Marine Dept.

Hydrographic Dept.

Port Authority of Thailand

National Sea Level Observation and Sea Level Activities in Thailand

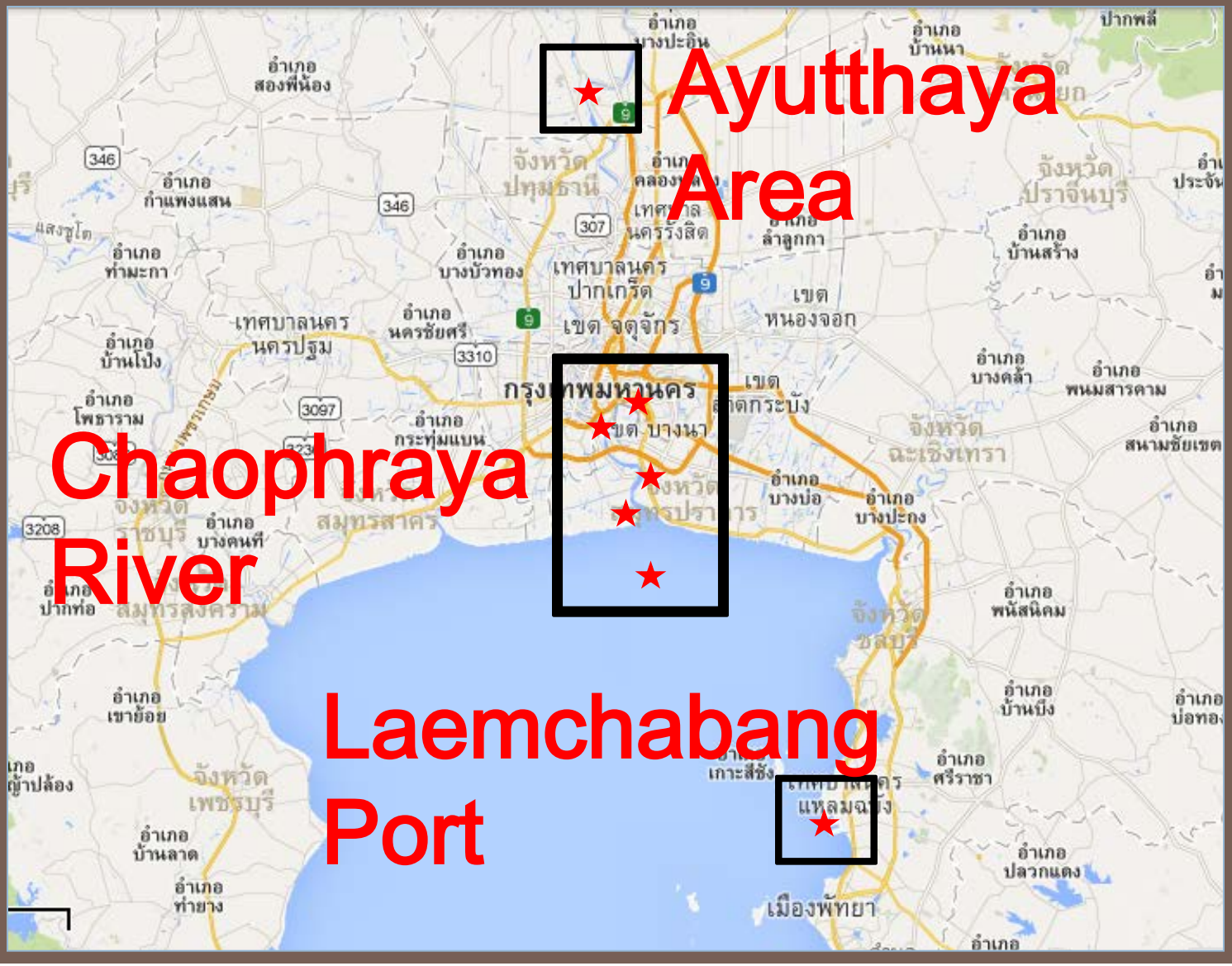
Cdr.Supasit Kongdee

eanographic and Tidal Section, Oceanographic Divis

OUTLINE

- Map of tide gauge network in Thailand
- List of gauge sites
- The gauge technology employed in the network
- Sea level products
- sea level science studies
- tidal analysis package
- addresses of data banks
- Tsunami warning system

Map of tide gauge network in Thailand (



List of gauge sites (PAT)

Present

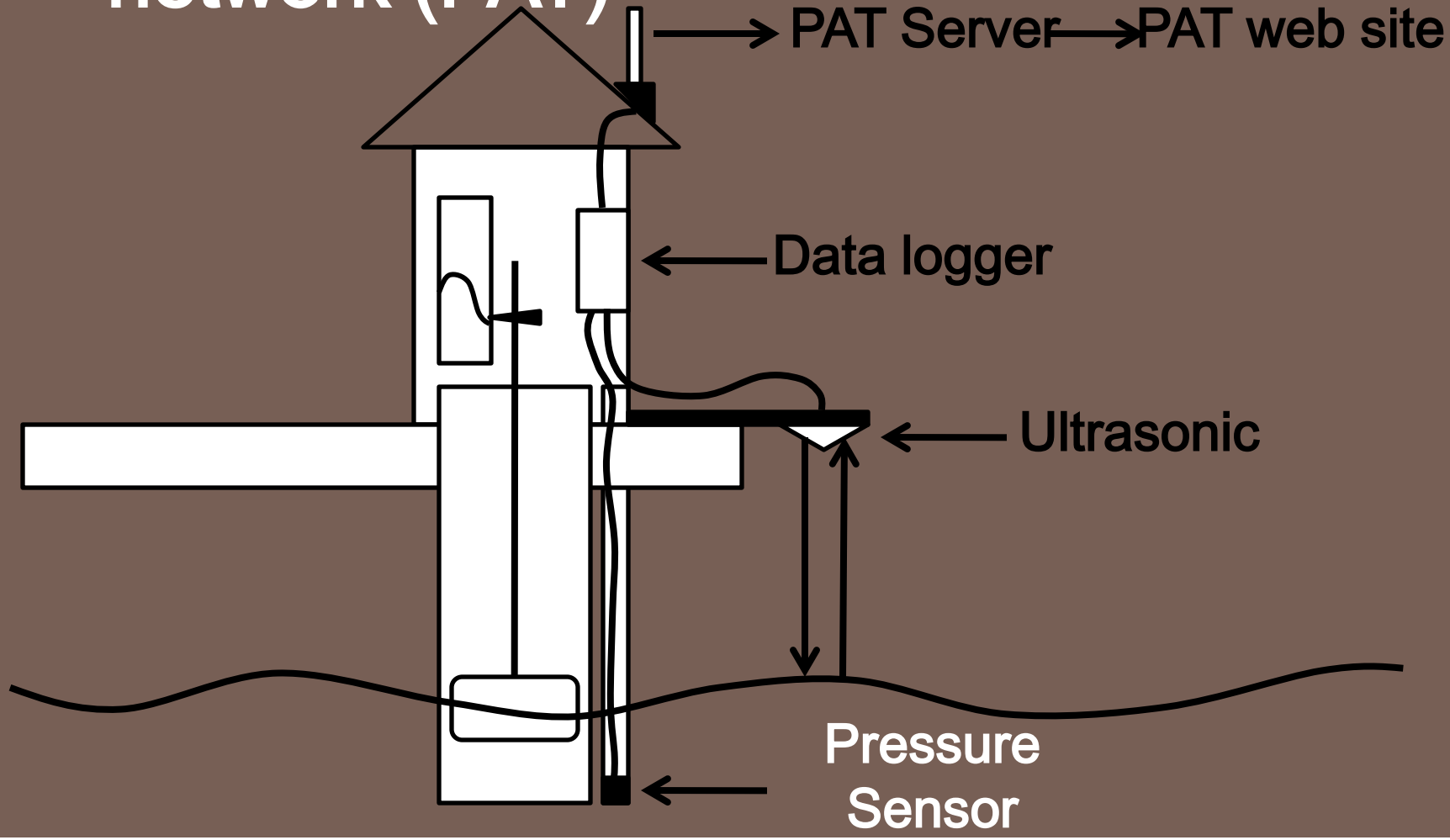
No.	Station	Manual	Auto	Remark
1	Bang Sai	X	X	Pressure Sensor
2	Bangkok Port	X	X	Pressure Sensor
3	Pra Pradaeng		X	Ultrasonic
4	Samutprakan	X		Under Construction
5	Phrachunlachomklao Fort	X		Under Construction
6	Beacon J	X		Under Construction
7	Laemchabang Port	X	X	Ultrasonic

List of gauge sites (PAT)

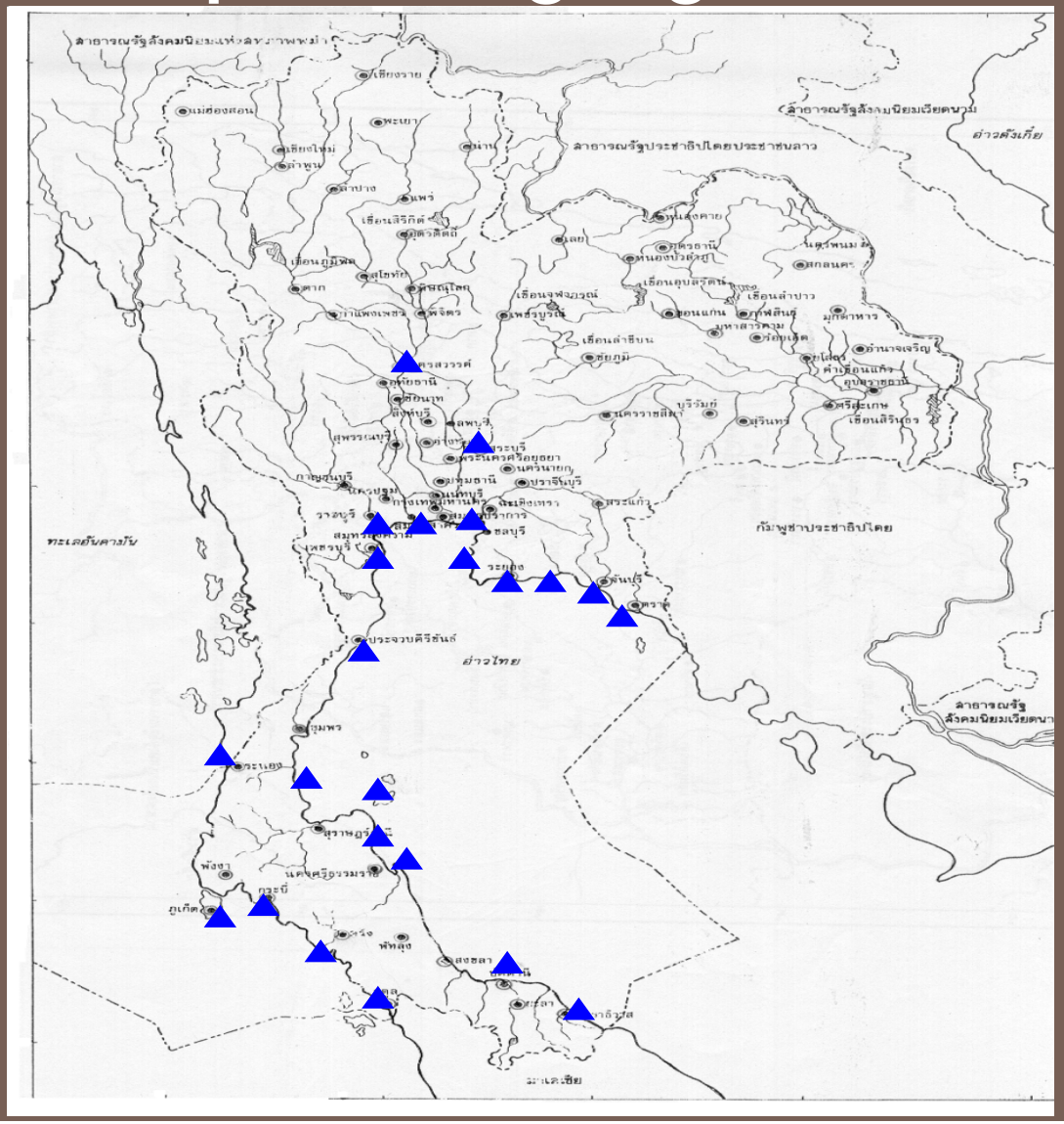
In 2015

No.	Station	Manual	Auto	Remark
1	Bang Sai	X	X	Pressure Sensor
2	Bangkok Port	X	X	Pressure Sensor
3	Pra Pradaeng		X	Ultrasonic
4	Samutprakan	X	X	Ultrasonic
5	Phrachunlachomklao Fort	X	X	Ultrasonic
6	Beacon J	X	X	Ultrasonic
7	Laemchabang Port	X	X	Ultrasonic

The gauge technology employed in the network (PAT)



Map of tide gauge network in Thailand (MI



23 stations
All are float tide gauge

List of gauge sites (MD)

Station name	Lat.	Long.	Location	Observation
Upcountry				
Nakhonsawan (KW)	15° 41' 19"	100° 07' 42"	Mae Nam Chaopraya, Nakhonsawan-ook Sub-distric, Mueang Distric, Nakhonsawan Province	Since 1996 - Present
Nakornluang (NK)	14° 28' 04"	100° 07' 54"	Mae Nam Pasak, Nakhonluang Sub-distric, Nakhonluang District,	Since 1997 - Present

List of gauge sites (MD), East coast o

Station name	Lat.	Long.	Location	Observation
Bangpakong (BK)	13° 29' 06"	101° 00' 11"	Mae Nam Bangpakong, Thephasdin Bridge, Thakam Sub-district, Bangpakong District, Chachoengsao Province	Since 1981- Present
Ao Udom (AU)	13° 07' 31"	100° 53' 34"	Multipurpose Port, thungsukha Sub-district, Sri racha District, Chonburi Province	Since 2006 - Present
Rayong (RY)	12° 39' 36"	101° 16' 15"	Paknam Rayong Sub-district, Mueang District, Rayong Provinc	Since 1986 - Present
Prasae (PS)	12° 41' 47"	101° 42' 09"	Paknam Prasae Sub-district, Klaeng District, Rayong Province	Since 1977 - Present
Thachalaep (TL)	12° 32' 00"	102° 03' 28"	Thachalap Pier, Bangkaja Sub-district, Mueang District	Since 1981 - Present

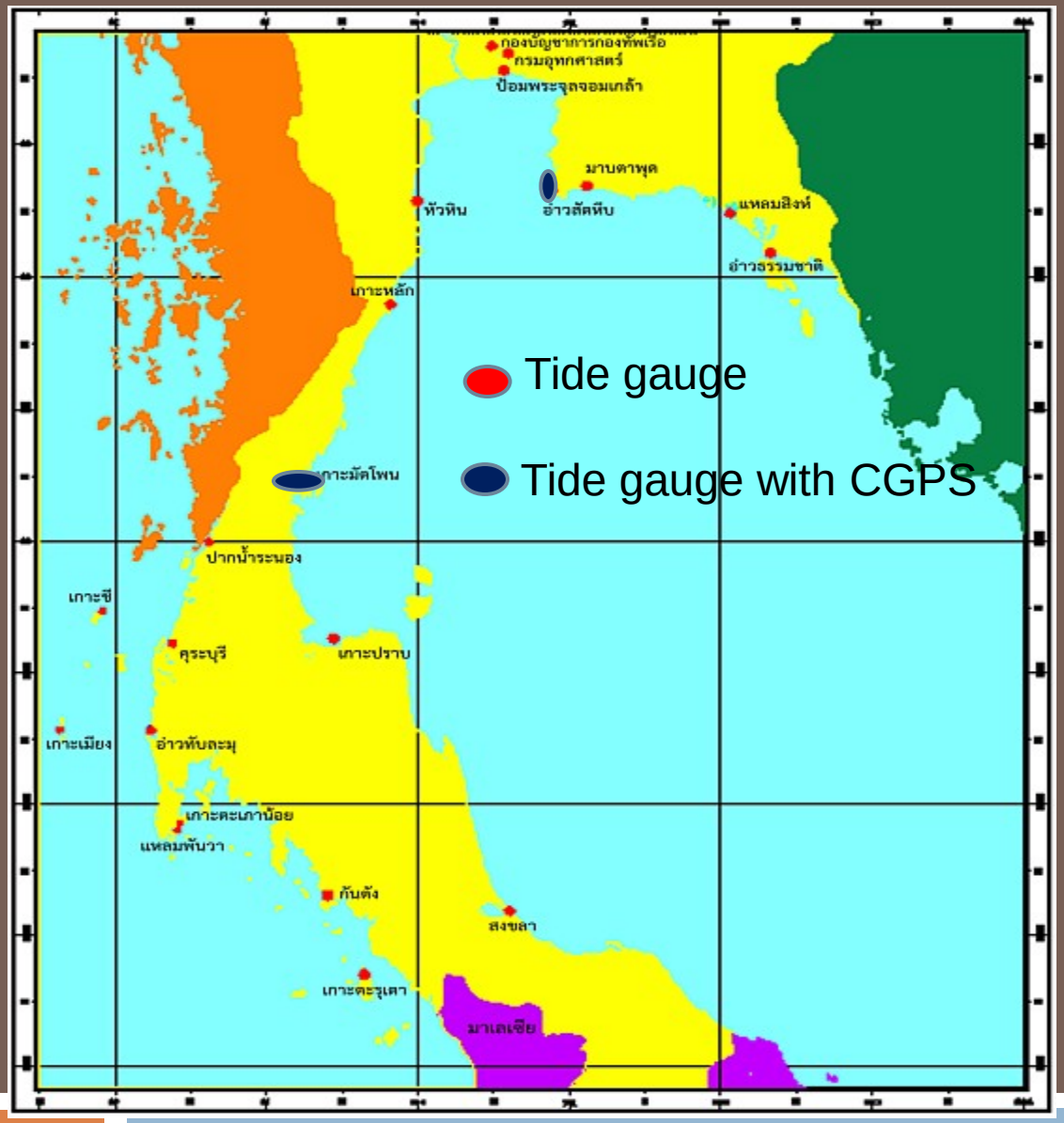
List of gauge sites (MD), West Coast of GOT				
Samutsakorn (TC)	13° 30' 42"	100° 16' 28"	Mae Nam Thachin, Wat Srisutharam, Mueang District, Samutsakhon Province	Since 1977 - Present
Samutsongkram (MK)	13° 22' 42"	99° 59' 32"	Mae Nam Maeklong Wat Radsatratham, Bangjakreng Sub-district, Mueang District, Samutsongkhram Province	Since 1977 - Present
Banlaem (BL)	13° 15' 53"	99° 56' 32"	Klong Bangtaboon, Bangtaboon-ook Sub-district, Banleam District, Phetchaburi Province	Since 1996 - Present
Klongwan (KV)	11° 44' 02"	99° 46' 56"	Pier, Klongwan Sub-district Mueang District, Prachuap kirikhan Province	Since 2006 - Present
Langsuan (LS)	9° 56' 45"	99° 09' 27"	Pier, Paknam Langsuan Sub-district, Langsuan District, Chumphon Province	Since 1982 - Present
Ko Samui (SA)	9° 32' 17"	99° 55' 51"	Ferry Port 2, Ko Samui Sub-district, Ko Samui District, Suratthani Province	Since 2006 - Present

List of gauge sites (MD), Andaman

Station name	Lat.	Long.	Location	Observation
Ranong (RN)	10° 00' 17" 09˚ 57' 03"	98° 36' 24" 98˚ 35' 45”	Multipurpose Port, Paknam Sub-district Mueang District, Ranong Province Ko Kontee	Since 2008 – Present 1977 – 2007
Ao Po (AP)	8° 03' 34"	98° 26' 10"	Ao po Port, Pakhlok Sub-distric Thalang District, Phuket Provinc	Since 2006 - Present
Krabi (KB)	8° 02' 46"	98° 54' 21"	Krabi Port, klongjilad Sub-district, Mueang District, Krabi Province	Since 1981- Present
Kangtang (KT)	7° 18' 40" 07˚ 24' 38	99° 24' 08" 99˚ 30' 43"	Chao-mai Port, Libong Sub-distric, Kantang District, Channel Development and Maintenance Centre3 (Trang)	Since 2007 - Present 1968-1992,1998-2006

The gauge technology employed in the network (MD)

Map of tide gauge network in Thailand (HD



List of gauge sites (HD)

Station Name	LAT	LONG	Observation Periods
1.Royal Thai Navy Headquarters	13-42-00	100-35-02	1945
2.Phra Chunlachomklao Fort (Samut Prakan)	13-33-06	100-34-44	1985
3.Ao Sattahip (Chon Buri)	12-38-42	100-52-55	1940
4.Laem Sing (Chanthaburi)	12-28-27	102-03-45	1960
5.Hua Hin (Prachuap Khiri Khan)	12-34-22	99-57-48	1992

List of gauge sites (HD)

Station Name	LAT	LONG	Observation Periods
6.Ko Lak (Prachuap Khiri Khan)	11-47-42	99-48-58	1939
7.Ko Mattaphon (Chumphon)	10-26-40	99-15-25	1954
8.Ko Prap (Surat Thani)	09-15-47	99-26-18	1977
9.Songkhla (Songkhla)	09-15-48	100-34-50	1986
10.Pak Nam Ranong (Ranong)	07-12-58.	98-35-15	2007
11Khura Buri (Phangnga)	09-13-30	98-22-37	2007

List of gauge sites (HD)

Station Name	LAT	LONG	Observation Periods
12.Ao Thap Lamu (Phangnga)	08-34-26	98-13-29	1986
13.Ko Thaphao Noi (Phuket)	07-49-54	98-25-30	1948
14.Ko Tarutao (Satun)	06-42-06	99-39-00	1986
15.Laem Ngop (Trat)	12-10-07.	102-23-45	2007
16.Pak Nam Trang (Trang)	07-24-13	99-30-45	2007

List of gauge sites (HD)

Station Name	LAT	LONG	Observation Periods
16.Mabtaprt Port	12-40-21.	101-08-20.	2003
17.Ko miang	08-34-16	97-38-23.	2005
18. Ko Stork	09-28-28	97-54-12	2005
19.Panwa cape	07-48-09	98-24-38	2012
15.hydrographic dept	13-40-20	100-35-22	2012

The gauge technology employed in the n

Sea level products

28 stations for Tide Table

Sea level products

KO THAPAO NOI (PHUKET)

พ.ศ. 2528 - 2548 (ค.ศ. 1985 - 2005)

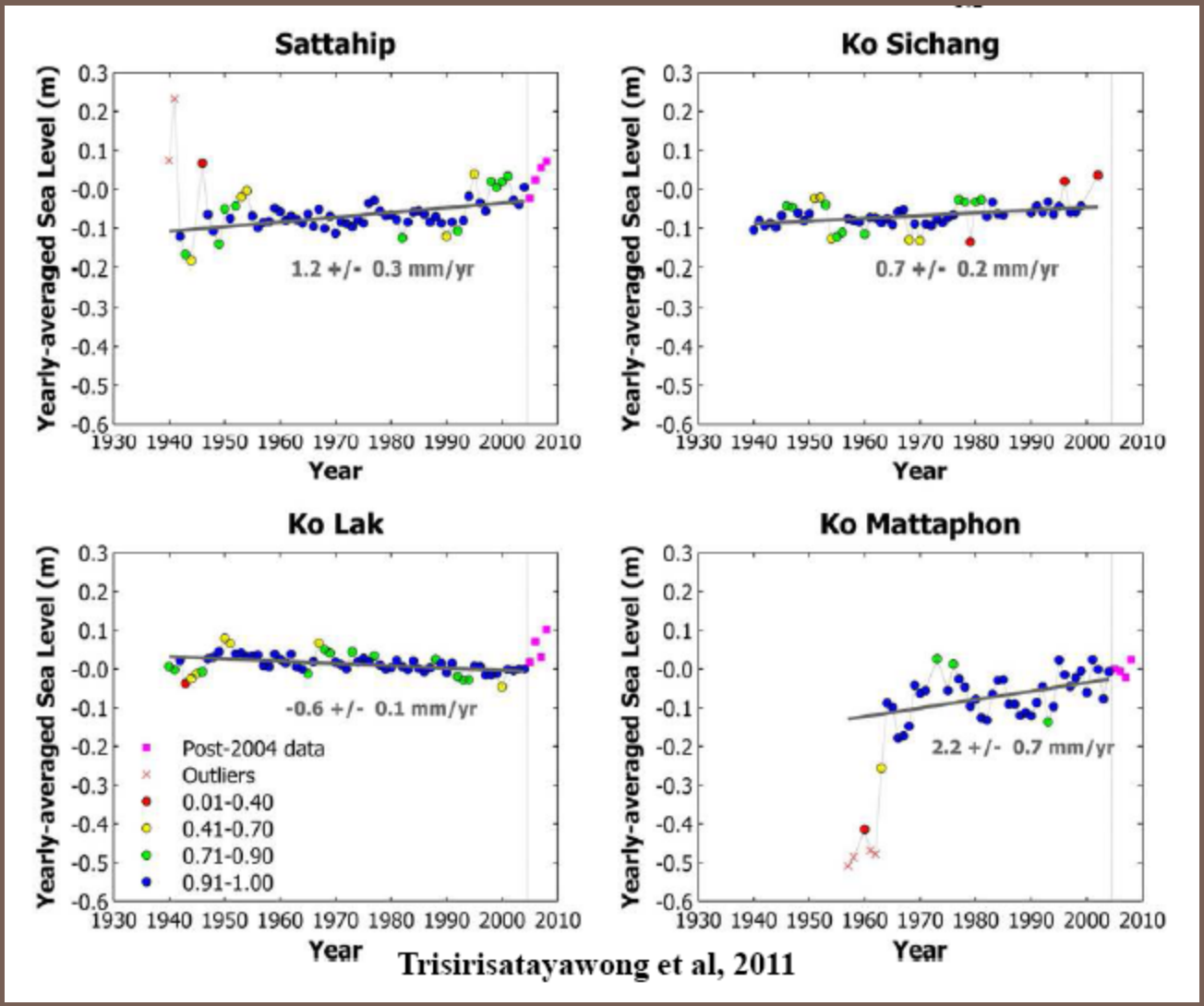
Non - Harmonic Tidal Quantities

ละติจูด (Lat.) 07° - 49' - 55" น.(N.) ลองจิจูด (Long.) 98° - 25' - 30" อ.(E.)

TIDAL INFORMATION	ชื่อย่อ	ค่าเฉลี่ย (เมตร)		ค่ารายการน้ำ
		จากศูนย์บรรทัดน้ำ	จาก M.S.L.	(เมตร)
MEAN HIGHER HIGH WATER	MHHW			
MEAN HIGH WATER SPRING	MHWS	3.42	0.92	3.21
MEAN HIGH WATER	MHW	3.04	0.54	
MEAN HIGH WATER NEAP	MHWN	2.68	0.18	2.47
MEAN LOWER HIGH WATER	MLHW			
LOCAL MEAN SEA LEVEL	LMSL	2.20	-0.30	
MEAN TIDE LEVEL	MTL	2.19	-0.31	
MEAN HIGHER LOW WATER	MHLW			
MEAN LOW WATER NEAP	MLWN	1.72	-0.78	1.51
MEAN LOW WATER	MLW	1.33	-1.17	
MEAN LOW WATER SPRING	MLWS	0.99	-1.51	0.78
MEAN LOWER LOW WATER	MLLW			
MEAN SPRING RANGE (Mn.Sg.Range)				2.43
MEAN NEAP RANGE (Mn.Np.Range)				0.96
MEAN RANGE (Mn.Range)				1.71
HIGHEST HIGH WATER	H'est HW.	4.22	1.72	ก.ย.2491
LOWEST LOW WATER	L'est LW.	0.21	-2.29	ก.พ.2495

28 stations for Tidal Information

sea level science studies



Sea level science studies

Long-term absolute rates of sea level rise at four tide gauges in the Gulf of Thailand. The vertical land motions at these tidal stations are derived from a) campaign GPS data at CHON, b) campaign GPS data at BANH, and c) difference of sea level change rates detected by satellite altimetry and tidal data (see Section 5.4).

Tidal stations	Apparent SLR rates (mm/yr)	Vertical land motions (mm/yr)	Absolute SLR rates (mm/yr)
Sattahip (1940–2004)	1.2 ± 0.3	3.8 ± 1.3^{a}	5.0 ± 1.3
Ko Sichang (1940–1999)	0.7 ± 0.2	3.8 ± 1.3^{a}	4.5 ± 1.3
Ko Lak (1940–2004)	-0.6 ± 0.1	3.6 ± 1.5^{b}	3.0 ± 1.5
Ko Mattaphon (1964–2004)	2.2 ± 0.7	2.2 ± 0.8^{c}	4.4 ± 1.1

Tidal analysis package

PAT's software developed by EGAT

(EGAT = Electricity Generating Authority of Thailand)

HD have used software package developed by Flinders University

addresses of data banks

4 Stations, Bangkok Port, Pra
Pradaeng,
Bang Sai, and
Laemchabang Port are
available at

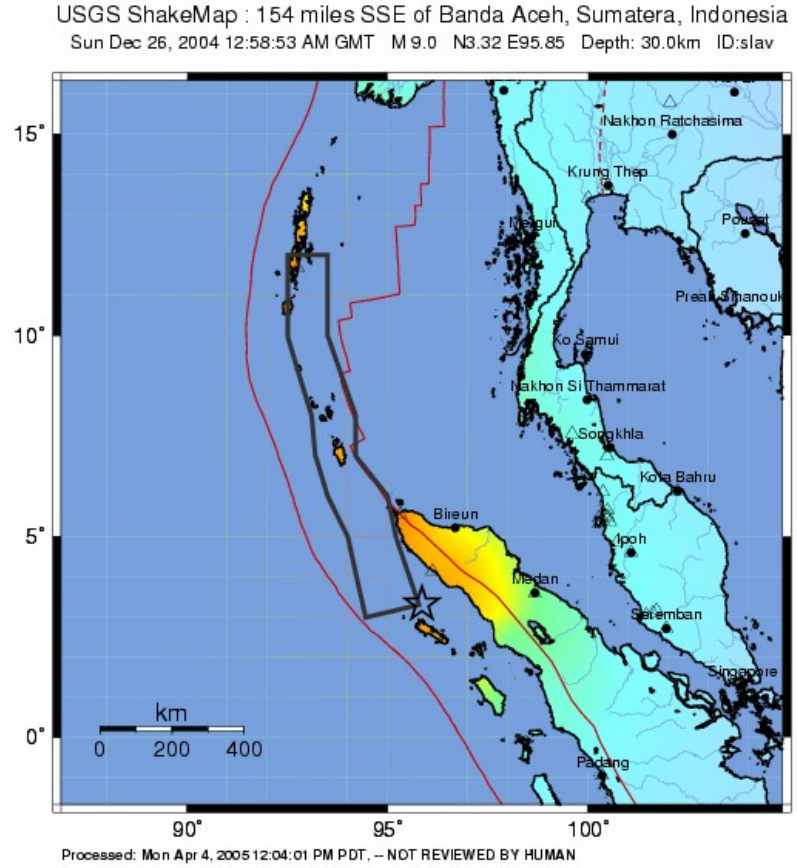
WWW.PORT.CO.TH

addresses of data banks

WWW.HYDRO.NAVY.MI.TH

Hydrographic Department Royal Thai Navy

26 December 2004 India Ocean Tsunami



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

07:57 26 December 2004

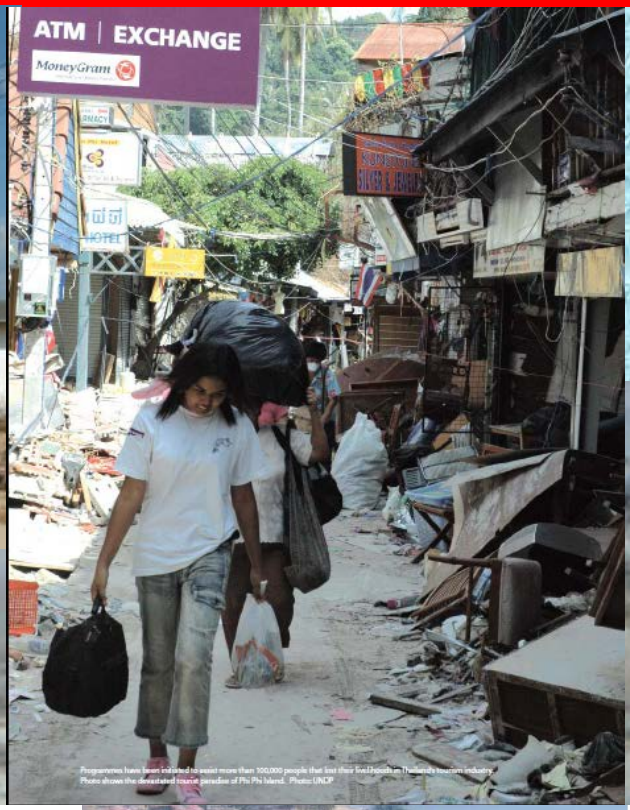
9.3 M Earthquake

Two hours later Tsunami hit west coast of Thailand

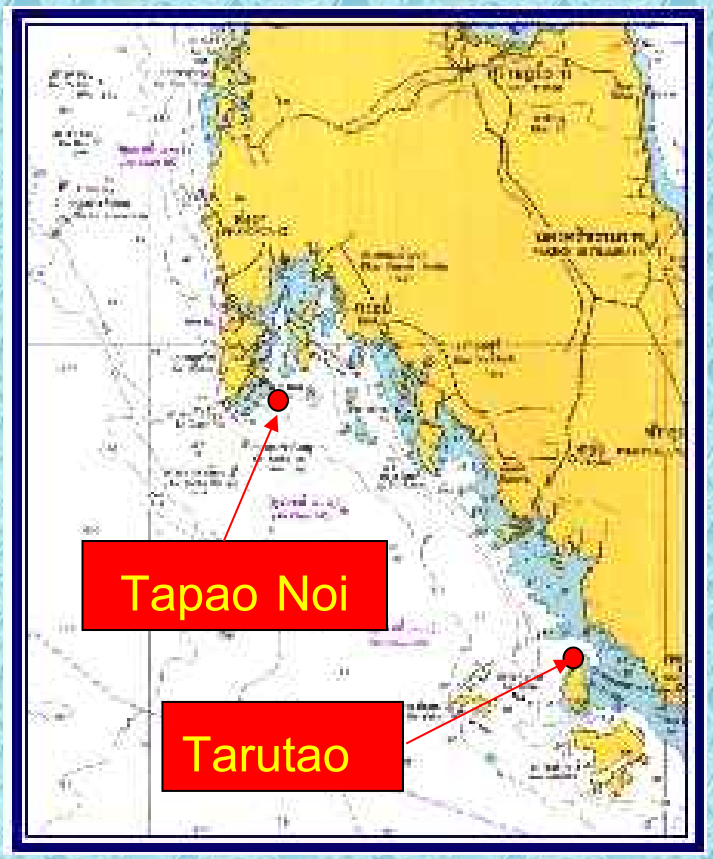
5,395 dead, 8,088 injured and 2,932 missing/unidentified

Cost 2 Billion USD in 6 provinces

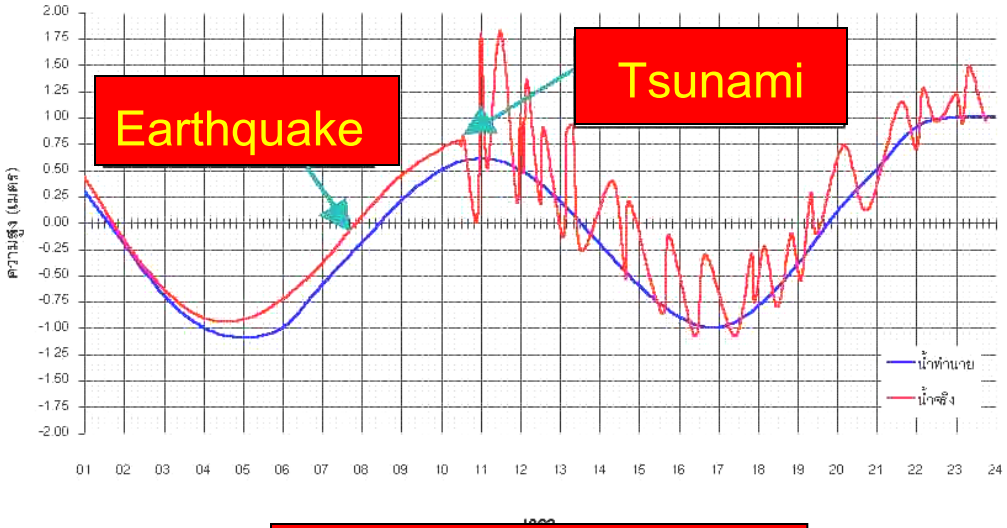
Hydrographic Department Royal Thai Navy



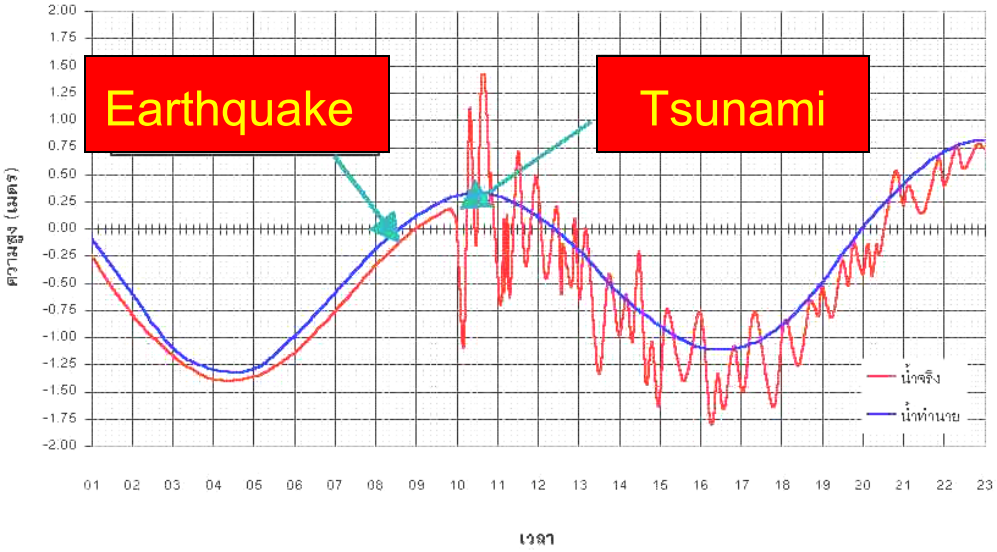
Hydrographic Department Royal Thai Navy



Tarutao

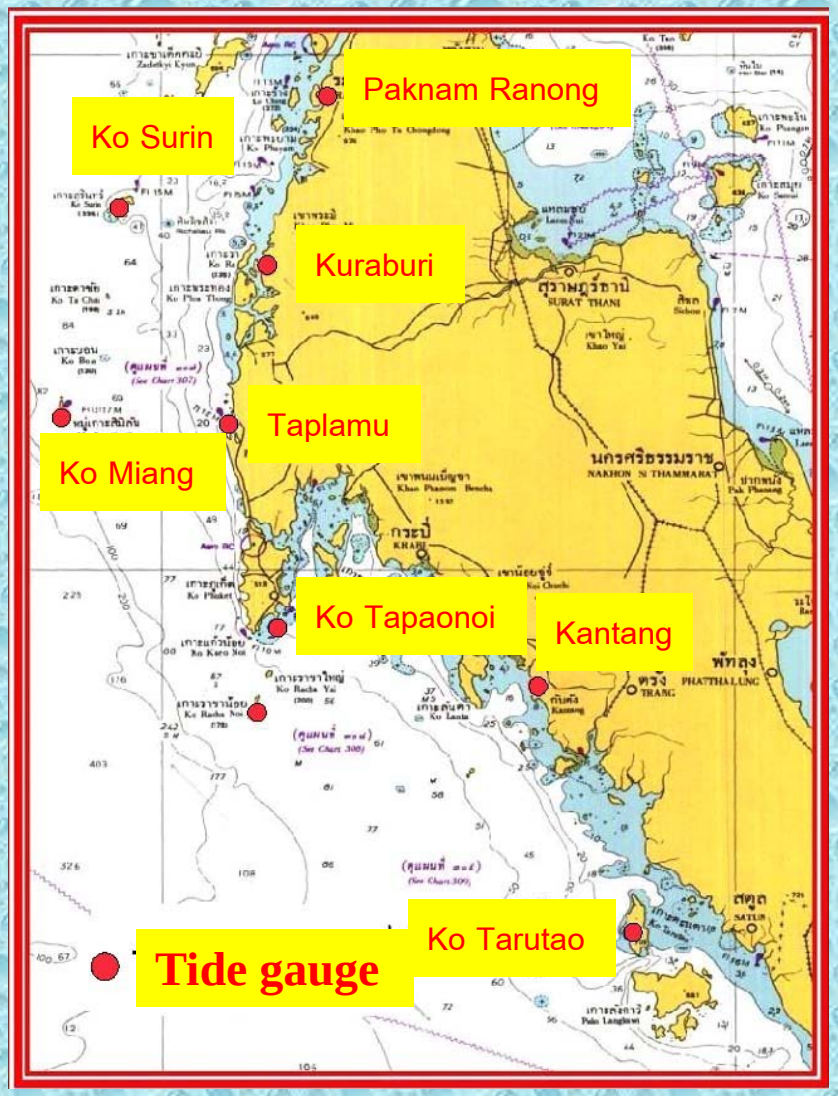


Tapao Noi



Hydrographic Department Royal Thai Navy

Hydrographic Department Royal Thai Navy



Real-time Tide gauge Network

- Paknam Ranong
- Ko (Island) Surin
- Kuraburi
- Ao (Bay) Taplamu
- Ko Miang
- Ko Tarutao
- Ko Tapaonoi
-Ko Rachanoi
- Kantang

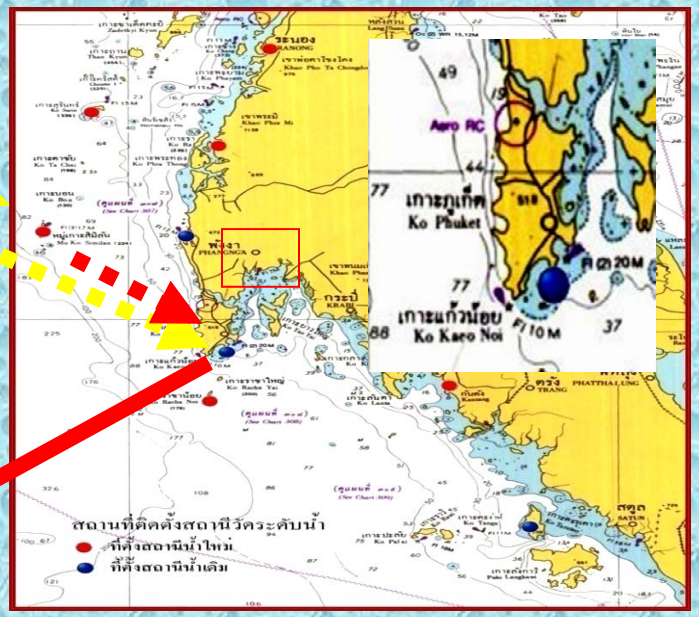
Hydrographic Department, Royal Thai Navy

TSUNAMI WARNING

Earthquake > 7

OP.Center RTN

OP.Center RTN HD



Alert tide gauge at Similan islands

If tsunami is highly likely : Alert

Andaman sea squadron and Pangnga naval base

Hydrographic Department Royal Thai Navy

Marine Dept.

Hydrographic Dept.

Port Authority of Thailand

THANK YOU