

First Institute of Oceanography, SOA Qingdao - China

A “TAO” Hybrid for the Indian Ocean

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Discussion Outline:

- Introduction/Background
- Project
- The Buoy & Mooring
- Sensors
- Buoy Logger and Telemetry
- Deployment
- Data

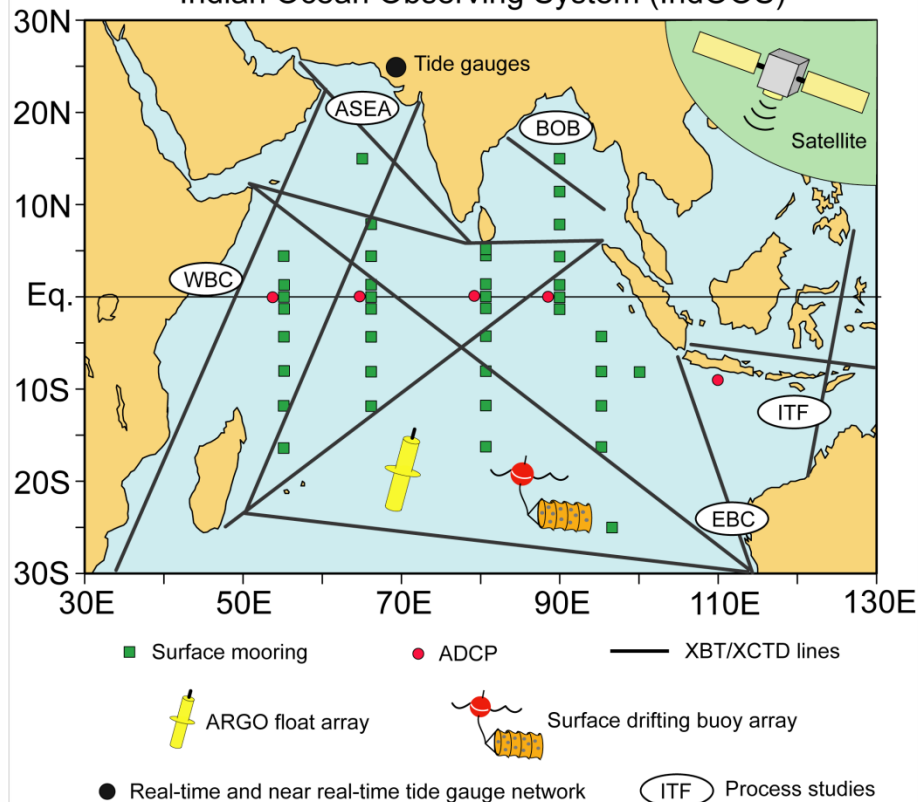
Dr. Weidong Yu and Staff: FIO



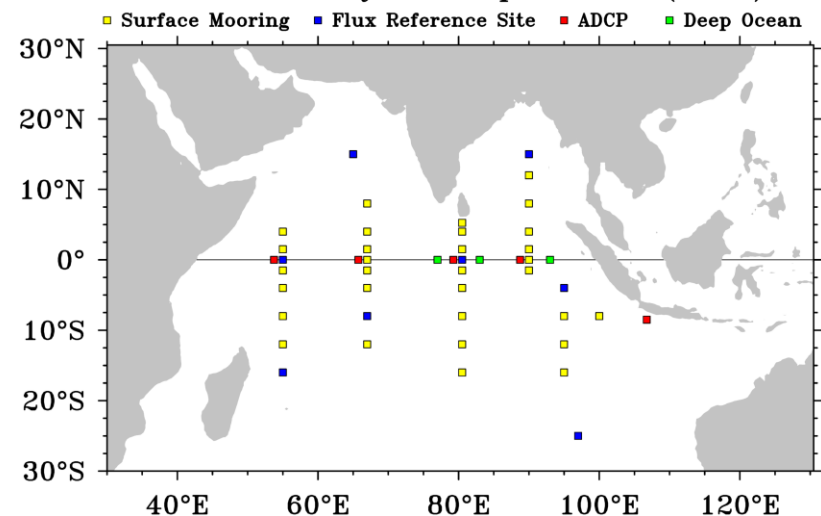
Agency for Marine Fisheries Research, Jakarta

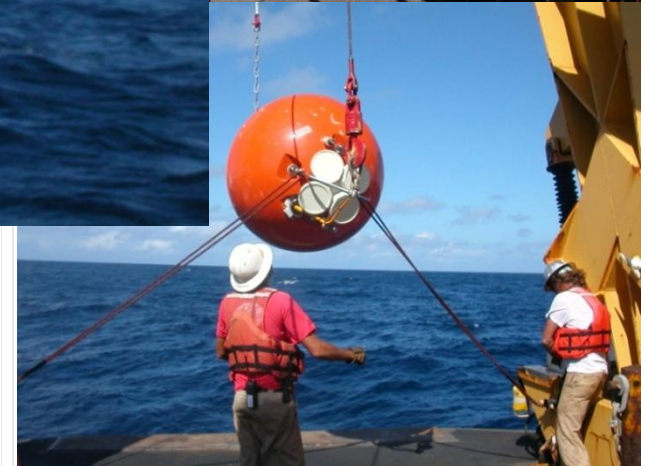
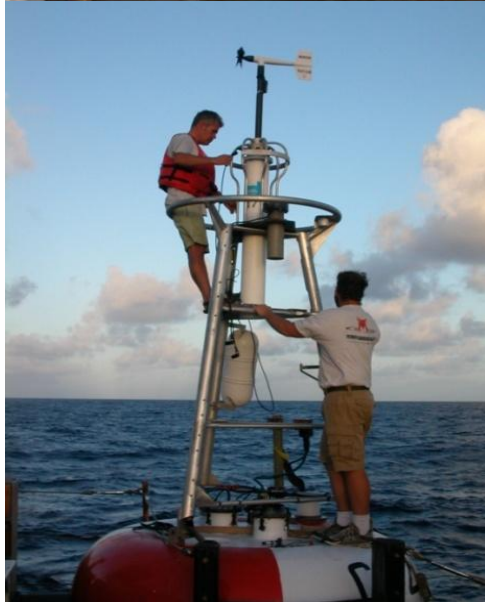
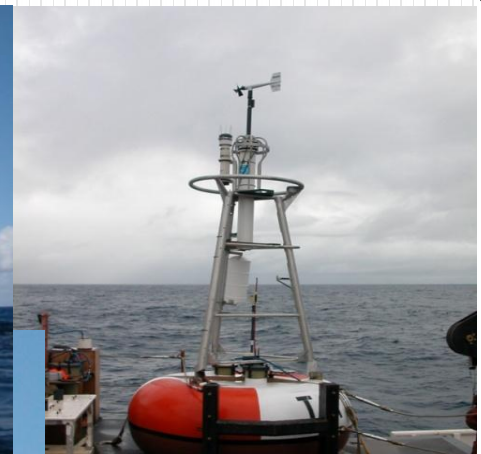
IndOOS and RAMA Programs

Indian Ocean Observing System (IndOOS)



Research moored Array for African-Asian-Australian Monsoon Analysis and prediction (RAMA)

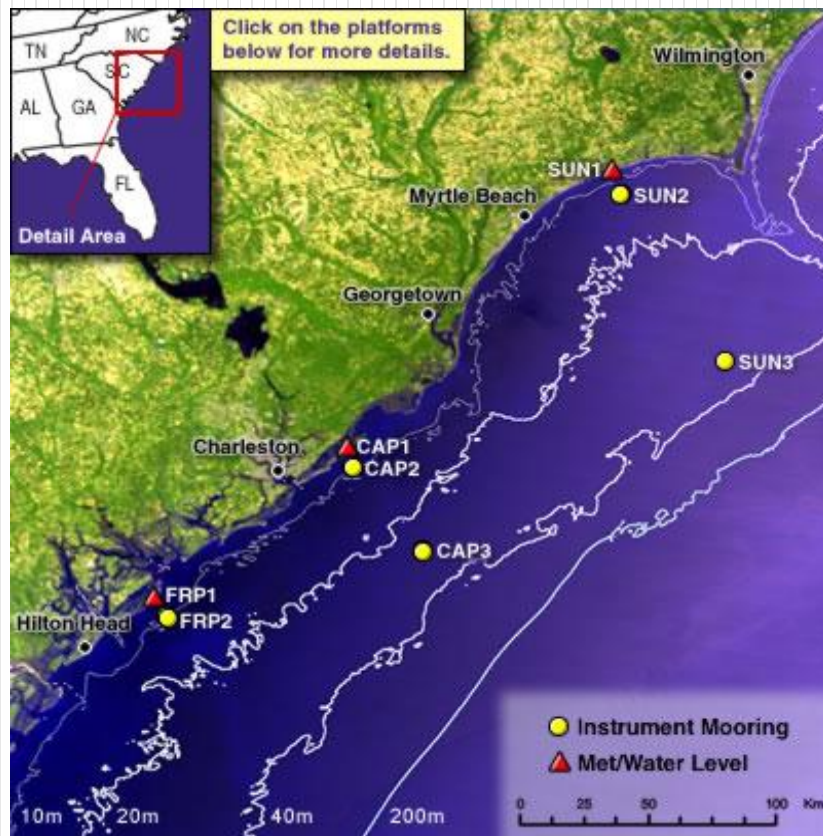




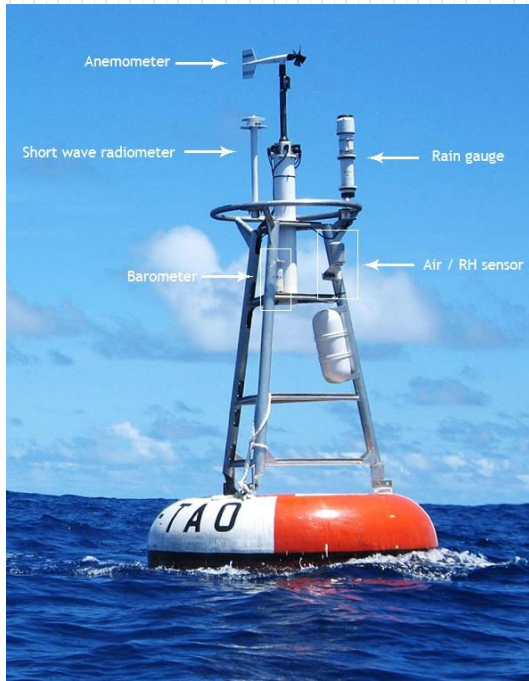
EPOCS, TOGA, TAO and WOCE

2010 DBCP Workshop, Oban, Scotland

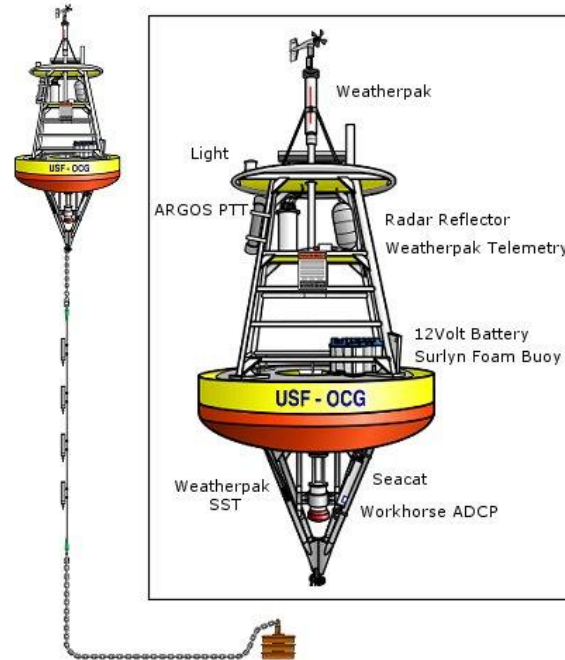
FIO-RAMA-BUOY System Ideas



FIO RAMA Buoy Evolution



NOAA – TAO
(Courtesy of NOAA-PMEL)

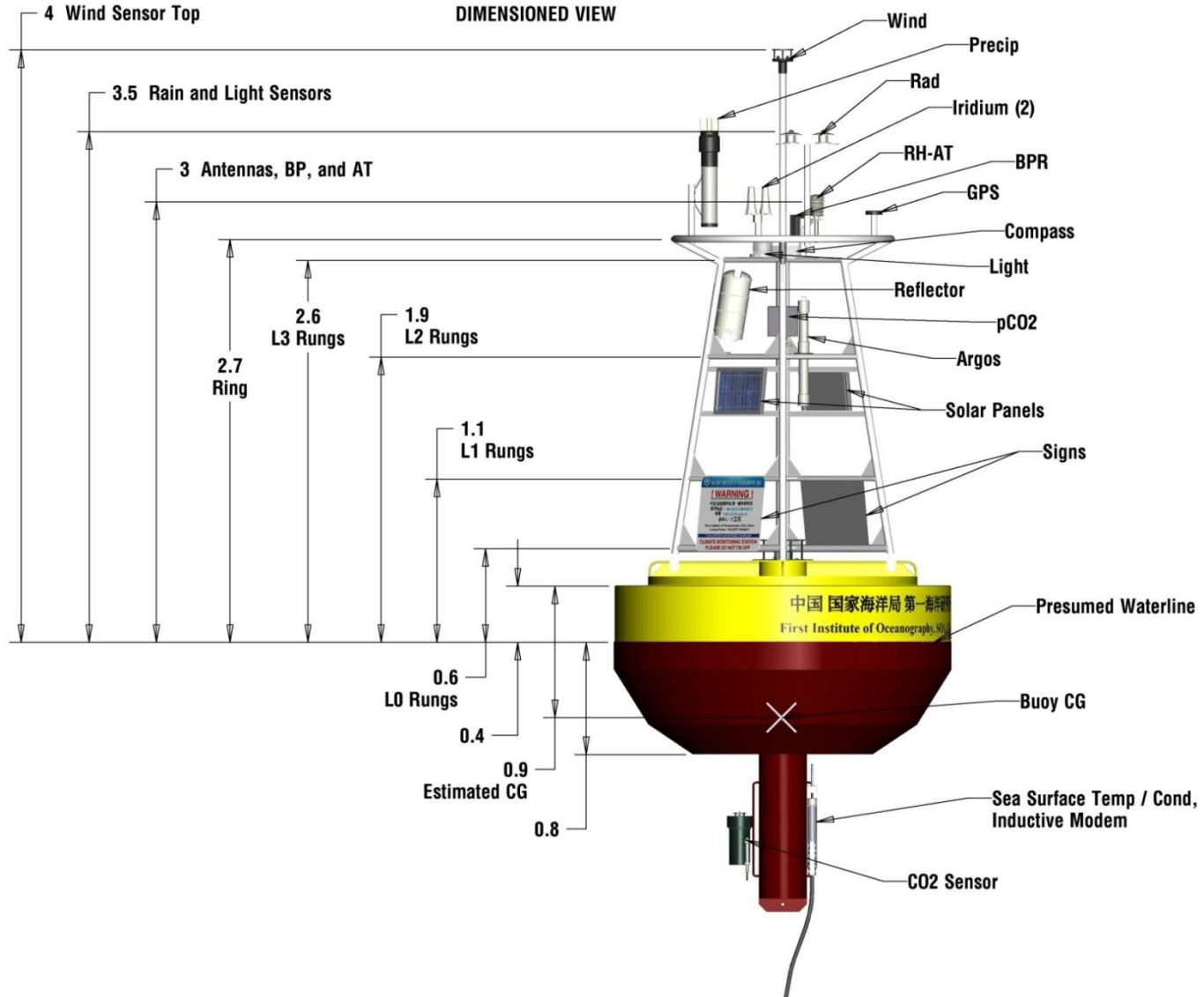


USF – COMPS
(Courtesy of USF)

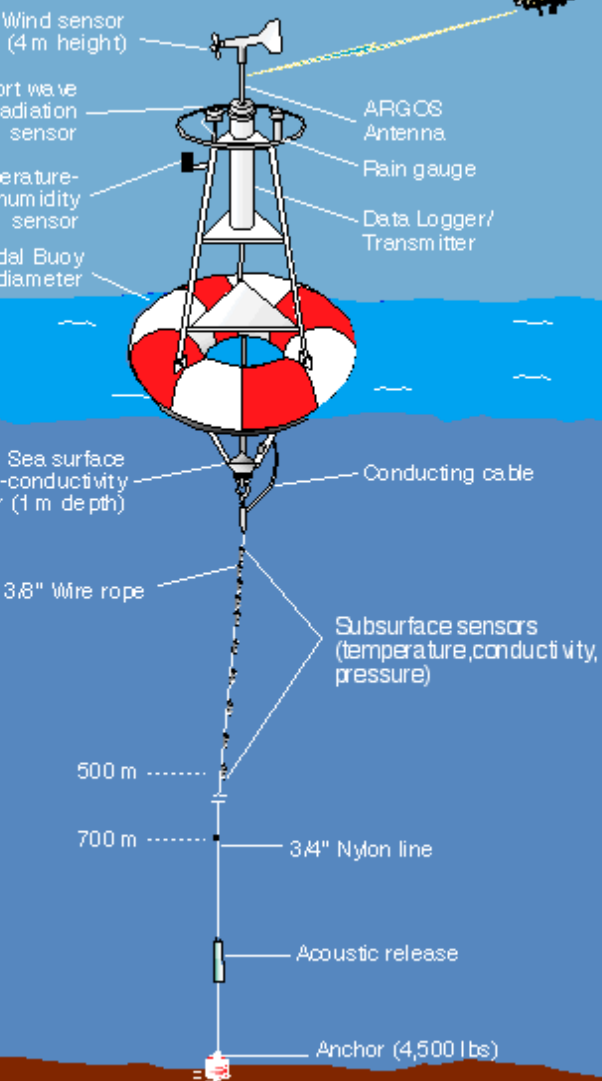


CaroCOOPS
(Courtesy UNCW)

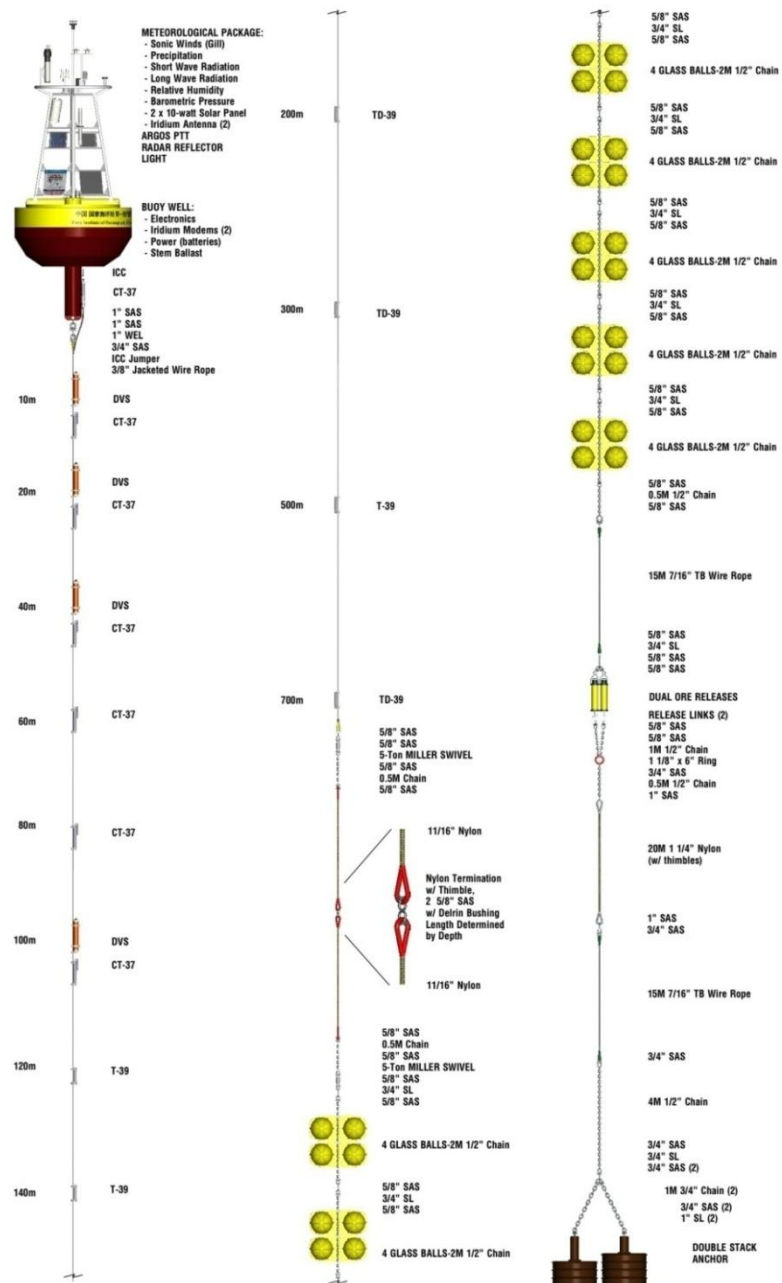
FIO-RAMA-Buoy Configuration



Next Generation ATLAS Mooring



300



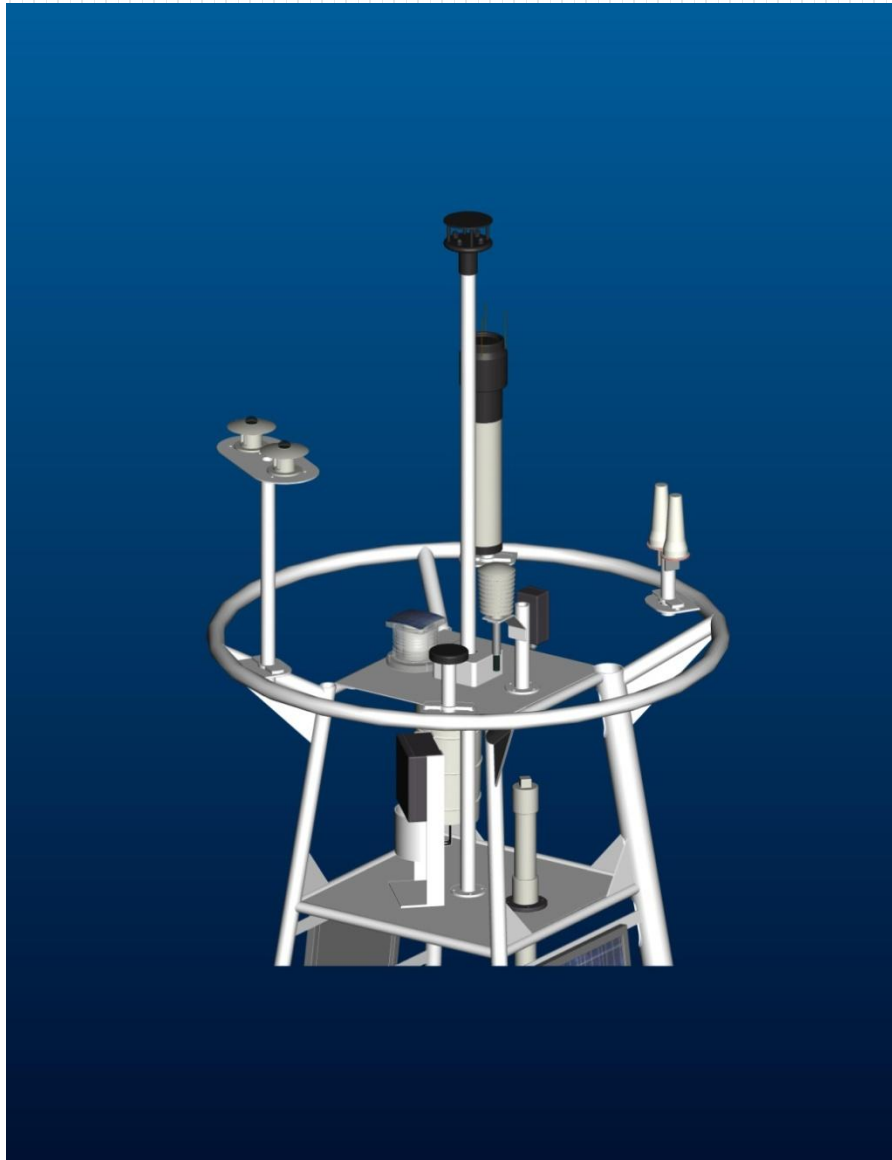
Buoy Build



Complete Systems Test, In Air and Wet



Surface MET: TAO Configuration

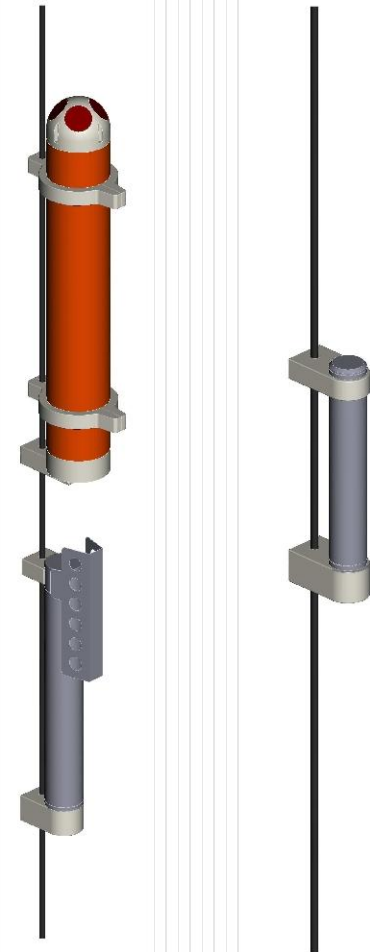
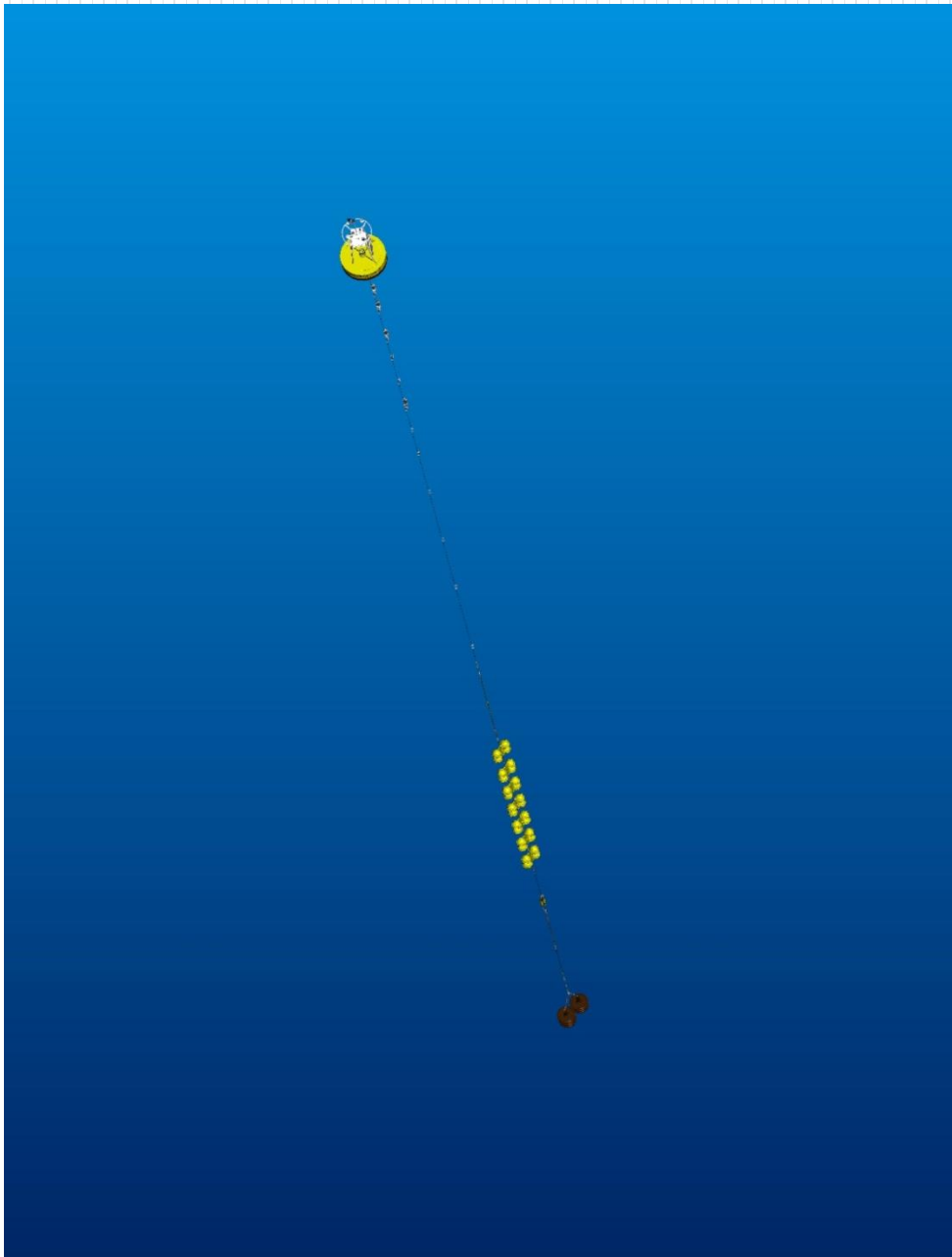


- Sonic Winds
- Air Temp
- Relative Humidity
- Barometric Pressure
- Short Wave Radiation
- Long Wave Radiation
- pCO₂
- Argos Beacon
- GPS Antenna
- Iridium Antennas

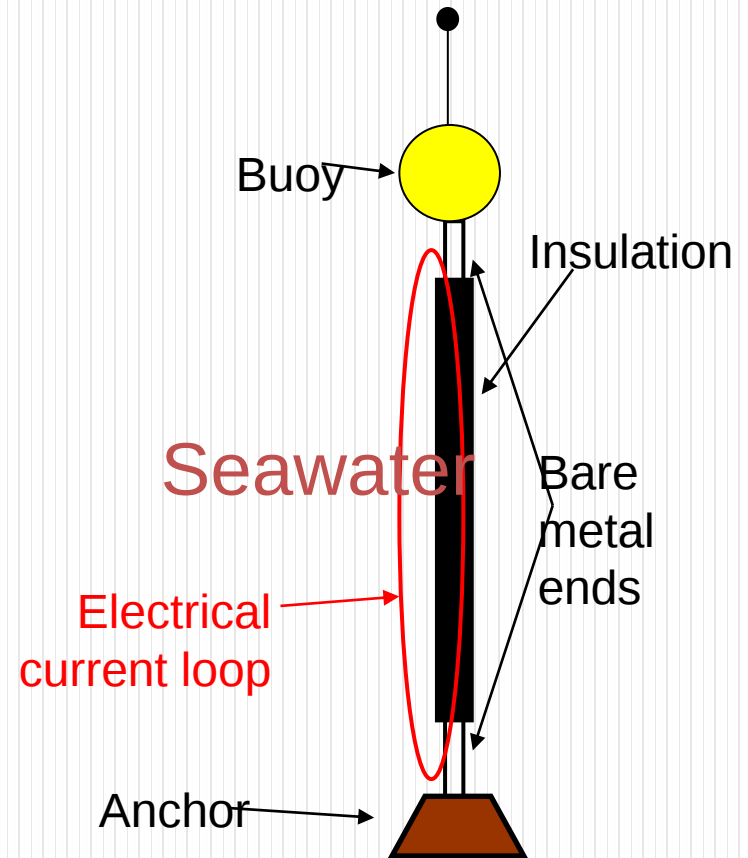
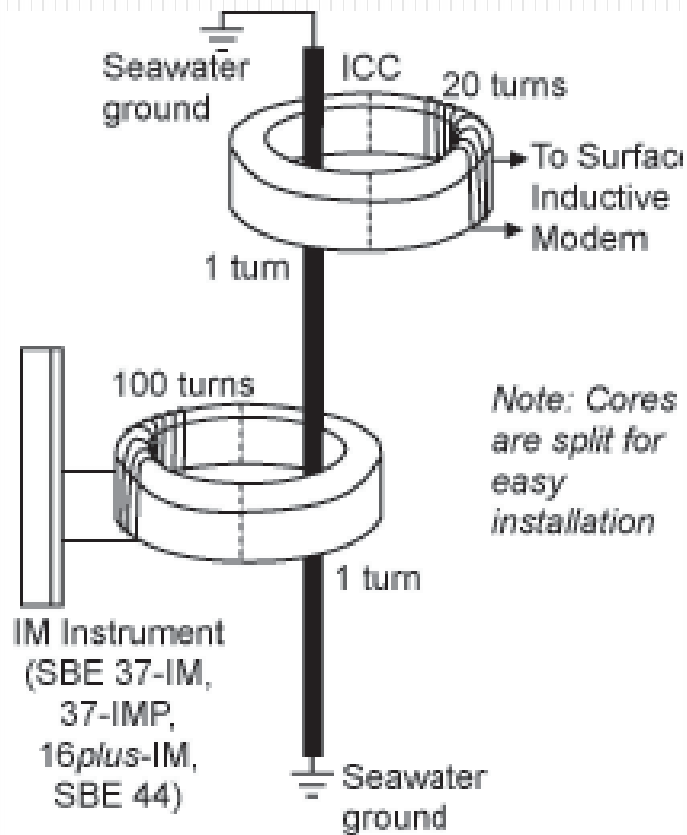
Sea Surface CO₂ Measurements



Doppler Volume Sampler (DVS) SBE-37IM-MicroCat SBE-39IM-MicroCat



Each Instrument has It's Own Inductive Modem Module (IMM)



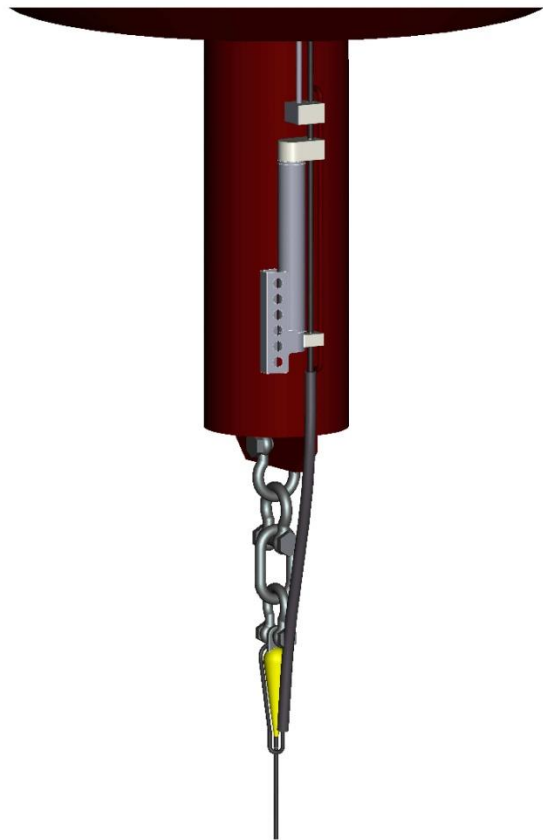
Inductive Coupling



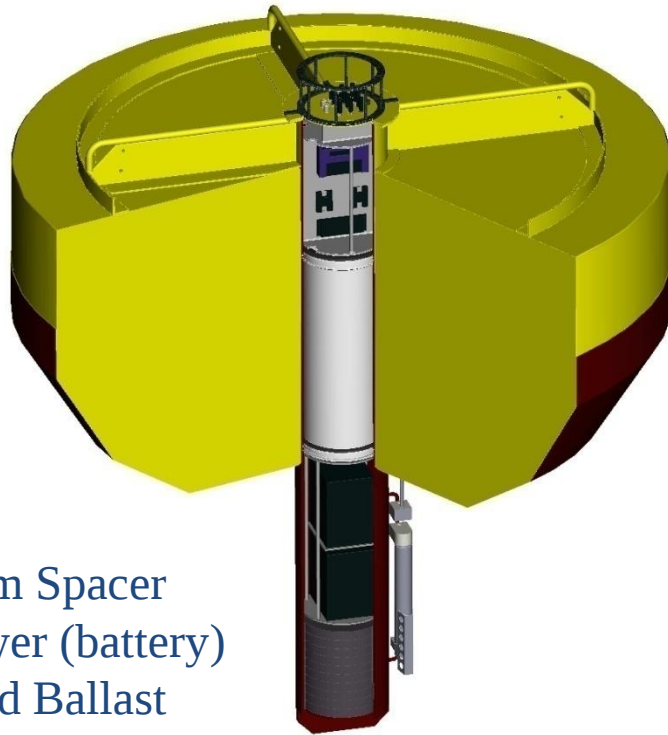
NOAA – PMEL Inductive Connection
Successful Since the Mid 1990's



ICC Connection (Jumper)



Data Logger and Telemetry



- Stem Spacer
- Power (battery)
- Lead Ballast



DataTaker
DT80G

Dual
Iridium
Modems



IMM Sensor ID Configuration

<u>ID</u>	<u>Instrument</u>	<u>Depth</u>
01	SBE-37	1 m
02	SBE-37	10 m
03	SBE-37	20 m
04	SBE-37	40 m
05	SBE-37	60 m
06	SBE-37	80 m
07	SBE-37	100 m
08	SBE-39	120 m
09	SBE-39	140 m
10	SBE-39 w/ pressure	200 m
11	SBE-39 w/ pressure	300 m
12	SBE-39	500 m
13	SBE-39 w/ pressure	700 m
14	DVS	10 m
15	DVS	20 m
16	DVS	40 m
17	DVS	100 m

Logger Control Strategy

SCHEDULE

C
D
E
F
G
H
I
X

DATA

10 minute interval – MET Suite, SBE
1 hour interval – Avg. MET, SBE
3 hour interval – CO2
DVS ID #14 – Most recent ensemble
DVS ID #15 – Most recent ensemble
DVS ID #16 – Most recent ensemble
DVS ID #17 – Most recent ensemble
8 hour interval - GPS

Ten Minute Schedule:

2009/06/04 15:12:15.4 18.61 1013.9 57.73 3.2 4.5 258.0 -0.23804 18.43 18.49 7.10756 24.0
0.0003 17.5457 332.0
0.0003 17.5480 308.0
0.0003 17.5450 308.0
0.0003 17.5588 308.0
0.0018 17.5450 431.0
0.0002 17.5718 404.0
0.0002 17.5693 402.0
17.5588 404.0
17.5320 404.0
17.4877 -0.006 450.0
17.4907 -0.016 407.0
17.5500 404.0
17.6150 0.057 404.0

One Hour Schedule:

All data values, with the exception of the DVSs, in the one-hour schedule represent the hourly means of the ten-minute measurements over the previous hour.

2009/06/10 12:00:11.9 12.7 6.78 -22 3.6 17.20 1013.1 63.84 3.2 4.1 270.0 -0.23804 16.81 16.83 7.10756
0.0003 16.7395
0.0003 16.7562
0.0003 16.7663
0.0003 16.7764
0.0018 16.7689
0.0002 16.7605
0.0003 16.7537
16.7406
16.7606
16.7762 -0.029
16.7815 -0.040
16.8067
16.8667 0.039

Three Hour Schedule:

The three-hour schedule polls the pCO₂ sensor for its most recent data record.

2010/01/08 03:00:33.1 47142 42483 661.90 54.4 20.8 28.3 1029

Where:

2010/01/08 03:00:33.1 – DT-80 Timestamp, YYYY/MM/DD HH:MM:SS.T

47142 – Raw zero counts

42483 – Raw CO₂ counts

661.90 – CO₂ in ppm

54.4 – Detector temperature, Celsius

20.8 – Water Vapor Pressure, mBars

28.3 – Humidity temperature, Celsius

1029 – Detector gas stream pressure, mBars

Eight Hour Schedule:

The eight-hour schedule collects latitude, longitude and UTC data from the on-board GPS receiver.

2009/06/10 12:02:26.0 3645.5537 N 08048.7260 W 12 02 26 A

Where:

2009/06/10 12:02:26.0 – Timestamp, YYYY/MM/DD HH:MM:SS.T

3645.5537 - Latitude, ddm.mmm

N - Latitude Hemisphere

08048.7260 - Longitude, dddmm.mmm

W - Longitude Hemisphere

12 02 26 - UTC Time, hh mm ss

A - Status, A = valid position, V = position warning

DVS Data Record

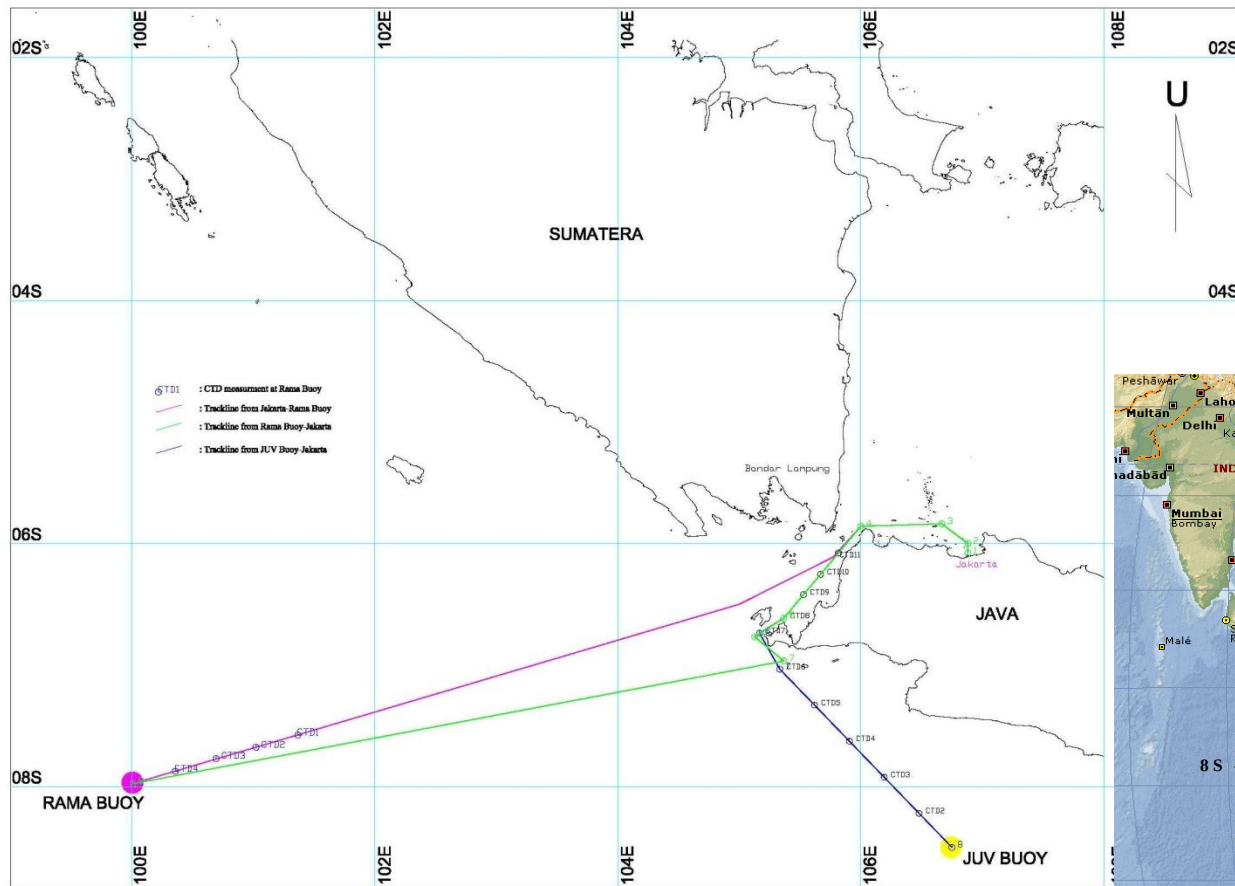
2009/06/10 12:00:12.3 7F8AA502063F81740000D907060A0B040A010092040000012202015E
5884FDEEA8E40080BC3F0000000000800300336200803900000000801F3200AEFF01008205
00800080008000800080008000800080008000800080008000800080008000800080008000800
08038534354385343543853435438534354385343540606060B0606060B0606060B0606060B0
606060B0000640000006400000064000000640000006400E221

2009/06/10 12:00:18.3 7F8AA502063F818D0000D907060A0B37000100BD0400000222020154E
68034EEA8E400805640000000000800500356000807A00000000801F3200AEFF01008205008
0008000800080008000800080008000800080008000800080008000800080008000800080008052
4C403F524C403F524C403F524C403F524C403F06070707060606060707070706060606060606
060000640000006400000064000000640000006400BA21

2009/06/10 12:00:22.2 7F8AA502063F81A10000D907060A0B3700010092040000012202015A
B98818F1A8E40080BC400000000008005002B6300803500000000801F3200AEFF01008205
00800080008000800080008000800080008000800080008000800080008000800080008000800
08041514A4D41514A4D41514A4D41514A4D41514A4D06070706060606070707070706060
6070707070000640000006400000064000000640000006400C421

2009/06/10 12:00:26.0 7F8AA502063F81740000D907060A0B0216010092040000012202015D
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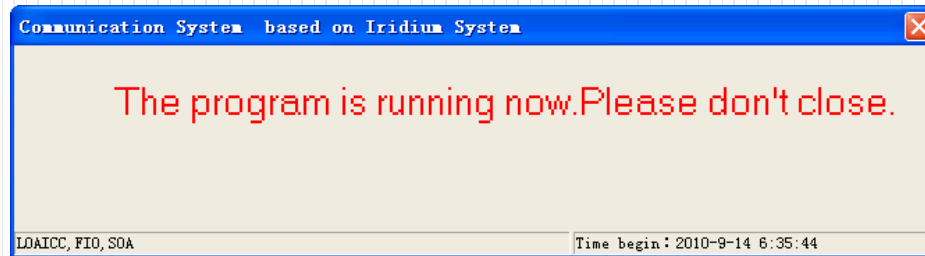
Deployment Location: 8S/100E – Indian Ocean



Communication System at FIO Lab, Qingdao



Communication System Program



- Unmanned program
- Auto creating log file and data file

Communication Protocol

- Initialization module
- Communication module
- Receiving module
- Logging file module
- Abnormal exit module

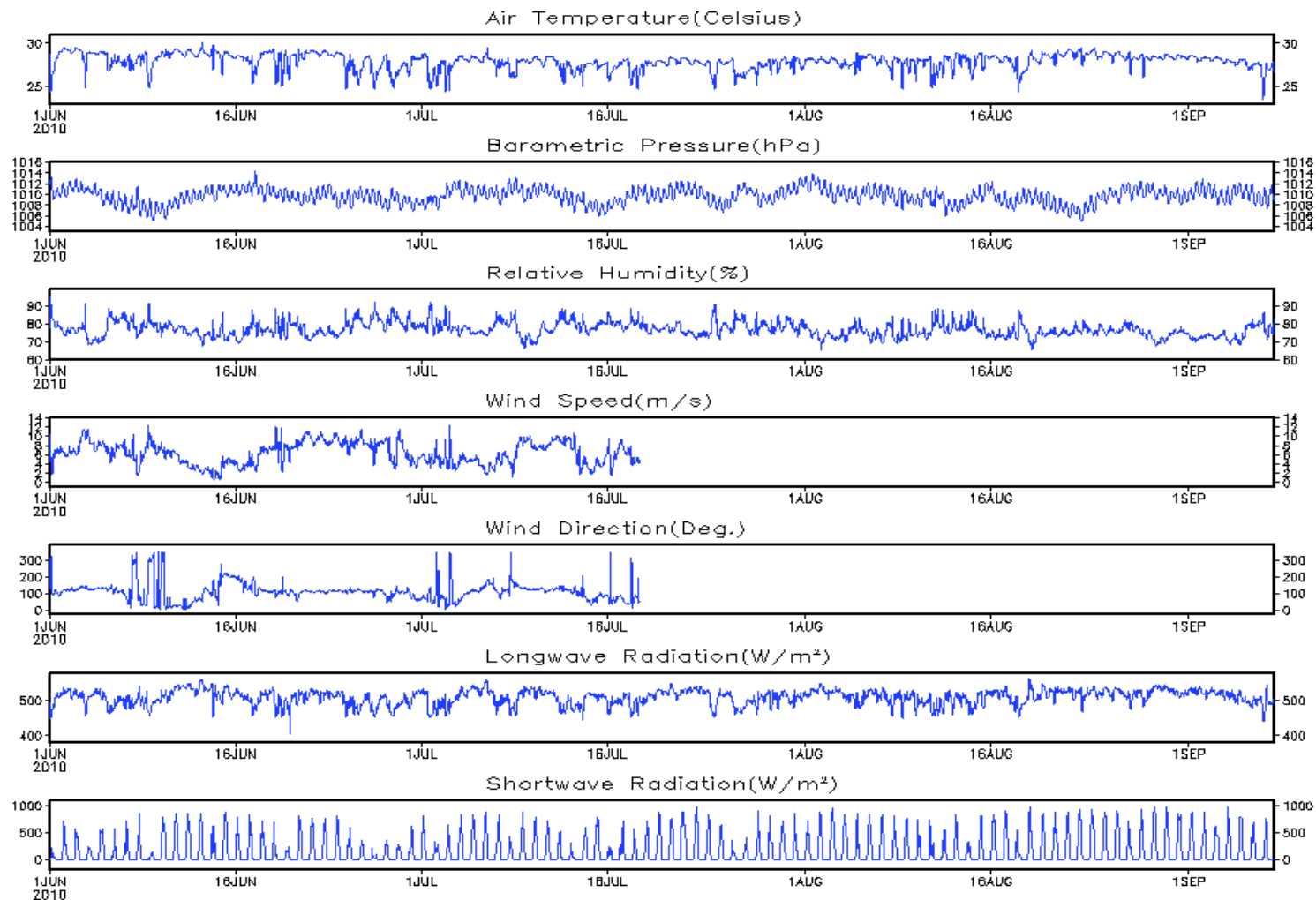
FIO Buoy Website: <ftp://ftp.org.cn/>

- Provides the daily 8S,100E 24hr Averaged data
- Updated every day.
- Data is then disseminated to the RAMA data website.



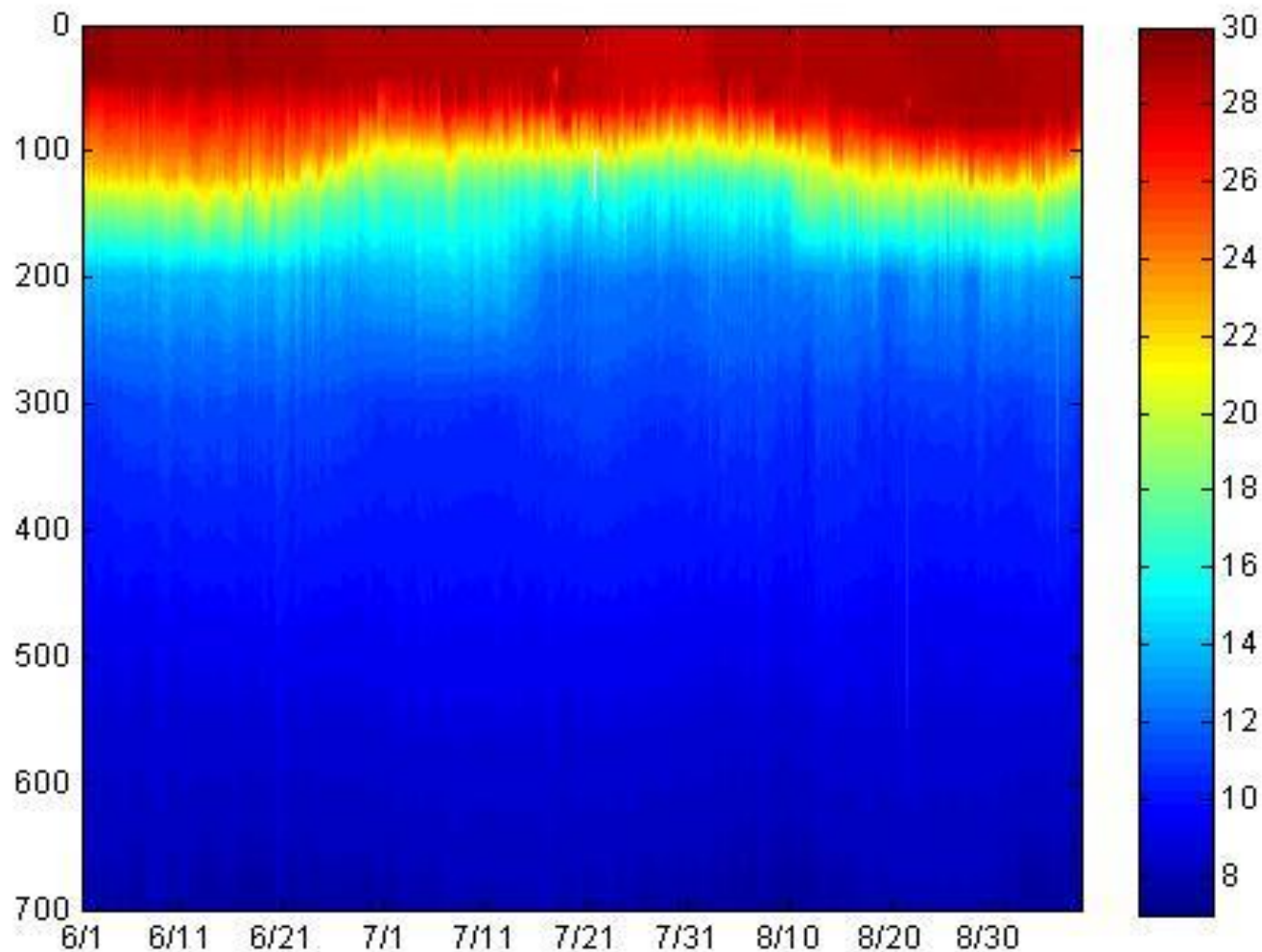
Hourly Meteorological Data plots

During June 1st – Sep. 7th 2010



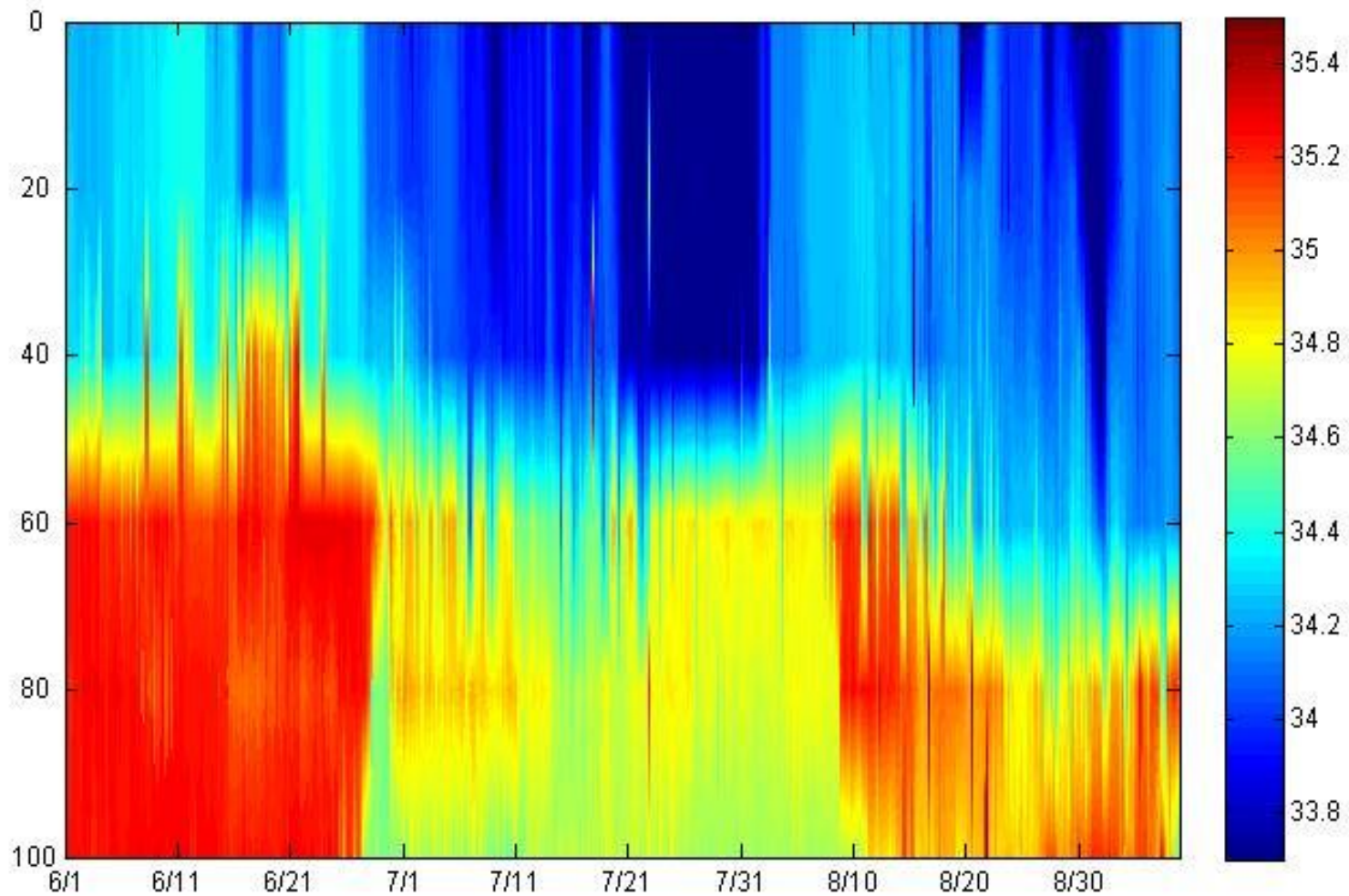
Hourly Temp-Profile: 0 – 700m

June 1 – September 1, 2010

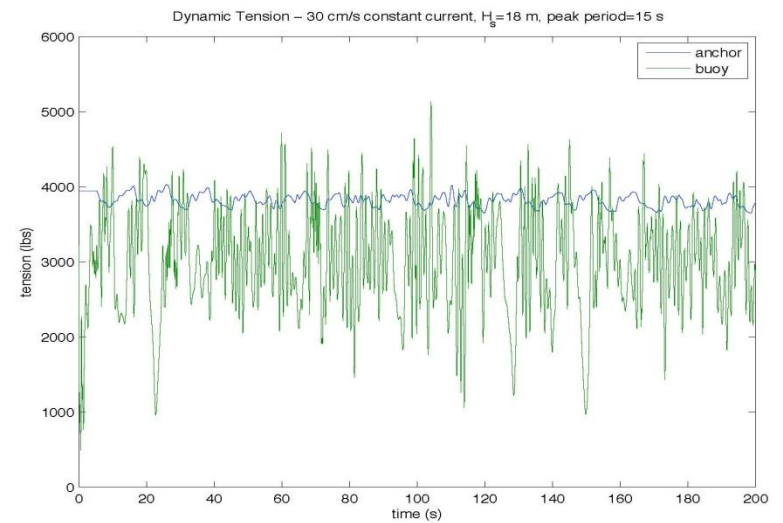
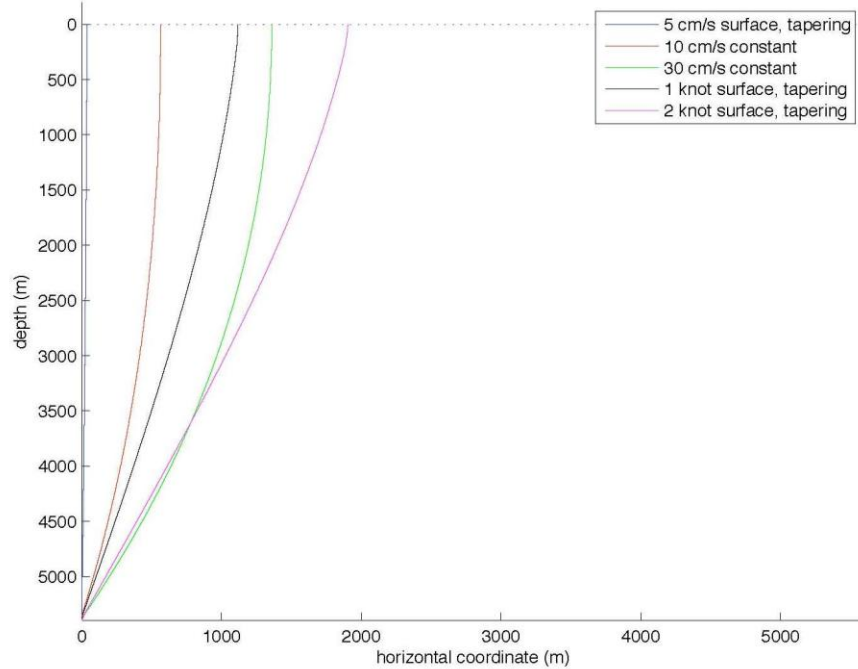


Hourly Salinity Profile: 0-100m

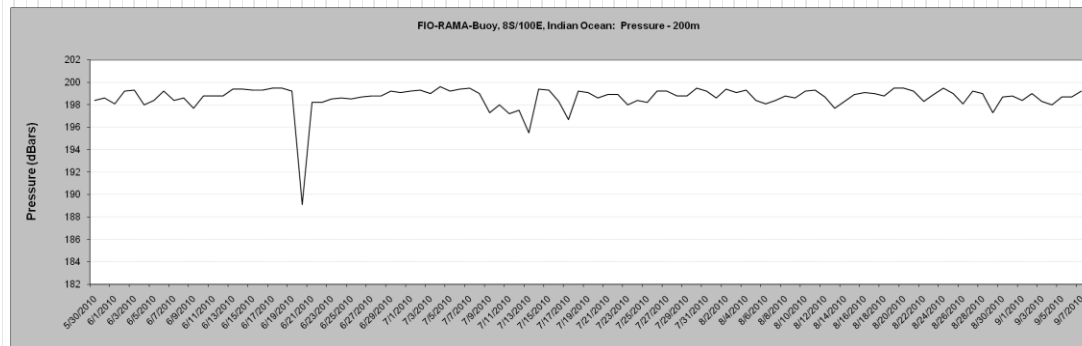
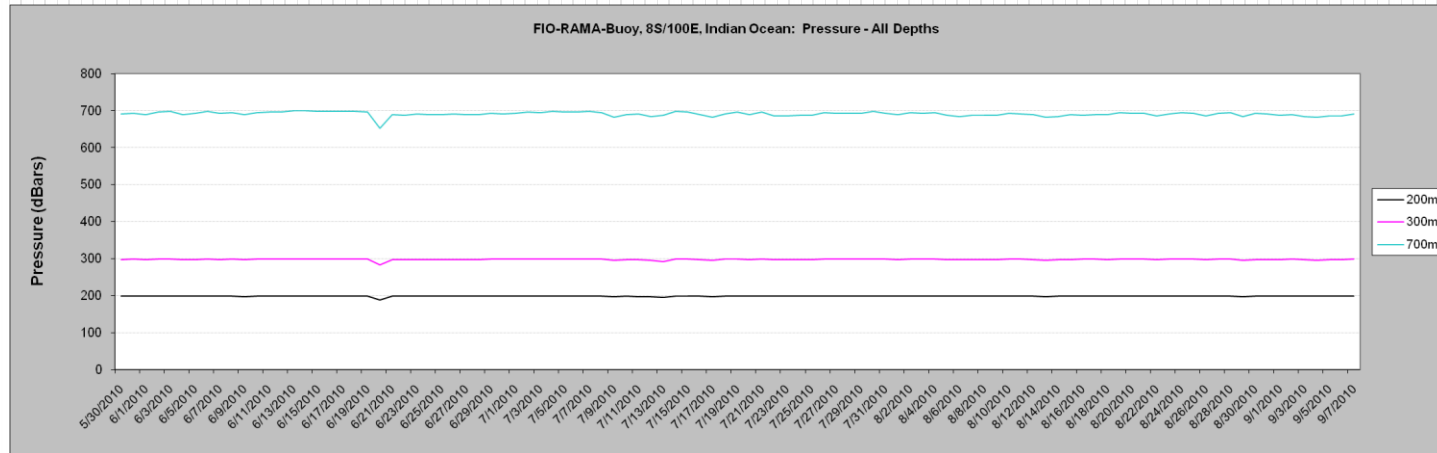
June 1 – September 7, 2010



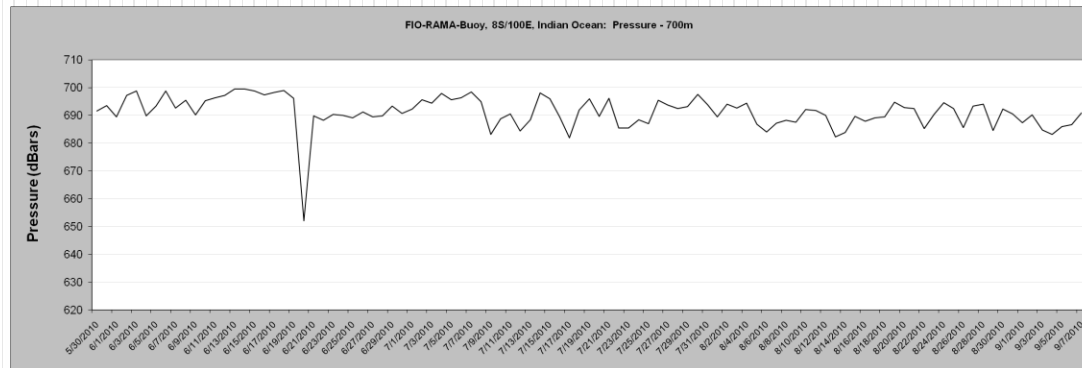
Mooring Performance



Pressure: 200m, 300m, & 500m



200m



700m

Thank You

wdu@fio.org.cn

