Gulf Integrated Spill Research

Mooring Deployment Cruise: **G01**
Cruise Summary

Vessel: R/V Pelican
Cruise Duration: 8 days

Mobilization: Cocadrie, LA	3-4 July 2012
At-sea:	5-11 July 2012
Demobilization: Cocadrie, LA	12 July 2012

<u>Cruise participants</u>
Scientists:

- Dr. Steven DiMarco (OCNG): Chief Scientist, Hydrography Lead
- Dr. Piers Chapman (OCNG): Water column chemistry: nutrients, oxygen
- Dr. Norman L. Guinasso, Jr (GERG): hydrocarbons
- Dr. Joe Kuehl (GERG): hydrography, moorings
- Mr. John Walpert (GERG): Mooring Deployment Lead

Technicians (GERG):

- Andrew Dancer: mooring tech
- Willie Fleming: mooring tech
- Paul Clark: mooring tech
- Erik Quiroz: nutrient tech
- Marty Bohn: winch ops

Students:

- Laura Spencer: CTD sampling, hydrography
- Heather Zimmerle: CTD sampling, hydrography
- Mengran Du: CTD and flowthrough; DIC and pH/alkalinity
- James Bounds (PHYS): CTD sampling, methane

Ship Crew: Captain, Mate, Engineer, Marine Tech, Deck hand, Cook

Participating GISR Project PIs: Bianchi, Chapman, DiMarco, Guinasso, Wade, Yvon-Lewis

<u>Cruise objectives</u>
1. To deploy six deepwater current meter moorings in the Mississippi Fan region of the northern Gulf of Mexico.

2. To make shipboard observations of current velocity (ADCP: 75 and 300 kHz), flow-through thermosalinograph, fluorometer (chlorophyll), Meteorology.

3. To collect water samples using Niskin bottles for chemical analyses. Nutrients, dissolved oxygen, DOM, DIC, CO2, petroleum hydrocarbons, CDOM.

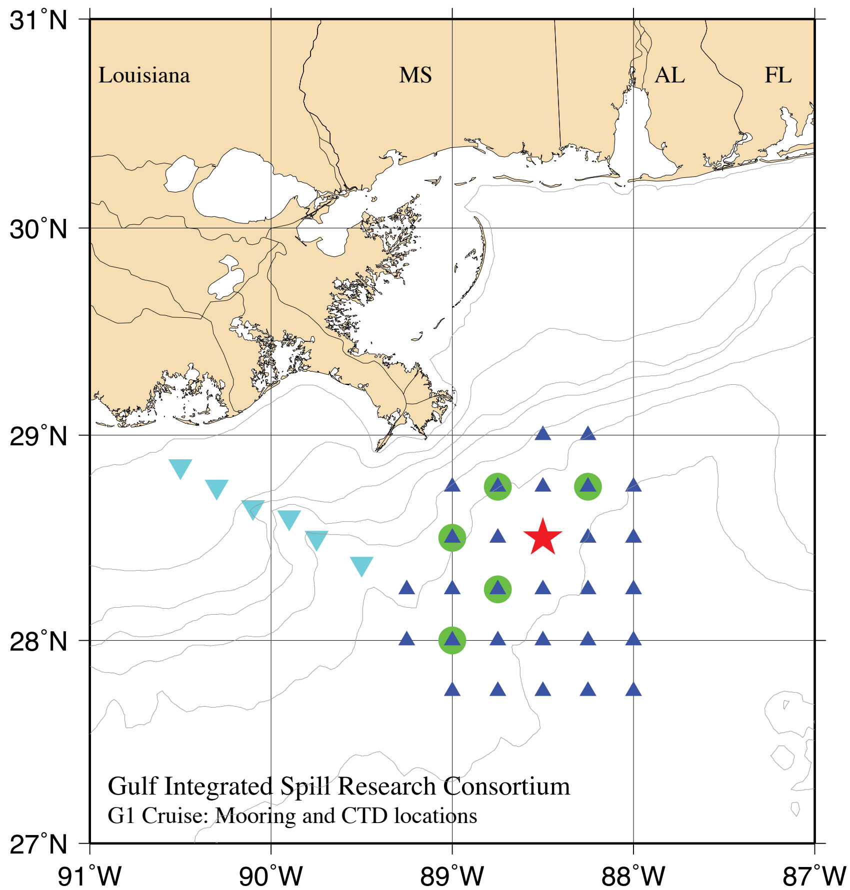

Figure 1. Map of north-central Gulf of Mexico showing G01 moorings (green circles) and CTD (dark blue triangles) locations. Red star indicates location of full water column mooring and dye release site. Light Blue triangles indicate Mississippi Canyon CTD station locations

Table 1. Deployment locations of six deepwater moorings deployed on G1 cruise.

Mooring Name	Latitude	Longitude	Water Depth (m) (approx)
M1	28° 29.9957'N	88° 30.0043'W	1500
M2	28° 44.8907'N	88° 44.7563'W	1000
M3	28° 45.0026'N	88° 15.0210'W	1500
M4	28° 29.9889'N	89° 00.0043'W	1000
M5	28° 15.0176'N	88° 44.9964'W	1500
M6	28° 00.0052'N	89° 00.0036'W	1500

<u>Cruise synopsis</u>

The G01 cruise is the first cruise of the Gulf Integrated Spill Research (GISR) project. The primary purpose of the cruise is to deploy six deepwater current meter moorings in the north-central Gulf of Mexico. The moorings will be deployed for a period of one year. The moorings will be serviced and redeployed in 2013. The second deployment will also be for one year. Recovery will be in summer 2014. A series of supporting observations were taken during the mooring deployment.

These observations consist of several flowthrough system variables (salinity, temperature, transmissometer, fluorescence), Niskin bottle samples from 12-bottle rosette (20 liter per bottle), and profiling sensors (e.g. Seabird 911 CTD, 75-kHz and 300 kHz shipboard ADCP). A suite of meteorological parameters were also collected aboard ship (relative humidity, wind speed and direction, atmospheric pressure).

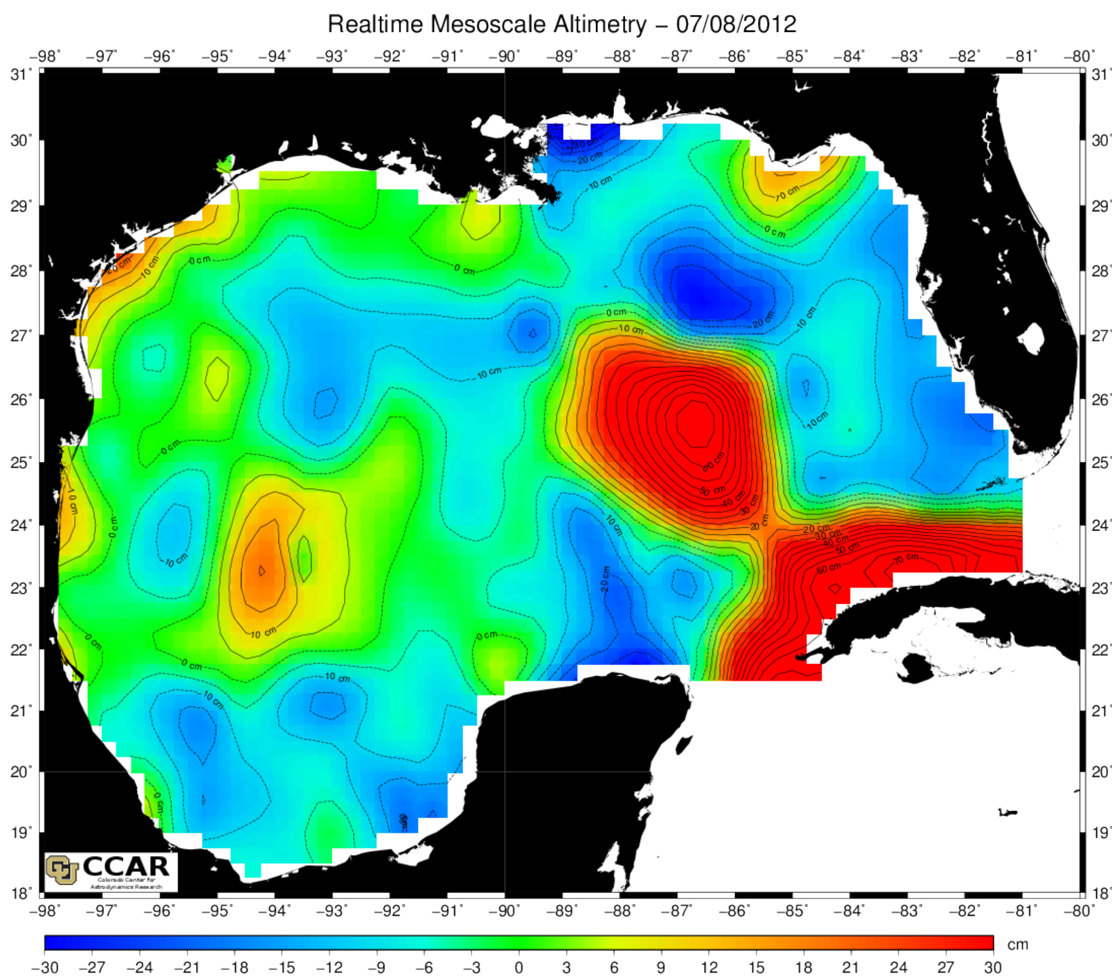

Figure 2. Sea surface height based on altimetry data for 8 July 2012. A Loop Current Eddy is seen to be forming in the eastern Gulf of Mexico as the Loop Current separates near 24°N,86°W.

The cruise planned for 26 CTD stations. Three additional stations were added to the main grid. Six stations were added along the axis of the Mississippi Canyon to tie the hydrography of the deep water to that of the continental shelf. In all, a total of 35 stations were occupied during the cruise. Table 2 summarizes the planned station locations and nominal depths of station. Table 3 summarizes the ACTUAL CTD station locations, water and sampling depths, and water samples taken at each station.

Table 2. Station plan summary. Locations as planned.

Latitude	Longitude	Location	Site Depth (m)
28.25	-89.25	G01L01S01	1300
28.00	-89.25	G01L01S02	1300
28.75	-89.00	G01L02S01	521
28.50	-89.00	G01L02S02M – M4	1100
28.25	-89.00	G01L02S03	1425
28.00	-89.00	G01L02S04M - M6	1650
27.75	-89.00	G01L02S05	1650
28.75	-88.75	G01L03S01M - M2	1014
28.50	-88.75	G01L03S02	1280
28.25	-88.75	G01L03S03M - M5	1720
28.00	-88.75	G01L03S04	2011
27.75	-88.75	G01L03S05	1737
29.00	-88.50	G01L04S01	366
28.75	-88.50	G01L04S02	1042
28.50	-88.50	G01L04S03M - M1	1792
28.25	-88.50	G01L04S04	1829
28.00	-88.50	G01L04S05	2157
29.00	-88.25	G01L05S01	1097
28.75	-88.25	G01L05S02M - M3	1280
28.50	-88.25	G01L05S03	2011
28.25	-88.25	G01L05S04	2194
28.00	-88.25	G01L05S05	2194
28.75	-88.00	G01L06S01	1828
28.50	-88.00	G01L06S02	2377
28.25	-88.00	G01L06S03	2377
28.00	-88.00	G01L06S04	2194
28.375	-89.50	G01MCAN01c	1000
28.50	-89.75	G01MCAN02c	500
28.60	-89.90	G01MCAN03c	300
28.65	-90.10	G01MCAN04c	100
28.75	-90.30	G01MCAN05c	50
28.85	-90.50	G01MCAN06c	20

Table 3. ACTUAL Station location, depths, and sampling summary.

Sequence	Niskin #	Station #	Latitude	Longitude	Date	Time	Max Depth		Depth	Bottles Fired	DO	Nutrients	Salt	DOC	Hydrocarbon	DIC	Methane
							log	data									
0	1	test	28 45.5056	89 06.2070	7/5/12	16:20	317.4	351.0	300	12	x						
-	2	-	-	-	-	-			300	-	x						
-	3	-	-	-	-	-			300	-	x	x	x				
-	4	-	-	-	-	-			300	-	x	x					
-	5	-	-	-	-	-			300	-	x						
-	6	-	-	-	-	-			300	-	x	x	x				
-	7	-	-	-	-	-			300	-	x	x	x				
-	8	-	-	-	-	-			300	-	x	x	x				
-	9	-	-	-	-	-			300	-	x		x				
-	10	-	-	-	-	-			300	-	x		x				
-	11	-	-	-	-	-			300	-	x		x				
-	12	-	-	-	-	-			300	-	x		x				
1	1	G01L02S01	28 44.9632	88 59.94610	7/5/12	17:39	509.8	515.5	509.8	12		x	x	x	x		
-	2	-	-	-	-	-			500.4	-		x		x	x		
-	3	-	-	-	-	-			448.8	-	x	x		x	x	x	
-	4	-	-	-	-	-			397.4	-	x	x		x	x	x	
-	5	-	-	-	-	-			350.7	-							
-	6	-	-	-	-	-			300.2	-	x	x	x	x	x	x	
-	7	-	-	-	-	-			250.3	-	x	x		x	x	x	
-	8	-	-	-	-	-			199.8	-		x		x	x	x	
-	9	-	-	-	-	-			150.6	-	x	x	x	x	x	x	
-	10	-	-	-	-	-			100.2	-		x		x	x	x	
-	11	-	-	-	-	-			50.1	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.8	-		x	x	x	x	x	
2	1	G01L03S01M-M2	28 44.5752	88 44.4489	7/5/12	22:16	1030.0	1036.0	1030	12		x	x	x	x	x	
-	2	-	-	-	-	-			900.7	-		x		x	x		
-	3	-	-	-	-	-			801.3	-		x		x	x		
-	4	-	-	-	-	-			700.6	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			601.6	-	x	x		x	x	x	
-	6	-	-	-	-	-			501.5	-	x	x		x	x	x	
-	7	-	-	-	-	-			400.9	-	x	x		x	x	x	
-	8	-	-	-	-	-			300.5	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			200.1	-	x	x		x	x	x	
-	10	-	-	-	-	-			100.5	-	x	x		x	x	x	
-	11	-	-	-	-	-			49.8	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.08	-	x	x	x	x	x	x	
3	1	G01L04S02	28 44.8716	88 30.0315	7/6/12	2:24	1351.6	1359.0	1352	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1200.4	-	x	x		x	x	x	
-	3	-	-	-	-	-			999.7	-	x	x		x	x	x	
-	4	-	-	-	-	-			800.6	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			700.5	-	x	x		x	x	x	
-	6	-	-	-	-	-			599.9	-	x	x		x	x	x	
-	7	-	-	-	-	-			499.8	-	x	x		x	x	x	
-	8	-	-	-	-	-			399.8	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			300	-	x	x		x	x	x	
-	10	-	-	-	-	-			199.7	-	x	x		x	x	x	
-	11	-	-	-	-	-			99.8	-	x	x		x	x	x	
-	12	-	-	-	-	-			1.2	-	x	x	x	x	x	x	
4	1	G01L04S01	29 00.1083	88 30.0264	7/6/12	5:44	615.5	620.4	615.5	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			574.5	-	x	x		x	x	x	
-	3	-	-	-	-	-			500.1	-	x	x		x	x	x	
-	4	-	-	-	-	-			400.2	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			350.7	-	x	x	x	x	x	x	
-	6	-	-	-	-	-			300.7	-	x	x		x	x	x	
-	7	-	-	-	-	-			250.6	-	x	x		x	x	x	
-	8	-	-	-	-	-			200.6	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			150.7	-	x	x		x	x	x	
-	10	-	-	-	-	-			100.3	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.7	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.9	-	x	x	x	x	x	x	
5	1	G01L05S01	29 00.0161	88 14.9831	7/6/12	8:20	934.5	942.5	934.5	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			900.1	-	x	x		x	x	x	
-	3	-	-	-	-	-			800.7	-	x	x		x	x	x	
-	4	-	-	-	-	-			701	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			600.7	-	x	x		x	x	x	
-	6	-	-	-	-	-			500.3	-	x	x		x	x	x	
-	7	-	-	-	-	-			400.2	-	x	x		x	x	x	
-	8	-	-	-	-	-			300.2	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			198.2	-	x	x		x	x	x	
-	10	-	-	-	-	-			100.8	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.8	-	x	x		x	x	x	
-	12	-	-	-	-	-			1	-	x	x	x	x	x	x	

6	1	G01L06S01	28 45.0247	87 59.0845	7/6/12	12:02	1986.0	1992.0	1986	12		x	x	x	x	x	
-	2	-	-	-	-	-			1800	-	x	x		x	x	x	
-	3	-	-	-	-	-			1426	-	x	x		x	x	x	
-	4	-	-	-	-	-			1200.4	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1002.9	-		x		x	x	x	
-	6	-	-	-	-	-			803	-	x	x		x	x	x	
-	7	-	-	-	-	-			600.7	-	x	x	x	x	x	x	
-	8	-	-	-	-	-			401.2	-	x	x		x	x	x	
-	9	-	-	-	-	-			199.7	-	x	x		x	x	x	
-	10	-	-	-	-	-			100.76	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.7	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.049	-	x	x	x	x	x	x	
7	1	G01L05S02M - M3	28 44.3764	88 15.0893	7/6/12	17:37	1382.0	1389.0	1382	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1188	-	x	x		x	x	x	
-	3	-	-	-	-	-			999.2	-	x	x		x	x	x	
-	4	-	-	-	-	-			800.7	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			700.9	-	x	x		x	x	x	
-	6	-	-	-	-	-			601.3	-	x	x		x	x	x	
-	7	-	-	-	-	-			501.1	-	x	x		x	x	x	
-	8	-	-	-	-	-			400.7	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			300.4	-	x	x		x	x	x	
-	10	-	-	-	-	-			200.7	-	x	x		x	x	x	
-	11	-	-	-	-	-			100.1	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.7	-	x	x	x	x	x	x	
8	1	G01L04S03M-M1	28 28.9871	88 30.1442	7/6/12	23:40	1552.2	1562.0	1552	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1401	-	x	x			x	x	
-	3	-	-	-	-	-			1300.5	-	x	x		x	x	x	
-	4	-	-	-	-	-			1150.3	-	x	x		x	x	x	
-	5	-	-	-	-	-			1000.3	-	x	x	x	x	x	x	
-	6	-	-	-	-	-			801.2	-	x	x		x	x	x	
-	7	-	-	-	-	-			600.9	-	x	x			x	x	
-	8	-	-	-	-	-			400.2	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			200.8	-	x	x		x	x	x	
-	10	-	-	-	-	-			101.5	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.2	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.9	-	x	x	x	x	x	x	
9	1	G01L05S03	28 30.0168	88 14.9449	7/7/12	3:15	1974.8	1981.0	1975	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1799	-	x	x			x	x	
-	3	-	-	-	-	-			1601	-	x	x		x	x	x	
-	4	-	-	-	-	-			1400	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1200	-	x	x		x	x	x	
-	6	-	-	-	-	-			999.8	-	x	x		x	x	x	
-	7	-	-	-	-	-			801	-	x	x		x	x	x	
-	8	-	-	-	-	-			600	-	x	x	x		x	x	
-	9	-	-	-	-	-			399.8	-	x	x		x	x	x	
-	10	-	-	-	-	-			201.5	-	x	x		x	x	x	
-	11	-	-	-	-	-			100.2	-	x	x		x	x	x	
-	12	-	-	-	-	-			1	-	x	x	x	x	x	x	
10	1	G01L06S02	28 30.0372	87 59.8460	7/7/12	7:25	2223.1	2237.0	2223.1	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			2000.7	-	x	x		x	x	x	
-	3	-	-	-	-	-			1800	-	x	x		x	x	x	
-	4	-	-	-	-	-			1399.7	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1199.6	-	x	x		x	x	x	
-	6	-	-	-	-	-			1000.2	-	x	x		x	x	x	
-	7	-	-	-	-	-			750	-	x	x		x	x	x	
-	8	-	-	-	-	-			650	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			350	-	x	x		x	x	x	
-	10	-	-	-	-	-			200	-	x	x		x	x	x	
-	11	-	-	-	-	-			99.5	-							
-	12	-	-	-	-	-			1.1	-	x	x	x	x	x	x	
11	1	G01L06S03	28 14.9558	87 59.9330	7/7/12	12:08	2248.5	2247.0	2248.5	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			2000.7	-	x	x		x	x	x	
-	3	-	-	-	-	-			1800.2	-	x	x		x	x	x	
-	4	-	-	-	-	-			1599.3	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1400	-	x	x		x	x	x	
-	6	-	-	-	-	-			1200.3	-	x	x		x	x	x	
-	7	-	-	-	-	-			1001.8	-	x	x		x	x	x	
-	8	-	-	-	-	-			801.5	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			599.6	-	x	x		x	x	x	
-	10	-	-	-	-	-			400.3	-	x	x		x	x	x	
-	11	-	-	-	-	-			200.2	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.7	-	x	x	x	x	x	x	
12	1	G01L05S04	28 14.9863	88 14.9587	7/7/12	16:36	2106.0	2111.0	2106	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1900.8	-	x	x		x	x	x	
-	3	-	-	-	-	-			1699.9	-	x	x		x	x	x	
-	4	-	-	-	-	-			1500.3	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1300.9	-	x	x		x	x	x	
-	6	-	-	-	-	-			1096.4	-	x	x		x	x	x	
-	7	-	-	-	-	-			901.3	-	x	x		x	x	x	
-	8	-	-	-	-	-			700.4	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			500.3	-	x	x		x	x	x	
-	10	-	-	-	-	-			300.4	-	x	x		x	x	x	
-	11	-	-	-	-	-			100.4	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.4	-	x	x	x	x	x	x	

13	1	G01L04S04	28 15.0867	88 29.8698	7/7/12	20:29	1682.0	1689.0	1682	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1499.7	-	x	x		x	x	x	
-	3	-	-	-	-	-			1299.4	-	x	x		x	x	x	
-	4	-	-	-	-	-			1099.9	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			899.2	-	x	x		x	x	x	
-	6	-	-	-	-	-			700.4	-	x	x		x	x	x	
-	7	-	-	-	-	-			500.4	-	x	x	x	x	x	x	
-	8	-	-	-	-	-			400.8	-	x	x		x	x	x	
-	9	-	-	-	-	-			301.7	-	x	x		x	x	x	
-	10	-	-	-	-	-			200.3	-	x	x		x	x	x	
-	11	-	-	-	-	-			100.4	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.8	-	x	x	x	x	x	x	
14	1	G01L03S04	28 30.0414	88 45.0442	7/8/12	0:21			1268.6	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1199.6	-	x	x		x	x	x	
-	3	-	-	-	-	-			1099.5	-	x	x		x	x	x	
-	4	-	-	-	-	-			899.8	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			700	-	x	x		x	x	x	
-	6	-	-	-	-	-			500	-	x	x		x	x	x	
-	7	-	-	-	-	-			400.3	-	x	x	x	x	x	x	
-	8	-	-	-	-	-			300.6	-	x	x		x	x	x	
-	9	-	-	-	-	-			199	-	x	x		x	x	x	
-	10	-	-	-	-	-			100.1	-	x	x		x	x	x	
-	11	-	-	-	-	-			50	-	x	x		x	x	x	
-	12	-	-	-	-	-			1.1	-	x	x	x	x	x	x	
15	1	G01L03S04	27 58.9194	88 45.2034	7/8/12	5:49			1791.1	12	x	x	x	x	x	x	
-	2	-		-	-	-			1601	-	x	x		x	x	x	
-	3	-	-	-	-	-			1399.7	-	x	x		x	x	x	
-	4	-	-	-	-	-			1200.1	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1000.1	-	x	x		x	x	x	
-	6	-	-	-	-	-			800.8	-	x	x		x	x	x	
-	7	-	-	-	-	-			600.5	-	x	x	x	x	x	x	
-	8	-	-	-	-	-			400.4	-	x	x		x	x	x	
-	9	-	-	-	-	-			199.7	-	x	x		x	x	x	
-	10	-	-	-	-	-			100	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.3	-	x	x		x	x	x	
-	12	-	-	-	-	-			1.2	-	x	x	x	x	x	x	
16	1	G01L02S03	28 15.0618	89 00.0168	7/8/12	10:08			1174.1	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1024	-	x	x		x	x	x	
-	3	-	-	-	-	-			900.5	-	x	x		x	x	x	
-	4	-	-	-	-	-			799	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			700	-	x	x		x	x	x	
-	6	-	-	-	-	-			601	-	x	x		x	x	x	
-	7	-	-	-	-	-			501	-	x	x	x	x	x	x	
-	8	-	-	-	-	-			401.5	-	x	x		x	x	x	
-	9	-	-	-	-	-			300.3	-	x	x		x	x	x	
-	10	-	-	-	-	-			200.7	-	x	x		x	x	x	
-	11	-	-	-	-	-			100	-	x	x		x	x	x	
-	12	-	-	-	-	-			1	-	x	x	x	x	x	x	
17	1	G01L02S02	28 30.5117	89 00.1953	7/8/12	14:15			1174.1	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1024	-	x	x		x	x	x	
-	3	-	-	-	-	-			900.5	-	x	x		x	x	x	
-	4	-	-	-	-	-			799	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			700	-	x	x		x	x	x	
-	6	-	-	-	-	-			601	-	x	x		x	x	x	
-	7	-	-	-	-	-			501	-	x	x	x	x	x	x	
-	8	-	-	-	-	-			401.5	-	x	x		x	x	x	
-	9	-	-	-	-	-			300.3	-	x	x		x	x	x	
-	10	-	-	-	-	-			200.7	-	x	x		x	x	x	
-	11	-	-	-	-	-			100	-	x	x		x	x	x	
-	12	-	-	-	-	-			1	-	x	x	x	x	x	x	
18	1	G01L02S04M-M6	28 00.0645	89 00.6544	7/8/12	22:06			1263	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1000	-	x	x		x	x	x	
-	3	-	-	-	-	-			900.2	-	x	x		x	x	x	
-	4	-	-	-	-	-			699.3	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			600.6	-	x	x		x	x	x	
-	6	-	-	-	-	-			500.2	-	x	x		x	x	x	
-	7	-	-	-	-	-			399.8	-	x	x	x	x	x	x	
-	8	-	-	-	-	-			298	-	x	x		x	x	x	
-	9	-	-	-	-	-			200.5	-	x	x		x	x	x	
-	10	-	-	-	-	-			100.9	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.3	-	x	x		x	x	x	
-	12	-	-	-	-	-			1.1	-	x	x	x	x	x	x	
19	1	G01L03S03M-M5	28 15.0536	88 44.9759	7/9/12	1:30			1621.2	12	x	x	x	x	x	x	
-	2	-	-	-		-			1399.8	-	x	x		x	x	x	
-	3	-	-	-	-	-			1200.1	-	x	x	x	x	x	x	
-	4	-	-	-	-	-			1000.3	-	x	x		x	x	x	
-	5	-	-	-	-	-			800.1	-	x	x		x	x	x	
-	6	-	-	-	-	-			599.9	-	x	x	x	x	x	x	
-	7	-	-	-	-	-			400.3	-	x	x		x	x	x	
-	8	-	-	-	-	-			299.9	-	x	x		x	x	x	
-	9	-	-	-	-	-			200.2	-	x	x		x	x	x	
-	10	-	-	-	-	-			99.7	-	x	x		x	x	x	
-	11	-	-	-	-	-			59.2	-	x	x		x	x	x	
-	12	-	-	-	-	-			1.1	-	x	x	x	x	x	x	
20	1	G01L04S05	28 15.0536	88 44.9152	7/9/12	5:56			1983.1	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1801.7	-	x	x		x	x	x	
-	3	-	-	-	-	-			1602	-	x	x		x	x	x	
-	4	-	-	-	-	-			1400.5	-	x	x		x	x	x	
-	5	-	-	-	-	-			1197	-	x	x	x	x	x	x	
-	6	-	-	-	-	-			1000.1	-	x	x		x	x	x	
-	7	-	-	-	-	-			801.1	-	x	x		x	x	x	
-	8	-	-	-	-	-			598.3	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			399.5	-	x	x		x	x	x	
-	10	-	-	-	-	-			200.5	-	x	x		x	x	x	
-	11	-	-	-	-	-			100.5	-	x	x		x	x	x	
-	12	-	-	-	-	-			1	-	x	x	x	x	x	x	
21	1	G01L05S05	28 00.0038	88 14.8528	7/9/12	9:58			2178	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			2000.1	-	x	x		x	x	x	
-	3	-	-	-	-	-			1799.2	-	x	x		x	x	x	
-	4	-	-	-	-	-			1500.9	-	x	x		x	x	x	
-	5	-	-	-	-	-			1200	-	x	x	x	x	x	x	
-	6	-	-	-	-	-			1000.3	-	x	x		x	x	x	
-	7	-	-	-	-	-			801	-	x	x		x	x	x	
-	8	-	-	-	-	-			600.6	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			400.9	-	x	x		x	x	x	
-	10	-	-	-	-	-			201.1	-	x	x		x	x	x	
-	11	-	-	-	-	-			100.7	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.6	-	x	x	x	x	x	x	
22	1	G01L06S04	28 00.0114	87 59.9387	7/9/12	13:17			2266	12	x	x	x	x	x	x	

22	1	G01L06S04	28 00.0114	87 59.9387	7/9/12	13:17			2266	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			2000.5	-	x	x		x	x	x	
-	3	-	-	-	-	-			1800.6	-	x	x		x	x	x	
-	4	-	-	-	-	-			1500.5	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1200.2	-	x	x		x	x	x	
-	6	-	-	-	-	-			1000.3	-	x	x		x	x	x	
-	7	-	-	-	-	-			800	-	x	x		x	x	x	
-	8	-	-	-	-	-			600.02	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			401.3	-	x	x		x	x	x	
-	10	-	-	-	-	-			200.28	-	x	x		x	x	x	
-	11	-	-	-	-	-			99.9	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.076	-	x	x	x	x	x	x	
23	1	G01L06S05	27 44.9966	87 59.9355	7/9/12	17:02			2209.2	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			2000.2	-	x	x		x	x	x	
-	3	-	-	-	-	-			1749.9	-	x	x		x	x	x	
-	4	-	-	-	-	-			1500.7	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			1250.4	-	x	x		x	x	x	
-	6	-	-	-	-	-			999.4	-	x	x		x	x	x	
-	7	-	-	-	-	-			700.4	-	x	x		x	x	x	
-	8	-	-	-	-	-			399.8	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			200.6	-	x	x		x	x	x	
-	10	-	-	-	-	-			100.9	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.3	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.6	-	x	x	x	x	x	x	
24	1	G01L05S06	27 45.0488	88 14.9769	7/9/12	21:06				0							
-	2	-	-	-	-	-				-							
-	3	-	-	-	-	-				-							
-	4	-	-	-	-	-				-							
-	5	-	-	-	-	-				-							
-	6	-	-	-	-	-				-							
-	7	-	-	-	-	-				-							
-	8	-	-	-	-	-				-							
-	9	-	-	-	-	-				-							
-	10	-	-	-	-	-				-							
-	11	-	-	-	-	-				-							
-	12	-	-	-	-	-				-							
25	1	G01L04S06			7/10/12	7:36			2122.7	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1886.8	-	x	x		x	x	x	
-	3	-	-	-	-	-			1697.5	-	x	x		x	x	x	
-	4	-	-	-	-	-			1499.5	-	x	x		x	x	x	
-	5	-	-	-	-	-			1301.5	-	x	x	x	x	x	x	
-	6	-	-	-	-	-			1100.5	-	x	x		x	x	x	
-	7	-	-	-	-	-			901.1	-	x	x		x	x	x	
-	8	-	-	-	-	-			700.7	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			500.7	-	x	x		x	x	x	
-	10	-	-	-	-	-			300.1	-	x	x		x	x	x	
-	11	-	-	-	-	-			99.1	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.9	-	x	x	x	x	x	x	
26	1	G01L03S05	27 45.0292	88 44.9486	7/10/12	16:11			1656	12	x	x	x		x		
-	2	-	-	-	-	-			1400.3	-	x	x			x		
-	3	-	-	-	-	-			1200.2	-	x	x			x		
-	4	-	-	-	-	-			1001.2	-	x	x	x		x		
-	5	-	-	-	-	-			801.5	-	x	x			x		
-	6	-	-	-	-	-			600.5	-	x	x			x		
-	7	-	-	-	-	-			400.3	-	x	x			x		
-	8	-	-	-	-	-			300.6	-	x	x	x		x		
-	9	-	-	-	-	-			200.5	-	x	x			x		
-	10	-	-	-	-	-			100	-	x	x			x		
-	11	-	-	-	-	-			50.1	-	x	x			x		
-	12	-	-	-	-	-			0.9	-	x	x	x		x		
27	1	G01L02S05	27 45.0487	89 00.0738	7/10/12	19:41			1513.7	12	x	x	x	x	x	x	
-	2	-	-	-	-	-			1400.1	-	x	x		x	x	x	
-	3	-	-	-	-	-			1199.6	-	x	x		x	x	x	
-	4	-	-	-	-	-			1000.8	-	x	x	x	x	x	x	
-	5	-	-	-	-	-			800.8	-	x	x		x	x	x	
-	6	-	-	-	-	-			600.7	-	x	x		x	x	x	
-	7	-	-	-	-	-			400.4	-	x	x		x	x	x	
-	8	-	-	-	-	-			300.6	-	x	x	x	x	x	x	
-	9	-	-	-	-	-			200.7	-	x	x		x	x	x	
-	10	-	-	-	-	-			100	-	x	x		x	x	x	
-	11	-	-	-	-	-			50.1	-	x	x		x	x	x	
-	12	-	-	-	-	-			0.6	-	x	x	x	x	x	x	
28	1	G01L01S02	28 00.0105	89 15.0590	7/10/12	23:09			1329.2	12	x	x	x	x	x		
-	2	-	-	-	-	-			1199.8	-	x	x		x	x		
-	3	-	-	-	-	-			998.5	-	x	x		x	x		x
-	4	-	-	-	-	-			799.4	-	x	x	x	x	x		
-	5	-	-	-	-	-			599.6	-	x	x		x	x		
-	6	-	-	-	-	-			498.8	-	x	x		x	x		
-	7	-	-	-	-	-			397.5	-	x	x	x	x			
-	8	-	-	-	-	-			299.8	-	x	x		x			
-	9	-	-	-	-	-			200.1	-	x	x		x			
-	10	-	-	-	-	-			100.7	-	x	x		x			
-	11	-	-	-	-	-			49.3	-	x	x		x			
-	12	-	-	-	-	-			1.2	-	x	x	x	x	x		
29	1	G01L01S01	28 15.0184	89 15.0577	7/11/12	2:24			828.5	12	x	x	x	x	x	x	x
-	2	-	-	-	-	-			799.5	-	x	x			x	x	
-	3	-	-	-	-	-			700.1	-	x	x		x	x	x	
-	4	-	-	-	-	-			599.8	-	x	x			x	x	
-	5	-	-	-	-	-			500	-	x	x	x	x	x	x	
-	6	-	-	-	-	-			400.9	-	x	x				x	
-	7	-	-	-	-	-			301.3	-	x	x	x	x		x	
-	8	-	-	-	-	-			200.2	-	x	x				x	
-	9	-	-	-	-	-			150.1	-	x	x				x	
-	10	-	-	-	-	-			100	-	x	x		x		x	
-	11	-	-	-	-	-			50.7	-	x	x				x	
-	12	-	-	-	-	-			0.9	-	x	x	x	x	x	x	

30	1	G01MCAN01C	28 22.5636	89 30.1190	7/11/12	5:05			700.5	10	x	x	x	x	x		x
-	2	-	-	-	-	-			600.5	-	x	x			x		
-	3	-	-	-	-	-			500.6	-	x	x		x	x		
-	4	-	-	-	-	-			400.7	-	x	x			x		
-	5	-	-	-	-	-			300.5	-	x	x	x	x			
-	6	-	-	-	-	-			199.9	-	x	x					
-	7	-	-	-	-	-			149.2	-	x	x					
-	8	-	-	-	-	-			100.5	-	x	x		x			
-	9	-	-	-	-	-			50.1	-	x	x	x				
-	10	-	-	-	-	-			1.1	-	x	x		x		x	
31	1	G01MCAN02C	28 30.0513	89 45.0421	7/11/12	7:26			564.5	8	x	x	x	x	x		x
-	2	-	-	-	-	-			501.1	-	x	x			x		
-	3	-	-	-	-	-			400.1	-	x	x		x	x		
-	4	-	-	-	-	-			301.2	-	x	x			x		
-	5	-	-	-	-	-			200.3	-	x	x					
-	6	-	-	-	-	-			100.3	-	x	x	x	x			
-	7	-	-	-	-	-			50.1	-	x	x		x		x	
-	8	-	-	-	-	-			0.9	-	x	x	x			x	
-	9	-	-	-	-	-				-							
-	10	-	-	-	-	-				-							
-	11	-	-	-	-	-				-							
-	12	-	-	-	-	-				-							
32	1	G01MCAN03C	28 36.0334	89 54.0133	7/11/12	9:10			356.9	6	x	x	x	x	x		
-	2	-	-	-	-	-			300.8	-	x	x			x		
-	3	-	-	-	-	-			200.5	-	x	x		x	x		
-	4	-	-	-	-	-			100.3	-	x	x	x		x		
-	5	-	-	-	-	-			50.5	-	x	x				x	
-	6	-	-	-	-	-			0.9	-	x	x	x	x		x	
-	7	-	-	-	-	-				-							
-	8	-	-	-	-	-				-							
-	9	-	-	-	-	-				-							
-	10	-	-	-	-	-				-							
-	11	-	-	-	-	-				-							
-	12	-	-	-	-	-				-							
33	1	G01MCAN04C	28 39.0361	90 06.0194	7/11/12	11:07			100.6	6	x	x		x			
-	2	-	-	-	-	-			79.6	-	x	x					
-	3	-	-	-	-	-			60.7	-	x	x					
-	4	-	-	-	-	-			40.9	-	x	x					
-	5	-	-	-	-	-			20.8	-	x	x					
-	6	-	-	-	-	-			0.6	-	x	x	x	x		x	
-	7	-	-	-	-	-				-							
-	8	-	-	-	-	-				-							
-	9	-	-	-	-	-				-							
-	10	-	-	-	-	-				-							
-	11	-	-	-	-	-				-							
-	12	-	-	-	-	-				-							
34	1	G01MCAN05C	28 45.0355	90 17.9882	7/11/12	12:49			23.7	5	x	x					
-	2	-	-	-	-	-			15.4	-	x	x					
-	3	-	-	-	-	-			10.6	-	x	x					
-	4	-	-	-	-	-			5.3	-	x	x					
-	5	-	-	-	-	-			0.8	-	x	x	x			x	
-	6	-	-	-	-	-				-							
-	7	-	-	-	-	-				-							
-	8	-	-	-	-	-				-							
-	9	-	-	-	-	-				-							
-	10	-	-	-	-	-				-							
-	11	-	-	-	-	-				-							
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Vessel Observations

- Shipboard ADCP: 300 and 75 kHz (LUMCON)
- CTD/Rosette: 12-bottle rosette
  - Nutrients: six constituents (nitrate, nitrite, phosphate, silicate, ammonium, urea): Freeze samples, Autoanalyzer run at GERG
  - Dissolved Oxygen (Winkler titration onboard)
  - Salinity (bottles collected, Salinometer run at GERG)
  - Electronic sensors
    - CTD: SeaBird 911: temperature-SBE55, conductivity-SBE3, pressure SBE45
    - Dissolved Oxygen: SBE43
    - Optical Backscatter: Seatech
    - Light Transmission: Chelsea/Seatech
    - Fluorometer (chlorophyll or CDOM): Chelsea Aqua3
    - PAR: Biospherical/Licor
  - Bianchi Lab: DOC (from Niskin Bottles)
  - Schuessler (Physics) Lab: CH4 (from Niskin bottles after O2 sample)

Wade Lab: hydrocarbons (instruction/protocol needed)
Yvon-Lewis: pCO_2, DIC/Alk (from flow through system), DIC from rosette

Flow-through System (MIDAS)
Thermosalinograph
Fluorometer (Wetstar: chlorophyll, Turner AU10)
Transmissometer
Meteorology

Bucket Sampling:
Salinity, nutrients as needed

Other equipment
Satellite internet
Meteorological package (MIDAS)

CTD Protocol
Bottle Trip depths: equal depth interval
Sample order: gases (Oxygen, DIC, methane), nutrients, salinity, hydrocarbons, DOC

Moored instrument sampling intervals (see mooring diagrams placement)
RCM-8 and RCM-11 current meters
75-kHz ADCP profiling current meters
MicroCat CTDs

Data Collection Protocol

All data collected during this cruise is subject to quality assurance and quality control protocol that are consistent with guidelines established by the Gulf of Mexico Research Initiative. Data Manager for the GISR Project is Dr. Matt Howard (TAMU).

Data Collection Synopsis

Bianchi Lab data collection synopsis

Dissolved organic carbon samples were extracted from Niskin bottles at selected CTD locations and depths.

DiMarco Lab data collection synopsis

Standard hydrographic protocol from NEGOM cruises. CTD was lowered to 5 m above bottom when possible. The ship hydro winch cable limited sample collection to 2400 m.

Wade Lab data collection synopsis

Wade lab collected water samples at selected CTD locations and depths for hydrocarbon analysis.

Yvon-Lewis Lab data collection synopsis

- 1 crate/box that is the racked pCO2 system itself and gets installed under the bench in the bottle room.
- 2 crates (each about 31"L X 24"D X 16"H) that contain the equilibrators and supplies for the pCO2 system. The equilibrators get mounted right next the sink in the bottle room.
- 5 crates (each about 31"L X 24"D X 16"H) with sample bottles (350 bottles)
- 1 smaller plastic crate with supplies for collecting and poisoning the DIC/Alk samples
- 3 gas cyllinders (2 short and 1 tall) that go with the pCO2 system.

Environmental Conditions

Environmental conditions in the northern Gulf of Mexico were ideal for mooring deployment and CTD casts. Winds were generally light (~5 knots) for the duration of the cruise. Seas were generally 1 -2 ft. The Loop Current did not extend into the study location during this deployment, however, inspection of the SSH from satellite altimeter (courtesy CCAR website, Figure 2) indicates the Loop Current maybe in the process of shedding an eddy. It is possible that this eddy moves into the study region within the next couple of months.

A large freshwater tongue, extended south and eastward from the mouth of the Mississippi River near Southwest Pass, LA, and into the deepwater region of the study site. The tongue was confined to the upper 5 m of the water column. The presence of the Mississippi River plume was likely the combined result of advection from a cyclonic circulation feature offshore of the delta and upwelling favorable winds close to the coast, which drive the river plume seaward.

Winkler titration

Dissolved oxygen titrations using the Winkler method were performed on water samples collected from each Niskin bottle. Two Seabird SBE43 dissolved oxygen sensors were deployed on the lowered CTD. The ship marine technician, Alex Ren, indicated that one SBE43 was recently calibrated, the other had a stale calibration. Comparison between the two SBE43 sensors is below.

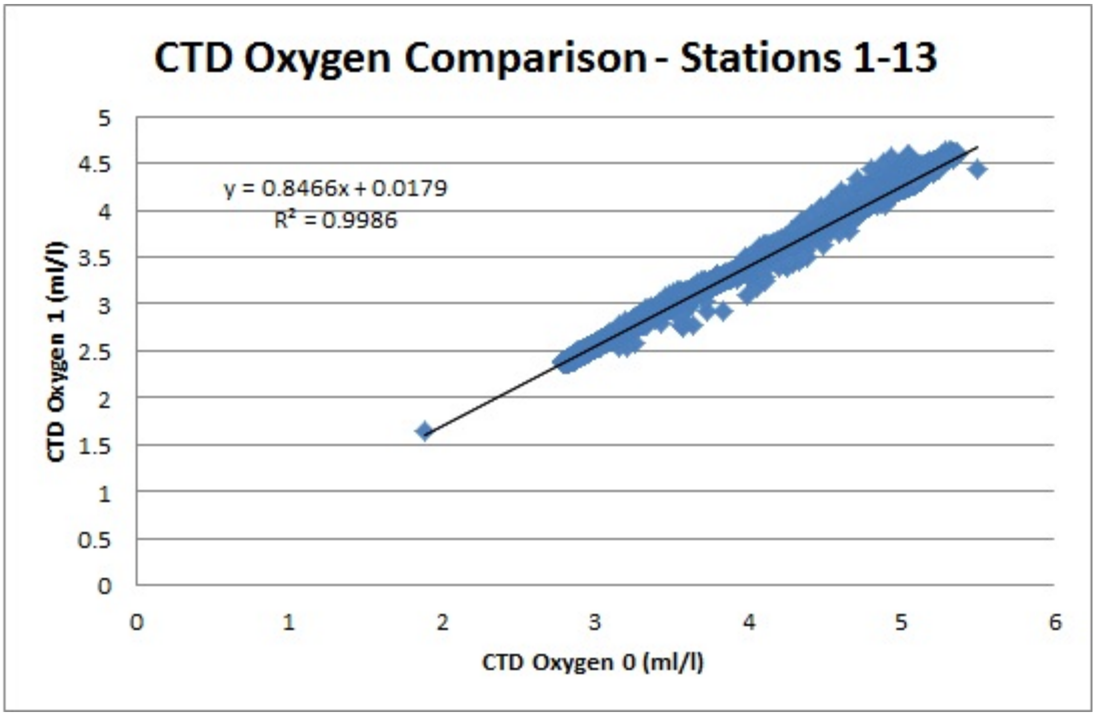

Figure 3. Comparison between two SBE43 DO sensors on G01 cruise.

The figure above shows that the two DO sensors on the CTD show a coefficient of determination, r2, greater than 0.99. This indicates a proportionality between the two sensors and small offset.

Comparison between the Winkler titration DO concentrations and the two electronic DO probes show reasonable agreement, r2 > 0.93. The comparison is shown in Figure 4.

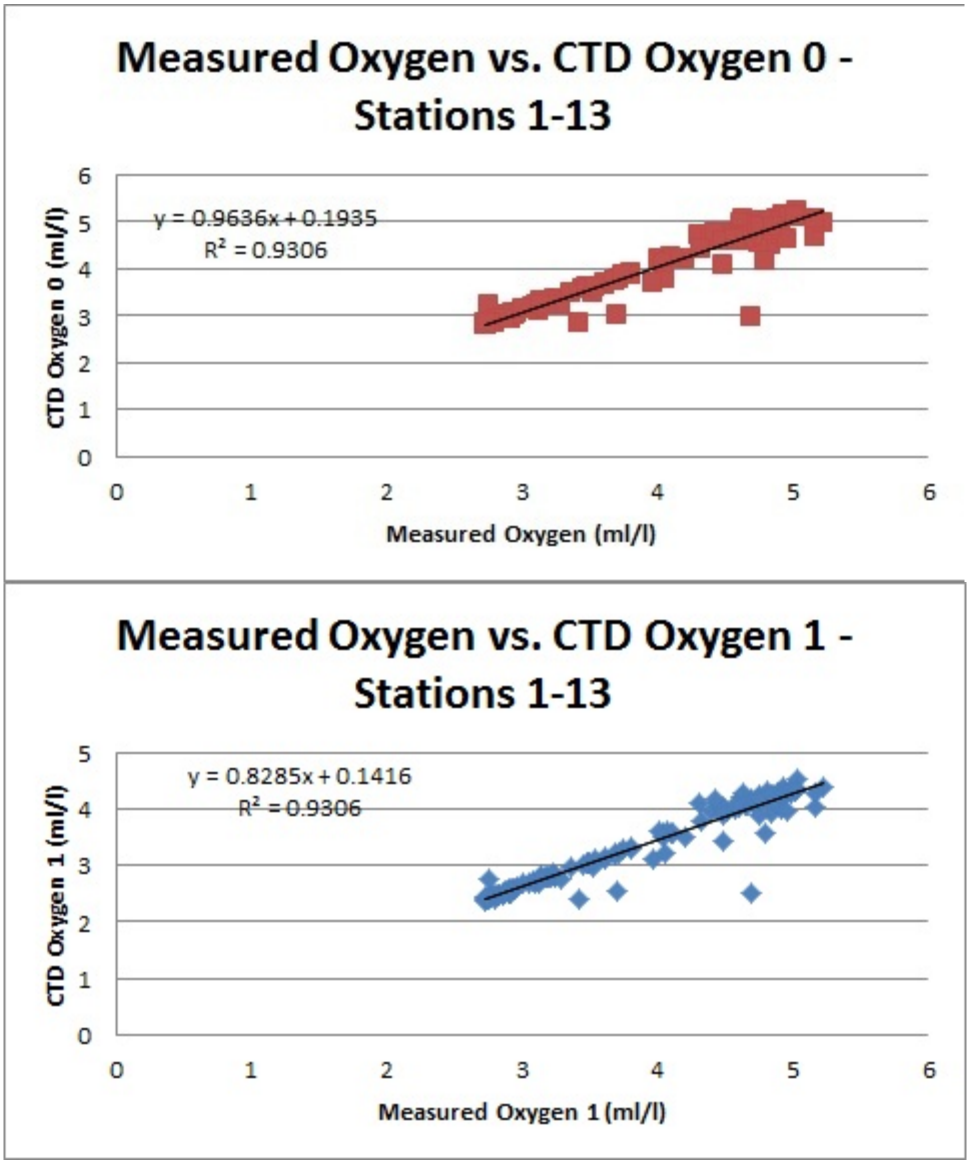

Figure 4. Comparison between SBE43 DO sensors and Winkler titration oxygen values from CTD stations 1-13.

<u>Surface properties</u>

The following sequence of figures show the near-surface (3-m) spatial distribution of salinity and fluorescence from data collected using the ship flowthrough system.

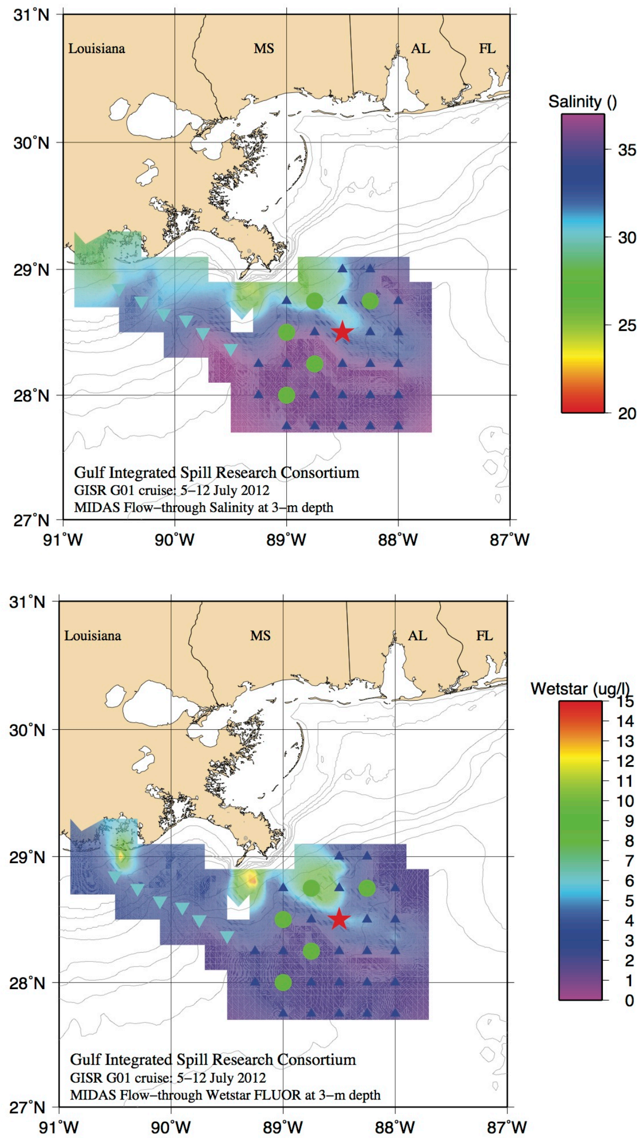

Figure 5. (Top) Near-surface (3-m) salinity field estimated from the ship flowthrough system. Field is estimated using nearest-neighbor interpolation. (Bottom) near-surface Westar fluorescence field estimated from ship flowthrough. Bathymetry contours shown are: 10, 20, 30, 40, 50, 100, 200, 500, 1000, 2000, and 3000 m isobaths.

Surface salinity shows intrusion of the Mississippi River plume into the study region. Salinity values are about 36 outside the river plume. Surface chlorophyll distribution is similar to the salinity distribution with highest fluorescence values being collocated with low salinity values.

The composite T/S diagram of all 35 CTD casts performed on the G01 cruise show the presence of the water masses typically found in the Gulf of Mexico. Signatures of Subtropical Underwater (STU), Antarctic Intermediate Water (AAIW) and North Atlantic Deepwater (NADW) are all present. Of particular note is the salinity maximum of the upper water column indicating the presence of recently advected STU into the Gulf of Mexico through the Yucatan Channel as the Loop Current. As this water mixes with the relatively fresh resident upper layers of the Gulf of Mexico, the salinity maximum becomes less pronounced. The Oxygen Minimum Zone for the Gulf is clearly seen at water depths between 200-800 m.

Hydrography

Composite T/S diagram

The T/S curve for the G01 cruise is shown in Figure X. Dissolved oxygen is shown in color.

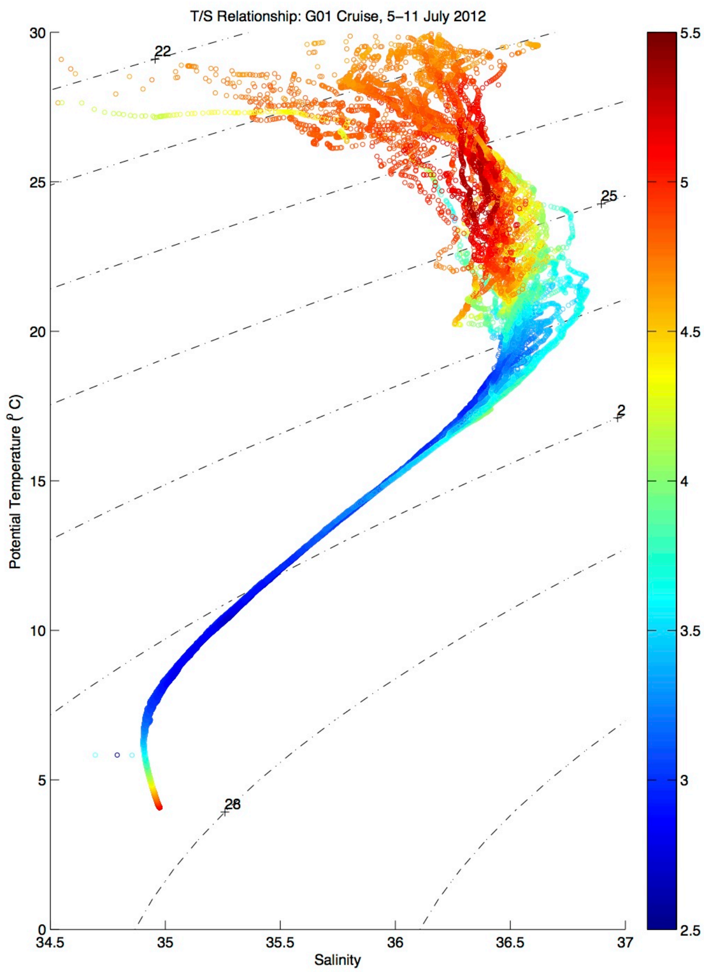

Figure X. T/S relationship for CTD casts taken during G01 cruise. Colorbar represents dissolved oxygen concentration (ml/l). Dashed lines indicate isopycnals.

Example Vertical Profile

Vertical profiles of each station were generated (example shown in Figure Y) and are available upon request from the GISR Data Manager or Chief Scientist.

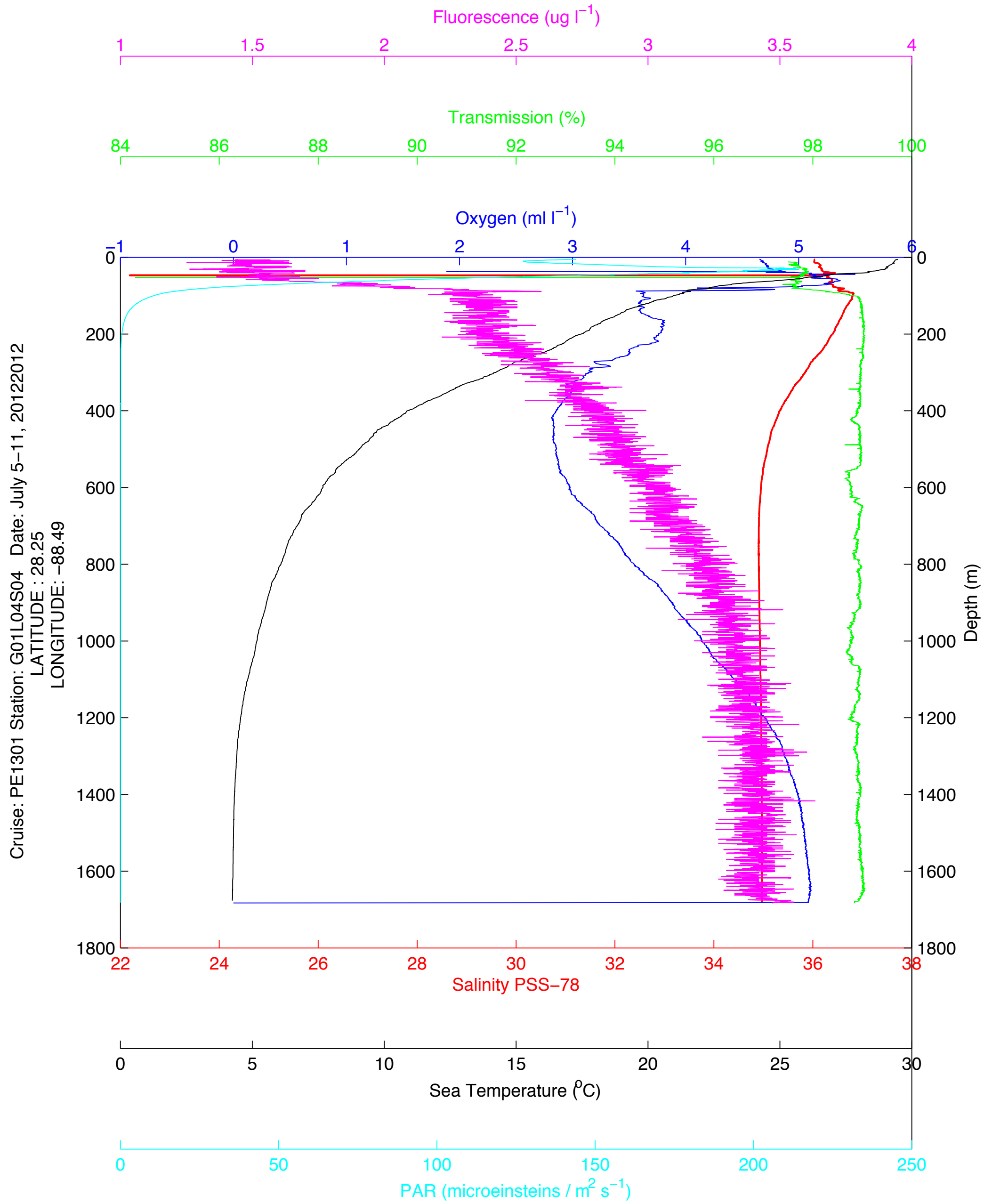

Figure Y. Example vertical profile from station G01L04S04 5 July 2012.

Vertical Section along axis of Mississippi Canyon

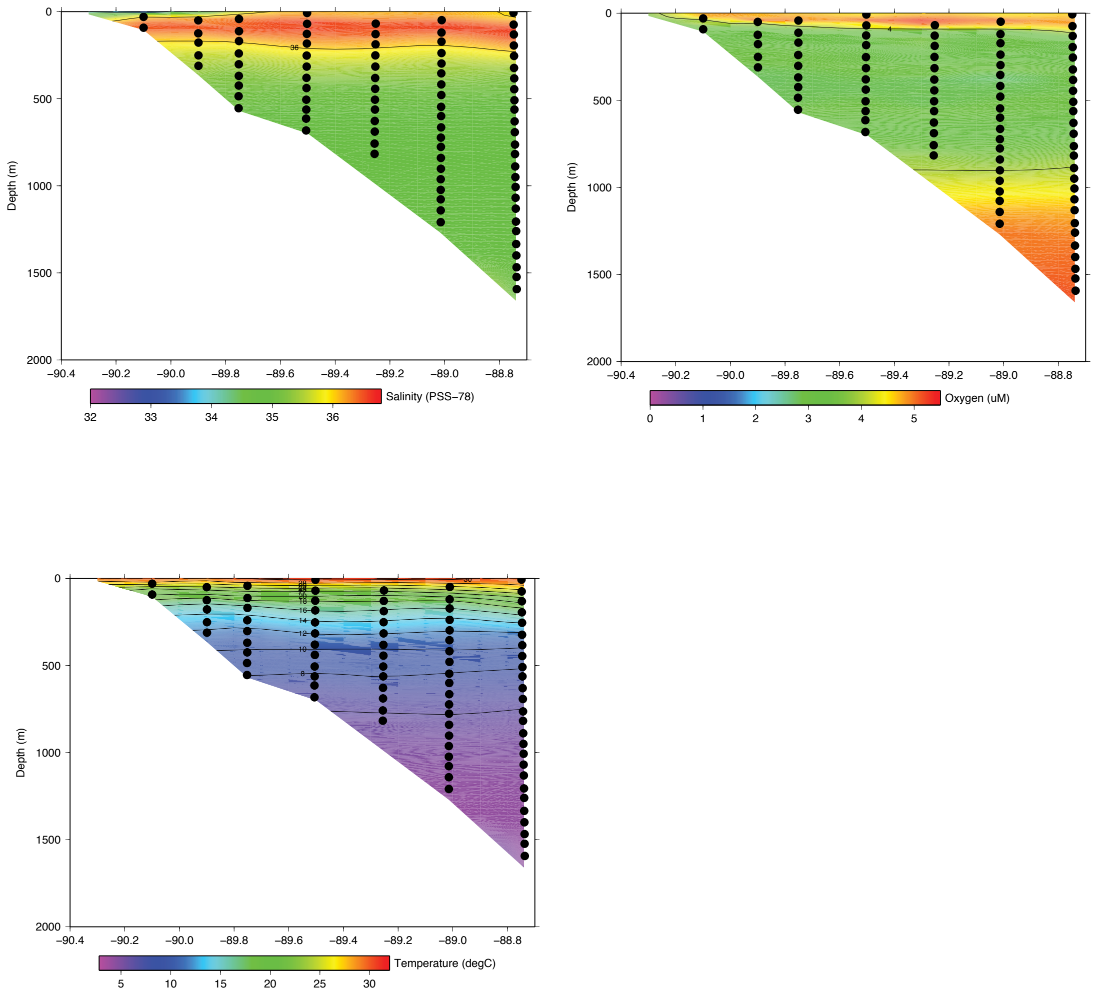

Figure Z. Vertical section of eight CTD casts during G01 cruise. West-most cast is station G01MCAN6, east-most cast is G01L2S05. The path of the section basically follows the axis of Mississippi Canyon.

GISR

BP Gulf of Mexico Research Initiative

Project: 02-462271-05001
Submitted by J. Walpert 13 March 2012

Mooring Fabrication Procedures

Six subsurface moorings are being fabricated in support of this project. Five of the moorings are 500m in length and one mooring is 1000m in length. Four moorings will be deployed in approximately 1500m of water on the Mississippi Fan, south of the Macondo Well site. One mooring will be in roughly 2000 m and one in roughly 1000 m depth. These moorings are in support of a much larger program that looks at the movement and dilution of dispersed oils when released at depth. Data from these moorings will be used to model the dispersion and dilution of an oil substitute (trifluoromethyl sulfer pentafluoride) over a two-year period. Each mooring will be deployed for a full year then turned around at sea.

The moorings are being fabricated from ¼" Validator 12 from Samson Rope which is a 12 strand Vectran co-polymer rope that has high strength (9,400 lbs break strength), low stretch, and a high specific gravity (sinks). It is easily spliced using a class II 12 strand splice available from Samson Ropes at
http://www.samsonrope.com/site_files/12S_C2_EyeSpl.pdf
Although the instructions call for a fid equal to the size of the rope, use either a 7/16" tubular fid or a ½" tubular fid for the ¼" rope. The ¼" fids are too small and will result in a weaker splice. There can be no shortcuts taken with this splice. Each finished splice is to be properly stitched using waxed stitching thread, whipped, and then covered using adhesive lined shrink tube with the line length printed on it. Final splices will be load tested to ~1500 lbs. When properly executed, this splice will maintain 90% - 100% of the original break strength of the rope.

Prior to splicing any piece of rope for these moorings, the stretch characteristic of the rope needs to be determined. This only needs to be done once per reel. To do this, measure 3 fid lengths from the end of the rope. Using a marker, make two lines around the circumference of the rope. Make an eye using a galvanized thimble by placing the two lines at the beginning of the eye (ear of the thimble). Use the marker to put a mark on the rope at the top center of the thimble. After the mark is made, put away the thimble. Pull the rope back through the counter until the mark is at the exit of the counter. Zero the counter before beginning the splice. Pull off enough rope to allow you to make an eye splice making sure your mark is at the top center of the galvanized thimble. After completing this first splice, use the line counter to measure off 33 feet of rope and put another mark on the line where it exits the counter. Make another eye splice (using a galvanized thimble) placing the mark at the top of the thimble. After both splices are complete, stretch out the rope (under about 13 lbs of strain) and measure the **EXACT** length of the finished rope. Record the length. Secure a 1-ton come along and a dynamometer to a forklift and the end of the rope to the hook on the come along. Attach the other end of the rope to the other forklift parked about 35 ft. away. Using the come along put 1000 lbs. of strain on the rope and holds the 1000 lbs for 5 minutes. Adjust the come along as necessary to maintain the 1000 lbs strain. After 5 minutes, measure the **EXACT** length of the rope while under tension and record this number. This represents how much the rope will stretch when deployed. The amount of stretch is important in determining final line lengths and where the instruments will be located in the water column. Once the line stretch has been determined, the final mooring line lengths can be calculated so mooring fabrication can begin.

Before beginning you will need the following:

1. ½" white adhesive lined shrink tube, permanent marker, heat gun
2. My splicing kit with proper fids, pushers, markers, scissors, sharp knife, waxed thread, sail maker needles, whipping twine, tape, splicing instructions
3. Flagging tape and marking pens to mark clamp on instrument positions
4. Galvanized thimbles and 4 Aanderaa thimbles
5. 6, wooden reels to spool the moorings onto
6. Cloth labels with twist ties or small tie wraps
7. Mooring listing
8. Instrument allocation list

NOTE: FOR ALL CLAMP ON/STRAP ON INSTRUMENTS. Thread a piece of flagging tape through the mooring line at the instrument location, tie in place and label with Instrument name, S/N and depth. This information is on the Instrument allocation sheet.

Except where specifically noted, all terminations will be made using galvanized heavy-duty 3/8" thimbles and lines will be measured from the top inside of the thimble to the top inside of the thimble.

After completion (including stitching and whipping), each termination is to be tested by picking up a two-wheel anchor. Watch for slippage around the ears of the thimble. A proper splice should not slip at all. There will be a very minor amount of stretch at the eye.

Completed moorings are to be spooled onto wooden reels with the top of the mooring going on first. Each in line instrument location is to be labeled using cloth tape and indicate Type, S/N and depth. This information is on the Instrument allocation sheet. Position is on the mooring listings.

Random mooring line sections will be selected and measured to confirm proper length.

If you are unsure of ANY procedure at any time, **STOP** what you are doing and ask. Do not proceed until your questions have been answered.

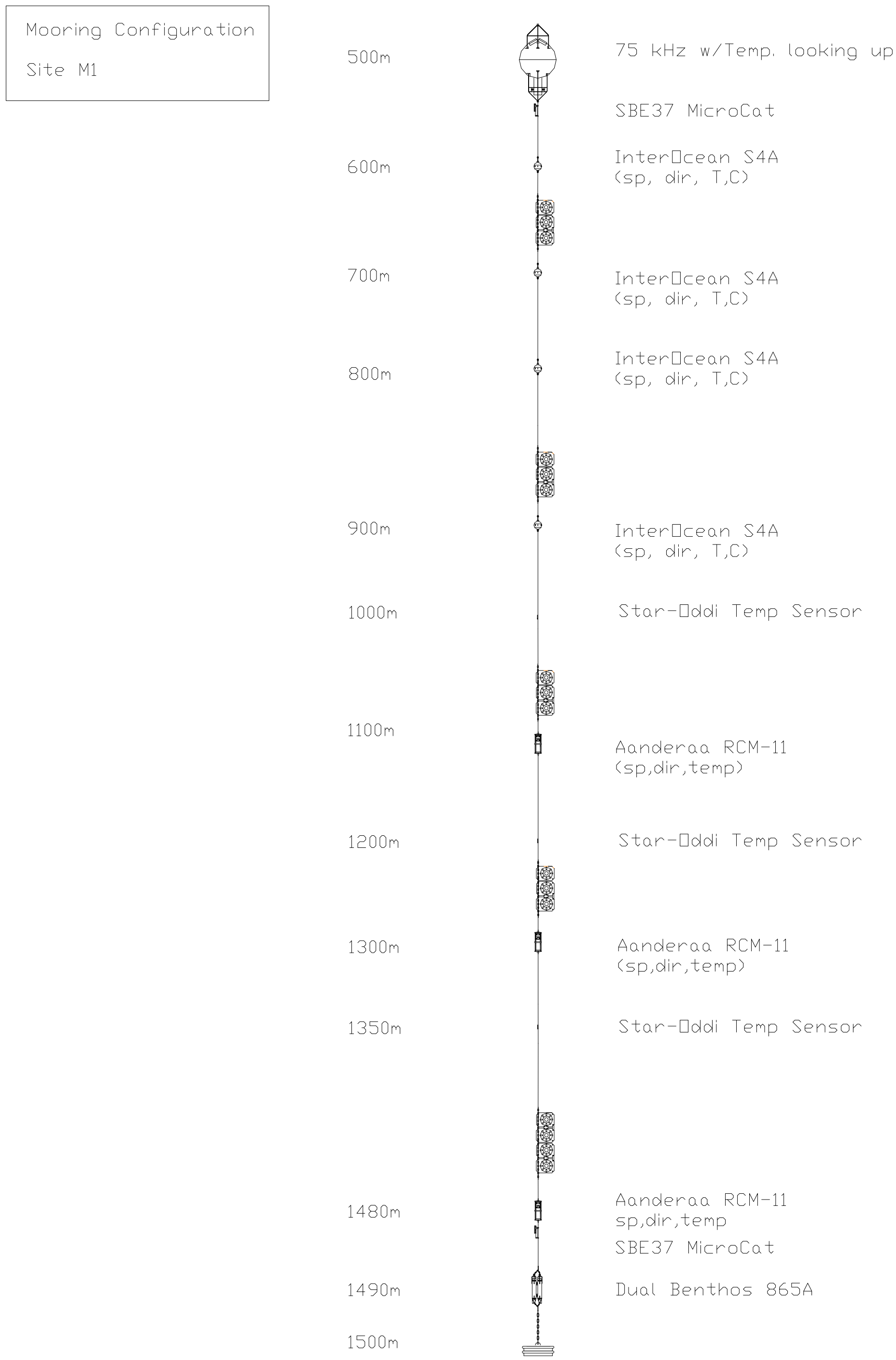

Figure M1. Full water column (central) mooring schematic. 1500 m water depth.

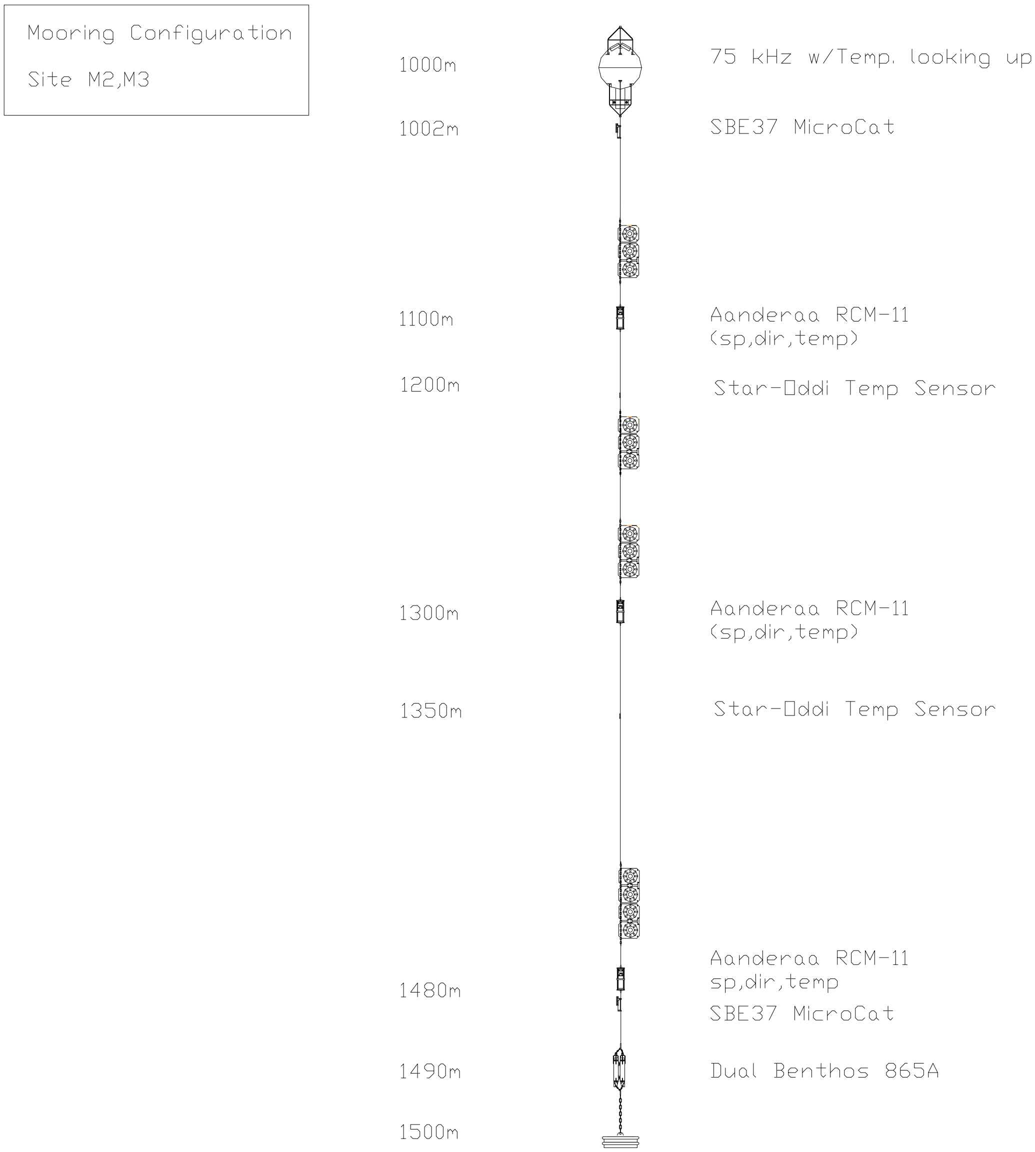

Figure M2. Short moorings, 1500 m water depth. Instruments extend 500 m from bottom.

4. F. Data Management Objectives

Summary of Approach

A sustained and dedicated data management activity is essential to the long-term preservation of the data, metadata and research results produced by the proposed work. Therefore, GoResCo will utilize an experienced Data Manager and supporting staff who will be responsible for meeting the requirements of the Gulf Research Initiative's Administrative Unit (GRI AU) for submittal and archiving of the full body of GoResCo's work. Additionally, the Data Management group will participate in the project effort by acquiring existing external environmental data sets for use in model assimilation and validation.

The RFP contained little guidance on GRI's data management requirements except for mention of the GRI AU Research Database and submittal and archiving requirements, which appear in RFP I Section III. In brief, they are:

- GRI AU will provide a public database to hold all GRI consortia data and metadata.
- Research Consortia (RC) are required to submit data and metadata to the GRI AU.
- RC are required to submit data and metadata to appropriate federal repositories.
- RC are required to submit evidence to the AU of submittals in 2 & 3 above.
- Video data must be tagged with appropriate information to be included in the submittal.
- Data and metadata should be submitted with minimum delay.

We understand the Research Board, in consultation with the GoResCo directors and the GRI AU, will develop appropriate formats and procedures for the GRI Research Database and once developed, GoResCo will be required to adhere to all GRI data policies. We anticipate the GoResCo Data Manager will be directly involved in these discussions as the GoResCo's representative.

It is unclear if the Research Board and GRI AU will develop data management policies and practices that apply beyond interactions with the GRI Research Database, (e.g., data sharing with the public, monitoring and reporting inventory, submittal to clearing houses, etc.). The following paragraphs describe GoResCo's approach to data management practice and data management issues. If GRI AU develops requirements or data policies at a later date which conflict with our approach we will modify our approach to conform with those of the GRI AU. After contract award GoResCo Data Management will develop a written plan for project data and review it with GRI AU.

In general, we will conduct data management practices in a manner that are aligned with the current data management practices of the National Science Foundation (NSF) and the National Oceanic and Atmospheric Administration (NOAA). We will follow evolving cyberinfrastructure developments in both the Ocean Observatory Initiative (OOI) and the Integrated Ocean Observing System (IOOS) and adopt their practice where appropriate. We work cooperatively with the National Coastal Data Development Center (NCDDC) on a number of projects and will continue to do so in GoResCo. We are closely aligned with the Gulf of Mexico Coastal Ocean Observing System (GCOOS), which is well-connected to the major observing systems in the Gulf of Mexico. The bulk of our data and model output will involve physical oceanographic, marine meteorological, and oceanic and coastal marine biogeochemical parameters. For these types of parameters the above agencies, groups and practices constitute the encompassing data management community.

Types of data, samples, physical collections, software and other materials produced

This section describes the GoResCo materials that will be submitted to the GRI AU Research Database and archived with a federal repository. In brief, we will submit and archive (1) model codes together with initialization fields and runtime parameters, (2) numerical model hindcasts for the time period of the Deepwater Horizon release and (3) original environmental data from the field experiments.

Model Codes

The Integrated Multi-scale Modeling System is a series of nested and associated numerical models to predict the trajectory and fate of discharged oil. These models will be customized for and tuned for the Gulf of Mexico and represent a major outcome of the project work. The model codes that constitute ROMS-WRF, SABGOM, ROMS-Shelf, SUNTANS, two new near-field models (HYDRO3D and SIMP), and LTRANS together with initialization/assimilation fields, forcing fields, run-time parameters and documentation will be submitted to the GRI AU within 30 days prior to the end of the project.

Deepwater Horizon Hindcast

To validate the general circulation models, GoResCo will produce a hindcast of the ocean circulation surrounding the time of the Deepwater Horizon blowout. These fields will likely be of particular interest to other GRI-researchers that do not have a modeling component. GoResCo will offer a web based trajectory service via LTRANS however others may wish to use the hindcast fields directly. The output may be prohibitively large and GRI AU may elect to link to our servers rather than host the hindcast files themselves. Output will be stored in NetCDF files and made available in a variety of formats and subsets through a GoResCo THREDDS server. The hindcasts will be submitted to GRI AU within 30 days of their completion in Year 2.

Environmental Data Sets

GoResCo will collect a variety of observational data during the Multi-scale Field and Laboratory Experimental Suite of experiments. Instrument platforms include remotely operated vehicles (ROV), CTD profilers, water samples from grab samples, flow-through systems, and Niskin bottles, neutrally-buoyant floats, integrated grab samplers, tow-fish tracks and profiles, drift cards, aerial observations, floating and moored buoys, subsurface fixed moorings, subsurface profiling moorings, hullmounted instruments on the research vessels. Sensor types include video, probes (conductivity, oxygen, etc.), acoustic (current profiles and depth sounders), *in situ* chemical analyses (e.g., mass spectrometry), and laboratory chemical analyses (e.g., dissolved organic matter, carbon chemistry). *In situ* measurements will be submitted to the GRI AU within two months of collection and laboratory analyses will be submitted within three months of collection in the field.

Data and Metadata Standards

The expression of data and metadata are increasingly being standardized. This increases usability and enables automated machine-to-machine exchanges, i.e. interoperability. Most researchers are familiar with standard units (SI) and binomial nomenclature for species names. Fewer are familiar with controlled vocabularies for measured parameters and metadata content standards. All researchers are familiar with issues surrounding data formats. The Data Management group will be responsible for submitting and archiving data and metadata according to the following standards.

Units. We will use standard units when reporting parameter values except where the oceanographic community practice is otherwise.

Controlled-vocabulary. We will use the NetCDF Climate and Forecast (CF) Metadata Conventions Standard Names for modeled and measured parameters with extensions from the IOOS Parameter Vocabulary for oceanographic terms not present in the CF Standard Names. We will create names for terms not appearing in either list (if needed) using the CF naming conventions.

Metadata. Content standards for metadata refers to the various pieces of semantic metadata deemed important by users. Different communities or classes of users will have different needs. Minimum semantic metadata are location (latitude, longitude, vertical position), time and units. Auxiliary metadata might include data originator, instrument type, platform, owner, etc. There are many content standards. In the United States, federal programs involving data with strong geospatial content (such as ours) are required to follow the Federal Geographic Data Committee's (FGDC) standards. FGDC is transitioning to an international standard, the North American Profile (NAP) of the ISO 19115 Geographic Information metadata model. We will use the NAP. We expect a list of desired auxiliary metadata to be worked out in agreement with the GRI AU. Our encoding will be FGDC/NAP compliant and we will build the metadata record using NCDDC's Metadata Enterprise Resource Management Aid (MERMAid) to generate, validate and manage metadata.

Formats. Model output will be stored in NetCDF containers according to the CF conventions for naming and array packing (time, depth, latitude, longitude). Observed data will be formatted to suit the consumer. Common data formats include comma-separated variables (CSV) in flat ASCII files, excel spreadsheets, Matlab files, ESRI shape files or coverages, and NetCDF. Video formats and image formats will be developed through discussions with GRI AU.

Policies for accessing and sharing data

Our default policy is one of free open public access to all data and metadata collected by the project with a minimum of delay. We do not envision collecting any data that would be considered private or confidential. Data and model output do not constitute intellectual property in this project. Our only security issues will be to guard against data loss and our computer systems against unauthorized access. We will reply on campus firewalls, strong passwords and good information technology practice to prevent unauthorized access. In the absence of GRI AU requirements to the contrary we propose to release data and model output to others without notifying or reporting such activity to GRI AGU. We will not log or document who has requested or gained access to data or model output except as incidentally occurs in webserver logs. We will not to collect or report access metrics for this project.

The minimum delay time will be shorter for the GRI AU and the public and longer for the national repositories for reasons of quality control and quality assurance (QA/QC) processing. Some data will be released in near real-time with little or no QA/QC. Some data will be released in near real-time with near real-time QA/QC applied (i.e. historical range limit checks, rate-of-change checks, stuck/dead sensor flagging). Some data will have preliminary delayed-mode QA/QC applied (i.e. wild point editing) before release. In some cases, data issues are not discovered until researchers begin to use the data in aggregation with other data (e.g. disagreement on wind or current direction with nearby sensors). Additional QA/QC processing might include post-calibration trend removals. Ultimately data are ready for long-term archiving at a trusted long-term digital repository.

We understand several consortia will be funded by the GRI and work will be conducted in parallel. It is likely that the results of this proposed work may be of benefit to other GRI-funded consortia, and vice versa. Since the benefit may be time sensitive, we are prepared to release data with any level of QA/QC. We will assign version numbers to each data set and advance the version numbers as data move from one QA/QC step to the next. Version numbers will be documented in the metadata as well. This will allow users to know which version of the data set they are using and if revised versions are available.

We envision several access pathways to project data and model output. In principal, if GoResCo submissions to the GRI AU with minimum delay, all requests for data or model output could be directly serviced by the GRI AU data center. In practice, requestors may be more familiar with the GoResCo project or project personnel than the GRI AU data center. We will likely be a fulfillment center as well. Project researchers will maintain their own original and working copies of data and model output. GoResCo Data Management will maintain a central server for model output, for forcing/assimilation fields and for project data. This will allow the Data Management team to prepare data, metadata, and model output for submission to the GRI AU and federal repositories. It will also be a resource for Project

Management to use to monitor and report project progress. We expect frequent informal data exchanges between GoResCo researchers. We expect the Data Management team will service requests from outside GoResCo, be they GRI-researchers or others. During the project performance period data may stream from several sources including project websites.

Policies and Provisions for Data Use

Our default policy for data use by others is one of open sharing with a minimum of delay. We recognize GoResCo's researcher's needs to have time to deliberate and properly prepare valid data. We therefore must strike a balance between releasing data before it has been properly examined and the point where significant additional effort yields only incremental improvements in data quality. We also recognize that the data originator should have the first and best opportunity to publish on their data. However, in keeping with GRI policy that data will be released to the public with minimum delay, in most cases this will precede the originator's ability to publish on the data. It has been our experience that releasing data to the public early rarely leads to opportunistic publication by persons not directly involved in the collection. However, we will ask, in the accompanying metadata, that individuals using the data consider contacting the data originator and having a discussion about authorship or joint authorship to minimize conflicts. Although it is not common practice, there has been discussion in the scientific community about publishing datasets in ways that can be cited. We will pursue this as well. In all cases of publication, products, or re-use we will ask that data users acknowledge the project and the funding agency.

Archiving

The models, selected model output, and quality-controlled data will be archived at the National Ocean Data Center (NODC). Archiving models and model output is a new service at NODC and we may be the first to archive model output with them. Immediately following contract award we will negotiate an archiving agreement with NODC with agreements on the format, media and method of transmittal of the data and model output. At that time we will request a NODC Project Code. All data and output will be labeled with the NODC Project Code before archiving. An NODC accession number will be assigned at the time of archiving. A copy of the executed archiving agreement and the accession number will be reported to the GRI AU. Essential metadata and maps and will be submitted to Geospatial One Stop. Data will be archived at NODC when they have reached final form but no later than 30 days prior to the end of the program.

4. G. Management Plan

Internal Organization

With 20 Principal Investigators and a number of other senior researchers from ten institutions, it is clear that a formal management plan is required for the successful execution of this program. The majority of the PIs come from Texas A&M University (TAMU), and the day-to-day organization of the program will be run by a small group of TAMU personnel (Chapman, DiMarco, Hetland and Socolofsky). These four people will also head the operational committees for fieldwork, modeling and laboratory work respectively. Howard (TAMU) will head the Data Management Group. He has many years of experience in handling, performing QA/QC, and disseminating oceanographic data and is in charge of data management for the Gulf Coast Ocean Observing System (GCOOS), a component of the national Integrated Ocean Observing System. However, all institutions involved in the program will be represented in the Steering Committee. In this table, Field/Model/Lab represents the main activity of each member of the consortium. However, they will all contribute to each aspect of the program, particularly during the synthesis and analysis work.