Tenth meeting of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region (ICG/PTWS WG-SCS), 28 & 30 September 2021

Seismic and Sea Level Core Stations in the SCS Region for Future Enhancing Tsunami Warning Capability

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Outline

1 Purpose of Data Sharing

2 Basic Information for Data Sharing in the SCS Region

3 Seismic Core Stations Evaluation of Data Availability in the SCS Region

4 Sea Level Core Stations Evaluation of Data Availability in the SCS Region

5 Summary

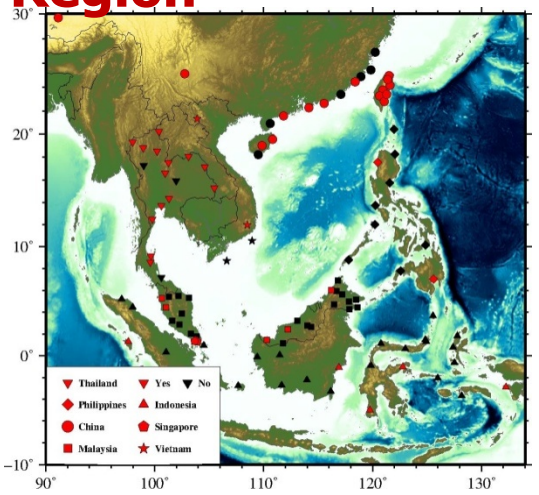
1 Purpose of Data Sharing

- Seismic and Sea level measurements are critical for tsunami warning in the following aspects:
  - Tsunami Detection in real time
  - Tsunami Threat Evaluation
  - Characteristic Parameters extraction (i.e. Earthquake Magnitude, Focal Depth, Arrival Time, Amplitude, Period, Duration)
  - Tsunami Forecast Correction
  - Tsunami Source Inversion

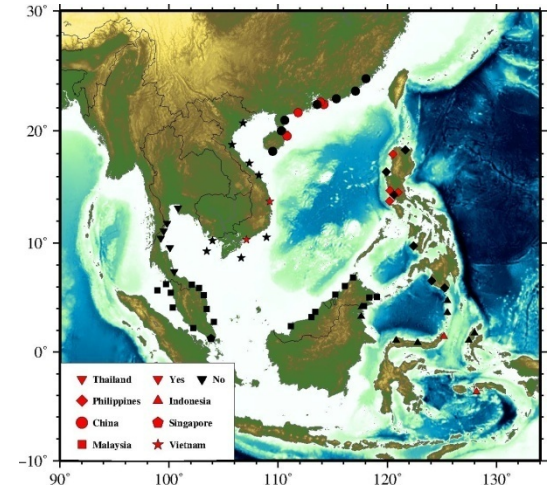
2 Basic Information for Data Sharing in the SCS Region

☐ Seismic and Sea Level Core Stations in the SCS Region

- **ICG/PTWS SCS-WG-IV Jakarta, Indonesia, 2015**
  Compiling the inventory of seismic and sea level stations in the SCS region
- **ICG/PTWS SCS-WG-V Manila, Philippine, 2016**
  Continuing to compiling the inventory of seismic and sea level stations
- **ICG/PTWS SCS-WG-VI Shanghai, China, 2017**
  Determination the lists of seismic and sea level stations
- **ICG/PTWS SCS-WG-VII Hanoi, Vietnam, 2018**
  Request SCSTAC to provide the reports on data availability of core stations
- **ICG/PTWS SCS-WG-VIII Jakarta, Indonesia,2019**
  SCSTAC provided the reports on data availability of core stations



Seismic Core Stations in the SCS region for further enhancing data sharing(115)



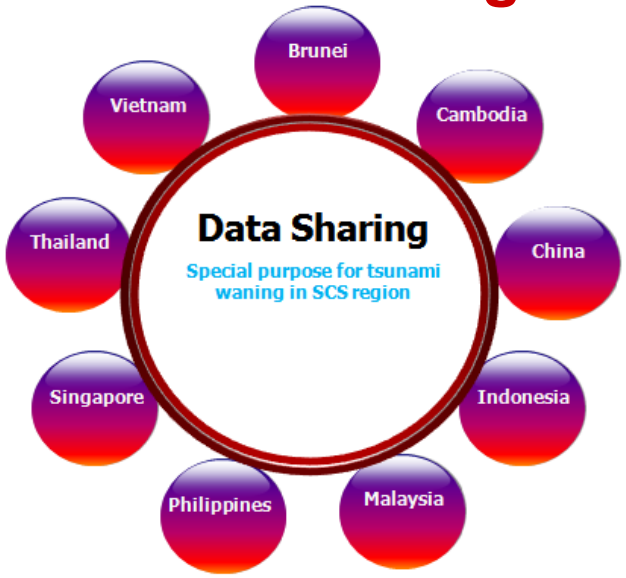
Sea Level Stations in the SCS region for further enhancing data sharing(69)

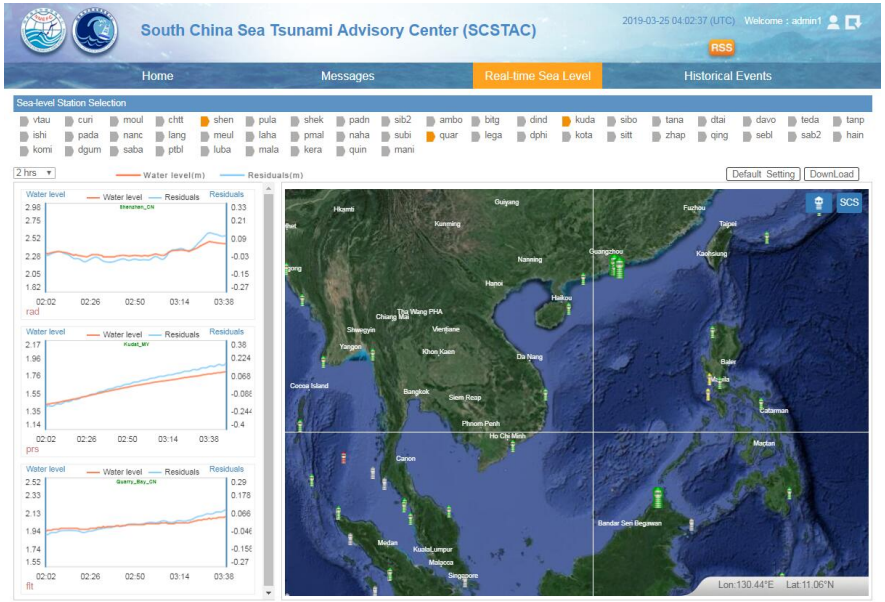
2 Seismic and Sea Level Data Availability in The SCS Region

☐Data Exchange and Sharing for SCS Tsunami Warning

●Seismic data

Building data sharing server for seismic core stations, using SeedLink client for exchange and share seismic data stream for WG-SCS Member States.



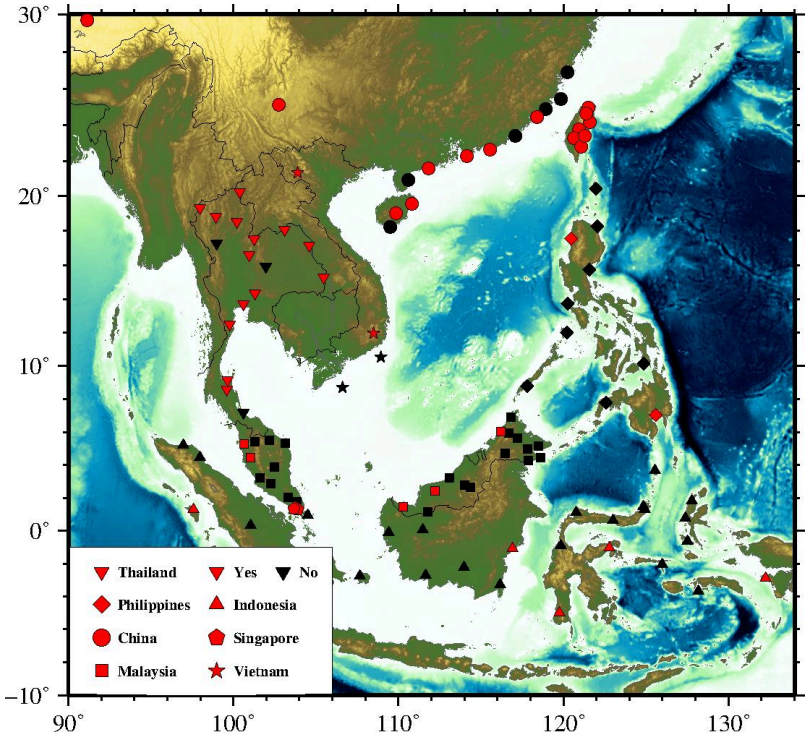


●Sea level data

Building sharing server for sea level core stations in real-time, by SCSTAC ftp for special users from WG-SCS Member States.

2 Seismic Core Stations in the SCS Region

- Seismic Core Stations in the SCS region for further enhancing data sharing (115), public accessibility (51)

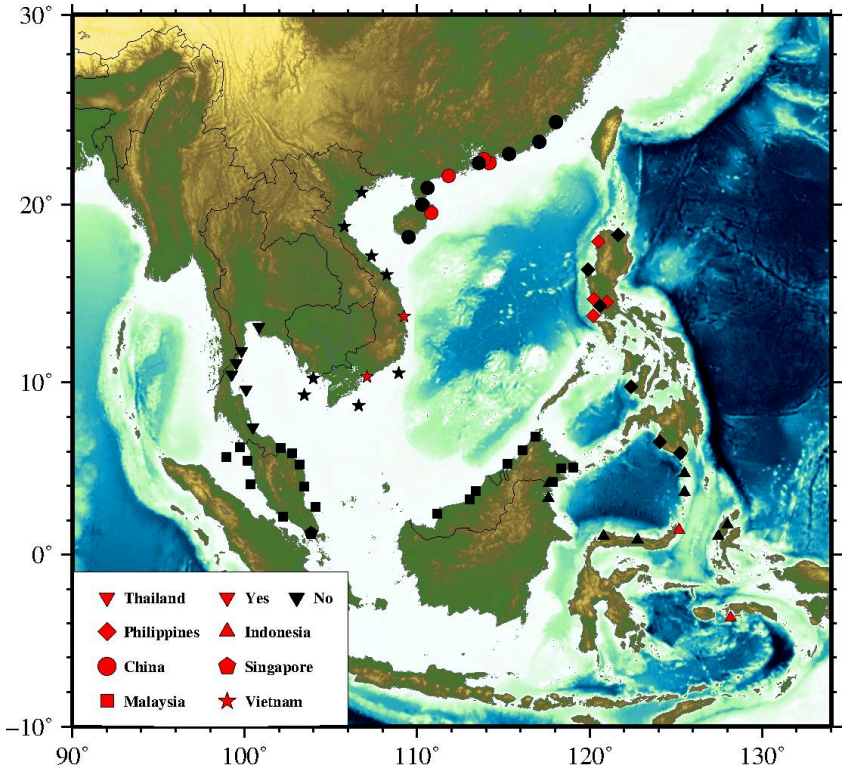


China: 22 [15Yes/7No]
Indonesia : 30 [8Yes/22No]
Malaysia : 25 [5Yes/20No]
Philippines : 10 [2Yes/18No]
Singapore: 4 [4Yes]
Thailand : 20 [15Yes/5No]
Viet Nam: 4 [2 Yes/2 No]

115[51 Yes/64 No]

2 Sea Level Core Stations in the SCS Region

- Sea Level Core Stations in the SCS region for further enhancing data sharing (71) , public accessibility (17)



China: **12 [5Yes/7No]**
Indonesia: **10 [2Yes/8No]**
Malaysia : **20 [3Yes/17No]**
Philippines: **11 [5Yes/6No]**
Singapore: **1 [0Yes/1No]**
Thailand : **7 [0Yes/7No]**
Viet Nam: **10 [2 Yes/8 No]**

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71 [17 Yes/54 No]

2 How to Evaluate the Availability of the Data

Key Performance Indicators for Evaluation on availability of Seismic and Sea Level Data

- **Continuous Rate =(1-gap/time)*100**

SCSTAC provide quarterly report on data availability

3 Continuous Rate for Seismic Station Contributed by WG-SCS

No.	Network	Station	Lon	Lat	202007-202009	202010-202012	202101-202103	202104-202106
1	HK	HKPS	114.14	22.28	99.52%	99.44%	99.93%	99.82%
2	OB	ZLG	115.57	22.65	99.00%	99.47%	99.42%	93.44%
3	OB	ZPO	111.83	21.58	98.93%	99.91%	99.97%	99.94%
4	OB	QLN	110.82	19.57	63.14%	75.77%	0.00%	0.00%
5	IC	LSA	91.13	29.70	98.20%	97.88%	99.80%	99.97%
6	IC	KMI	102.74	25.12	60.00%	72.00%	0.00%	0.00%
7	IC	QIZ	109.84	19.03	99.40%	99.30%	99.86%	99.95%
8	IU	TATO	121.50	24.97	98.52%	98.42%	99.02%	99.82%
9	TW	KMNB	118.39	24.46	98.14%	97.80%	99.83%	99.81%
10	TW	NACB	121.59	24.17	99.27%	99.13%	100.00%	99.66%
11	TW	SSLB	120.95	23.79	99.28%	99.16%	99.91%	99.80%
12	TW	TPUB	120.63	23.30	98.58%	98.29%	100.00%	95.47%
13	TW	TWGB	121.08	22.82	99.25%	99.10%	100.00%	99.80%
14	TW	YHNB	121.37	24.67	98.91%	98.74%	99.78%	99.80%
15	TW	YULB	121.30	23.39	98.63%	99.02%	96.66%	98.87%
16	GE	BKB	116.90	-1.11	99.99%	99.99%	99.98%	100.00%
17	GE	BKNI	101.04	0.33	98.68%	99.55%	94.31%	97.82%
18	GE	FAKI	132.25	-2.92	97.51%	99.73%	86.39%	99.98%
19	GE	GSI	97.58	1.30	99.73%	99.68%	99.99%	100.00%
20	GE	LHMI	96.95	5.23	98.95%	98.79%	99.72%	100.00%
21	GE	LUWI	122.77	-1.04	99.34%	99.24%	99.88%	100.00%
22	GE	TNTI	127.37	0.77	99.80%	99.76%	100.00%	99.95%
23	II	KAPI	119.75	-5.01	88.04%	85.70%	99.73%	99.82%
24	MY	IPM	101.03	4.48	70.01%	64.05%	99.82%	5.43%
25	MY	KKM	116.21	6.04	66.56%	68.37%	57.51%	90.51%

3 Continuous Rate for Seismic Station Contributed by WG-SCS

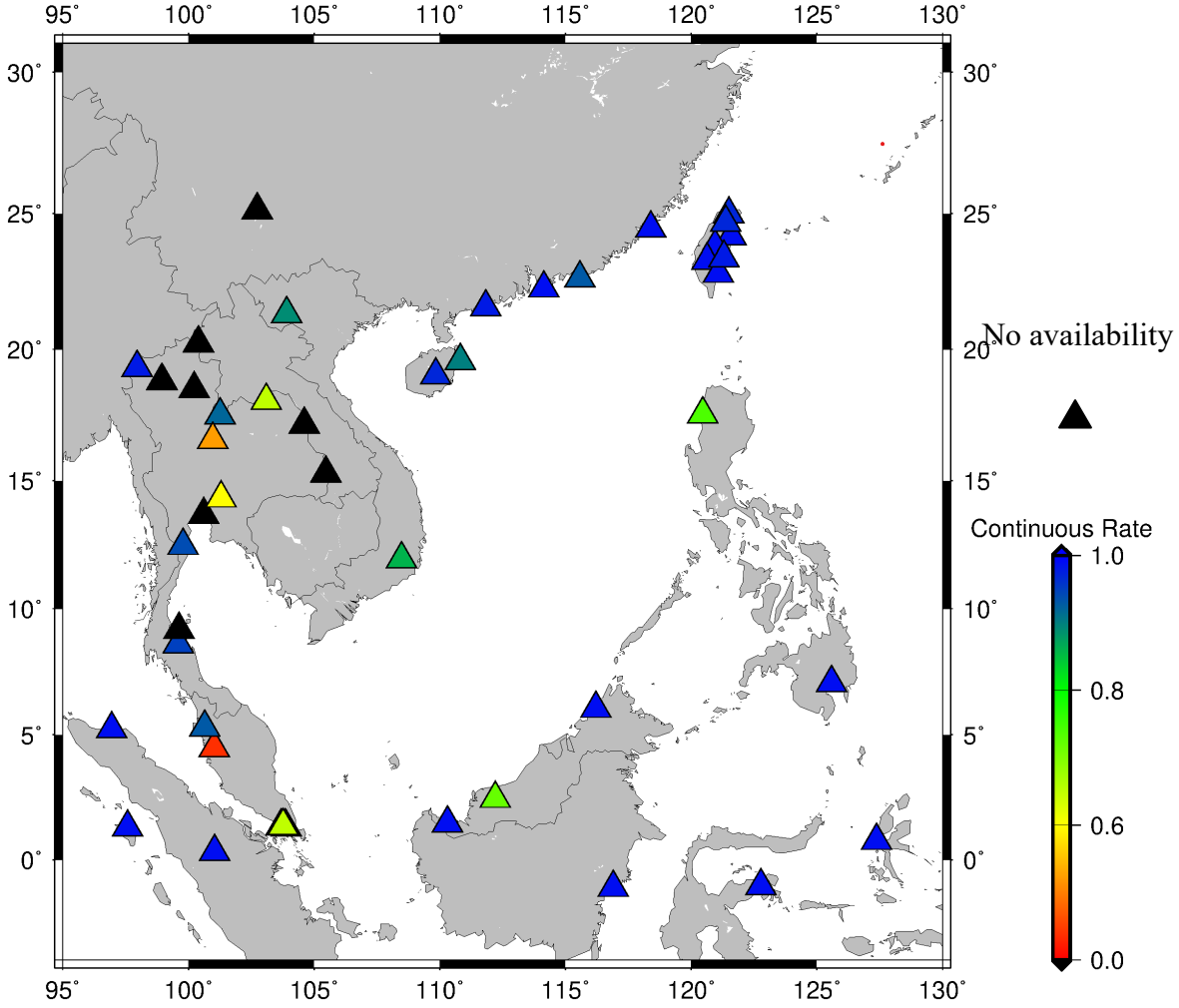
Cont. above table

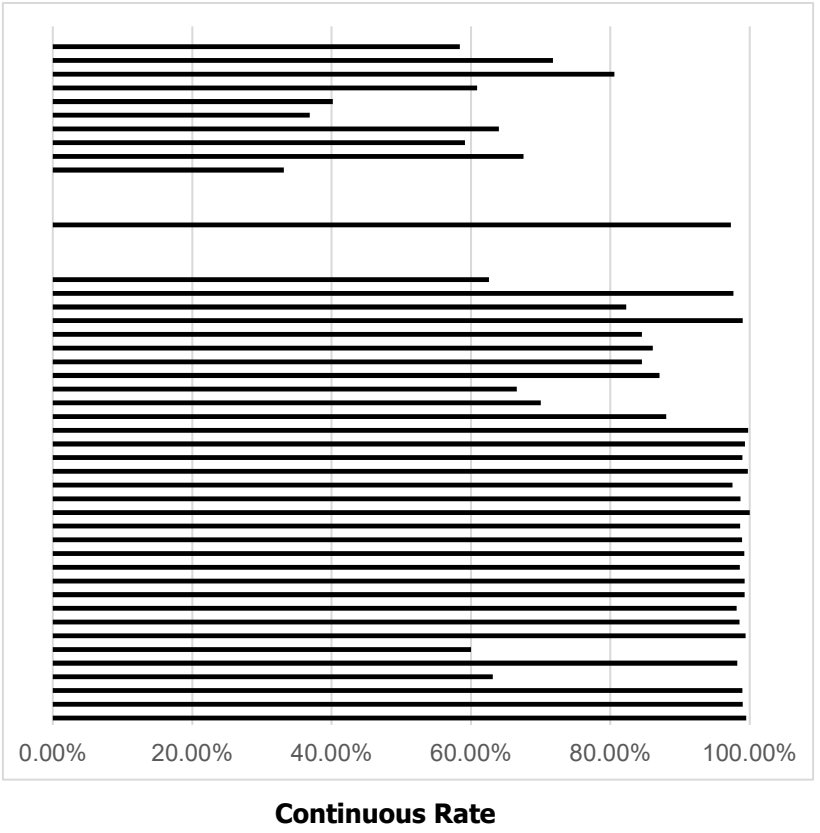
No.	Network	Station	Lon	Lat	202007-202009	202010-202012	202101-202103	202104-202106
27	MY	KUM	100.65	5.29	84.52%	89.49%	59.64%	71.41%
28	MY	SBM	112.21	2.45	86.09%	85.10%	91.03%	90.99%
29	IU	CHTO	98.94	18.81	84.52%	81.63%	99.01%	99.91%
30	IU	DAV	125.58	7.07	98.98%	99.12%	98.31%	99.70%
31	RM	DLV	108.48	11.95	82.27%	78.98%	98.70%	98.64%
32	RM	SLV	103.91	21.33	97.66%	97.30%	99.51%	99.73%
33	RM	SZP	120.46	17.55	62.56%	72.20%	14.36%	0.00%
34	MS	BESC	103.85	1.34	0.00%	0.00%	0.00%	0.00%
35	MS	KAPK	103.89	1.30	0.00%	0.00%	0.00%	0.00%
36	MS	NTU	103.69	1.35	0.00%	0.00%	0.00%	0.00%
37	MS	BTDF	103.77	1.36	97.30%	98.48%	91.39%	99.64%
38	TM	CRAI	100.40	20.23	0.00%	0.00%	0.00%	0.00%
39	TM	PANO	104.61	17.15	0.00%	0.00%	0.00%	0.00%
40	TM	TMDB	100.61	13.67	0.00%	0.00%	0.00%	0.00%
41	TM	CMMT	98.95	18.81	33.12%	39.75%	0.00%	26.09%
42	TM	LOEI	101.26	17.51	67.53%	81.03%	0.00%	27.47%
43	TM	MHIT	97.96	19.31	59.14%	56.11%	74.28%	21.42%
44	TM	NAYO	101.30	14.32	63.99%	76.79%	0.00%	27.46%
45	TM	NONG	103.10	18.06	36.88%	44.25%	0.00%	0.00%
46	TM	PBKT	100.97	16.57	40.16%	48.20%	0.00%	27.47%
47	TM	PHRA	100.23	18.50	60.87%	73.04%	0.00%	27.47%
48	TM	PRAC	99.79	12.47	80.60%	76.92%	99.04%	44.34%
49	TM	SRIT	99.60	8.60	71.77%	85.90%	1.11%	46.52%
50	TM	SURA	99.63	9.17	58.41%	57.77%	61.65%	27.47%
51	TM	UBPT	105.47	15.28	0.00%	63.82%	0.00%	0.00%

3 Continuous Rate for available Seismic Stations in SCS Region

202007-202009

45 stations are available

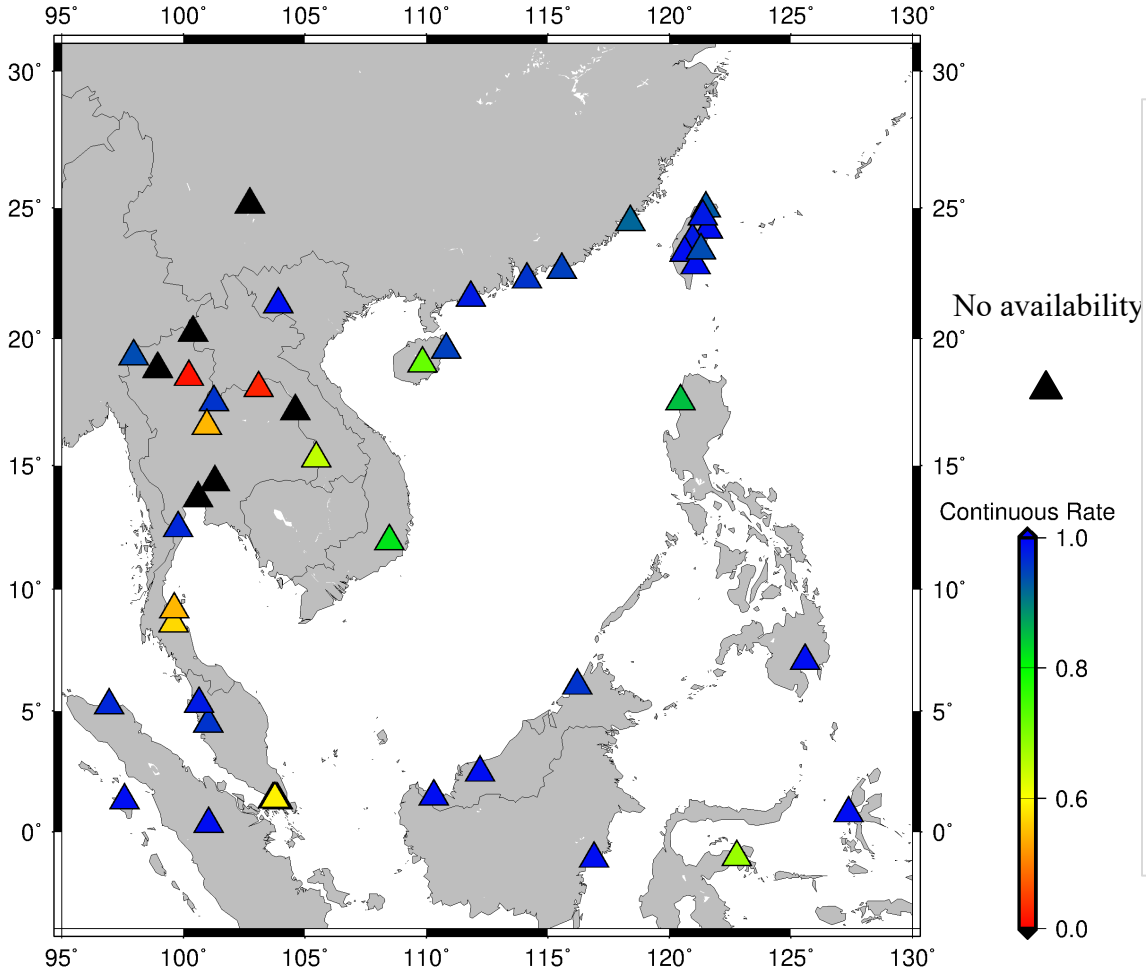


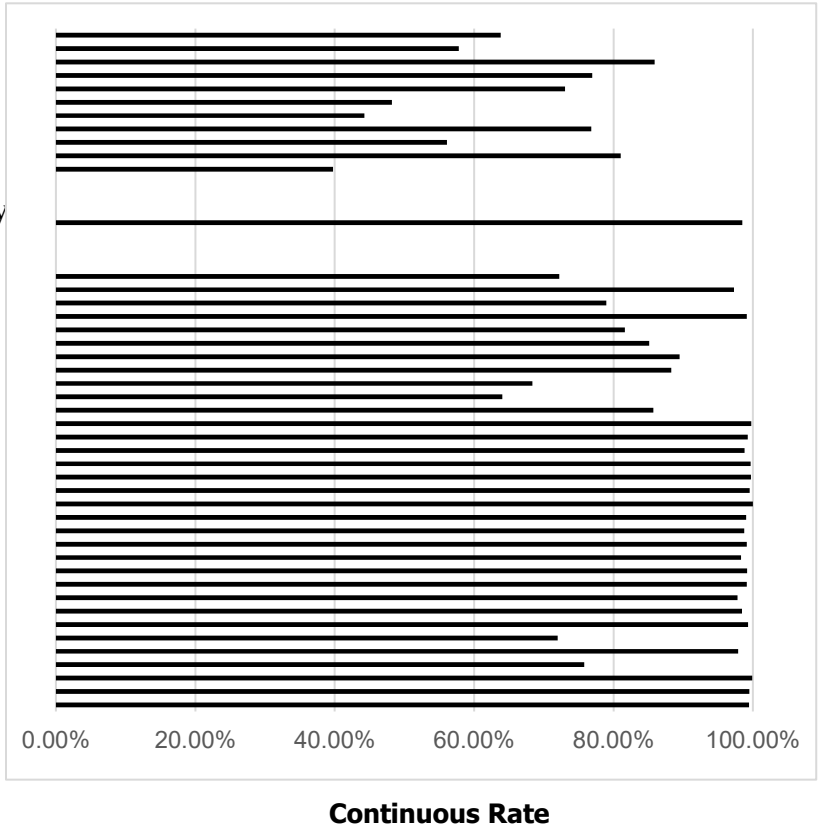


3 Continuous Rate for available Seismic Stations in SCS Region

202010-202012

45 stations are available

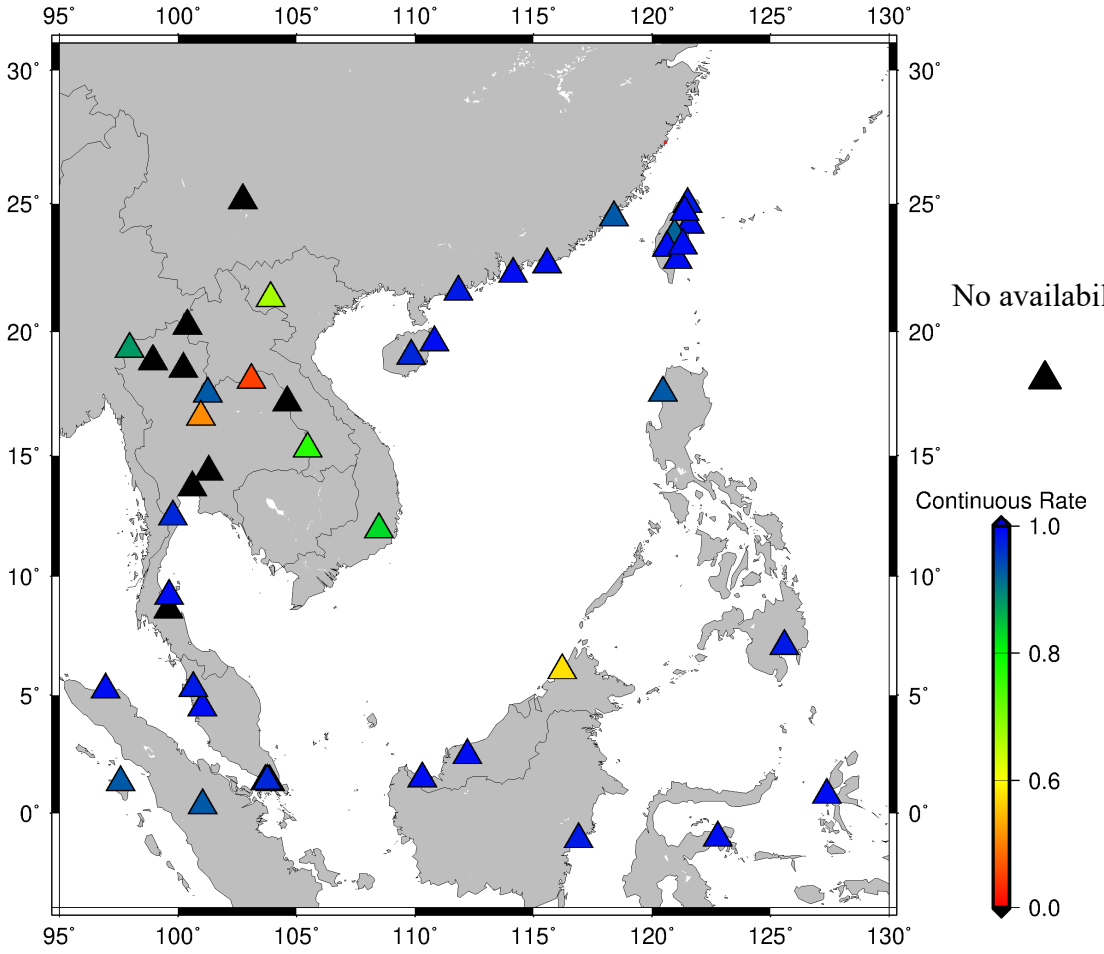


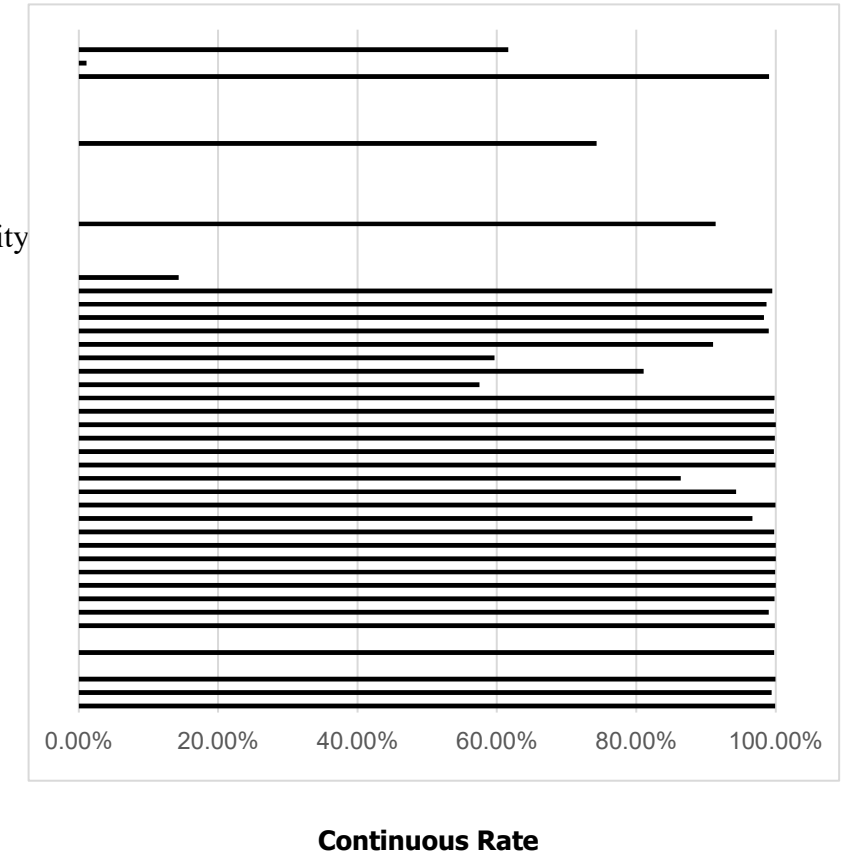


3 Continuous Rate for available Seismic Stations in SCS Region

202101-202103

45 stations are available

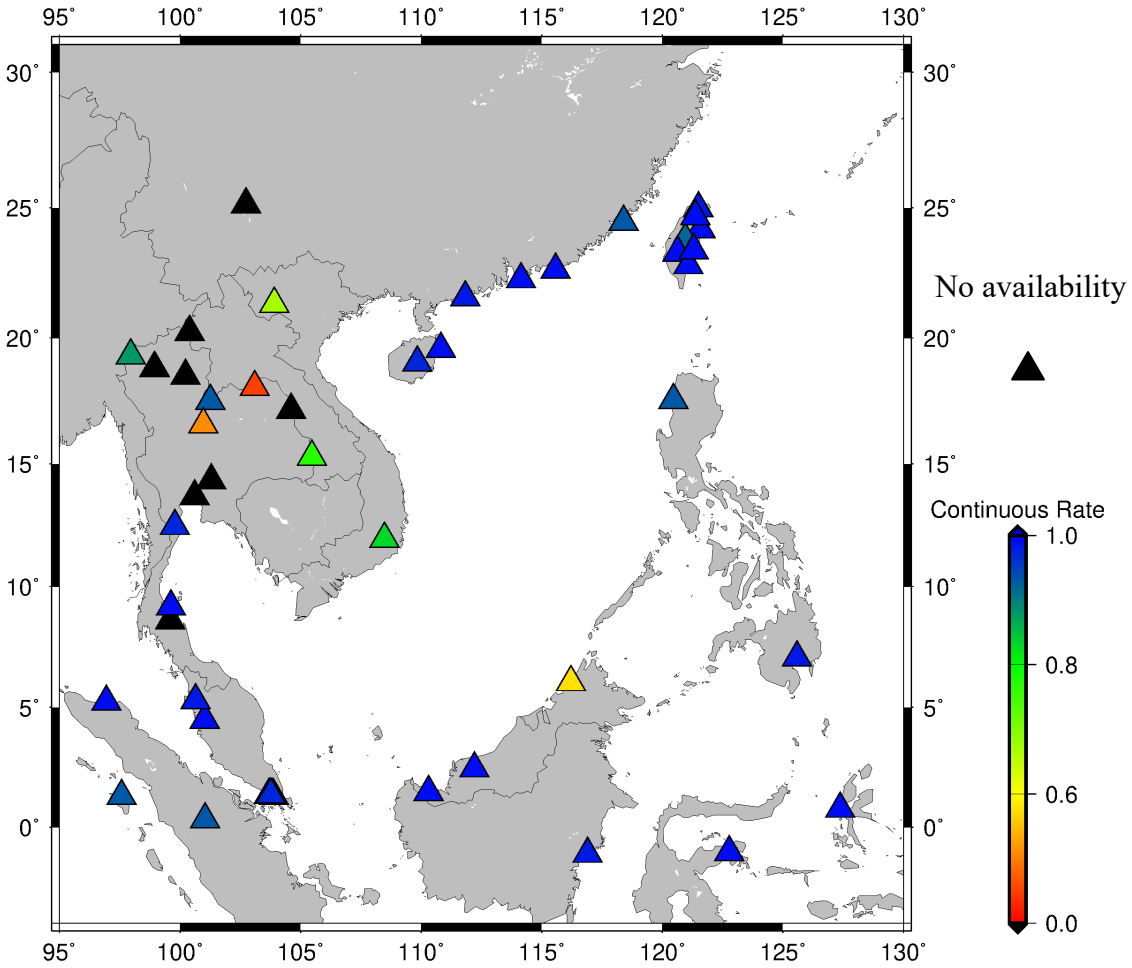


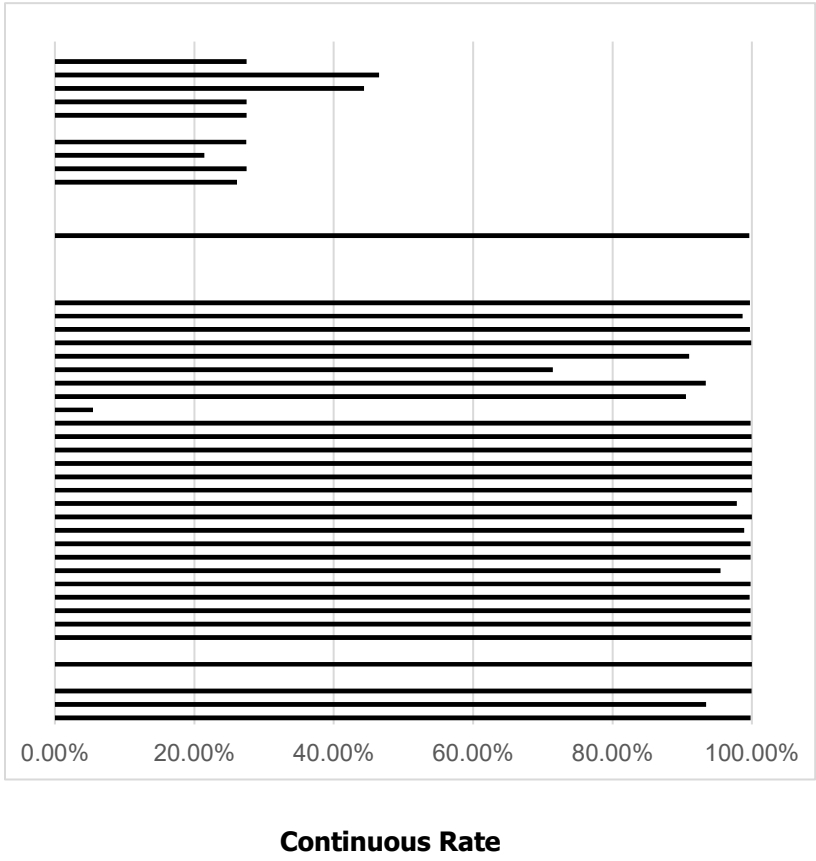


3 Continuous Rate for available Seismic Stations in SCS Region

202104-202106

45 stations are available

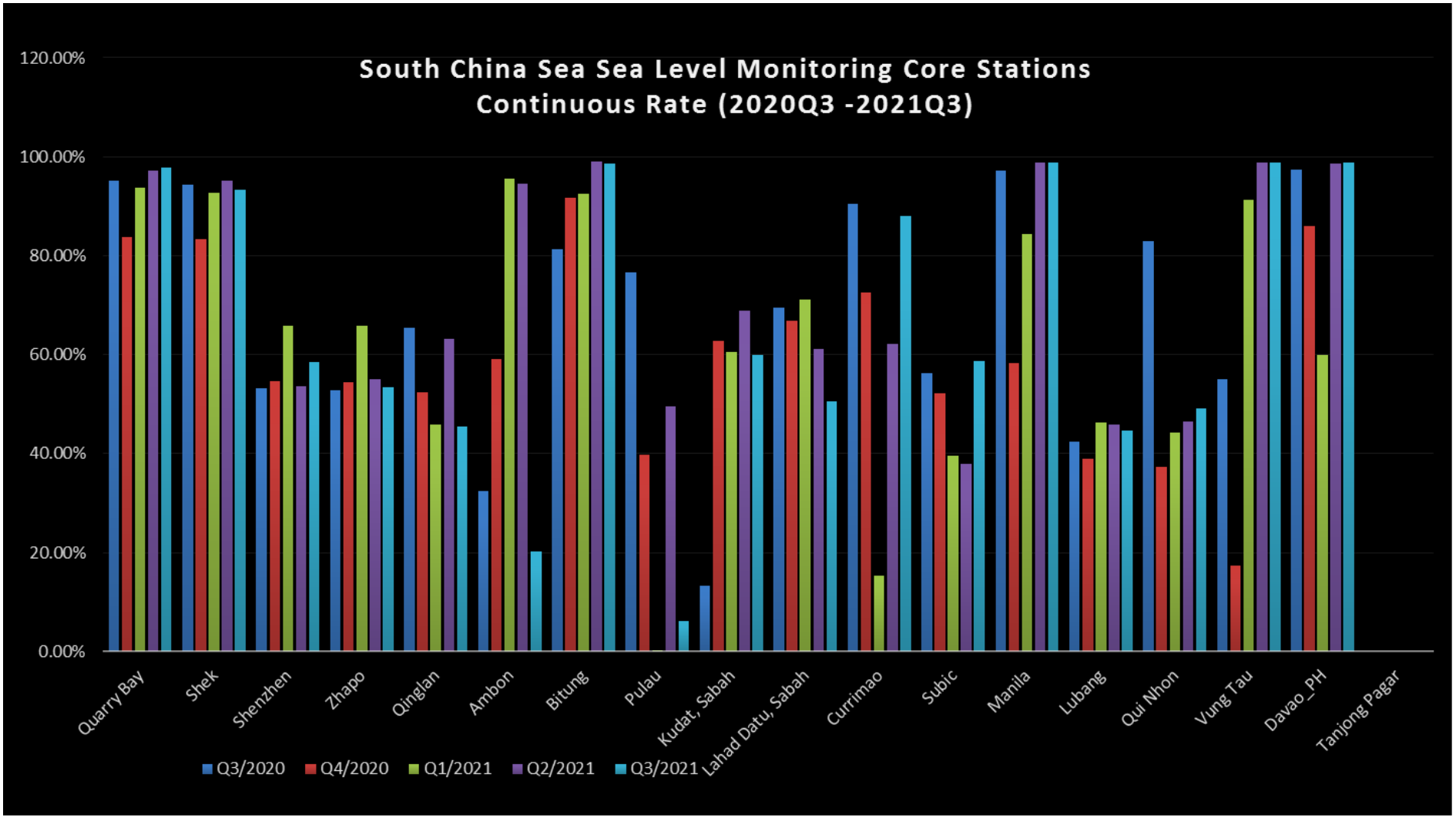




4 Continuous Rate for available Sea Level Stations

South China Sea Key Sea Level Monitoring Stations Inventory 2020-2021								Performance Statistics				
No.	Station Name	Code(IOC)	Lat	Lon	Country	Availability (Yes/No)	Data Transfer Mechanism	Continuous Rate (%)				
								Q3/2020	Q4/2020	Q1/2021	Q2/2021	Q3/2021
1	Quarry Bay	quar	22.29	114.21	China	Yes	GTS	95.16%	83.81%	93.67%	97.21%	97.88%
2	Shek	shek	22.22	113.89	China	Yes	GTS	94.27%	83.39%	92.79%	95.13%	93.23%
3	Shenzhen	shen	22.47	113.88	China	Yes	GTS	53.30%	54.64%	65.89%	53.70%	58.42%
4	Zhapo	zhap	21.58	111.82	China	Yes	GTS	52.79%	54.53%	65.88%	55.13%	53.40%
5	Qinglan	qing	19.57	110.82	China	Yes	GTS	65.46%	52.47%	45.83%	63.24%	45.38%
6	Ambon	ambon	-3.68	128.18	Indonesia	Yes	GTS	32.43%	59.19%	95.52%	94.47%	20.24%
7	Bitung	bitu	1.44	125.19	Indonesia	Yes	GTS	81.38%	91.67%	92.59%	98.96%	98.66%
8	Pulau	ms004	5.93	102.77	Malaysia	Yes	GTS	76.53%	39.69%	0.01%	49.54%	6.12%
9	Kudat, Sabah	ms005	6.88	116.85	Malaysia	Yes	GTS	13.38%	62.73%	60.63%	68.90%	59.99%
10	Lahad Datu, Sabah	ms006	5.08	119.08	Malaysia	Yes	GTS	69.49%	66.77%	71.19%	61.18%	50.65%
11	Currimao	curri	17.98	120.48	Philippines	Yes	GTS	90.44%	72.52%	15.28%	62.14%	88.07%
12	Subic	subi	14.77	120.25	Philippines	Yes	GTS	56.17%	52.13%	39.49%	37.85%	58.75%
13	Manila	mani	14.58	120.97	Philippines	Yes	GTS	97.22%	58.20%	84.44%	98.78%	98.76%
14	Lubang	luba	13.82	120.2	Philippines	Yes	GTS	42.41%	39.04%	46.38%	45.80%	44.72%
15	Qui Nhon	quin	13.76	109.25	Vietnam	Yes	GTS	82.90%	37.37%	44.31%	46.58%	49.12%
16	Vung Tau	vung	10.34	107.07	Vietnam	Yes	GTS	55.04%	17.40%	91.23%	98.77%	98.80%
17	Davao_PH	davo	7.15	125.66	Philippines	Yes	GTS	97.40%	85.99%	59.91%	98.68%	98.78%

4 Continuous Rate for available Sea Level Stations



4 Continuous Rate for available Sea Level Stations

South China Sea Sea Level Monitoring Core Station Inventory

								Potential for -immediate-sharing		
								Yes	No	
No.	Station Name	Code (IOC)	Lat	Lon	Country	Availability (Yes/No)	Data Transfer Mechanism	What needs to be done, by whom when?	What should be done to remove obstacles?	Detailed comments - technical issues - GTS, BGAN, http or URL address / decommissioned?
1	Quarry Bay	quar	22.3	114.2	China	Yes	GTS			
2	Shenzhen	shen	22.5	113.9	China	Yes	GTS			
3	Zhapo	zhap	21.6	111.8	China	Yes	GTS			
4	Qinglan	qing	19.6	110.8	China	Yes	GTS			
5	Xiamen		24.5	118.1	China	No			before WG-IX (Guangzhou) to share gradually through FTP	
6	Shanwei		22.8	115.4	China	No			idem	
7	Xiuying		20	110.3	China	No			idem	
8	Nan'ao		23.4	117.1	China	No			idem	
9	Zhuhai		22.3	113.6	China	No			idem	
10	Naozhou		20.9	110.6	China	No			idem	
11	Sanya		18.2	109.5	China	No			idem	
12	Bitung	bitu	1.44	125.2	Indonesia	Yes	GTS			
13	Ambon	ambon	-3.7	128.2	Indonesia	Yes	GTS			
14	Nunukan		4.15	117.7	Indonesia	No			Proposal is to involve BIG in works of WG-SCS through communication wth BMKG	Available at www.big.go.id
15	Tarakan		3.28	117.6	Indonesia	No			idem	Available at www.big.go.id
16	Masore		4.72	125.5	Indonesia	No			idem	Available at www.big.go.id
17	Anggrek		0.86	122.8	Indonesia	No			idem	Available at www.big.go.id
18	Toli-Toli		1.05	120.8	Indonesia	No			idem	Available at www.big.go.id
19	Jailolo		1.06	127.5	Indonesia	No			idem	Available at www.big.go.id
20	Tobelo		1.72	128	Indonesia	No			idem	Available at www.big.go.id
21	Tahuna		3.6	125.5	Indonesia	No			idem	Available at www.big.go.id
22	Pulau Perhentian	ms004	5.9	102.8	Malaysia	Yes	GTS			
23	Kudat	ms005	6.88	116.8	Malaysia	Yes	GTS			
24	Sahabat	ms006	5.08	119.1	Malaysia	Yes	GTS			
	Pulau Perak	ms001			Malaysia	Yes	GTS	Station need to be relocated	2 MORE STATIONS TO BE SHARED THROUGH GTS	
	Kerancut	ms002			Malaysia	Yes	GTS	Station need to be relocated	2 MORE STATIONS TO BE SHARED THROUGH GTS	

SCS Sea Level Monitoring Core Network for ICG/PTWS WG-SCS data sharing discussion in the IOC South China Sea training, Hangzhou, China (October 25 2019)

4 Continuous Rate for available Sea Level Stations

South China Sea Sea Level Monitoring Core Station Inventory										
								Potential for -immediate-sharing		
								Yes	No	
No.	Station Name	Code (IOC)	Lat	Lon	Country	Availability (Yes/No)	Data Transfer Mechanism	What needs to be done, by whom when?	What should be done to remove obstacles?	Detailed comments - technical issues - GTS, BGAN, http or URL address / decommissioned?
40	Porto Malai	ms001	6.26	99.73	Malaysia	No	GTS			CURRENTLY NOT WORKING
41	Layang-Layang Tsunami Buoy, Sabah				Malaysia	No	Tsunameter (deep ocean buoy)		OPERATION DISCONTINUED	
	Langkawi	lank					GTS			
42	CURRIMAO	curri	18	120.5	Philippines	Yes	GTS			
43	SUBIC	subi	14.8	120.3	Philippines	Yes	GTS			
44	MANILA	mani	14.6	121	Philippines	Yes	GTS			
45	LUBANG	luba	13.8	120.2	Philippines	Yes	GTS			
46	APPARRI		18.4	121.6	Philippines	No			PHIVOLCS working with JICA to explore sharing data - results hopefully by WG-SCS-IX	Stations donated by JICA -
47	BOLINAO		16.4	119.9	Philippines	No			idem	idem
48	CORREGIDOR		14.4	120.6	Philippines	No			idem	idem
49	SIPALAY		9.74	122.4	Philippines	No			idem	idem
50	SARANGGANI BAY		5.92	125.3	Philippines	No			idem	idem
									idem	idem
51	KALAMANSIG		6.55	124	Philippines	No	GTS		idem	NOT OPERATIONAL
52	Tanjong Pagar	tanjo	1.26	103.9	Singapore	No	GTS			Singapore to replace with another station?

SCS Sea Level Monitoring Core Network for ICG/PTWS WG-SCS data sharing discussion in the IOC South China Sea training, Hangzhou, China (October 25 2019)

5 Summary

- **Summary of availability of core seismic station**
  Total: 151 ;
  Public Accessibility: 51 (45 Data available; 6 No data);
  Percentage of availability of core seismic station:~30%
  No adding new station

- **Summary of availability of core sea level station**
  Public accessibility by GTS and IOC Sea Level Facility Portal: 17
  Accessibility by SCSTAC:
  6 out of 17 stations have continuous rate above 70%
  No adding new station

- **Notable Issue**
  Data continuous rate needs to be improved
  Seismic and Sea Level monitoring gaps exist in the tsunami-prone areas
  No tsunami buoy in service within the area

- **Encourage**
  Member States of the WG-SCS to share more seismic and sea level stations to further enhance the tsunami warning capability in the South China Sea region, especially for the Sulu Sea, Celebes Seas and North Borneo

Thank You

Tingting Fan
South China Sea Tsunami Advisory Center, UNESCO/IOC