Pacific Wave 2022 - Pacific Island Countries and Territories Regional Exercise

1. INTRODUCTION

The massive volcanic explosion on the island of Hunga Tonga-Hunga Ha'apai (HTHH), about 30 km (19 mi) south-southeast of Fonuafo‘ou island in Tonga, on 15 January 2022 at about 4:14 UTC, generated a tsunami that caused damages locally, regionally, and across the Pacific.

This was the first time that the PTWC had to respond to such an event, since its system is primarily focused on earthquake-generated tsunamis representing nearly 90% of the past cases of tsunami in the world.

The HTHH event brought back a forgotten tsunami source in the Pacific Tsunami Alert System focused on earthquake-generated tsunamis representing nearly 90% of the past cases of tsunami in the world. The possible late tsunami warning for this type of event recall everyone the need to have regional cooperation in Tsunami Early Warning.

On 25 July 2022, the Chair of the Intergovernmental Coordination Group (ICG) for the Pacific Tsunami Warning and Mitigation System (PTWS) approved the “Hunga Tonga-Hunga Ha’apai type” Volcanic Tsunami Hazard Response: Pacific Tsunami Warning Centre (PTWC) Interim Procedures and PTWS Products User’s Guide following the review conducted by the ICG/PTWS Steering Committee.

The ICG/PTWS Steering Committee approved the recommendation of WG-PICT to evaluate and test the PTWC interim products through Exercise Pacific Wave 2022 to test the “Hunga Tonga-Hunga Ha’apai type” Volcanic Tsunami Hazard Response: PTWC Interim Procedures and PTWS Products User’s Guide.

Accordingly, the Pacific Island Countries and Territories (PICT) Regional Working Group on Tsunami Warning and Mitigation System (WG-PICT), with support from the French Polynesian Tsunami Warning Centre (CPPT), the Pacific Tsunami Warning Centre (PTWC), International Tsunami Information Centre (ITIC) and UNESCO/IOC conducted on 9 November 2022 a 2-hour live table top regional exercise (PacWave22-PICT) to test the following objectives (IOC Circular Letter 2908):

1. Test the Hunga Tonga Hunga Ha’apai (HTHH) PTWC Interim Procedures and PTWS Products (IOC Circular Letter 2902), and whether the HTHH PTWS products are interpreted by PICT Member States accurately and in a timely manner, and

2. Test regional communication and cooperation between PICT Member States, and the value of information sharing in facilitating national tsunami alert decision-making.

2. CONCEPT AND CONDUCT

2.1. OBJECTIVES

With reference to IOC Circular Letter 2894 and 2904, the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (PTWS) is conducting Exercise Pacific Wave 2022 (PacWave22) in the months of September through November 2022, providing a valuable opportunity for Pacific countries to engage regionally in coordination and cooperation, review their tsunami response procedures, test internal and external communication systems, and engage with communities through public education activities.

The WG-PICT announced its regional exercise (IOC Circular Letter 2908) and its twofold objectives :

Objective 1 :
Test the Hunga Tonga Hunga Ha'apai (HTHH) PTWC Interim Procedures and PTWS Products and whether the HTHH PTWS products are interpreted by PICT Member States accurately and in a timely manner.

Objective 2 :
Test regional communication and cooperation between PICT Member States, and the value of information sharing in facilitating national tsunami alert decision-making.

WG-PICT Pacific Wave 2022 regional exercise (PacWave22-PICT) encouraged to consider:

- Conducting exercises based on limitations derived from the COVID-19 pandemic, such as the absence of a warning center duty officer(s), the requirement for virtual exercises, and/or evacuations/sheltering considering physical distancing practices of a pandemic.
- Testing the capability to carry out their national warning and response responsibilities.
- Conducting the exercise down to the community level, including where possible, an extensive public awareness campaign.

2.2. DATES

Timeline and milestones for PacWave22-PICT Regional Exercise :

19 July 2022	WG-PICT online Meeting, Pacwave22-PICT exercise scenario and objectives validation
27 September 2022	IOC Circular Letter No 2908 : Pacific Island Countries and Territories Regional Exercise during Pacific Wave Exercise 2022 (PacWave22-PICT) on 9 November 2022
7 October 2022	Registration Deadline *(extended to the 1rst November 2022)*
2 November 2022, 2300 UTC	Online Informational Webinar
7 November 2022	PacWave22-PICT exercise manual including MSEL
8 November 2022, 2300 UTC	Communication Test (Email Listserv, WhatsApp, HF Radio) -
9 November 2022, 2300 UTC	**Live Tabletop Regional Exercise**
11 November 2022,	*Real event, an earthquake of magnitude Mw 7.3 occurred East of Tonga islands. Regional cooperation tools of Pacwave22-PICT were valuable.*
16 November 2022, 2300 UTC	Cold Wash and Debrief
21 December 2022	PacWave22-PICT Post-Exercise Evaluation Form Deadline for Member States to complete and submit *(extended to the 10th February 2023)*
2 - 3 February 2023	9th WG-PICT Meeting at Suva, Fiji

The team members formed to plan this exercise are given in Annex I.

2.3. DOCUMENTATION

All documents and information regarding this exercise are posted on its dedicated webpage : http://itic.ioc-unesco.org/index.php?option=com_content&view=article&id=2224&Itemid=2333

The following lists PacWave22-PICT documents :

• IOC Circular Letter 2908, Pacific Island Countries and Territories Regional Exercise during Pacific Wave Exercise 2022 (PacWave22-PICT) on 9 November 2022, 27 Sep 2022	(PDF)
• Webinar - Exercise PacWave22 - Pacific Island Countries and Territories (PICT) - Guidelines	(PDF) video recording
• Exercise Manual for PacWave22-PICT Regional Exercise Master Schedule of Events List (MSEL) - PacWave22-PICT Regional Exercise - (MSEL)	(PDF)
• PTWC Messages (version 2, 7 Nov 2022) - PacWave22-PICT Regional Exercise	(ZIP)

• HTHH Tsunami Travel Time Map
  ○ Local 2h, IOC/DART stations
  ○ Regional 6h, IOC stations
  ○ Regional 6h, DART stations
• HTHH Estimated Time of Arrival (ETA)
  ○ IOC stations
  ○ DART stations
• HTHH Observations - IOC Sea Level Network
  ○ Data
  ○ Marigrams
IOC *(Intergovernmental Oceanographic Commission: Sea level station monitoring facility). DART (Deep-ocean Assessment and Reporting of Tsunamis).*
	(PNG)
	(PNG)
	(PNG)
	
	(TXT)
	(TXT)
	
	(ZIP)
	(ZIP)

• Country Photos/Videos - injects and activities
  ○ Fiji
  ○ France - New Caledonia
  ○ France - Tahiti
  ○ France - Wallis & Futuna
  ○ Nauru
  ○ Samoa
  ○ Tonga
  ○ HF Radio Comms Test (Fiji, New Caledonia, Nauru, Tonga)
	
	(ZIP)
	(ZIP)
	(ZIP)
	(ZIP)
	(ZIP)
	(ZIP)
	(ZIP)
	(ZIP)

• UNESCO News Release, 10 November 2022	(website)

• Cold Wash and Debrief Meeting Presentation
  ○ All exercise inject timeline on WhatsApp
  ○ All exercise inject timeline on Listserv
	(PDF)
	(XLSX)
	(XLSX)

○ Country and Observer Feedback Notes, ITIC, IOC	(DOCX)

3. PARTICIPATION

A total of 18 Pacific Island Countries and Territories registered to PacWave22-PICT, 15 registered as players and 3 as observers as shown in the table below :

Territories/ Islands	Territory Code 2-letters	Participant	Observer
American Samoa, USA	AS	Yes	
Australia	AU	Yes	
Cook Islands	CK	Yes	
Fiji	FJ	Yes	
French Polynesia, France	PF	Yes	
Kiribati	KI	No	Yes
Marshall Islands	MH		
Micronesia	FM		
Nauru	NR	Yes	
New Caledonia, France	NC	Yes	
New Zealand	NZ		
Niue	NU	No	Yes
Norfolk Island, Australia	NF		
Palau	PW		
Papua New Guinea	PG	Yes	
Pitcairn Islands	PN		
Samoa	WS	Yes	
Solomon Islands	SB	Yes	
Timor-Leste	TL	Yes	
Tokelau	TK	Yes	
Tonga, Kingdom of	TO	Yes	
Tuvalu	TV	No	Yes
Vanuatu	VU	Yes	
Wallis and Futuna, France	WF	Yes	

We estimate almost 80 persons were involved in the exercise.

4. COLD WASH AND DEBRIEF MEETING

A **Cold Wash and Debrief occurred on 16 November 2022, at 2300 UTC.**
Participating Countries and Exercise Observers and Controllers were invited to share their experiences and feedback. Information on the webinar, including documents, can be found on this meeting website. A video recording is also available.

Feedback synthesis from the countries are highlighted below :

- Tonga report of eruption used as 1st product before PTWC message.
- Mobile phone applications like WhatsApp are simple, timely and give ideas, though not as detailed as E-mail but versatile for exchange of information (includes texts, images and voice clips).
- Given the rapid nature of a tsunami event and demand for rapid response, WhatsApp can be hard to follow in the emergency room especially when duty officer is alone, there is a need to formalize the communication structure in the EOCs for both warning centres and NDMOs for seamless response operation procedure. The Listserv is really important as well to share more detailed information and easier to follow but less timely than WhatsApp.
- Countries and Observers were unanimous that Info sharing was valuable
- Following the real-event on 11th November (Mw 7.3 , Tonga), Countries wanted to keep the WhatsApp-Group.
- Countries highlighted the unique value of HF radio (housed in differing agencies within country and not tsunami-specific), as along with Satellite Phone (essential and critical, but expensive), it was the only comms that worked post-HT
- Tonga and Fiji agreed on high value of HF Radio and want to continue checking and testing so that it is a regular comm method for Tsunami Info by countries. Will be good to list the frequencies that work in the Region.

5. POST-EXERCISE EVALUATION

5.1 EXERCISE OVERVIEW

During the 2 hours Live tabletop exercise replaying the exact scenario timeline of the HTHH Volcanic Eruption and Tsunami form last 15 January 2022, the 18 participants composed by 15 players and 3 observers were able to test four PTWC bulletin simulated bu controllers.

The timeline for sending the simulated HTHH interim procedure and products was given by the PTWC. The first bulletin was estimated to be able to be send 25 minutes trigger by the observation of 0-crest of 55 cm on Nuku'Alofa tide gauge.

The PTWC messages were sent by mail through the Listterv and notified to players also through the WhatsApp group.

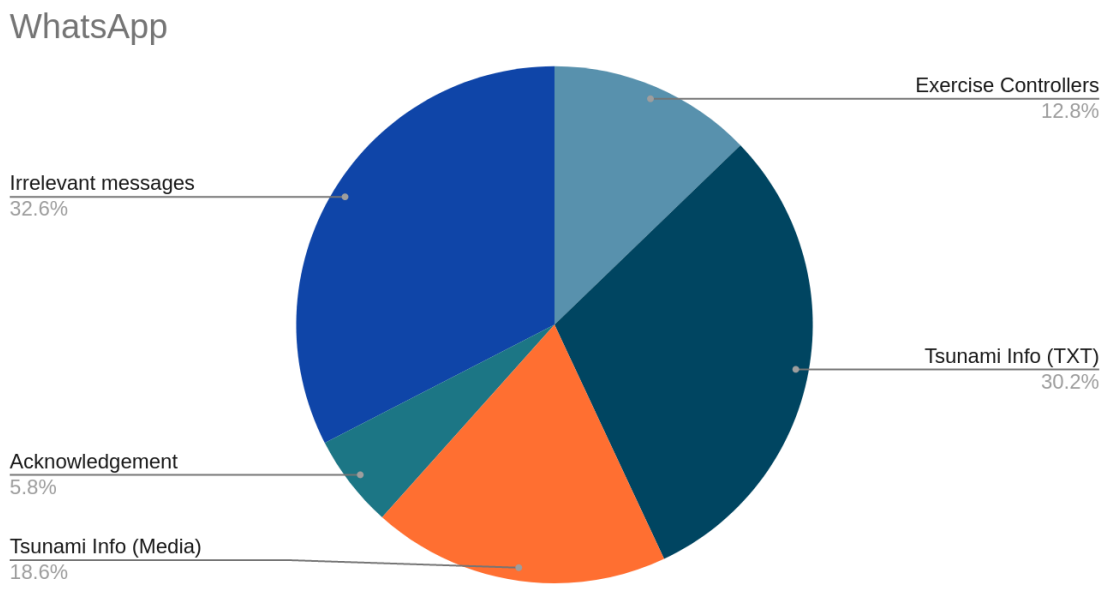
Four PICT members registered for a HF Radio test communication (TO, FJ, NC, NR), a dedicated WhatsApp group was generated to allow them to set the best frequencies between each other.

The first information shared by Tonga was 9 min after the Origin time at (Wed Nov 9 23:09 UTC) to warn about the HTHH Eruption.

5.1.1 WhatsApp group communication overview

- ***42 members***
- A total of 86 messages exchanged between 2255 UTC 09 Nov to 0100 UTC 10 Nov 2022
- Messages sent by controllers : 11
- **Test messages sharing event/tsunami information : 26**
- **Medias sharing event/tsunami information : 16**
- Acknowledgment receipt : 5
- Irrelevant messages : (Audio, Office pictures, Comm. issue …) : 28
- Senders : AU, FJ, NC, NR, PF, PG, TO, WF, WS, Controller

Overall, 48.8 % of the messages exchanged on the group was for the event information sharing against 33 % irrelevant messages composed at the beginning by HF Radio check.



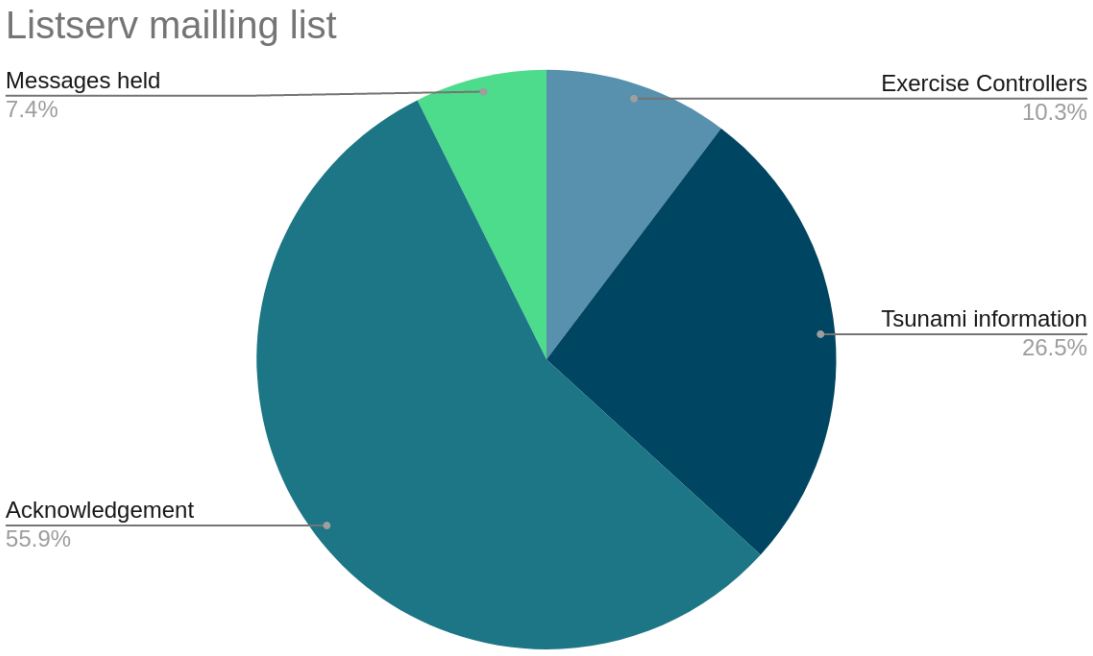
5.1.2 Mailing list overview (listserv hosted by ITIC)

- **86 members**
- 63 messages exchanged - 2255 UTC 09 Nov to 0126 UTC 10 Nov 2022
- Messages sent by controllers : 7
- Messages sharing information : 18
- Acknowledgement receipt : 38
- Messages held : 5 (3 from AU, 2 from TO) - mails sent from unregistered address to the Listserv.

- AS, CK, FJ, NC, NR, NU, PF, PG, SB, TO, WF, WS, Controller

First tsunami information shared by mail at OT+20 min (Wed Nov 9 23:20 UTC) from Fiji,

Early Tonga messages were held at the beginning because they were sent from an unregistered email address.



The mailing list was very difficult to follow because of all acknowledgements (~60%) sent soon as someone was sharing information.

5.2 EVALUATION FORM COMPILATION

This section contains a compilation of the responses provided by countries to the PacWave22-PICT evaluation form. Altogether, 13 island countries and territories over the 15 players submitted evaluation forms between November 2022 and February 2023.
Surveys were completed online through the Survey Monkey online survey and questionnaire tool, or submitted by transmission of the completed survey file to team leader.
The survey was divided into two sections according to objectives, and evaluation statements and questions focused on different components of the warning and response process.

For each question, a short statement is provided that summarizes the responses, and this is followed by comments provided by the participants.

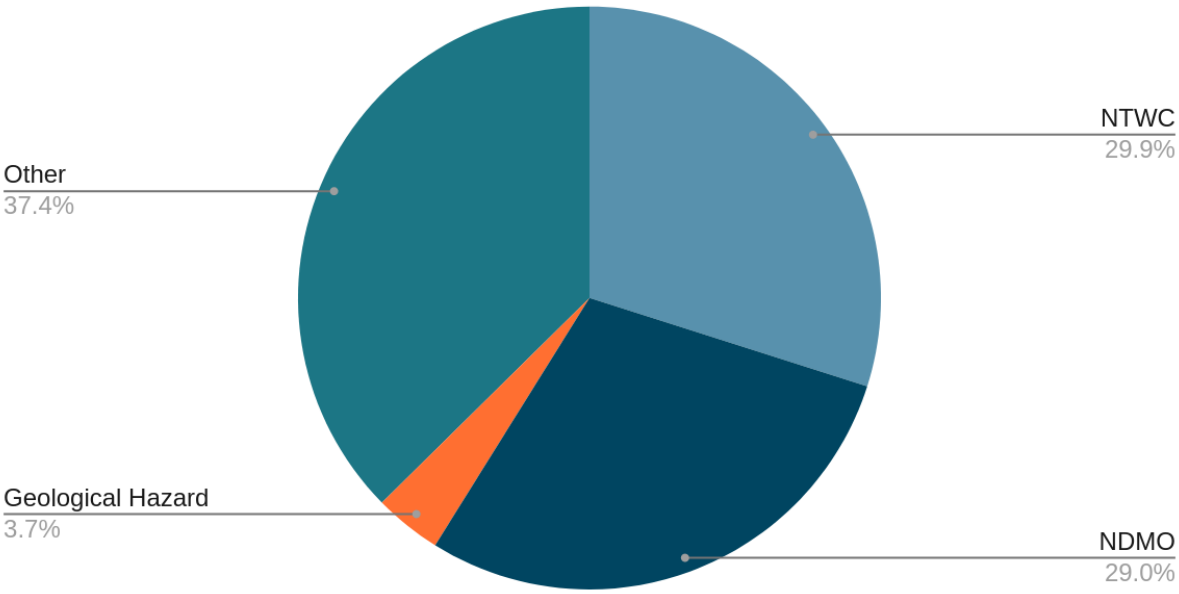
Overall PICT and Agency that submitted the evaluation form :

	PICT Member	**Agency**
1	Australia	JATWC
2	Cook Islands	Cook Islands Meteorological Service
3	Fiji	NTWC
4	FRENCH POLYNESIA	CPPT
5	New Caledonia	Direction de la sécurité civile et de la gestion des risques - DSCGR - Government of New Caledonia
6	Niue	Niue Meteorological Service, Ministry of Natural Resources, Government of Niue
7	Papua New Guinea	Port Moresby Geophysical Observatory
8	SAMOA	Meteorology Division - MNRE
9	Solomon Islands	Solomon Islands NDMO/Meteorological Services
10	Tokelau	National Disaster Management Unit
11	Tonga	Tonga Meteorological Services
12	Vanuatu	Vanuatu Meteorology and Geo-hazards department: MOCC
13	Wallis et Futuna	Sécurité Civile

Over the 13 submitted forms 3 forms are incomplete, so the post-evaluation survey compilation represents only 55% of the 18 participants.

110 Persons involved in the exercise

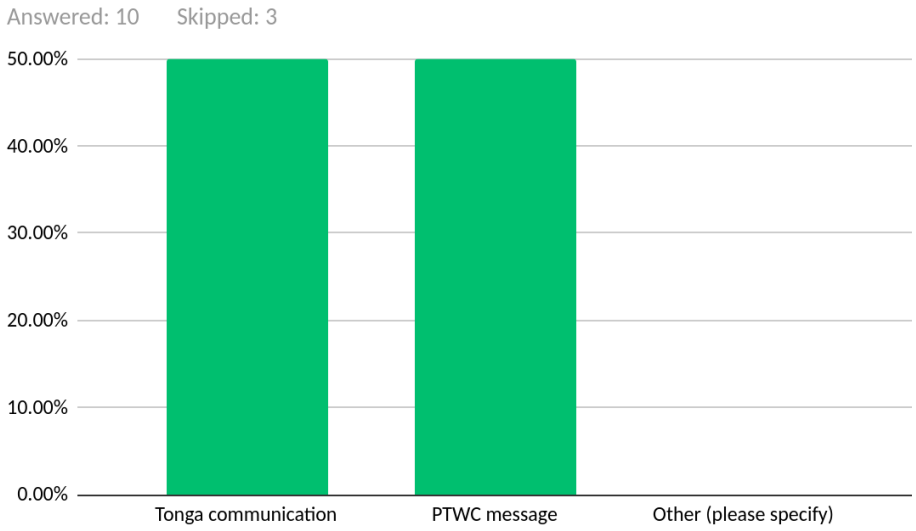
Answered: 11 Skipped : 2



5.2.1 Objective 1 evaluation compilation

Objective 1 : Test the Hunga Tonga Hunga Ha'apai (HTHH) PTWC Interim Procedures and PTWS Products and whether the HTHH PTWS products are interpreted by PICT Member States accurately and in a timely manner.

1.1 How did you find out about the HTHH event?

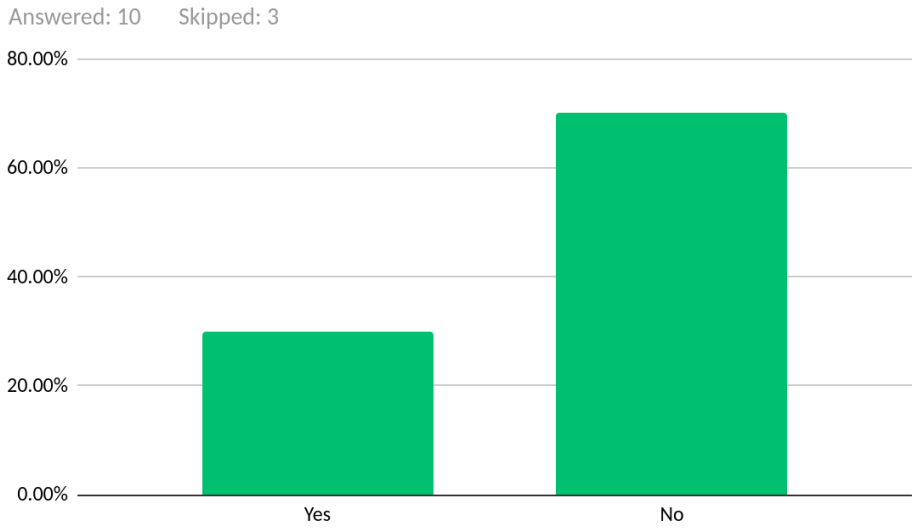


1.2 When did you find out about the HTHH event? Please provide the time in UTC ?

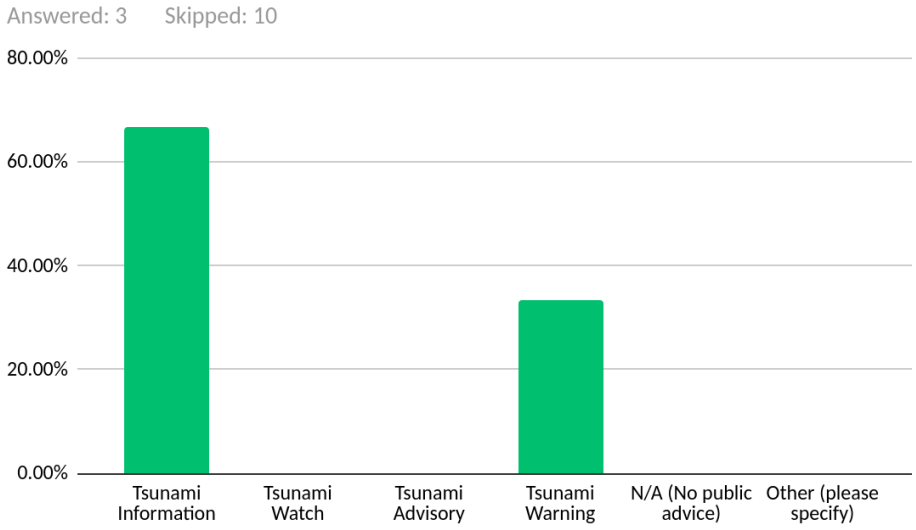
Responses	
Answered	8
Skipped	5

	Date / Time (UTC)
Tonga	09/11/2022 11:00 PM
Solomon Islands	09/11/2022 11:18 PM
Tokelau	09/11/2022 11:16 PM
Fiji	09/11/2022 11:00 PM
Samoa	09/11/2022 11:20 PM
French-Polynesia	09/11/2022 11:09 PM
Australia	09/11/2022 11:20 PM
New Caledonia	09/11/2022 11:25 PM

1.3 Did you issue an Alert before the PTWC Tsunami Message Number 1 (Threat Message)?



1.4 If your answer is Yes to Q1.3, what Alert Level was issued by your NTWC and/or NDMO?



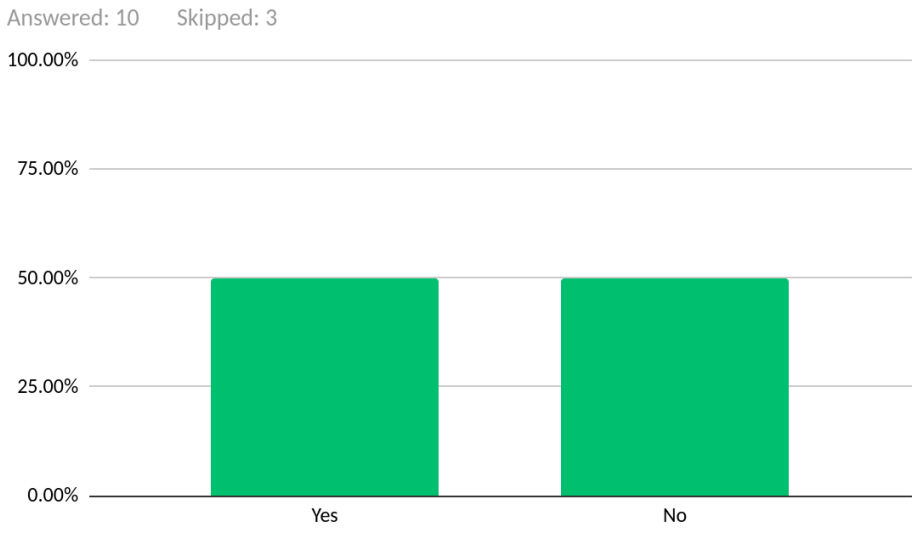
1.5 If your answer is Yes to Q1.3, what time was the Alert issued by your NTWC and/or NDMO? Please provide the time in UTC.

Responses	
Answered	3
Skipped	10

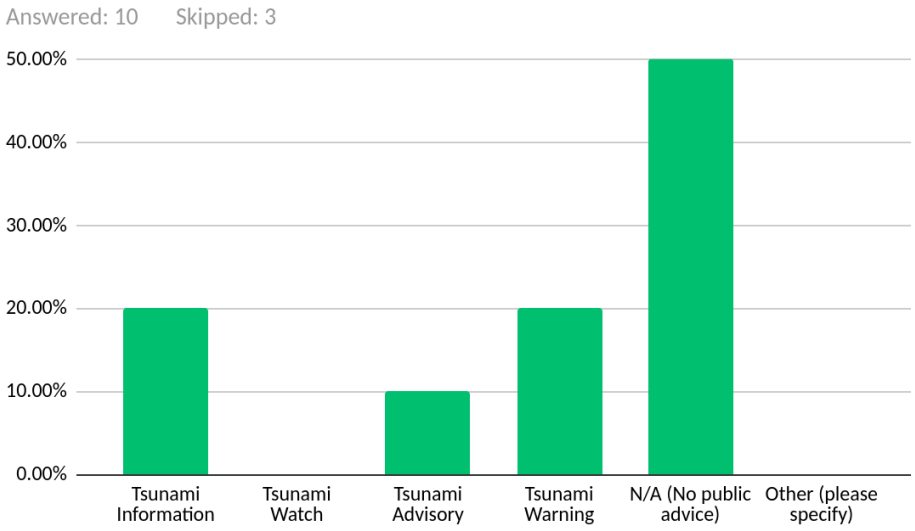
The table below gives the date and time in UTC for the three participants that issued their tsunami alert before receiving the PTWC bulletin.

PICT	Date and time (dd/mm/yyyy UTC)
Tonga	09/11/2022 11:00 PM
Wallis et Futuna	09/11/2022 11:20 PM
Fiji	09/11/2022 11:20 PM

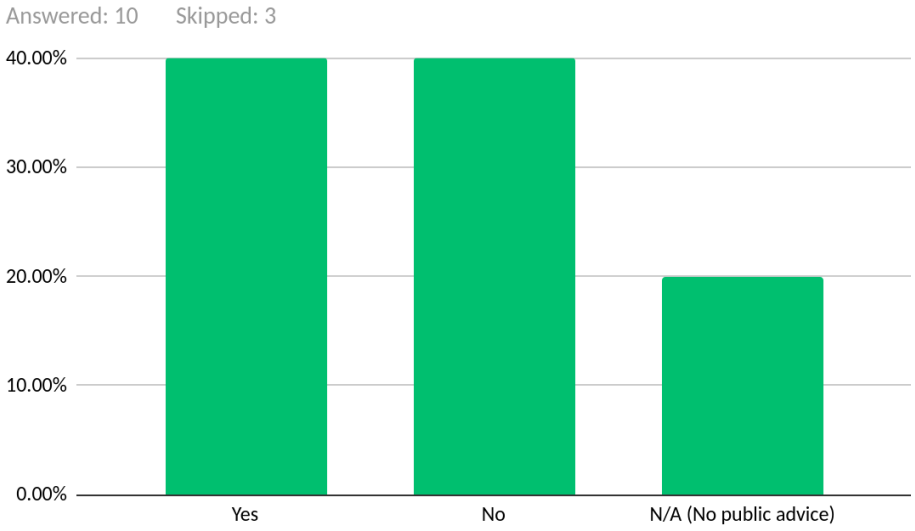
1.6 Did the PTWC Tsunami Message Number 1 (Threat Message) result in the issuance of an Alert at your NTWC and/or NDMO?



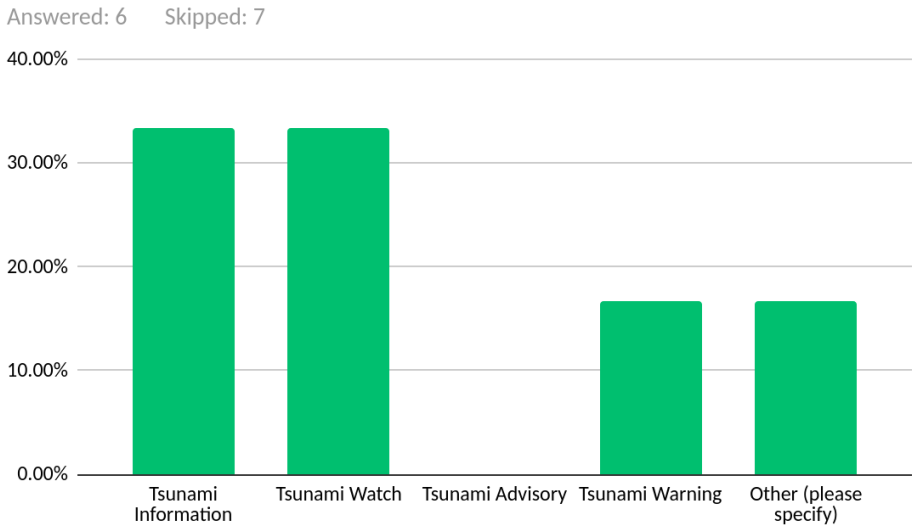
1.7 Upon the receipt of the PTWC Tsunami Message Number 1 (Threat Message), what Alert Level was issued by your NTWC and/or NDMO?



1.8 By the end of the exercise after the four PTWC Tsunami Threat Messages, did your Alert Level change since your first advice?



1.9 If your answer is Yes to Q1.8, what was the Alert Level issued?



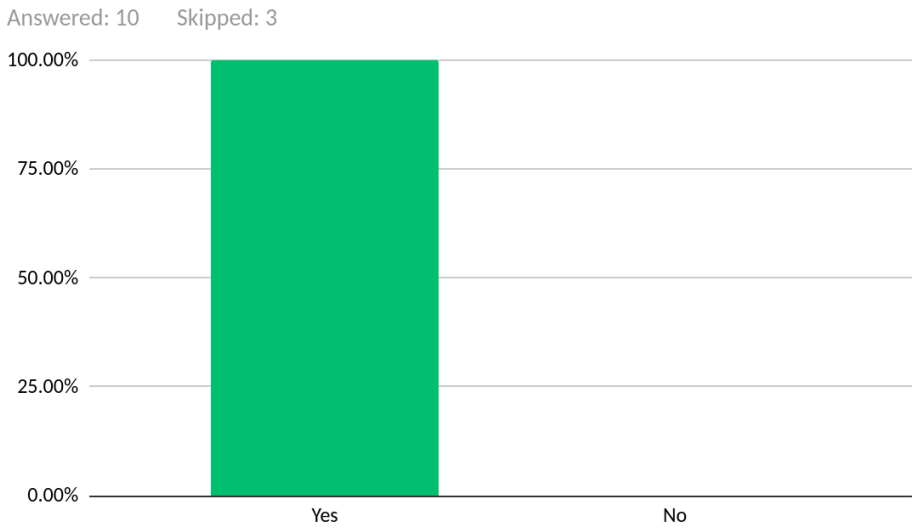
One participant selected Other (French Polynesia) with the following comment :

“NTWC forecast maximal tsunami height between 0.3 and 1 m to NDMO, marine threat level is recommended.”

This comment describes the tsunami watch level, so the final statistics over the tsunami alert level is describe in the table below :

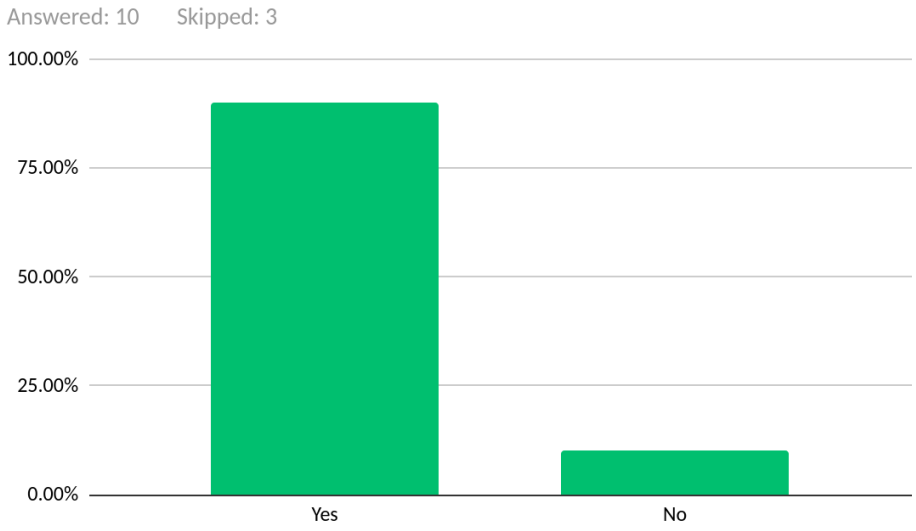
Tsunami Information	33.33%
Tsunami Watch	50.00%
Tsunami Advisory	0.00%
Tsunami Warning	16.67%

2.1 The information provided by PTWC was understood by the NTWC or/and NDMO.

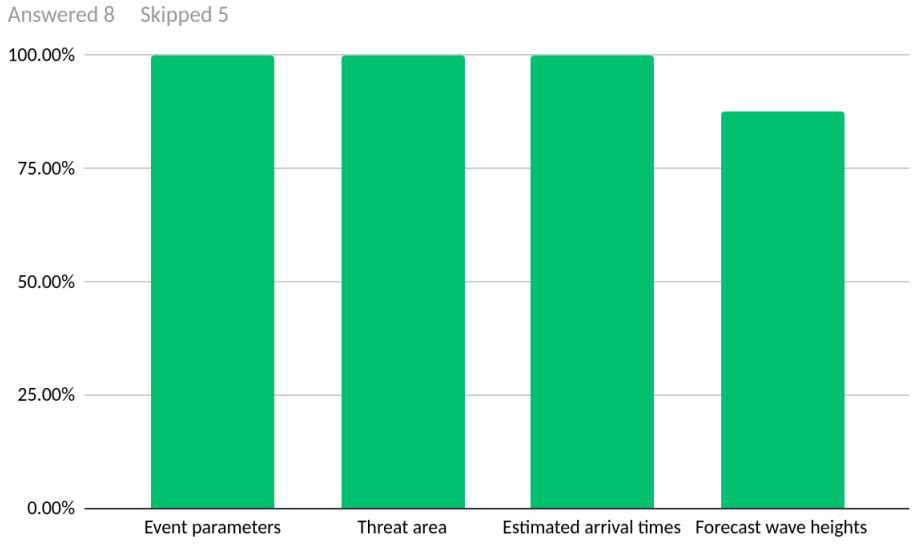


100% of answered agreed to say that the HTHH PTWC interim products were well understood by the NTWC or/and NDMO.

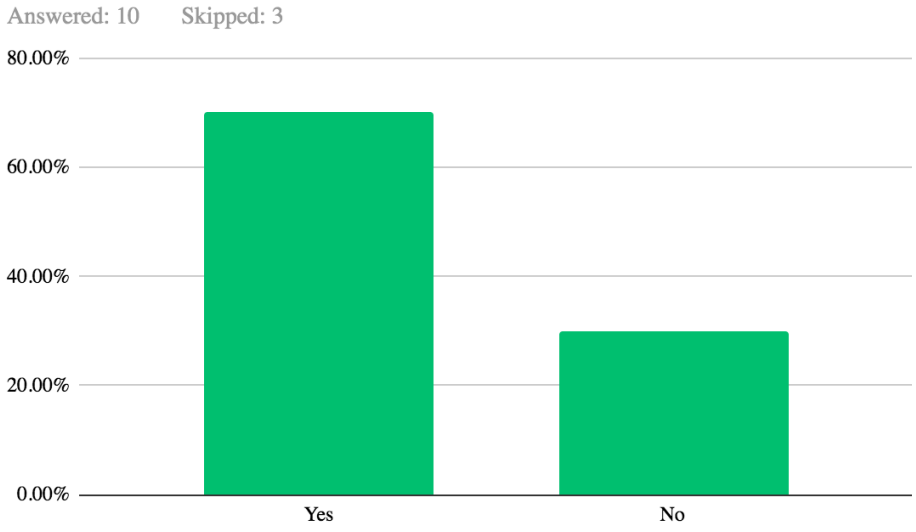
2.2 The information provided by PTWC assisted with decision making (e.g., Event parameters, Threat area, Estimated arrival times, Forecast wave heights, etc.)



2.3 On the PTWC Threat Messages content, please describe how the following information supported your analysis of the event and risk assessment in-country.

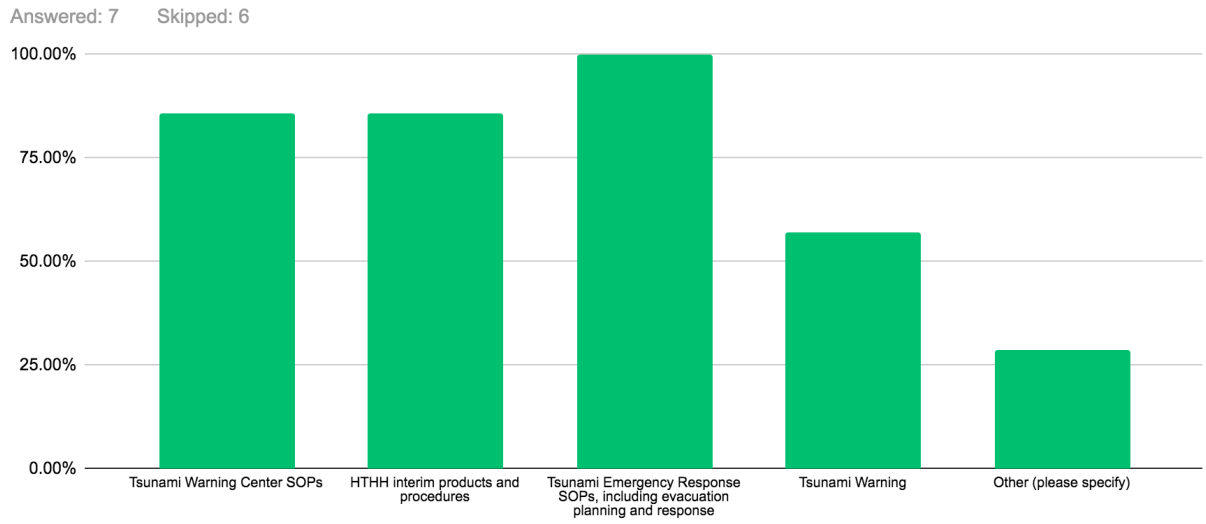


2.4 Does your country need additional training on tsunami warning and/or emergency responses standard operating procedures (SOP)?



70% of the participants that have answered are willing to have additional training on tsunami warning.

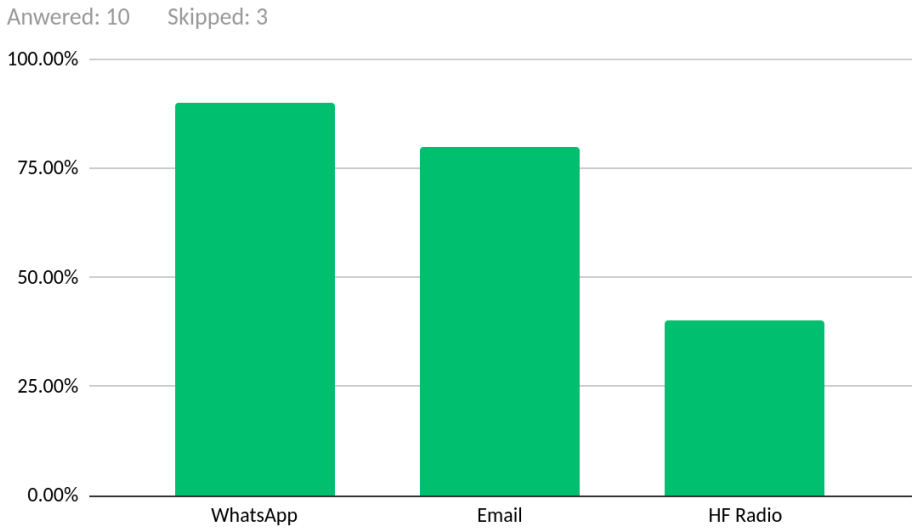
2.5 If your answer is Yes to Q2.4, please indicate which training topics (multiple choice).



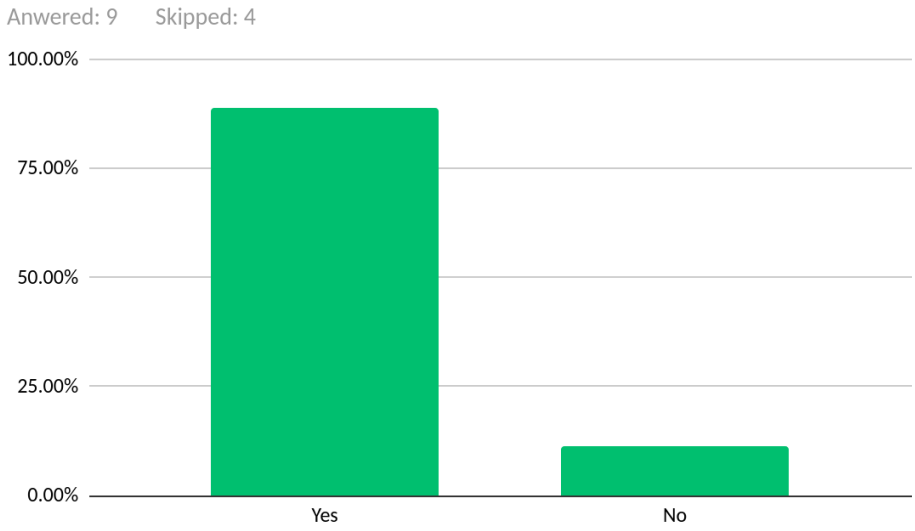
Additional training topics were suggested as follow :
Tonga suggested **Tsunami Competency** training and **Fiji** suggested also **Communications training** (issuing clear public advisories and working with the media).

5.2.2 Objective 2 evaluation compilation

3.1 How did you share or receive information from PICT participants? (multiple choice)



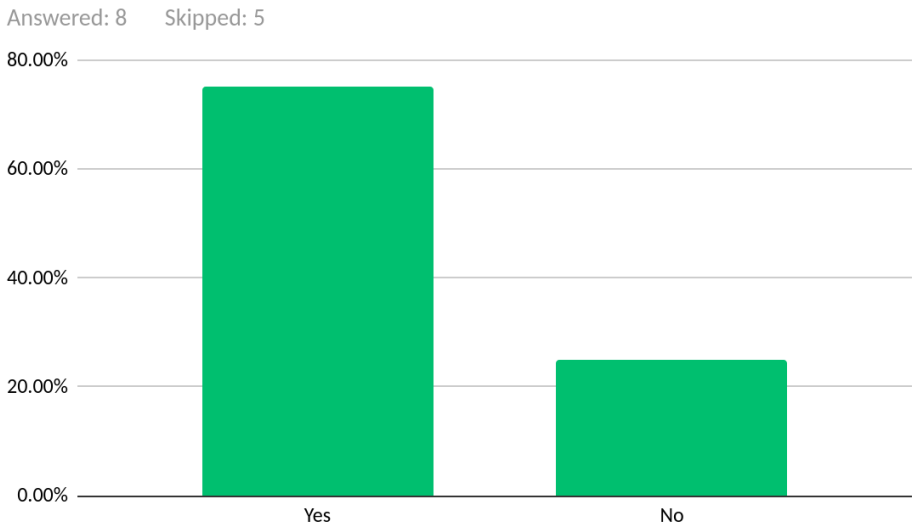
3.2 If you chose WhatsApp for Q3.1, was the information shared through this communication method clear and understandable?



If No, please explain what was not clear or what was confusing (1 answer) :

New-Caledonia : "Too much infomation transited on Whats'App, usefull information was lost in the multitude of messages. It was impossible for us to manage the flow."

3.3 If you chose Email for Q3.1, was the information shared through this communication method clear and understandable?



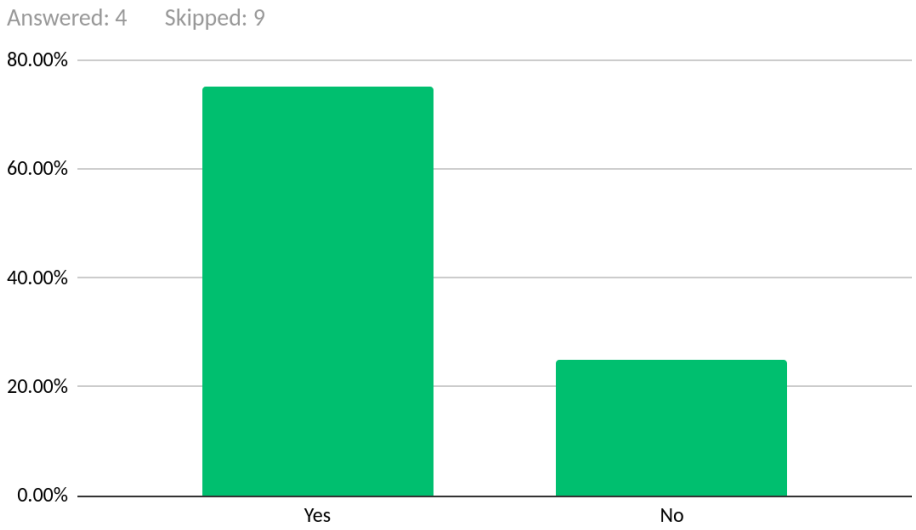
If No, please explain what was not clear or what was confusing (2 answers) :

Australia : "It was clear enough but each email came with the content provided as a html attachment and there were too many unnecessary confirmation emails. "

New-Caledonia : “Too much information transited on Email, useful information was lost in the multitude of messages. It was impossible for us to manage the flow. It seems essential not to answer to the messages for PICTs, not to overload the operational mailbox. ”

This refer to all unnecessary acknowledgement of e-mails going through the listserv. One solution could be no answer possible to emails sent through the listserv to avoid such problems.

3.4 If you chose HF Radio for Q3.1, was the information shared through this communication method clear and understandable?



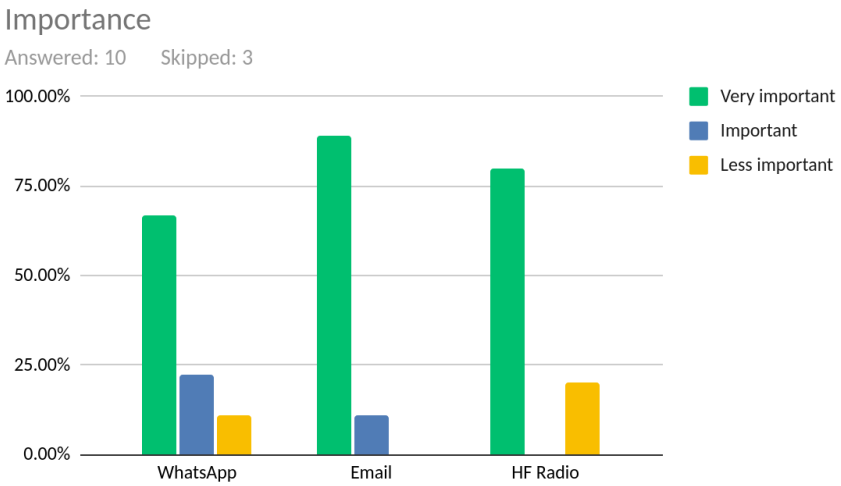
If No, please explain what was not clear or what was confusing (1 answers) :

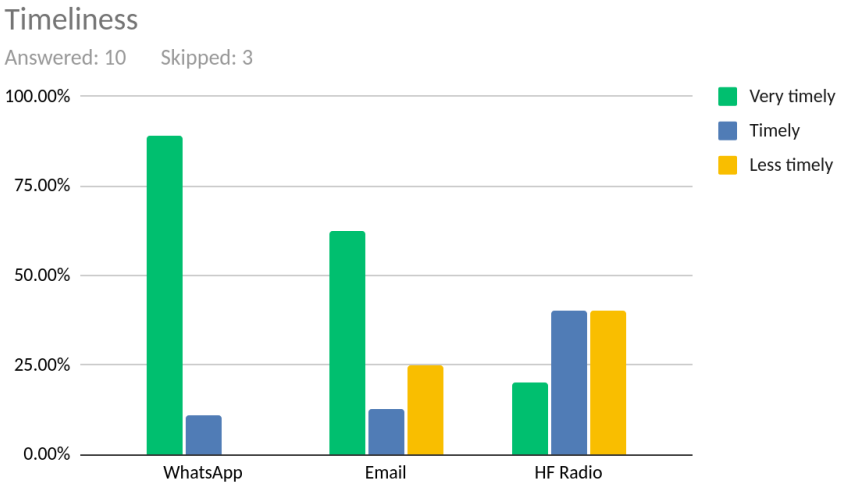
Tonga : “There were some HF base stations could not get clear calling frequencies and distorted messages were heard.”

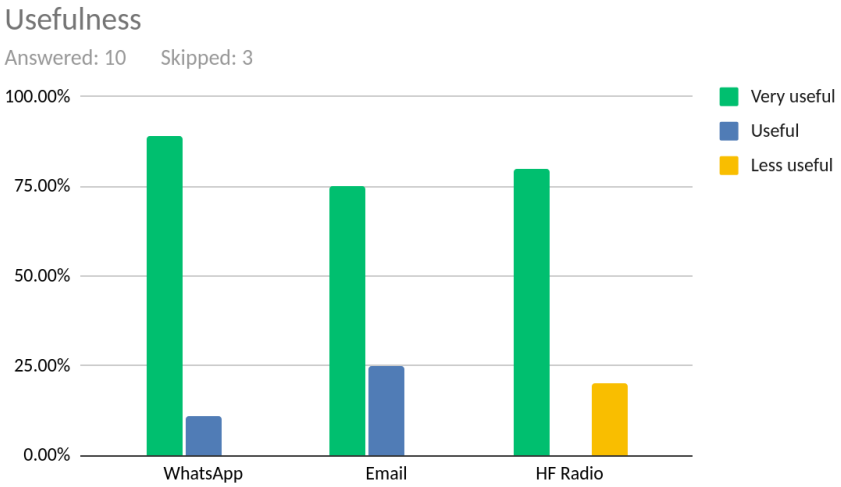
Other comment provided by a participant that answered “Yes” :

Fiji : “But Radio communication took time to establish.”

3.5 Based on your experience during the exercise, please provide your feedback on the application and use of the communication methods?







Detailed feedbacks on the application and use of WhatsApp :

Answered: 7 Skipped : 5

Participant	*Feedback*
Tonga	Needs to establish this WhatsApp group not only for exercises but should be a real time operational platform for daily use and readily available.
Papua New Guinea	Timely and faster .
Solomon	Members only.
Fiji	Not recognized as a formal platform for communication. Timely and concise information.
Samoa	Information was very timely. Encouraged participants to interact and report issues/observations ASAP.
French-Polynesia	Strengths: - A quick share between all duty officers(NTWC / NDMO) of the region to help in the decision making by sharing tsunami information. - Easy to share photography, media of impact if needed.(with parsimony). - Short messages are crucial, whatsapp can rely info about sharing more content by e-mail (listserv). Weakness : - People that write too long messages or questions to understand an unclear previous message can make a loss of information and time that is precious. NOTE: Only share relevant information on tsunami and earthquake. Further and details informations should be share by mail.
Australia	Strengths: - Instant communication - easy to share photos/movies without the need to change devices - can read through multiple short messages quickly Weaknesses - individual based and not all staff signed up - not an official form of communication at the Bureau of Meteorology - not suitable for larger messages Could be improved with some protocols about what type of information should be shared.
New-Caledonia	- Necessary to have a distinct WhatsApp group dedicated to HF radio communication - Necessary to rationalize exchanges - there has been an overload of our WhatsApp, drowning out important messages in the mass - Necessary to maybe define a precise organization internally for this influx of information and at the level of the Pacific zone to define communication rules - Reflexion needed for DSCGR on how to integrate this new tool

Detailed feedbacks on the application and use of Email :

Answered: 9 Skipped : 4

Participant	*Feedback*

Tonga	Email was ok, as standard it was received very well
Cook islands	Most public servants on e-mail; E-mail domain supported by government; E-mail is linked to mobile phones;
Papua New Guinea	Provides more detailed information and products, however, I wasn't added onto the mailing list and so did not receive the PTWC products sent through email
Solomon	Members on distribution list
Fiji	Messages are to be pasted onto the body of the email and not as attachments because weak connectivity may not allow email attachments to open.
Samoa	More formal way of sharing information. Less timely than whatsapp
French-Polynesia	Very useful, to share more contents and share data if needed. Since it is a listerv, acknowledgement is not necessary otherwise it makes it difficult to follow the discussions.
Australia	Strengths: - Formal form of communication - Can be sent to generic mailboxes that can be updated with staff movement - Suitable for large messages Weaknesses - Easy to miss important messages amongst many automated messages sent during tsunami events. Over 500 emails were received by some staff members during the HTHH event. - Subject to internet outages
New-Caledonia	- Necessary to rationalize exchanges - There has been an overload of our operational mailbox, drowning out important messages in the mass - Necessary to maybe define a precise organization internally for this influx of information and at the level of the Pacific zone to define communication rules - Reflexion needed for DSCGR on how to integrate this new tool

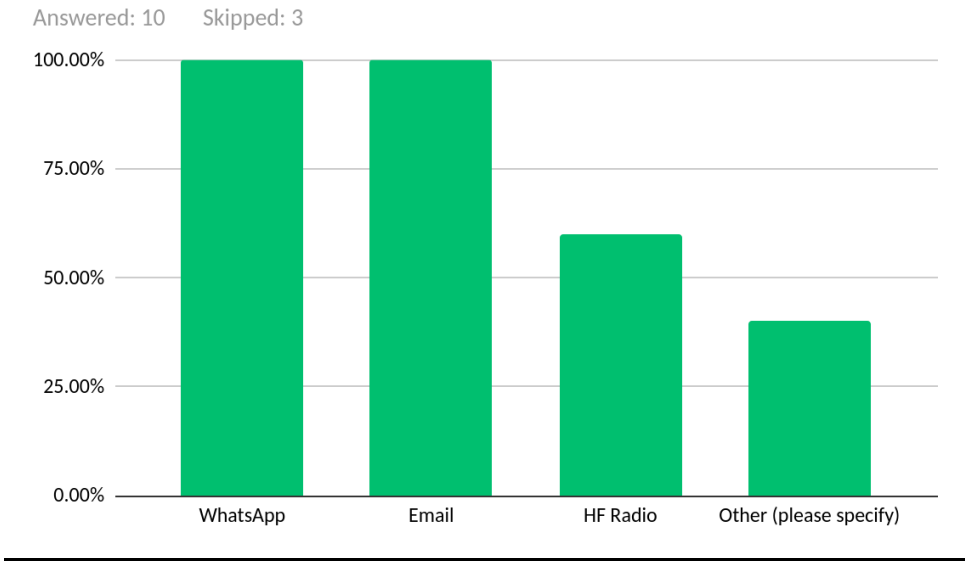
Detailed feedbacks on the application and use of Email :

Answered: 5 Skipped : 8

Participant	*Feedback*
Tonga	The HF radio is very important because this is the dissemination platform that will still work when all internet connection is down. There should be a focus to re strength this

	HF radio component in all tsunami warning agencies and for a dedicated working channel for communication
Solomon	Key technical Agency
Fiji	To be practiced as a mode of communication.
French-Polynesia	NTWC does not have anymore HF Radio capability. The renew of HF Radio is under discussion following this exercise.
New-Caledonia	- Very useful to test DSCGR material - Proposition of implementing a half-day of tests with other PICTs on a semi-annual basis - Necessary to have a dedicated WhatsApp group - Necessary to establish a procedure for communication PICTs, indeed, only Fiji was audible in New Caledonia, having taken the lead, set the frequency and having contacts with Tongal

3.7 For future exercises, which communication method(s) would you like to keep testing?

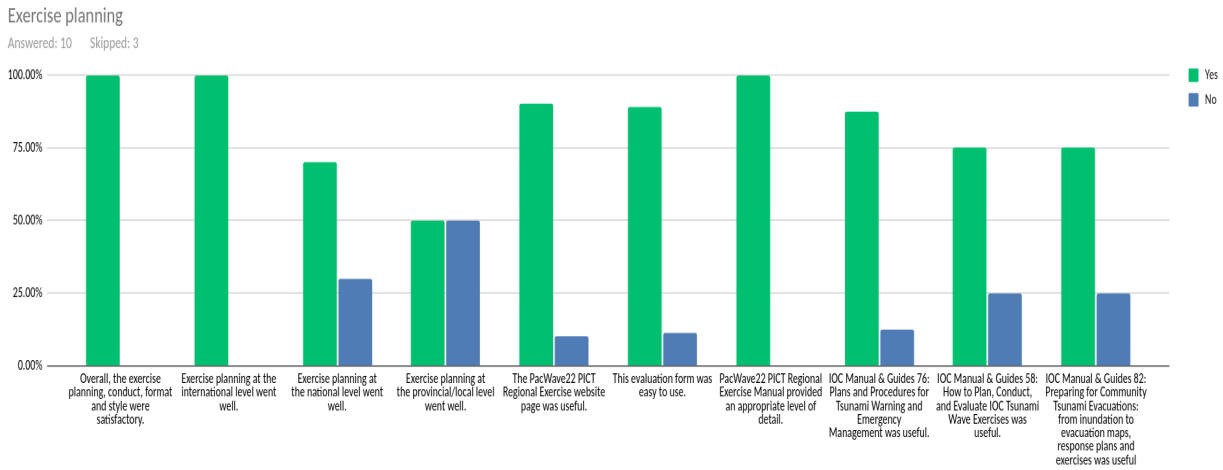


Other modes of communication have been suggested to be tested in future exercises :

- WMO CAP
- Satellite Phones
- SIBC- Radio/FM
- Video-Conference (MS Teams, …)

5.2.3 Exercise planning and conduct evaluation

Which documentation was useful to plan this regional exercise ?



General statement about what went well :

Answered: 9 Skipped: 4

Participant	*Feedback*
Cook islands	All good, Information was received well at first
Tonga	Planning process was done very well, Conducting of the exercise was good.
Papua New Guinea	Communication through whatsapp was the only thing that went well.
Solomon	Overall planning very good, Overall Running of the exercise was very good
Fiji	Timing of exercise; use of Whatsapp, HF radio; exercise scenario; hot wash. Good coordination by the control team and NTWC
Samoa	The planning and coordination from international agencies were really good. Receipt of messages and interaction between other regions and Samoa.
French-Polynesia	Cook islands sharing was very useful, For Tonga's region tsunami source event , Niue is very crucial for French-Polynesia since no SL Tide gauge is available.
Australia	Supplementary material on the event webpage was useful. Excellent engagement from SW Pacific nations was noted.
New-Caledonia	Exercise was well prepared with kind reminders among time, which were really helpful (shared links, ...). Messages were clear.

General statement about what did not go well.

Answered: 9 Skipped: 4

Participant	*Feedback*
Cook islands	Information was a bit vague after the few warnings
Tonga	the coordination of the HF radio frequency was not so well and should be tested ahead of the exercise date to ensure functionality from all participating agencies
Papua New Guinea	The initial contact person involved in the planning stage was not available to participate in the exercise, so I had to step in. I was not added onto the mailing list and therefore didn't receive the products.
Solomon	Funding support limited. Funding support to reach out to communities none
Fiji	There was no flow in the messaging from email and Whatsapp and also HF radio comms took time to establish.
Samoa	National coordination and communication for the implementation of the exercise. No staff - only two in office
French-Polynesia	- NDMO could not participate to PACWAVE Regional exercise - The first message of PTWC is not received (on listserv) - avoid staff video and audio. share after or before
Australia	Australia did not have time to engage other agencies due to lack of information. Additionally, Nov-Feb is the peak severe weather season for emergency services to manage. Australia was unable to share information via the list server due to unrecognized email addresses that were not provided.
New-Caledonia	Webinar needed maybe to be more focused on the exercise with questions allowed for PICTs, more operational ? Important messages were drowned in a flood of unuseful replies.

General statement about what could be improved.

Answered: 8 Skipped: 5

Participant	*Feedback*
Cook islands	Encourage all to use a different scenario. An example is, if you took a table exercise this time round, then you should look at taking a scenario where you communicate this information to your sub-committees.
Tonga	There needs to be a dedicated HF radio and frequency to be used in every regional exercise. Please continue this regional exercise and to provide more scenarios for exercise like linking it to a national exercise event
Solomon	Funding support must be improved.
Fiji	Monthly communication tests should be done with all PICT.
Samoa	Agency ties - local level. Proper coordination and planning in office.
French-Polynesia	- Include geographical coordinates for the source - Don't forget to give a time origin, even a rough estimate - The first PTWC bulletin should consider an initial threat area for region in the 6 hours tsunami travel time. - In PTWC Bulletin rename NZ's DART using their true names as NZH , NZI , NZG etc to consistent with GEONET website.
Australia	Exercise manual should have been provided much earlier. Less confirmation messages. Instead log confirmation of key messaged in the evaluation process
New-Caledonia	Implement communication procedures for each tool ?

6. EXERCISE FINDINGS SUMMARY

The main findings after a cold wash debrief (16 November 2022) and results from the exercise evaluation form compilation are summarized below.

Objective 1 :

- The HTHH PTWC interim products were found useful by all participants. Some comments and requests were shared by PICTs :
    - All participants agreed that the interim products were clearly understandable by NTWC and/or NDMO.
    - Scaled forecast heights are useful for issuing warning, upgrade, downgrade and cancellation.
    - How is it possible to have more forecast points in the text bulletin, especially for PICTs with many islands.
    - Request PTWC to extend the first bulletin to report (forecast and ETA) to countries and territories located at 6 hrs tsunami travel time (instead of 3 hrs).

Objective 2 :

- The exercise highlights the need to keep building regional cooperation and direct links between PICT NTWC and/or NDMO.
  In this manner, the 9th WG-PICT meeting (2 and 3 February 2023) agreed to continue such regional exercises in order to strengthen regional Tsunami Early Warning coordination and gives the following recommendations :
    - Guidelines should be developed on the use of non-traditional platforms like WhatsApp to be used for unofficial communication during exercises and tsunami warning operations, noting the need for differentiation of official and shared content for operations (consider the establishment of a task team. Lead – FP supported by SB)
    - The Secretariat facilitate monthly testing of non-traditional communication systems eg HF radio, WhatsApp, satellite phones between countries
    - that members to continue to explore options in relation to a communications strategy in order to enhance national tsunami warning systems

ANNEX I. TASK TEAM ON PACWAVE22-PICT

The planning, conduct, and evaluation of Exercise PacWave20 was coordinated by a joined group formed by members below from WG-PICT and PTWS Exercise PacWave22 Task team.

PacWave22-PICT Regional Exercise Team (unofficial)

Esline Garaebiti, Vanuatu (WG-PICT Chair)
Mathew Moihio, PNG, (WG-PICT Co-chair)
Dr. Laura Kong, ITIC, USA
Tammy W.L. Fukuji, ITIC, USA
Carolina Hincapie-Cardenas, ITIC, USA
Jiuta Korovulavula, UNESCO
Saula Mule, Fiji
Céline Barre, France, New-Caledonia
Anthony Jamelot, CPPT, Fance, French-Polynesia

This Exercise PacWave22 Summary Report and Annexes were compiled by Carolina Hincapie-Cardenas (International Tsunami Information Center) and Anthony Jamelot (French Polynesian Tsunami Warning Center).

ANNEX II. LIST OF ACRONYMS

CPPT	Centre Polynésien de Prévention des Tsunamis French Polynesian Tsunami Warning Center
ICG	Intergovernmental Coordination Groups
ICG/PTWS	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (formerly ITSU)
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
ITIC	International Tsunami Information Center (UNESCO/IOC–NOAA)
NDMO	National Disaster Management Office
NOAA	National Oceanic & Atmospheric Administration (USA)
NTWC	National Tsunami Warning Centre
PacWave22	Pacific Wave 2022 International tsunami exercise
PacWave22-PICT	Pacific Wave 2022 - Pacific Island Countries and Territories Regional Exercise
PTWC	Pacific Tsunami Warning Center (USA)
SOP	Standard Operating Procedures
TNC	Tsunami National Contact
TSP	Tsunami Service Provider
TWFP	Tsunami Warning Focal Point
UNESCO	United Nations Educational, Scientific & Cultural Organization
WG	Working Group
WG-PICT Tsunami	Working Group on the Pacific Island Countries and Territories Warning and Mitigation System