Z Looks Peculiar	5
SS07	SP55	4x4	82	OBS10GP57	F32	1912	5x Sync Required	8.87	Y	Y	Y	Y		4
SS06	SP13	4x4	44	OBS10GP64	F96	1785		8.83	Y	Y	Y	Y		3
SS05	SP56	4x4	84	OBS10GP16	F62	1639		8.69	Y	Y	Y	Y	Strobe Issue	2
SS04	SP11	4x4	148	OBS10GP10	F40	1827		8.66	Y	Y	Y	Y	Strobe and Radio Issue	1
SS021A	SP117	4x4	80	OBS10GP71	F58	4400	Redeployment	9.43	Y	Y	Y	Y		45

Anne asked us to modify our Segy processing scripts so that the shot.db header trace would include air-gun depths. I forwarded her request to Sean McPeak back at the Scripps OBS lab and he was kind enough to make the changes required to the 3_segy.py code. I now have this newest version in my Proc2Segy_2016 folder and it appears to be working great.

Logger SP78 for site SS45 had a very large drift at recovery.
Time TAG: 2016:337:15:16:26.9228389

The Scripps GUI 4x4 Zyfer display gave a drift calculation of:
Drift = +26.9228389

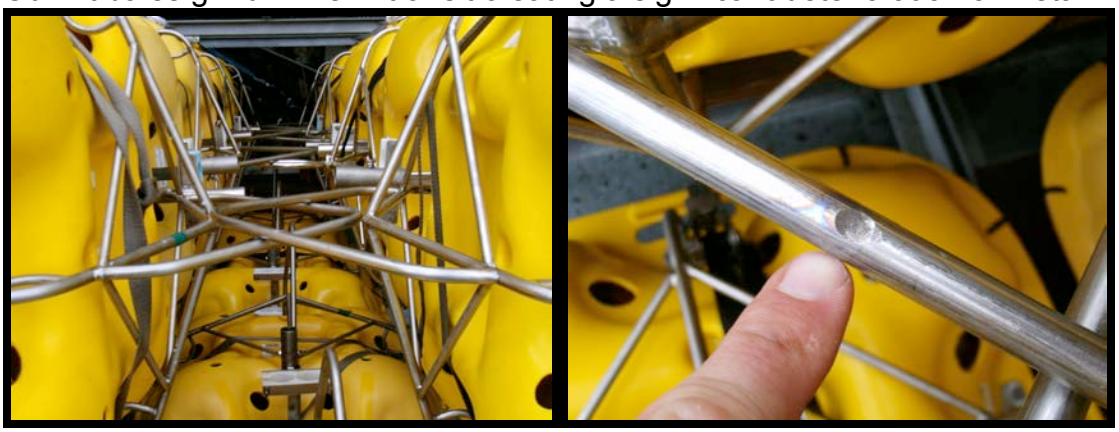
After reviewing the processed data Anne commented that the timing was off, so I guessed that I needed to invert the drift to see if this resolves the offset issue.
New Drift = 26.9228389 - 60sec = -33.0771611
The SS45-2 folder contains processed data using this new negative value for the drift.

12/06/16 11:00 Local
I was just informed by Anne Trehu that the shotlogs provided to me for making SEGY from all but the final six OBS station was incomplete and now they all need to be remade. This is very disappointing because I was fairly certain that I had the full shotlog record and now it may be impossible to finish the SEGY before we arrive in port for offloading. We'll see.

SEGY folder has files that are missing the final shots in (shots-trehu-ext.db)
SEGY2 folder has files that cover all shots (shots-trehu-all.db)
SEGY3 folder has files that cover only the missed shot files (shots-trehu-ext.db)

Anne asked that instead of redoing all of the SEGY files, I should run a shortened shot database that covers missed shots only and that she will stitch them together at a later date. This is to ensure that I can finish all processing and backups by the end of the cruise, which is fast approaching.

8. Notable Stuff
- The wet-bay floor is lifting from rust, which makes it very difficult to bolt racks.
- Acoustic #110 would not respond during the rosette test- failed rosette testing.
- Acoustic #113 has a ground fault issue internally- failed deck testing.
- I had Tom Spoto cut off the useless hook on our pelican release.
- One plastic vac-port broken off and was replaced with a new metal vac-port.
- Our surge protection power strips cause ship ground faults.
- Acoustic #60 may have range accuracy issues.
- The split rings on some of the pull pins deform at removal and can cut you.
- One XEOS was off on surface, then on for one pulse, off until on deck.
- The bases of the XEOS antennas will detach within the rubber base.
- The ships new hull-transducers have completely solved their past noise issues.
- Our lift bales grind while in transit creating a significant deterioration of metal.



- I recycled XBT tubes and zip-tied them to a wire basket for tag pole holders.

Josh Manger Comments:
- The ships crew does not communicate effectively.
- The overall concern for ships maintenance is deficient.

9. Cruise Summary

Fifty-one for fifty-one Scripps OBS were the bookends of this lengthy seismic operation. This was one of the longer cruises I've experienced on the Langseth and it's really good to be heading towards the hill.

We were all very pleased with the performance of the new hull mounted transducers, especially those of us who have previous cruise experience with the old systems. These new transducers alleviated a great deal of concern, which typically accompanies work on this ship and our ability to effectively communicate with our instruments.

The new processing software adaptations that Sean has been developing make the tedious nature of data management at sea much less painful.

It was a pleasure to work with Anne Trehu again and the group of students that volunteered for this cruise all did a fine job.