

**NATIONAL MAPPING AND RESOURCE INFORMATION AUTHORITY  
HYDROGRAPHY BRANCH**



**REPORT ON SEA LEVEL STATION  
IN THE  
PHILIPPINES**

**ENGR. RAUL S. CAPISTRANO**





# **VISION**

“A highly-professionalized, technologically advanced, globally-competitive, and environment and natural resources-caring agency”

# **MISSION**

“To generate and disseminate reliable and up-to-date geographic information and provide related services, by employing state-of-the-art technology in support of national development”

# **MANDATE**

“The National Mapping and Resource Information Authority (NAMRIA) shall act as the central mapping and resource information agency of the government”

# HYDROGRAPHY BRANCH

- Conducts hydrographic and oceanographic surveys
- Provides nautical charts, bathymetric charts, tide and current tables, and maritime publications
- Responsible for the delineation of the various maritime zones such as archipelagic waters, territorial sea and contiguous zone, Exclusive Economic Zone (EEZ) and Continental Shelf (ECS).
- Operate and maintain tide stations (telemetry and non telemetry)
- Provide oceanographic data to local and international institutions.



# OCEANOGRAPHIC SERVICES

- Examines physical characteristics of ocean water such as salinity, temperature, conductivity, depth, and densities.
- Provides tidal hourly heights
- Provides historical monthly and annual mean sea level and other tidal datum.
- Compute tide reducers
- Provides services on the processing of tidal data
- Provides certification of tidal benchmarks

# PHYSICAL OCEANOGRAPHY DIVISION

```
graph TD; A[PHYSICAL OCEANOGRAPHY DIVISION] --> B[OCEANOGRAPHIC SURVEY SECTION]; A --> C[OCEANOGRAPHIC DATA PROCESSING AND ANALYSIS SECTION]; A --> D[OCEANOGRAPHIC DATABASE MANAGEMENT SECTION]; B --> E[47 TIDE STATIONS];
```

OCEANOGRAPHIC  
SURVEY  
SECTION

OCEANOGRAPHIC DATA  
PROCESSING AND  
ANALYSIS SECTION

OCEANOGRAPHIC  
DATABASE MANAGEMENT  
SECTION

47  
TIDE STATIONS



# PHYSICAL OCEANOGRAPHY DIVISION

- Operates and maintains 47 tide stations for the continuous monitoring and recording of tides.
- Annual inspection and re-leveling of tidal benchmarks
- Establishment of tide house and installation of tide gauge.
- Processing and analysis of tidal data and tidal datum
- Publication of tide and current tables
- Sea level rise and climate change research
- Storm surges and tsunami sea level assessment
- Other related oceanographic activities

## OCEANOGRAPHIC SURVEY SECTION

- Operates and maintains 47 tide stations for the continuous gathering of tidal data
- Reconnaissance and establishment of tide station
- Installation and calibration of tide gauge
- Annual inspection and re-leveling of tidal benchmarks and geodetic control points
- Monitoring of storm surges and tsunami



# OCEANOGRAPHIC SURVEY SECTION



Installation of tide gauge equipment



# OCEANOGRAPHIC SURVEY SECTION



Tidal Leveling



# OCEANOGRAPHIC SURVEY SECTION



Calibration of tide gauge and  
reading of tide staff

## OCEANOGRAPHIC DATA PROCESSING AND ANALYSIS SECTION

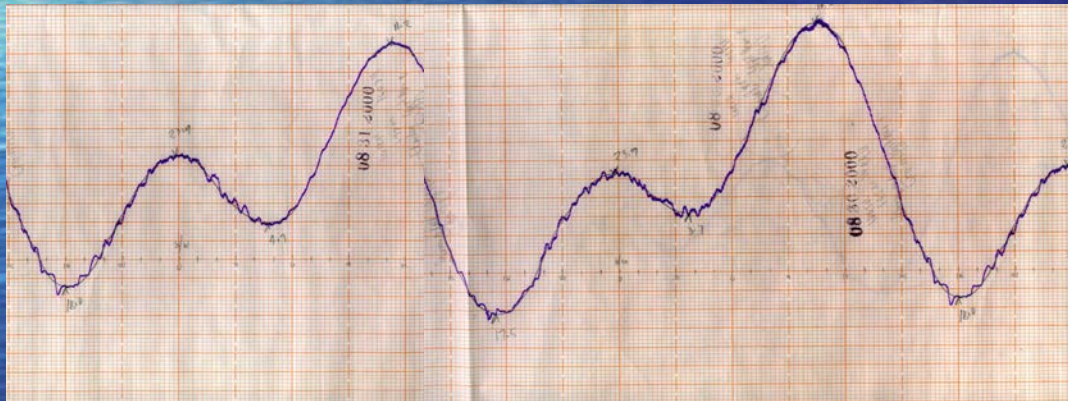
- Processing and analysis of sea level data
- Computation of tidal datums
- Comparison simultaneous of observations
- Tidal predictions
- Preparation of manuscript for the publication of tide and current table
- Sea level variation
- Storm surges and tsunami
- Reduction of tides



# TIDE PROCESSING AND ANALYSIS SECTION

## Computation of tidal datums

- HIGHEST OBSERVED WATER LEVEL
- MEAN SEA LEVEL (MSL)
- MEAN TIDE LEVEL (MTL)
- MEAN HIGHER HIGH WATER (MHHW)
- MEAN HIGH WATER (MHW)
- MEAN LOW WATER (MLW)
- MEAN LOWER LOW WATER (MLLW)
- LOWEST TOBSERVED WATER LEVEL



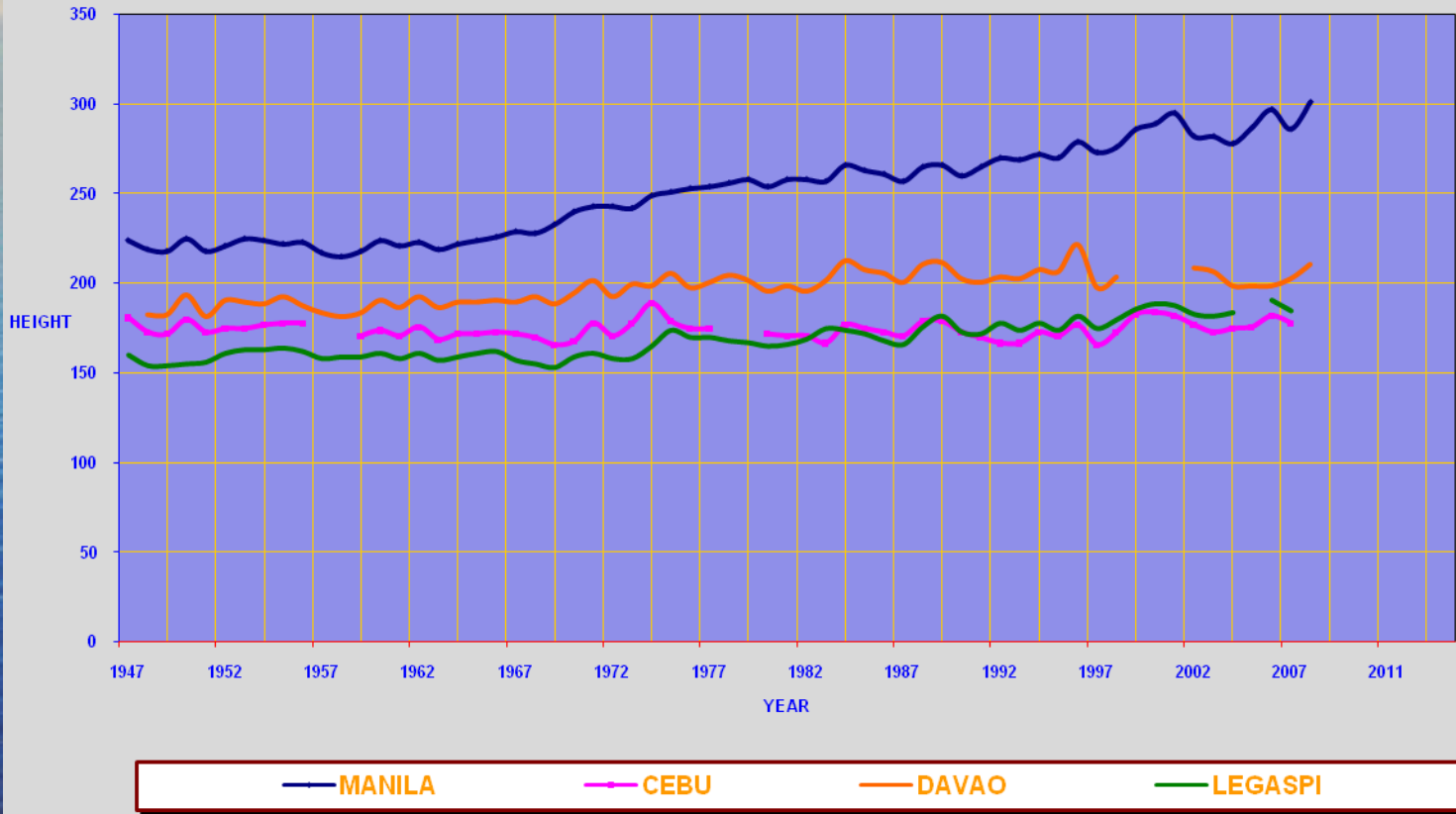
Paper chart/ marigram

Tidal datum

TIDES: HIGH AND LOW WATERS											
STATION	MANILA			LAT	7 5						
YEAR	2009			LONG	125 39						
MONTH	NOVEMBER			degree minute							
							DIGITAL				
DAY	MOON'S TRANSIT	TIME		LUNITIDAL INTERVAL		HEIGHT OF TIDES CORRECTED				REMARKS	
		HW	LW	HW	LW	HW	MLW	MHHW	LLW		
		hr dec	hr dec	hr dec	hr dec	m	m	m	m		
1	2.1										
2	2.9	22.7	7.8	8.2	4.9	3.72	2.36	3.72	2.36		
3	3.8	15.3	23.4	8.1	5.1	3.76	2.45	3.76	2.42		
4	4.8	18.2	23.7	8.9	7.5	3.70	2.36	3.70	2.29		
5	5.4	17.0	9.3	4.7	8.0	3.81			3.31		
6	6.1	17.7	0.3	10.4	8.6	5.0	3.69	2.36	3.69	2.38	
7	6.9	18.5	1.4	11.0	6.9	4.9	3.62	2.41	3.62	2.41	
8	7.8	19.3	2.5	13.2	8.0	6.3	3.67	2.47	3.67	2.47	
9	8.3	20.0	4.5	13.3	9.3	3.92	2.47	3.92	2.56		
10	8.9	20.5	5.4	13.3	12.9	5.7	3.78	2.56	3.78	2.56	
11	9.4	20.7	5.9	14.0	13.7	5.7	3.73	2.57	3.73	2.57	
12	9.9	21.5	6.5	1.0	9.8	4.3	3.57	2.55	3.57	2.55	
13	10.6	22.4	7.2	13.8	19.3	4.5	3.41	2.52	3.41	2.52	
14	11.1	22.4	8.5	2.7	11.0	5.2	3.27	2.56	3.27	2.56	
15	11.9	22.4	9.8	14.4	10.4	4.4	3.24	2.55	3.24	2.55	
16	12.4	23.4	10.9	3.8	9.8	5.4	3.24	2.55	3.24	2.55	
17	12.9	23.4	11.9	20.7	4.6	9.8	3.28	2.44	3.28	2.44	
18	13.2	24.0	21.4	5.8	9.5	5.2	3.20	2.27	3.20	2.27	
19	13.8	24.0	21.7	6.7	8.7	5.2	3.20	2.27	3.20	2.27	
20	14.1	24.0	22.8	6.7	8.7	5.2	3.16	2.26	3.16	2.26	
21	14.5	24.0	22.8	7.7	8.7	5.1	3.16	2.26	3.16	2.26	
22	15.1	24.0	23.3	8.2	8.2	4.94	2.26	3.16	2.26		
23	15.7	24.0	23.3	8.5	8.2	4.8	2.26	3.16	2.26		
24	16.2	24.0	23.3	8.5	8.5	4.8	2.26	3.16	2.26		
25	16.8	24.0	23.3	9.7	8.5	5.1	4.03	2.26	4.03	2.26	
26	17.1	24.0	23.3	10.8	8.1	5.0	3.90	2.26	3.90	2.26	
27	17.8	24.0	23.3	11.7	8.1	5.4	3.83	2.26	3.83	2.26	
28	18.7	24.0	23.3	12.1	8.1	5.4	3.83	2.26	3.83	2.26	
29	19.3	24.0	23.3	12.1	8.1	5.4	3.83	2.26	3.83	2.26	
30	19.9	24.0	23.3	12.1	8.1	5.4	3.83	2.26	3.83	2.26	
31	20.5	24.0	23.3	12.1	8.1	5.4	3.83	2.26	3.83	2.26	
SUM						358.5	183.5	131.25	91.80	103.43	74.11
MEAN						MHW	MLW	MHHW	MLLW		
						3.64	2.55	3.69	2.47		
CORRECTION TO INTERVALS						0.67	0.67	CORRECTED			
LOCAL INTERVALS						10.30	5.77	Mn	1.00		
GREENWICH INTERVALS								MTL	3.05		
								WRITE HERE			
Gr						1.22					
DHC						0.75		HOURLY HEIGHTS			
DLQ						0.08		CORRECTIONS			0
HIGHEST TIDE						4.06					
DATE						15					
TIME											
LOWEST TIDE						2.12		Leveling Factor			
DATE						16		Sensor Factor			
TIME								Final Corrections			

# OCEANOGRAPHIC DATA PROCESSING AND ANALYSIS

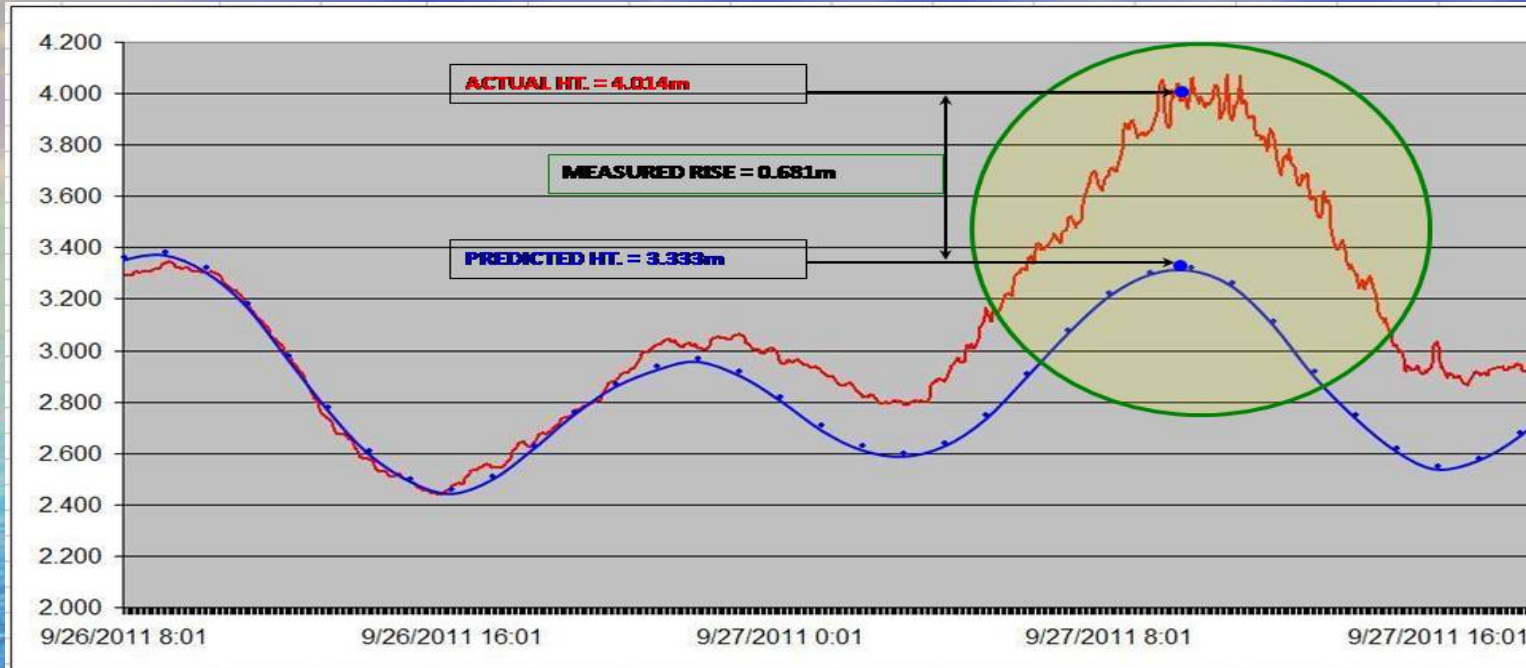
## SECTION SEA LEVEL VARIATIONS (1947-2007)



Sea Level Variations



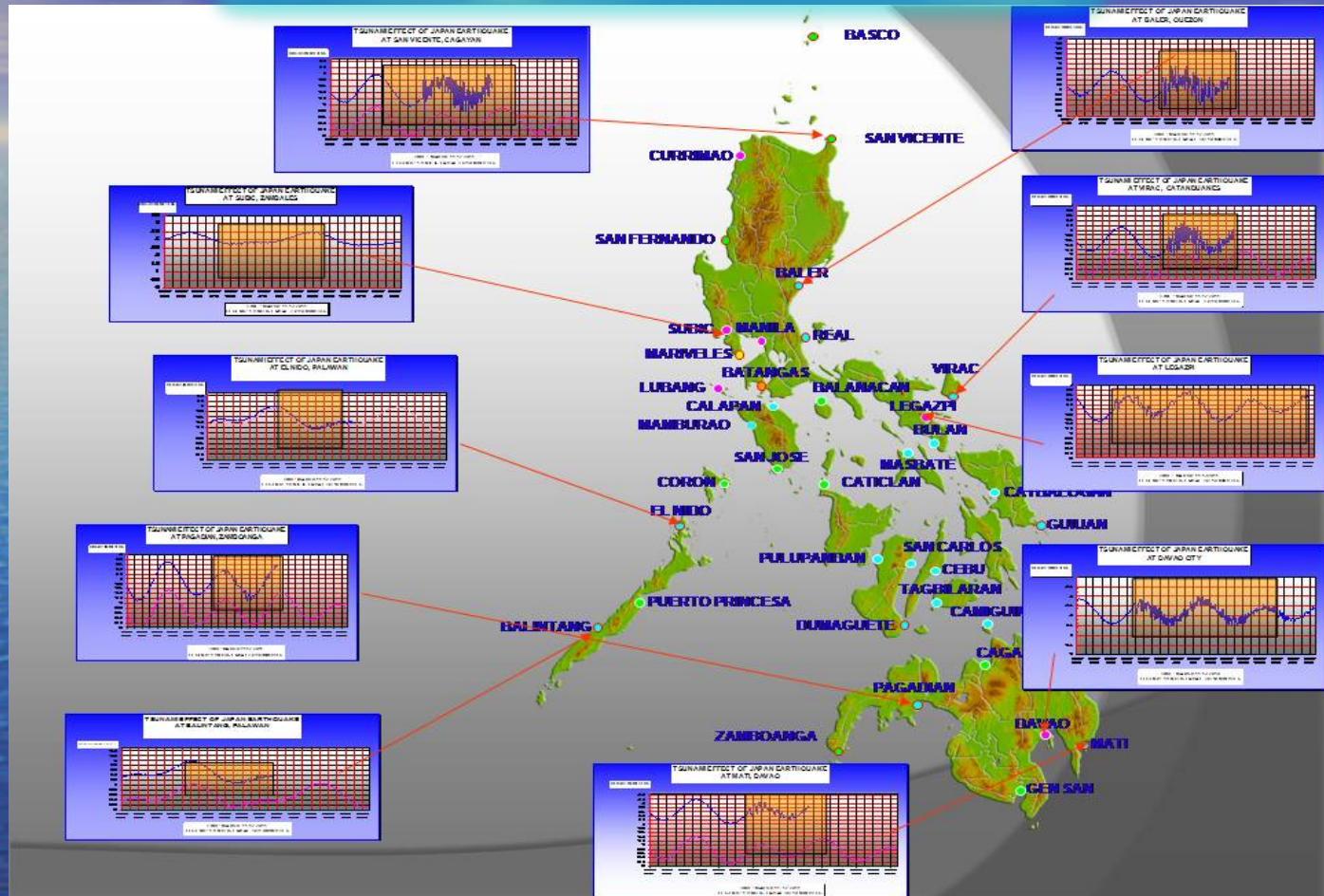
# TIDE PROCESSING AND ANALYSIS SECTION



**The predicted high tide on 27 Sept. 2011 at 0946H is 3.333m with reference to the zero of the tide staff in Manila. Actual observation is measured to be 4.014m with a rise of 0.681m from the predicted tide.**

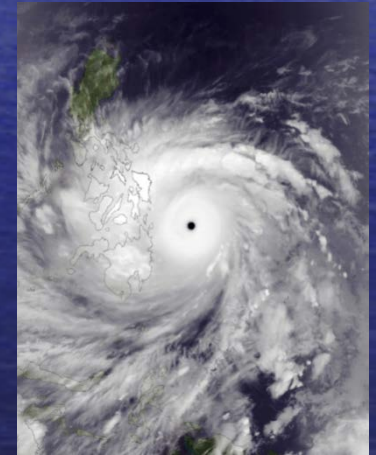
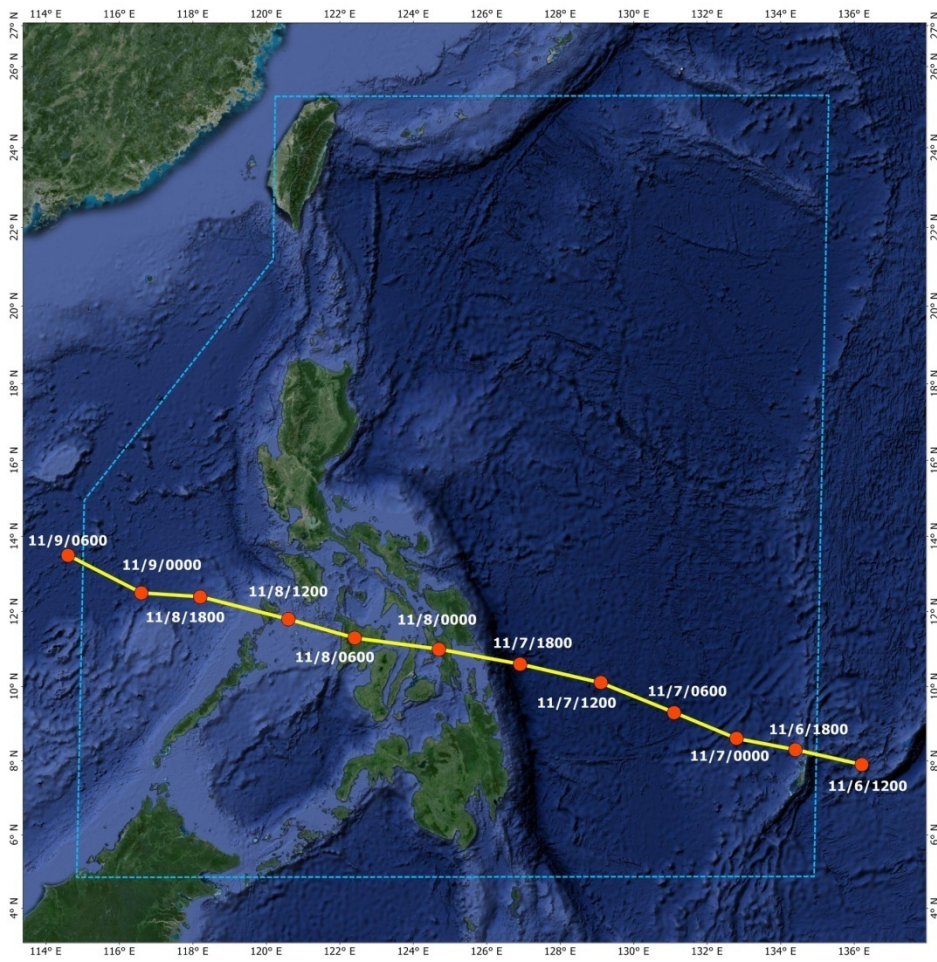
Storm surges effect of Typhoon Pedring

# OCEANOGRAPHIC DATA PROCESSING AND ANALYSIS SECTION



THE TSUNAMI EFFECT OF SENDAI EARTHQUAKE IN THE PHILIPPINES





### Path of Super Typhoon Yolanda (Haiyan)

Source of Information:

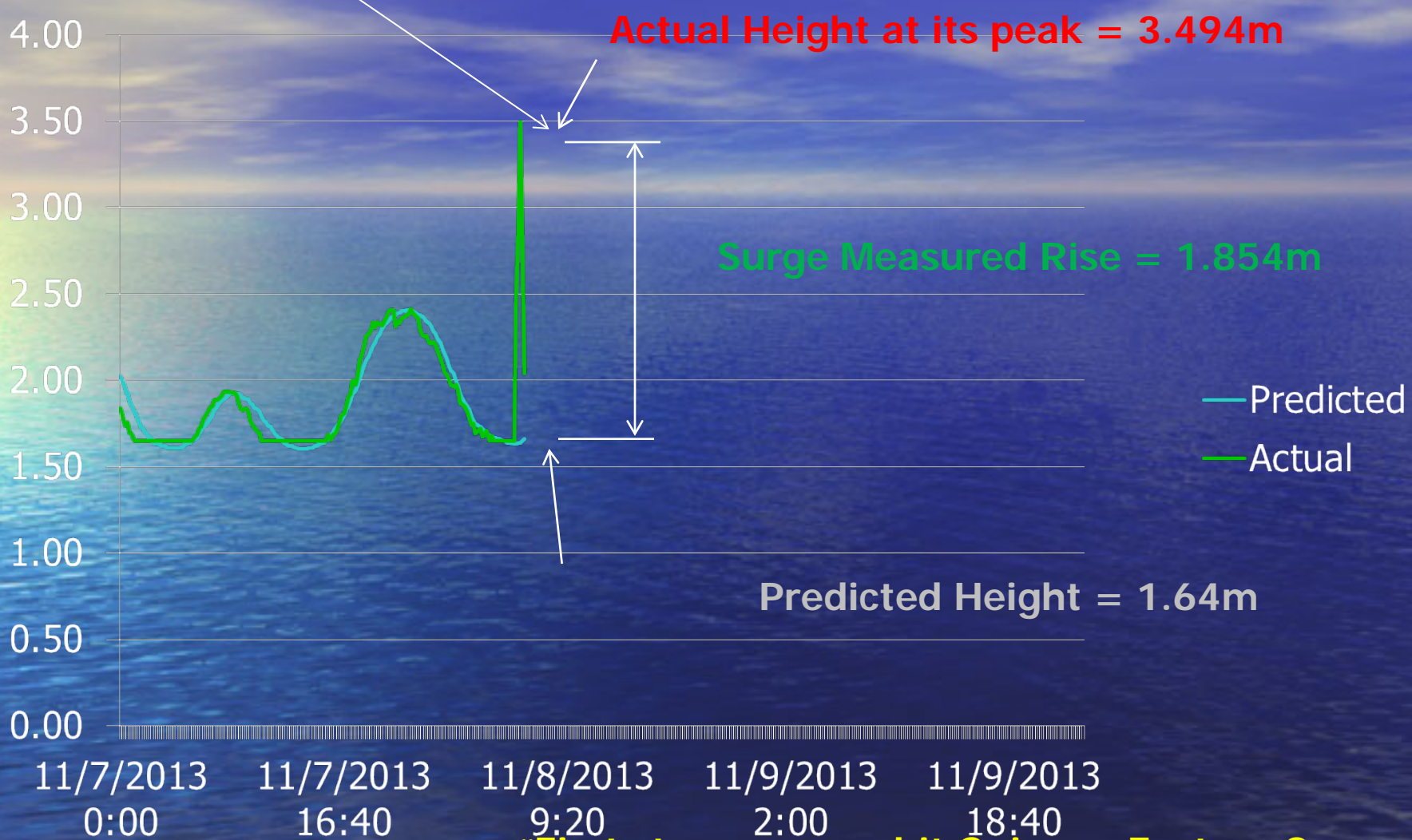
PAGASA  
November 14, 2013

Scale: 1:15000000



- Date and Time of Observation (Phil. Standard Time)
- Path
- - - PAR

Time = 0530H of November 8, 2013

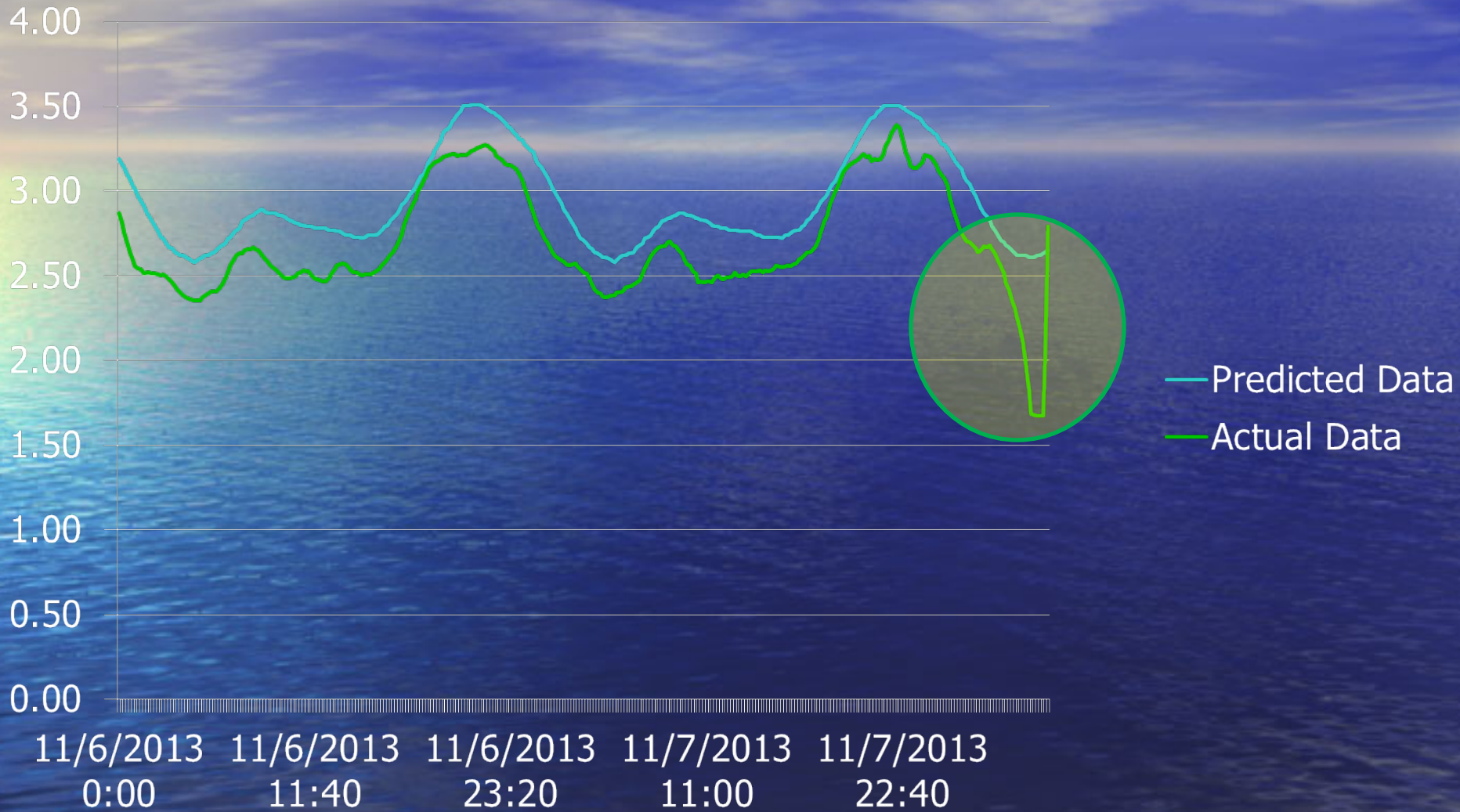


**"First storm surges hit Guiuan , Eastern Samar"**

**OBSERVED TIDAL HEIGHTS IN GUIUAN, EASTERN SAMAR**

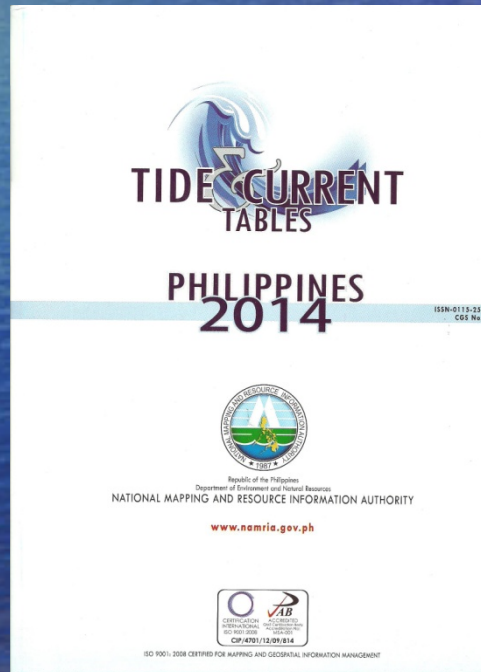


**GRAPH OF ACTUAL AND PREDICTED TIDAL HEIGHTS IN  
TACLOBAN FROM 0000H of 06 NOV. TO 0710H of 08 NOV. 2013**



# TIDE PROCESSING AND ANALYSIS SECTION

• PUBLICATIONS OF TIDE AND CURRENT TABLES  
2000 COPIES





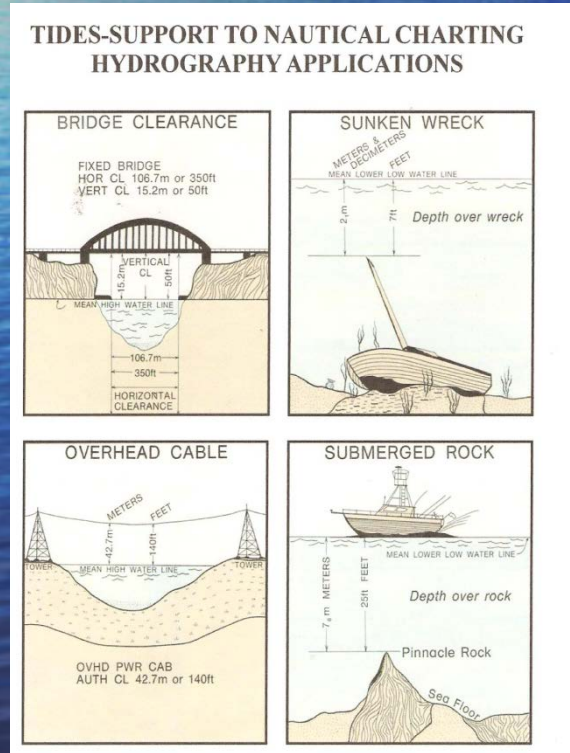
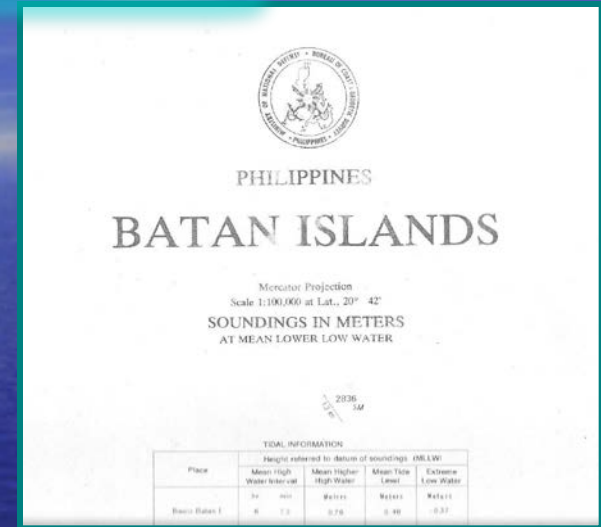
## OCEANOGRAPHIC DATABASE MANAGEMENT SECTION

- Gathered physical oceanographic raw data: CTD, Temperature and Salinity
- Organized historical tidal data
- Updating of tidal information and datum planes
- Oceanographic data exchange on local and international institutions
- Updating of tidal benchmarks

# OCEANOGRAPHIC DATABASE MANAGEMENT SECTION

- UPDATING OF TIDAL INFORMATION

MEAN HIGH WATER INTERVAL  
MEAN HIGHER HIGH WATER  
MEAN TIDE LEVEL  
EXTREME LOW WATER



## TIDAL INFORMATION OF NAUTICAL CHARTS



TIDE STATIONS NETWORK  
IN THE  
PHILIPPINES



# TELEMETRY STATIONS



REAL TIME TIDE STATIONS



NEAR-REAL TIME TIDE STATIONS



PROPOSED LOCAL TELEMETRY STATIONS





## REAL TIME TIDE STATIONS

### REGIONAL INTEGRATED MULTI-HAZARD EARLY WARNING SYSTEM FOR AFRICA (RIMES STATIONS)

- CURRIMAO
- LUBANG

### GLOBAL SEA LEVEL STATION SYSTEM (GLOSS STATIONS)

- MANILA
- DAVAO
- SUBIC
- LEGAZPI

**NOTE: ALL STATIONS ARE SUPPORTED WITH THE**

- 1. INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC)**
- 2. GLOBAL SEA LEVEL OBSERVING SYSTEM (GLOSS)**
- 3. THE UNIVERSITY OF HAWAII SEA LEVEL CENTER (UHSLC)**

# LOCAL TELEMETRY STATIONS



COMMUNICATION ANTENNA



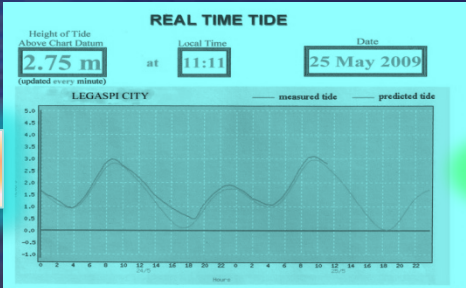
COMPUTER SERVER



TIDE STATION



WORK STATIONS



TIDAL DATA





# TYPICAL TIDE STATION



## SEA LEVEL INSTRUMENTS



OTT STRIP CHART WATER LEVEL  
AND  
OTT THALIMEDES DATA LOGGER



# SEA LEVEL INSTRUMENTS



COMMUNICATIONS:

RS232 Real-time data



RECORDING DEVICE

LCD DISPLAY

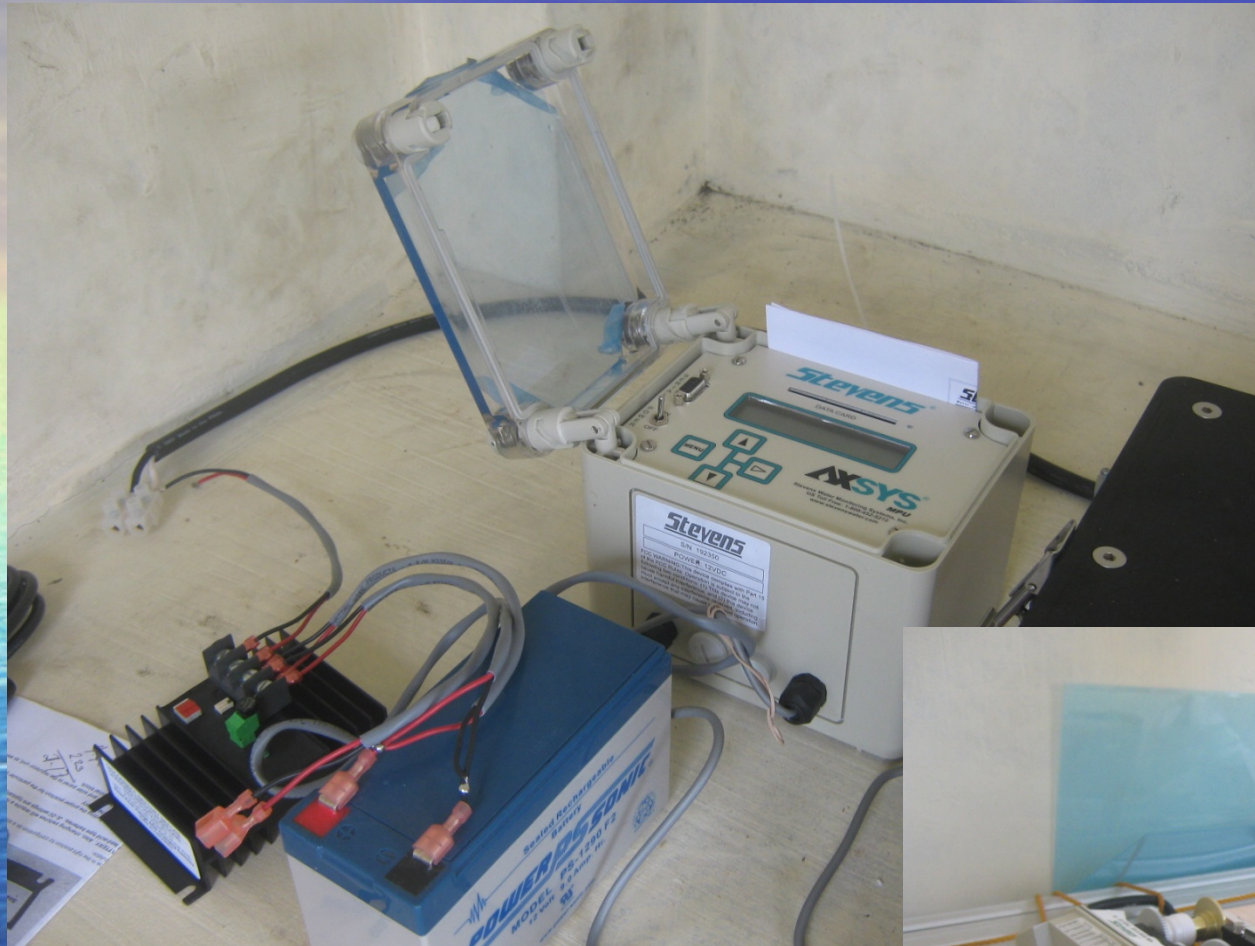


OTT THALIMEDES DATA  
LOGGER

Thalimedes  
in solo-operation



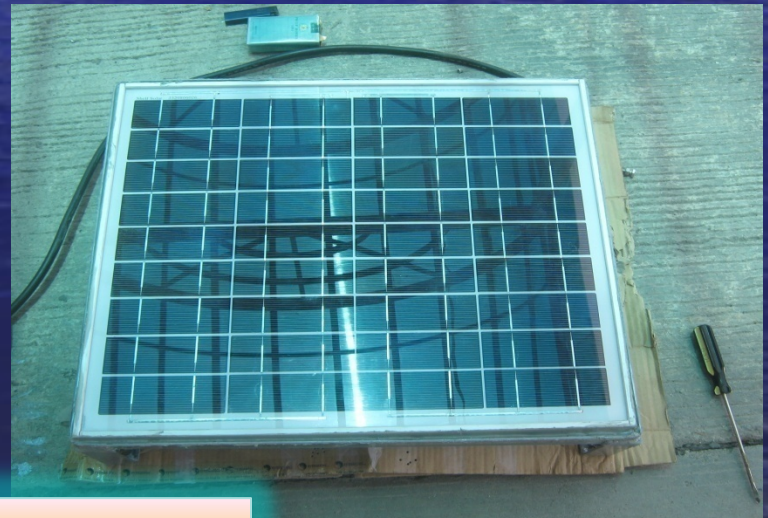
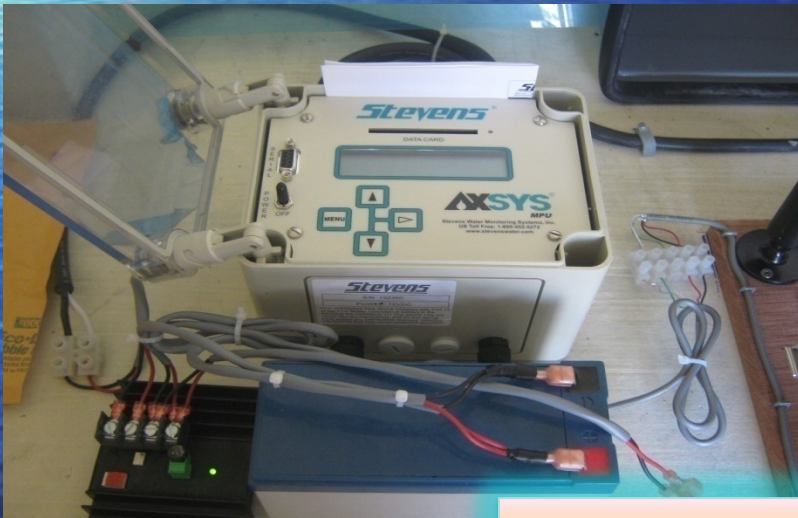
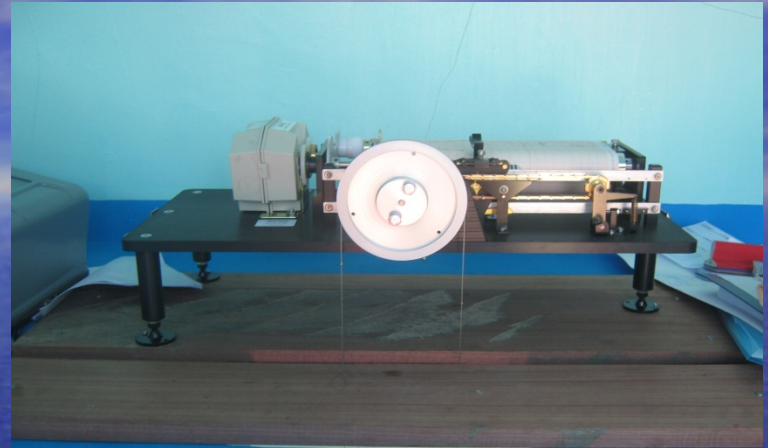
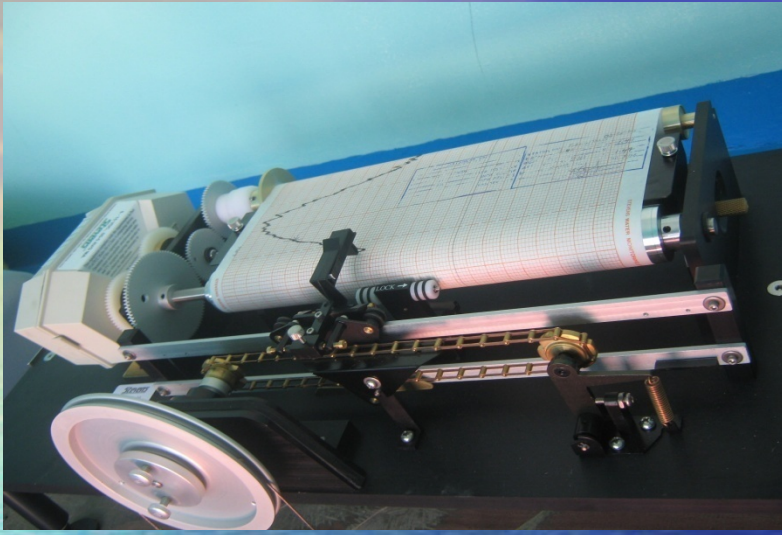
# SEA LEVEL INSTRUMENTS



STEVENS ANALOGUE WATER  
LEVEL RECORDER AND  
AXYS DIGITAL DATA LOGGER



# SEA LEVEL INSTRUMENTS



STEVENS ANALOGUE WATER  
LEVEL RECORDER AND  
AXYS DIGITAL DATA LOGGER



## SEA LEVEL INSTRUMENTS



SUTRON MULTI-PARAMETER  
SENSOR TIDE STATION





## SEA LEVEL INSTRUMENTS



PORTABLE WAVE AND TIDE  
GAUGE

## STS PORTABLE TIDE GAUGE







# **INTERNATIONAL LINKAGES**

- 1. Intergovernmental Oceanographic Commission (IOC)**
- 2. Global Sea Level Observing System (GLOSS)**
- 3. Permanent Service for Mean Sea Level (PSMSL)**
- 4. University of Hawaii Sea Level Center (UHSLC)**
- 5. Pacific Tsunami Warning Center (PTWC)**
- 6. Regional Integrated Multi-hazard Early Warning System for Africa and Asia (RIMES)**