11th Session (online) of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region (ICG/PTWS WG-SCS), Guangzhou, China, 25–27 September 2023

Report on the South China Sea Tsunami Advisory Center (SCSTAC)

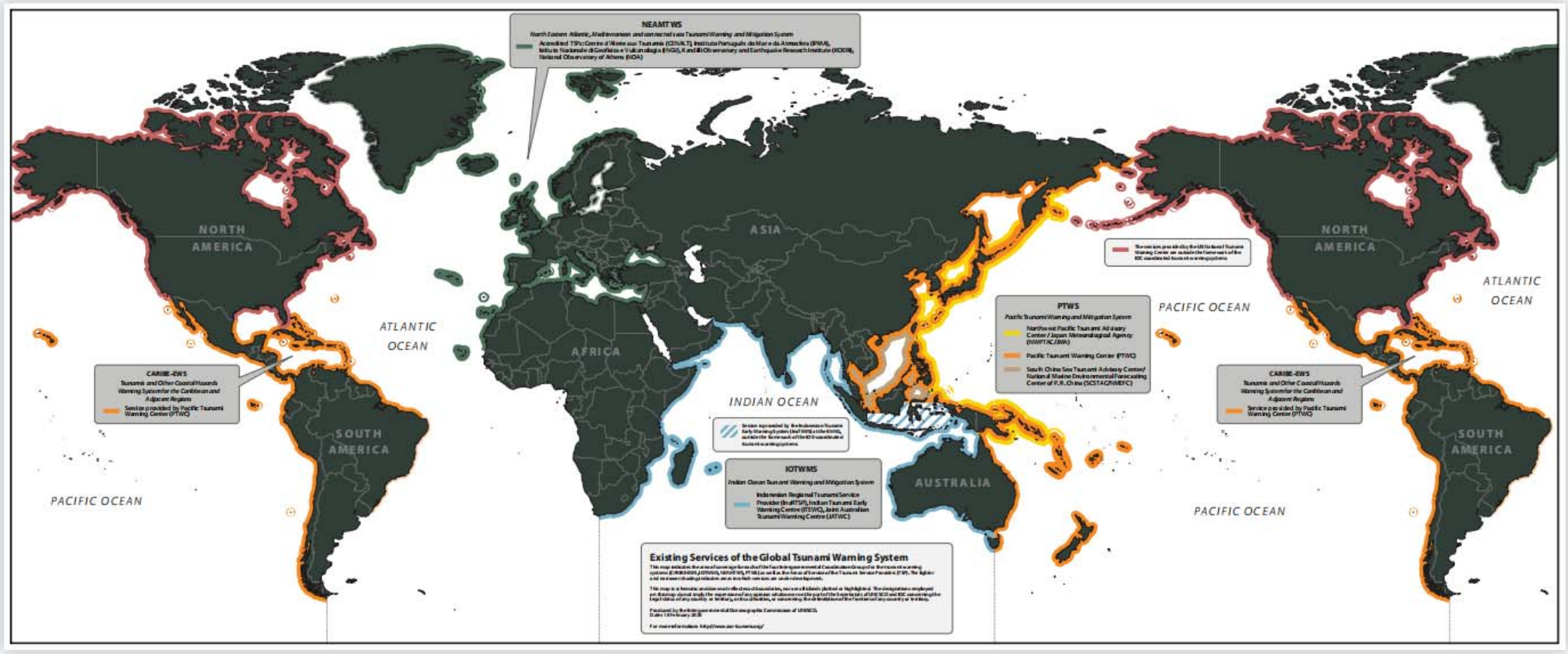
Zhiguo Xu
South China Sea Tsunami Advisory Center, UNESCO/IOC

Outline

1. SCS Tsunami Warning and Mitigation System
2. Operation of SCSTAC
3. Communication Test and Exercise
4. Other Activities
5. Further Plans

1. SCS Tsunami Warning and Mitigation System

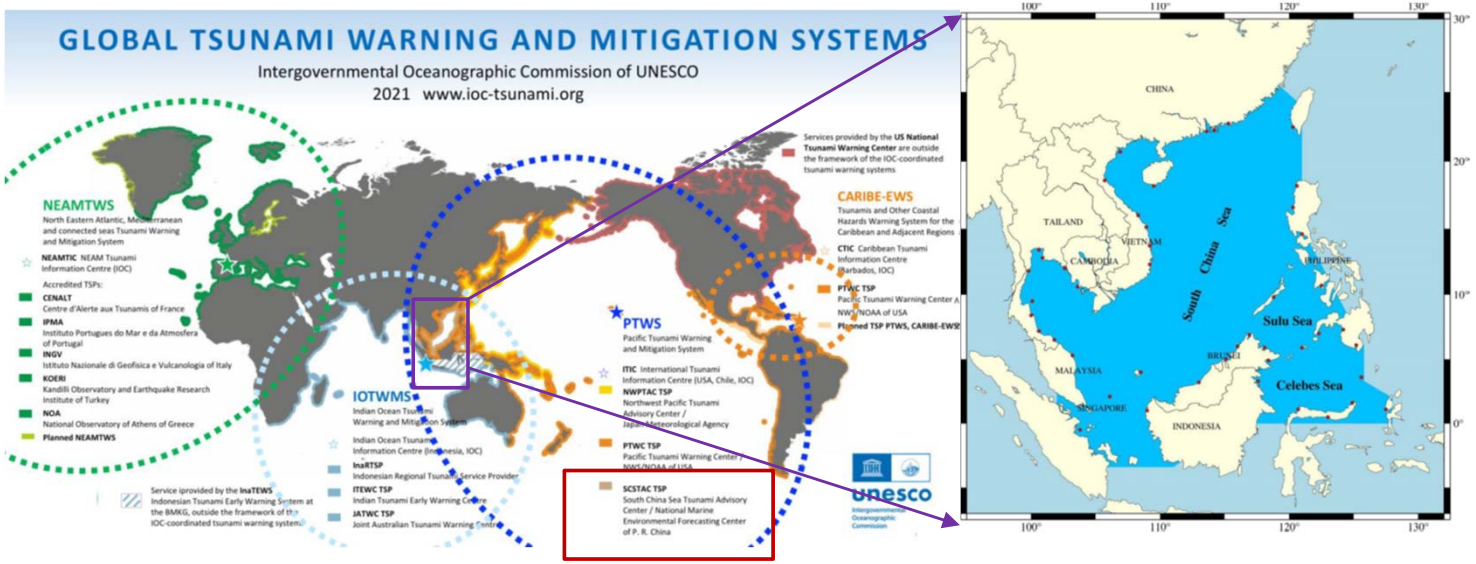
1.1 Existing Services of the Global Tsunami Warning System



Produced by the Intergovernmental Oceanographic Commission of UNESCO (update Feb 2020).

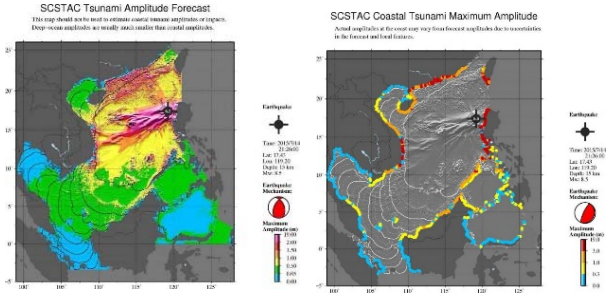
1. SCS Tsunami Warning and Mitigation System

1.2 UNESCO's IOC SCSTAC

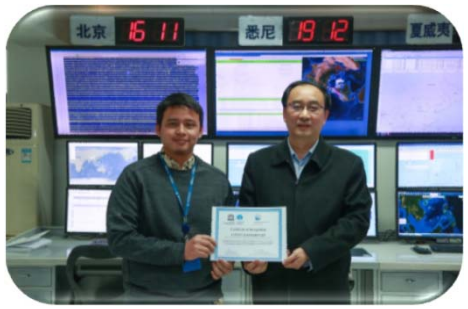


Tsunami Advisory Products

- Text messages
- Graphical Products



The Area of Service (AoS) for the SCSTAC specified by ICG/PTWS embraces all coasts of the South China Sea, and the adjacent Sulu Sea and Celebes Sea, separated by Palawan and Sulu Archipelago from north to south respectively. Nine Member States of the SCS region include **Brunei, Cambodia, China, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam** (in alphabetic order).



The South China Sea Tsunami Advisory Center (http://scstac.oceanguide.org.cn) has been in full operation since November 5th, 2019.

1.SCS Tsunami Warning and Mitigation System

1.2 Standard Operating Procedures for SCSTAC

Magnitude(Mw)	Tsunami Potential Description
$6.0 \le M_w \le 7.0$	There is no tsunami threat from this earthquake
$7.1 \le M_w \le 7.5$	Possibility of a destructive local tsunami confined to 100-300 km of the epicenter
$M_w \ge 7.6$	Possibility of a destructive basin-wide tsunami

Bulletin type		Criteria	Content	Timeline
Tsunami Information	Only one bulletin	Mag. of 6.0-6.4; or on land; or depth≥100km	EQ parameters and statement of 'No tsunami threat'	8-10 min
	Only one bulletin unless minor waves observed and should be reported	Mag. of 6.5-7.0	EQ parameters and statement of 'No tsunami threat'	8-10 min
Tsunami Threat Message	Bulletin with quantitative forecast	7.1 and above	EQ parameters and quantitative forecasts on threat level and Estimated Time of Arrival (ETA)	8-15 min
	Supplementary with observations		EQ parameters, quantitative forecast and tidal gauge observations	If revision on EQ & tsunami forecasts, or observation available
	Final bulletin		Statement of 'No tsunami confirmed or threat passed'	hazardous waves has passed or no significant tsunami observations

2. Operation of SCSTAC

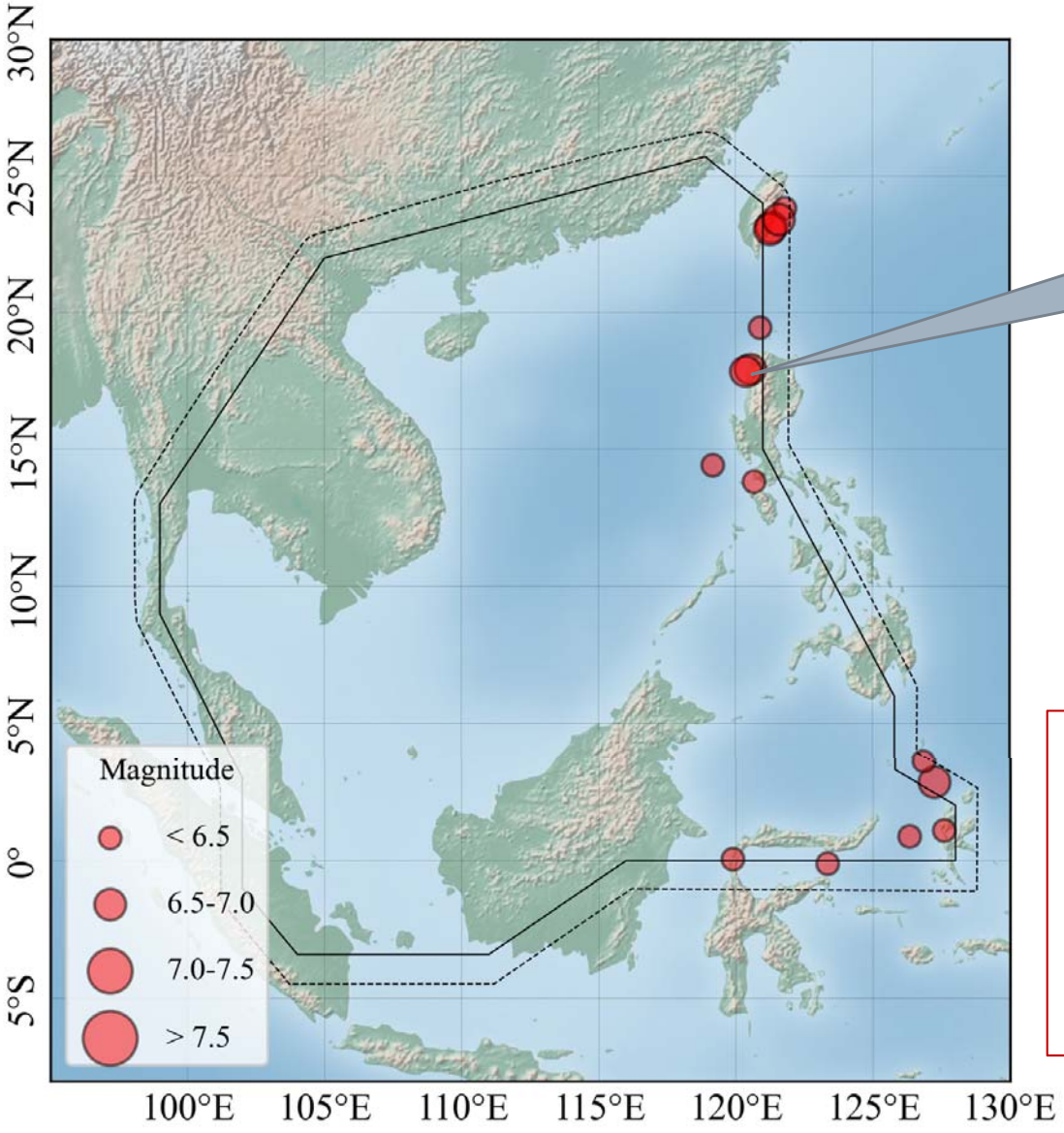
2.1 Issued Tsunami Bulletins（Oct. 2021- Aug. 2023）

No	Mag	Origin Time (UTC)	Depth (km)	Lon (°)	Lat (°)	Location	Message
1	6.4	2023-09-12 11:03:00	10	120.89°E	19.46°N	PHILIPPINE ISLANDS REGION	Detail..
2	6.1	2023-09-11 12:51:00	157	127.57°E	1.09°N	HALMAHERA, INDONESIA	Detail..
3	6.1	2023-09-09 14:43:00	15	119.87°E	0.05°N	MINAHASSA PENINSULA, SULAWESI	Detail..
4	6.3	2023-06-15 02:19:00	119	120.68°E	13.82°N	MINDORO, PHILIPPINES	Detail..
5	7.0	2023-01-18 06:06:00	60.0	127.22°E	2.85°N	NORTHERN MOLUCCA SEA	Detail..
6	6.2	2023-01-18 00:34:00	140.0	123.32°E	0.10°S	MINAHASSA PENINSULA, SULAWESI	Detail..
7	6.1	2022-12-15 04:03:00	10.0	121.78°E	23.82°N	TAIWAN	Detail..
8	6.6	2022-10-25 14:59:00	15.0	120.52°E	17.93°N	LUZON, PHILIPPINES	Detail..
9	6.9	2022-09-18 06:44:00	10.0	121.30°E	23.15°N	TAIWAN	Detail..
10	6.6	2022-09-17 13:41:00	10.0	121.25°E	23.06°N	TAIWAN	Detail..
11	7.0	2022-07-27 00:43:00	15.0	120.37°E	17.85°N	LUZON, PHILIPPINES	Detail..
12	6.7	2022-03-22 17:41:00	15.0	121.57°E	23.43°N	TAIWAN	Detail..
13	6.2	2022-03-13 21:05:00	10.0	119.15°E	14.42°N	LUZON, PHILIPPINES	Detail..
14	6.0	2022-01-22 02:26:00	70.0	126.84°E	3.63°N	TALAUD ISLANDS, INDONESIA	Detail..
15	6.0	2021-10-11 12:34:00	15.0	126.33°E	0.88°N	NORTHERN MOLUCCA SEA	Detail..

Issued for 15 events，an earthquake (*M*7.0) that occurred in Luzon, Philippines generated small tsunami.

2. Operation of SCSTAC

2.1 Issued Tsunami Bulletins（Oct. 2021- Aug. 2023）



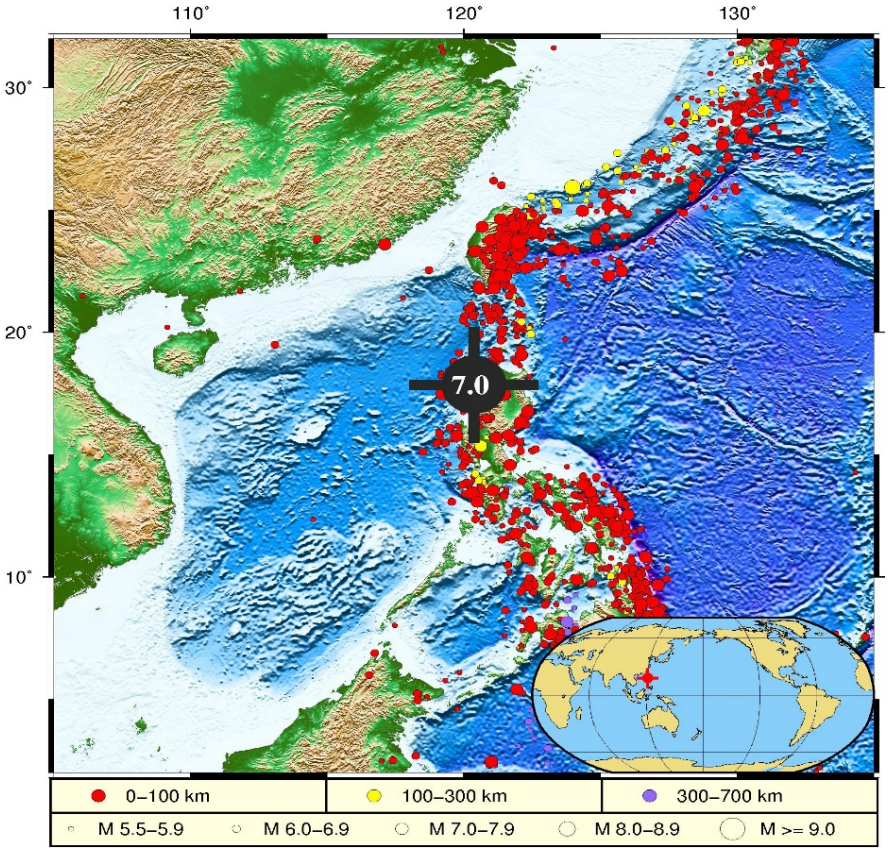
The Luzon shallow earthquake (*M*7.0) generated a small tsunami with maximum wave height 8cm.

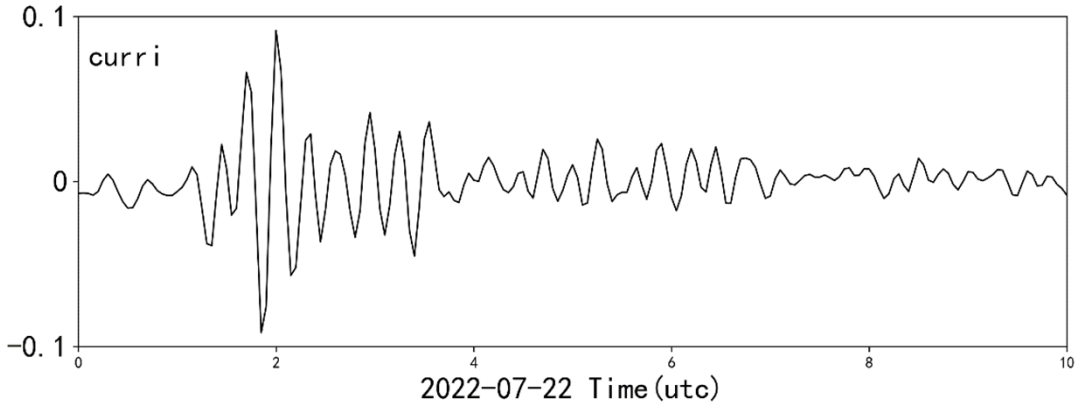
Most earthquakes are located in the northwestern Philippines and eastern Taiwan region, as well as in southeastern Indonesia. The maximum magnitude is up to 7.0, they are the northern Molucca Sea earthquake and the Luzon earthquake, respectively.

2. Operation of SCSTAC

2.2 The Luzon, Philippine earthquake generated a local tsunami

Original Time: 2022-07-27 00:43 (UTC)
Epicenter: 17.85 N,120.37 E
Depth: 15km
Location: LUZON, PHILIPPINES





Tsunami waves recorded in Currimao tide gauge

- The earthquake occured on 00:43(UTC) 27 July;
- Tsunami waves are observed about 35min after the earthquake;
- The earthquake caused a local tsunami.

2. Operation of SCSTAC

Timeline of the *M*7.0 Luzon event

(UTC Time)

00:43 EQ Occured

00:45 EQ Preliminary Parameters

00:47 SCSTAC **Issued 1st** Tsunami Message(M_{WP}=6.8)

00:55 SCSTAC W-phase solution

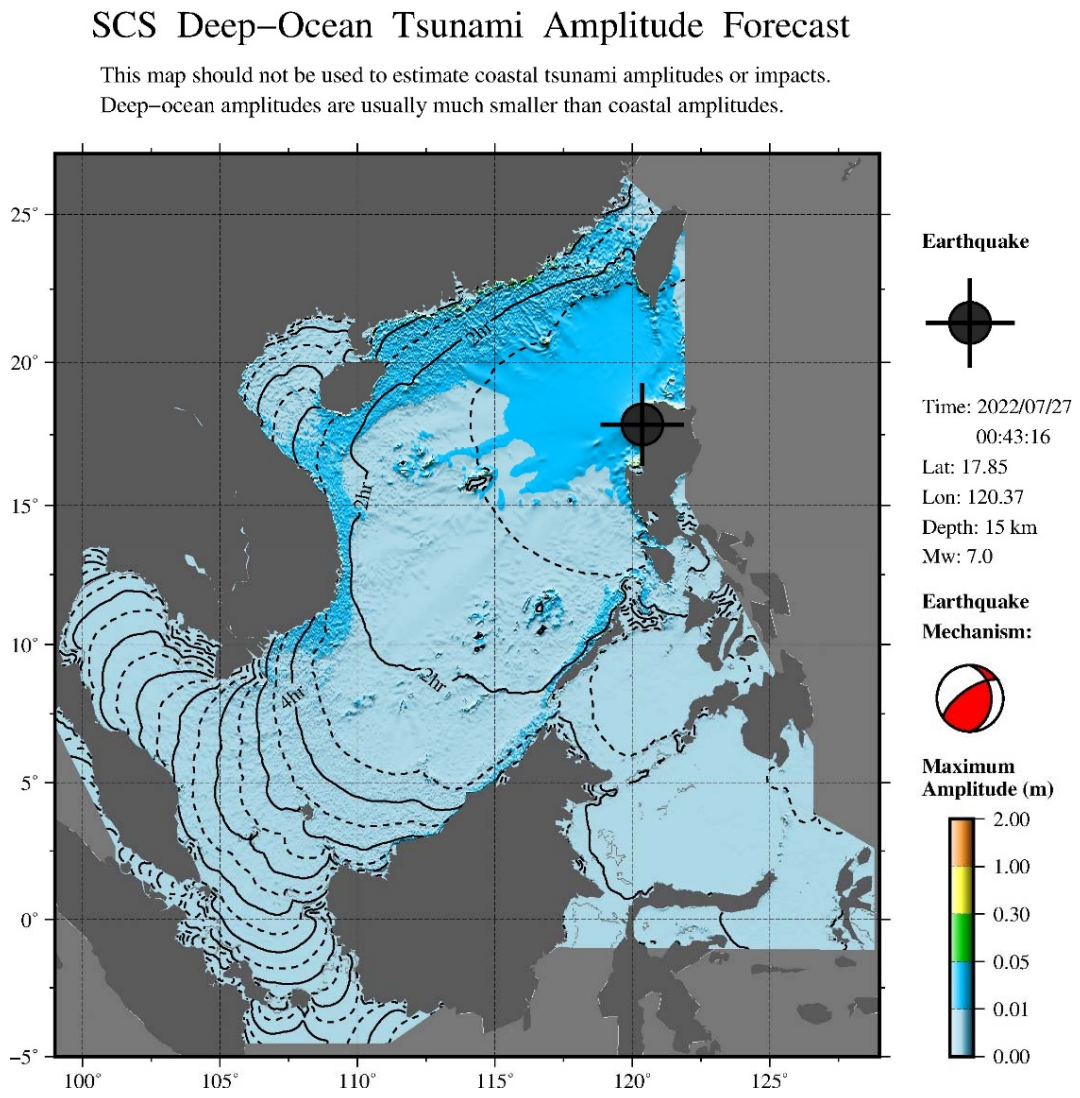
01:18 The tsunami arrived at Currimao tide gauge

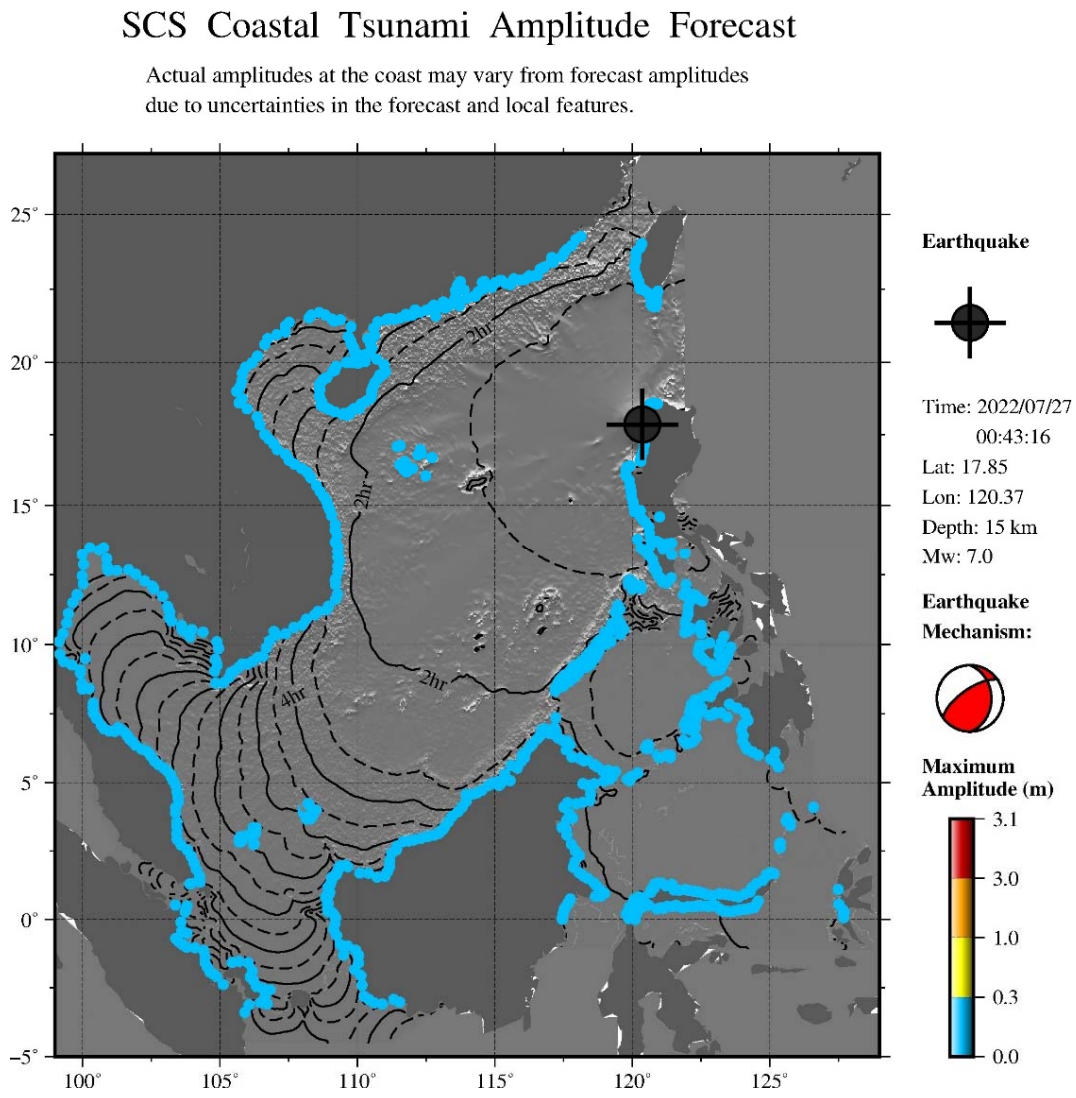
02:00 Currimao tide gauge recorded the maximum tsunami height (8cm)

02:47 SCSTAC **Issued 2st(Final)** Tsunami Message(*M* Revised to 7.0)

2. Operation of SCSTAC

Tsunami simulation





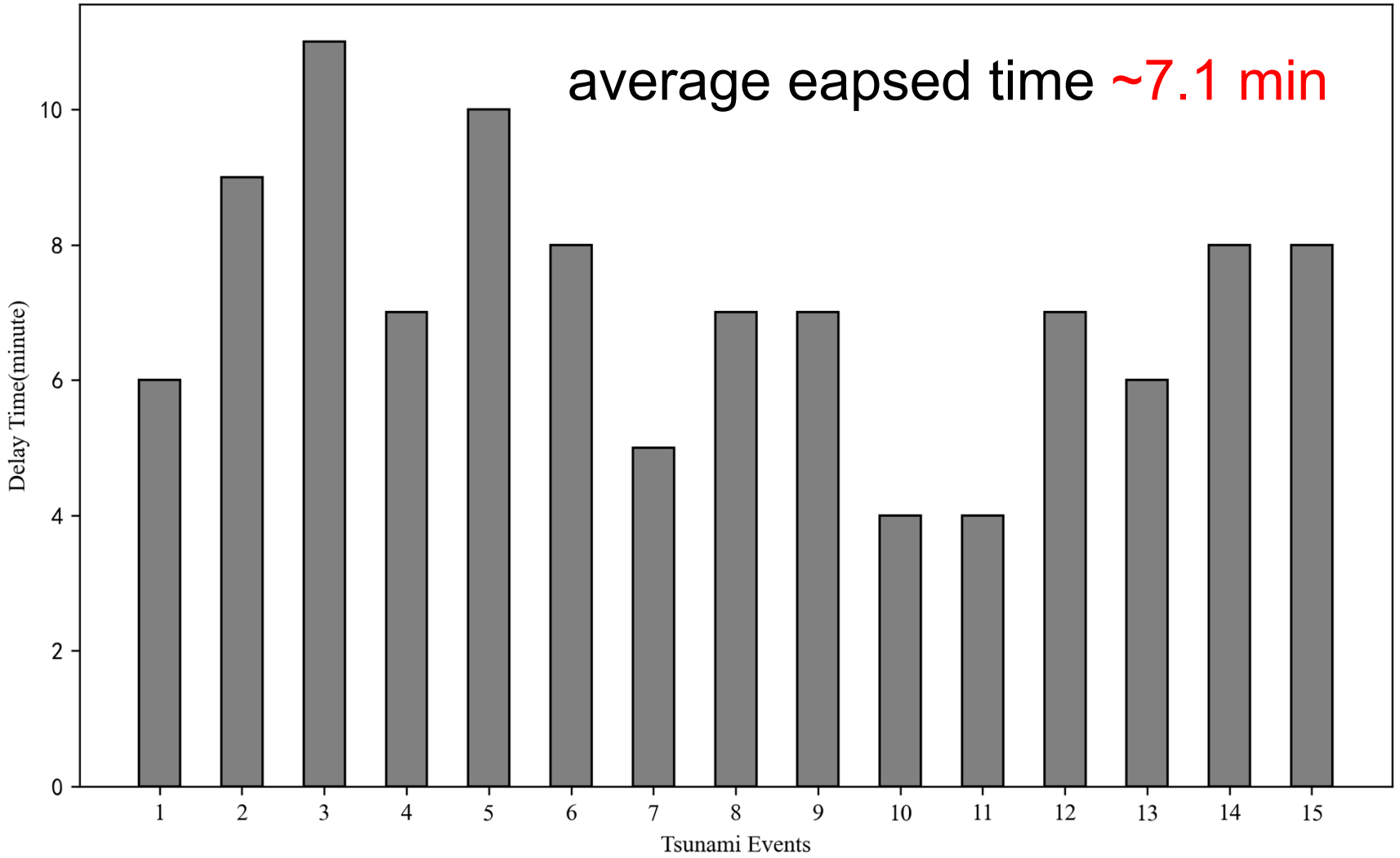
2. Operation of SCSTAC

2.3 Evaluation of SCSTAC Key Performance Indicators for full Operation

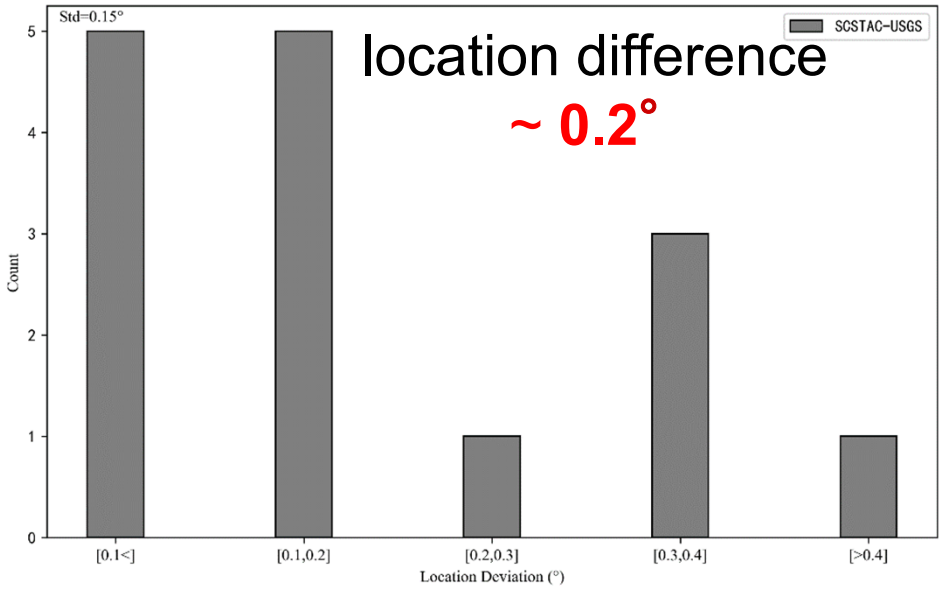
Key Performance Indicators	Target values
Elapsed time from earthquake to issuance of initial tsunami products with preliminary earthquake parameters	Within 8-15 min
Probability of detection of earthquakes with *M*w>=6.0	100%
Accuracy of preliminary earthquake parameters on hypocenter location/magnitude/depth	0.3° /0.2/30km
Accuracy of the Estimated Time of Arrival (ETA) and amplitudes of the tsunamis actually is triggered	Within 10% of travel time
Percentage of Member States that receive products issued by SCSTAC	100%
Percentage of time the SCSTAC is operating and able to respond to a tsunami event	100%
Regular communication tests	4 times per year

2. Operation of SCSTAC

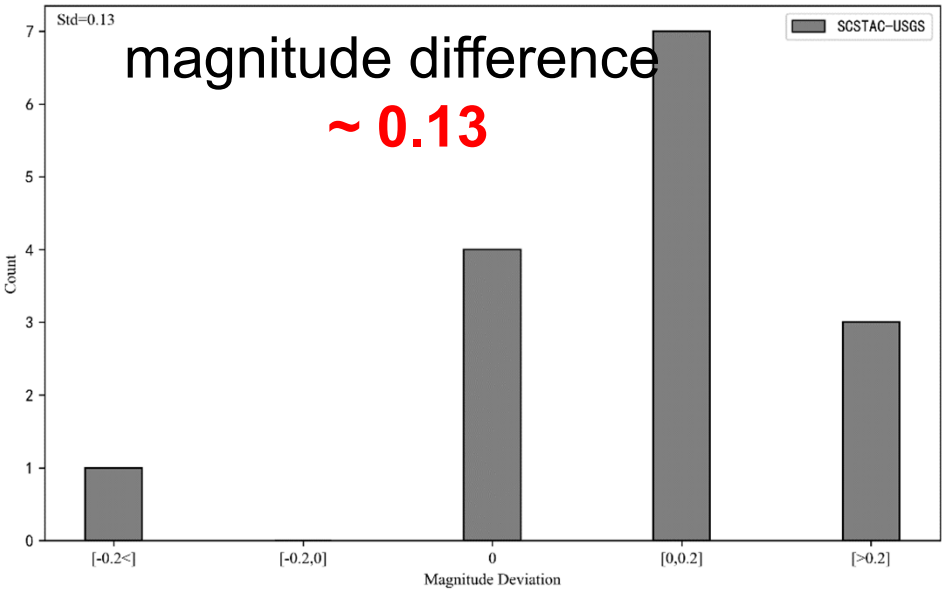
Elapsed time from earthquake to issuance of initial tsunami products

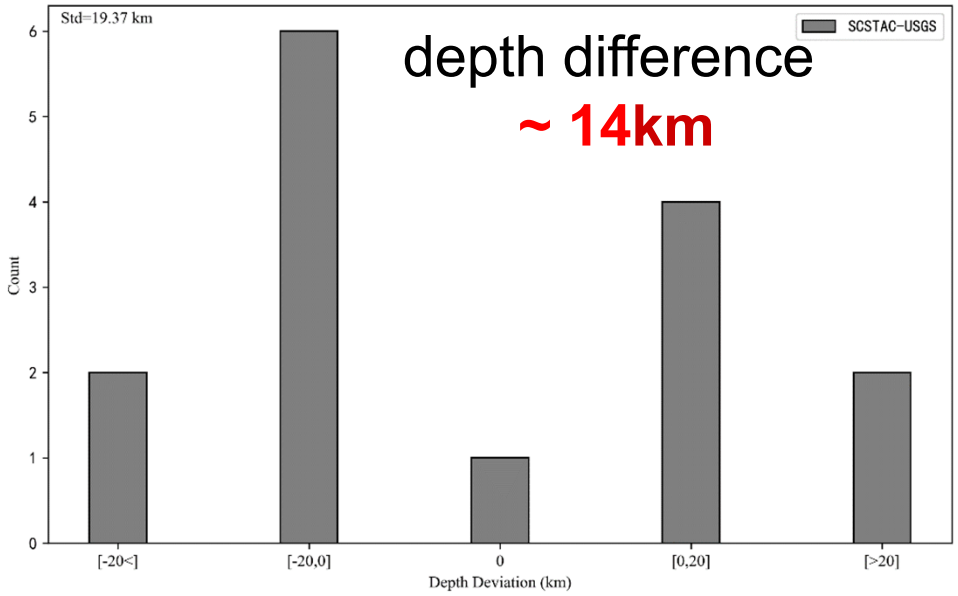


2. Operation of SCSTAC



Epicentral location/magnitude /depth contrasting with USGS final PDE





2. Operation of SCSTAC

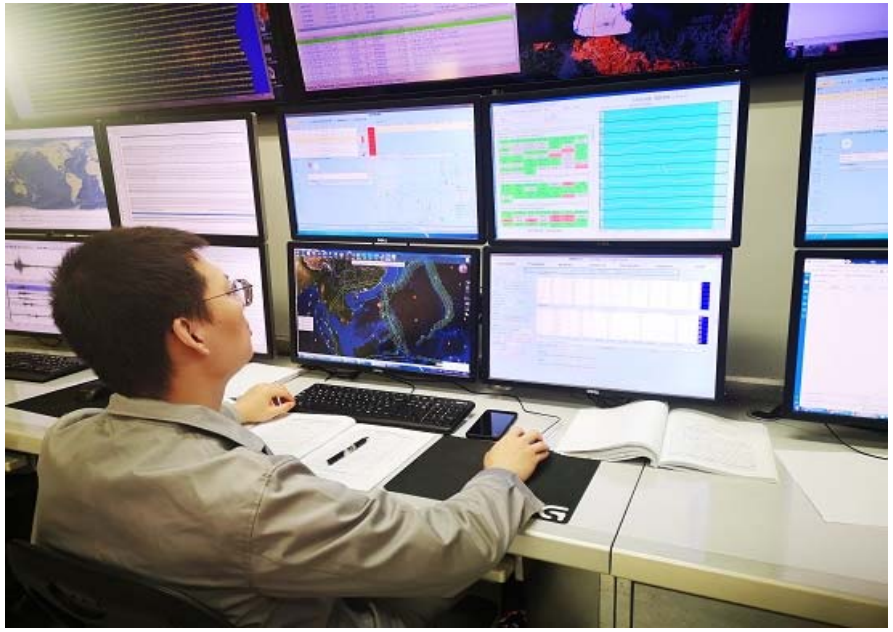
Key Performance Indicators	Target values	Evaluation Result	Yes/No
Elapsed time from earthquake to issuance of initial tsunami products with preliminary earthquake parameters	Within 8-15 min	average elapsed time ~7.1 min	**Yes**
Probability of detection of earthquakes with Mw>=6.0	100%	15 events with Mw>=6.0, **100%**	**Yes**
Accuracy of preliminary earthquake parameters on hypocenter location/magnitude/depth	0.3° /0.2/30km	The difference for location/magnitude /depth contrasting with USGS **0.2° /0.13/14km**	**Yes**
Accuracy of the Estimated Time of Arrival (ETA) and amplitudes of the tsunamis actually is triggered	Within 10% of travel time	**No *M* ≥ 7.1** earthquakes occurred in AoS of SCSTAC	-
Percentage of Member States that receive products issued by SCSTAC	100%	GTS/Fax/email/website **100%**	**Yes**
Percentage of time the SCSTAC is operating and able to respond to a tsunami event	100%	24 hours × 365 days; two watch standers,**100%**	**Yes**
Regular communication tests	4 times per year	**each quater**	**Yes**

All results meet the key performance indictors

3. SCSTAC Communications Tests and Exercise

3.1 Communications tests

- **SCSTAC has conducted 6 communications tests since Sep. 2021**



Thanks to the coordination of the secretariat and the Member States.

In order to simplicy communication testing workflow and fix the testing time, **Suggest** starting at the first working day of each quarter.

SCSTAC COMMUNICATIONS TEST
ISSUED BY SOUTH CHINA SEA TSUNAMI ADVISORY CENTER (SCSTAC)
ISSUED AT 0600Z 28 MAY 2021
THIS IS A TEST BULLETIN
THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE TRANSMISSION TIMES INVOLVED IN THE DISSEMINATION OF OPERATIONAL TSUNAMI ADVICE PRODUCTS FROM THE SOUTH CHINA SEA TSUNAMI ADVISORY CENTER TO DESIGNATED 24-HOUR TSUNAMI WARNING FOCAL POINTS OF THE SOUTH CHINA SEA TSUNAMI WARNING SYSTEM.
RECIPIENTS ARE REQUESTED TO PLEASE RESPOND BACK TO THE SOUTH CHINA SEA TSUNAMI ADVISORY CENTER.
PLEASE RESPOND VIA ONE OF THE FOLLOWING MEANS
***TEL:+86-10-62104561**
***EMAIL:TSU@NMEFC.CN**
***FAX:+86-10-62173638**
THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST

3. SCSTAC Communications Tests and Drills

Communication test feedback 2021.09-2023.08

Country	202109			202202			202205			202209			202304			202308		
	GTS	EMAIL	FAX	GTS	EMAIL	FAX	GTS	EMAIL	FAX	GTS	EMAIL	FAX	GTS	EMAIL	FAX	GTS	EMAIL	FAX
Malaysia	0:05	0:02	F	0:00	0:06	0:03	0:00	0:00	F	0:00	0:00	F	0:00	0:00	F	0:00	0:06	0:00
Thailand	F	0:03	0:01	F	0:01	0:11	F	0:06	F	F	0:00	0:07	F	0:07	F	F	0:03	F
Vietnam	F	F	F	F	0:00	F	F	F	F	F	0:00	F	F	F	F	F	F	F
Brunei	F	F	F	0:01	0:00	0:03	0:00	0:00	0:00	0:05	0:00	F	0:00	0:00	0:00	0:00	0:06	F
Singapore	0:08.	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:02	F	00:00	F	0:00	0:00	0:01	0:00	0:00	0:01
Cambodia	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Philipines	.F	0:00	0:00	0:01	0:00	0:00	0:01	0:00	F	F	F	F	0:09	0:00	F	F	0:02	F
Indonesia	F	F	F	0:02	0:00	F	0:01	0:00	F	F	F	F	F	F	F	F	F	F
HongKong, China	0:01.	0:02	0:03	0:02	0:01	0:01	0:04	0:00	F	0:01	0:01	0:10	0:01	0:00	0:01	0:01	0:07	0:08
Japan	.0:00	0:00	0:03	F	F	F	F	F	F	F	F	F	0:00	F	0:02	0:00	F	0:02
USA	F	F	F	.0:00	0:00	0:03	F	0:00	F	F	F	F	F	0:00	F	F	F	F

F: Failed to response. N: Don't attend Communication Tests.

Suggesting regularly updating the receive information contact list

3. SCSTAC Communications Tests and Exercise

3.2 Exercise Pacific Wave 2022

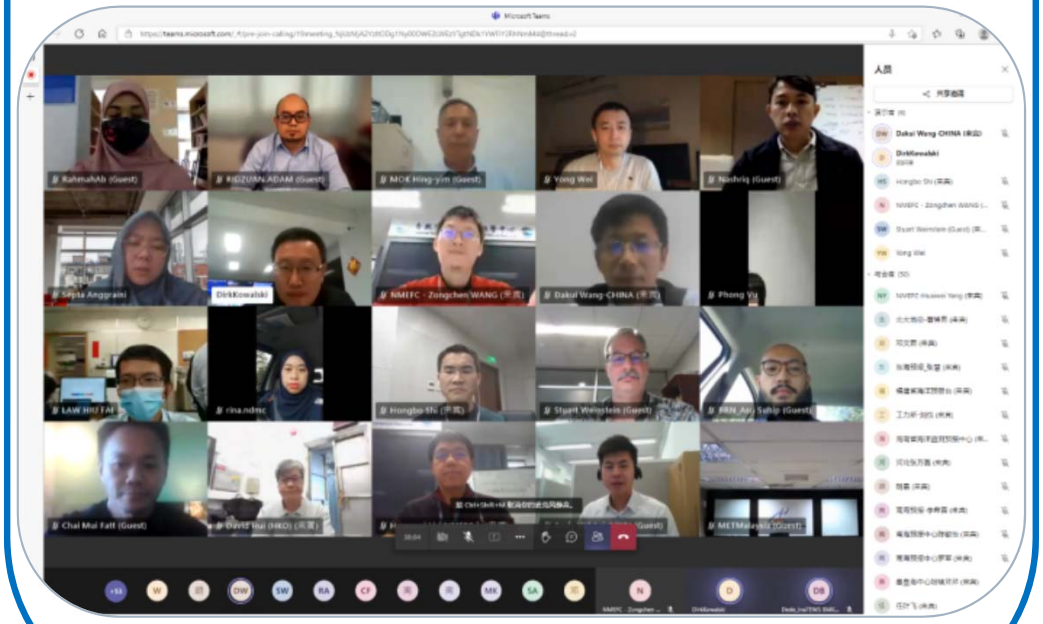
The aim of the PacWave22 is to test PTWS tsunami service provider arrangements, and country preparedness arrangements and operational procedures to respond and recover from a destructive tsunami.

The SCS Tsunami Warning and Communications Exercise was conducted on 13 October 2022.

4. Other Activities

4.1 Regional Training and Workshop

Training for seismic and tsunami warning operators on strengthening standard operating procedures for seismic data and tsunami warning in the South China Sea region, 9-10 December 2021, Online.



First NMEFC-BMKG Workshop on Non-seismic Tsunamis and Complex Tsunamis, 14 July 2022, [Online].

4. Other Activities

4.1 Regional Training and Workshop

2022 International Symposium on Applied Technologies for Earthquake and Tsunami Monitoring, Early Warning and Disaster Mitigation in the South China Sea Region, 20th December 2022, Online.

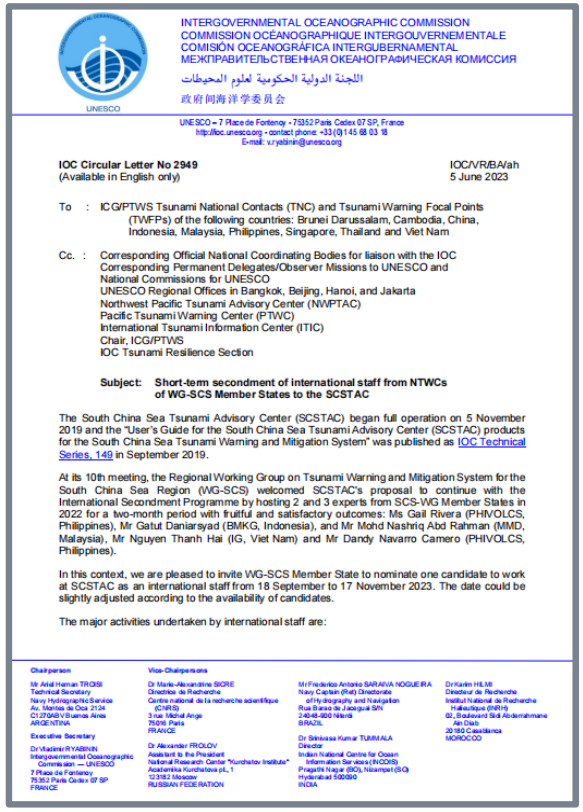
Face to face communications between SCSTAC and Hong Kong Observatory, 6-18 February 2023. Topic not limited to operation workflow, earthquake detection, tsunami modelling, product making, experience and skills.

4. Other Activities

4.2 Short-Term visits of International Staff in 2023

SCSTAC continues International Secondment Programme with full funding by hosting 4 experts from SCS-WG Member States from October to December 2023 for a two-month period.

- Ms. Nadira Binti Janius (MMD)
- Mr. Muhammad Hafizh Ghifari (BMKG)
- Mr. Fakhry Dwi Sulistio (BMKG)
- Mr. TomCarlo E.Simborio (PHIVOLCS)



INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
COMMISSION OCÉANOGRAPHIQUE INTERGOUVERNEMENTALE
COMISIÓN OCEANOGRÁFICA INTERGUBERNAMENTAL
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ
اللجنة الدولية الحكومية لعلوم المحيطات
政府间海洋学委员会

UNESCO – 7 Place de Fontenoy - 75352 Paris Cedex 07 SP, France
http://ioc.unesco.org - contact phone: +33 (0)1 45 68 03 18
E-mail: v.ryabinin@unesco.org

IOC Circular Letter No 2949 IOC/VR/BA/ah
(Available in English only) 5 June 2023

To : ICG/PTWS Tsunami National Contacts (TNC) and Tsunami Warning Focal Points (TWFPs) of the following countries: Brunei Darussalam, Cambodia, China, Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam

Cc. : Corresponding Official National Coordinating Bodies for liaison with the IOC
Corresponding Permanent Delegates/Observer Missions to UNESCO and National Commissions for UNESCO
UNESCO Regional Offices in Bangkok, Beijing, Hanoi, and Jakarta
Northwest Pacific Tsunami Advisory Center (NWPTAC)
Pacific Tsunami Warning Center (PTWC)
International Tsunami Information Center (ITIC)
Chair, ICG/PTWS
IOC Tsunami Resilience Section

Subject: Short-term secondment of international staff from NTWCs of WG-SCS Member States to the SCSTAC

The South China Sea Tsunami Advisory Center (SCSTAC) began full operation on 5 November 2019 and the "User's Guide for the South China Sea Tsunami Advisory Center (SCSTAC) products for the South China Sea Tsunami Warning and Mitigation System" was published as IOC Technical Series, 149 in September 2019.

At its 10th meeting, the Regional Working Group on Tsunami Warning and Mitigation System for the South China Sea Region (WG-SCS) welcomed SCSTAC's proposal to continue with the International Secondment Programme by hosting 2 and 3 experts from SCS-WG Member States in 2022 for a two-month period with fruitful and satisfactory outcomes: Ms Gail Rivera (PHIVOLCS, Philippines), Mr Gatut Daniarsyad (BMKG, Indonesia), and Mr Mohd Nashriq Abd Rahman (MMD, Malaysia), Mr Nguyen Thanh Hai (IG, Viet Nam) and Mr Dandy Navarro Camero (PHIVOLCS, Philippines).

In this context, we are pleased to invite WG-SCS Member State to nominate one candidate to work at SCSTAC as an international staff from 18 September to 17 November 2023. The date could be slightly adjusted according to the availability of candidates.

The major activities undertaken by international staff are:

Chairperson
Mr Ariel Human TROISI
Technical Secretary
Navy Hydrographic Service
Av. Montes de Oca 2124
C1270ABV Buenos Aires
ARGENTINA

Executive Secretary
Dr Vladimir RYABININ
Intergovernmental Oceanographic Commission — UNESCO
7 Place de Fontenoy
75352 Paris Cedex 07 SP
FRANCE

Vice-Chairpersons
Dr Marie-Alexandrine SICRE
Directrice de Recherche
Centre national de la recherche scientifique (CNRS)
3 rue Michel Ange
75016 Paris
FRANCE

Dr Alexander FROLOV
Assistant to the President
National Research Center "Kurchatov Institute"
Academika Kurchatova pl., 1
123182 Moscow
RUSSIAN FEDERATION

Mr Frederico Antonio SARAIVA NOGUEIRA
Navy Captain (Ret) Directorate of Hydrography and Navigation
Rua Barao de Jaceguai S/N
24048-900 Niterói
BRAZIL

Dr Srinivasa Kumar TUMMALA
Director
Indian National Centre for Ocean Information Services (INCOIS)
Pragathi Nagar (BO), Nizampet (SO)
Hyderabad 500090
INDIA

Dr Karim HILMI
Directeur de Recherche
Institut National de Recherche Halieutique (INRH)
02, Boulevard Sidi Abderrahmane
Ain Diab
20180 Casablanca
MOROCCO

the major activities will be involved in are:

- ✓ Receive training on the earthquake location and focal mechanism inversion and tsunamiscenario database, forecast model and decision support system of the SCSTAC;
- ✓ Serve as a watch-stander once every week with shift time of 12 hours;
- ✓ Conduct communication and coordination among WG-SCS Member States regarding theactivities related to the full operation of SCSTAC.

4. Other Activities

4.2 Attend the International Meetings and Sessions

- PTWS Post-event Brief III, Hunga-Tonga-Hunga-Ha'apai Volcanic Eruption and Tsunami
- Perform PACWAVE2022 exercise and SCS regional communicaiton test
- Attend the 32nd session of the IOC Assembly
- Participate in the TSP working group online meeting
- Take active in the ITIC Trainning Program (Hawaii)
- Attend the ICG/PTWS-XXX hosted by Tonga .

5. Further Plans

- Ensures the continuous and stable operation of SCS tsunami warning and mitigation system;
- Continues to SCSTAC Communication Test and tsunami warning drill;
- Continues to provide opportunities for in-person education, outreach and training activities in the region;
- Conducts an online Training Workshop on Tsunami Warning Technology and Platforms in the South China Sea region hosted by China.

Thank You

Zhiguo Xu
South China Sea Tsunami Advisory Center, UNESCO/IOC