**PTWC Interim Procedures**

**and**

**PTWS Products**

**for**

**Tsunamis from the**

**Hunga Tonga – Hunga Ha`apai Volcano**

April 6, 2022

**Introduction**. The January 15, 2022 explosive eruption of the Hunga Tonga – Hunga Ha`apai (HTHH) Volcano generated tsunami waves that caused inundation, damage, and casualties on the nearby islands of Tonga as well as significant sea level oscillations and damage across most of the Pacific including places as far away as Japan, the U.S. West Coast, and the Pacific coast of South America. The character of this tsunami – that it spread so far with destructive amplitudes – is enigmatic. Any disturbance of the sea with an areal extent similar to that of the volcanic edifice should have attenuated rapidly as it spread across the vast Pacific. But this did not occur and the usual tsunami forecast models driven solely by a deformation of the sea surface at the source were inadequate for this event. Another forcing mechanism related to atmospheric pressure fluctuations from the eruption was likely involved. As a result, the only information disseminated by Pacific Tsunami Warning Center (PTWC), as a Tsunami Service Provider for the Pacific Tsunami Warning and Mitigation System (PTWS), was to report: 1) that there had been a tsunami observed from the eruption of a Tongan volcano, and 2) tsunami amplitudes as they were observed on sea level gauges across the Pacific. There was no numerical forecast possible, nor even an ad-hoc qualitative forecast utilizing the knowledge and experience of the PTWC staff since there had never been such an event before.

This was the first time that the Pacific Tsunami Warning and Mitigation System (PTWS) responded to a volcano-generated tsunami.  Given that the PTWS is designed for earthquake-generated tsunamis, which cause nearly 90% of the world’s tsunamis, non-standard procedures were required during the event by the PTWS Tsunami Service Provider and by Member States.

To move forward, the International Tsunami Information Centre (ITIC) immediately convened three PTWS Post-Event Briefs on the 15 January 2022 HTHH Volcanic Eruption and Tsunami to share information and experience, and to discuss the development of interim guidance should another HTHH volcanic eruption occur. The [PTWS Post-Event Brief I](https://oceanexpert.org/event/3380#overview) on 20 January 2022 focused the warning aspects. The PTWS Working Group 2 and PTWC presented a proposal for immediate interim guidance on warnings for volcanic sources. [PTWS Post-Event Brief II](https://oceanexpert.org/event/3387) on 3 Feb 2022 shared the warning and response by Tonga and by Member States in the nearby region. [PTWS Post-Event Brief III](https://oceanexpert.org/event/3401)on 10 February 2022 shared the warning and response by Member States in distant regions and discussed lessons learned for strengthening national tsunami warning systems and improving the PTWS.

Due to the potential for another HTHH volcanic eruption and tsunami, immediate development of PTWS interim volcano tsunami alert procedures began following the proposal presentation to Member States, their feedback, and the agreed upon ‘Actions Forward’ concluded from PTWS Post-Event Brief I. Further Member State feedback was provided during PTWS Post-Event Brief II and PTWS Post-Event Brief III (PTWS Interim Procedures Implementation Plan - v1.0 presented on 10 February 2022).

To facilitate implementation of PTWS Interim Volcano Tsunami Alert Products and Procedures, the ICG/PTWS established a Task Team on the HTHH Volcanic Tsunami Hazard Response under PTWS Working Group 2 on Detection, Warning, and Dissemination. The TT-HTHH Terms of Reference were to review and finalize the Implementation Plan, and review and provide feedback to the PTWC during the implementation and for the User’s Guide.

The TT-HTHH finalized the Implementation Plan on 1 March 2022 (v1.1), which was provisionally approved by the PTWS Steering Committee, and announced officially to Member States through IOC Circular Letter 2822 ‘Interim Volcano-generated Tsunami Alert Products and Procedures of the Pacific Tsunami Warning and Mitigation System’ dated 18 March 2022. Final approval is targeted for the ICG/PTWS-XXX (November 2022).

**Interim Standard Operating Procedures**

***Overview.*** Noting the above, the PTWC will use first available information that a tsunami has been generated to underpin PTWC Threat Messages for any future HTHH events. Specifically, PTWC

* Will use observed tsunami amplitudes as the basis of a forecast. These include amplitudes from the sea level gauge at the Nuku`alofa and the deep ocean NZG DART gauge, which is the nearest DART to the HTHH volcano. Tsunamis generated at the HTHH volcano will arrive at those stations within approximately 20 to 30 minutes. Observations on these stations will likely constitute the first evidence of a tsunami threat.
* Create the forecast for the future HTHH event by scaling observed maximum amplitudes across the Pacific from the 15 January 2022 event with observed amplitudes of the future HTHH event, starting with the observed amplitudes at Nuku`alofa, the NZG DART, or other nearby sea level stations. Forecast values are only for specific sea level locations and do not represent a wider forecast for that coast.
* Calculate estimated tsunami arrival (ETA) times according to tsunami propagation generated by a sea level disturbance at HTHH.
* Re-assess the forecast at least every hour based upon later arriving sea level readings and then revise and re-issue the forecast if necessary.

NTWCs will need to apply their knowledge of what happened along all their coasts during the 15 January event and also scale it accordingly. A useful reference can be the comparison of the barometric pressure change of the 15 January eruption with record(s) during the future HTHH event from any country weather station or nearby stations.

These interim Threat Messages for HTHH are not meant to provide the same level of detail and/or certainty as normal forecasting products delivered during earthquake-generated tsunami responses. It is expected that this interim SOP will evolve based on advancing science as well as recommendations from WG 2. No graphic products will be provided for this interim service.

This will be a best endeavors approach to creating Threat Messages. Some judgement of the PTWC duty staff will be applied to limit or extend the region around the volcano designated to have a threat and to raise or lower forecast amplitudes based upon the evolving observations as the tsunami propagates across the Pacific.

***Activity Alert***. Should there be future activity at HTHH resulting in another tsunami, PTWC will probably not become aware until the waves reach either the closest coastal sea level gauge at Nuku`alofa (nkfa), the closest deep-ocean gauge (DART 01003 - dnzg) or some other nearby sea level gauge. These signals will cause PTWC alarms to sound and PTWC Duty Scientists to respond. Other early alerts, such as a report of the observation of an ash cloud in Tonga, from satellite observations by Volcanic Ash Advisory Centers, or from detection of an atmospheric pressure wave may be possible.

***Product Types and Frequency***. Based on the amplitude of the tsunami waves at the closest stations, PTWC will issue either: 1) a Tsunami Information Statement reporting the activity but indicating there is no tsunami threat, or 2) a Tsunami Threat Message indicating that there is a tsunami threat. A Tsunami Information Statement will typically be the only message unless a supplement is issued later to report observations. A Tsunami Threat Message will be followed by additional Threat Messages at least once an hour until the threat has passed and a Final Threat Message is issued.

***Product Content***

Time of the HTHH Event. An approximate time of the tsunamigenic activity at HTHH will be estimated from the tsunami arrival times at Nuku`alofa (nkfa) and/or DART NZG (dnzg) and/or other gauges, by subtracting the estimated tsunami travel time from HTHH (Table 1 and Figure 1) from the observed tsunami arrival time at the gauge.

Threat Area. For a Tsunami Threat Message, the area initially considered to have a potential tsunami threat will be those areas within three hours of tsunami travel time unless there are sufficient initial data to prescribe a larger or smaller threatened area. The threat area may expand or contract in later messages as additional data are received.

Estimated Arrival Tsunami Times. Tsunami Threat Messages will contain estimated tsunami arrival times within the threatened area using the standard list of PTWS Warning Points. These arrival times will assume the tsunami is generated at the volcano. They will not represent potential earlier wave arrivals that may occur, as they did on January 15, as a result of tsunami waves excited by atmospheric pressure fluctuations from an explosive eruption. Countries can use the January 15 early arrival times to estimate possible early arrival times for future events.

Tsunami Amplitude Forecast. Tsunami Threat Messages will also contain a tsunami amplitude forecast. The forecast will be based upon the maximum tsunami wave amplitudes observed on coastal and deep-ocean (DART) gauges for the January 15, 2022, event (Table 1), but scaled up or down using the initial gauge readings of the current event. Note that the forecast is only for specific gauge locations – it is not a comprehensive coastal forecast like the one produced by PTWC for earthquake-generated tsunamis. Tsunami amplitudes along coasts in the region of each gauge could be different. Coastal impacts observed on January 15 in relation to gauge readings observed on January 15 can be used as a guide to estimate more comprehensive coastal impacts for the current event.

***Product Dissemination***

Messages will be disseminated to all Member States by the same methods used by PTWC for messages regarding earthquake-generated tsunamis:

1) the WMO’s Global Telecommunications System (GTS),

2) The Aeronautical Fixed Telecommunications Network (AFTN),

3) email, and

4) telefax,

using designated contact addresses that have been transmitted by each Member State to the IOC through official channels.

Further, PTWC will call the Tonga National Tsunami Warning Centre using their operational phone numbers.

In addition, for a few key contacts in Tonga an SMS message will be disseminated for the first Tsunami Information Statement or the first Tsunami Threat Message as a rapid heads-up. The content of the SMS follows.

For a Tsunami Information Statement:

*The Pacific Tsunami Warning Center has issued a Tsunami Information Statement regarding activity at the HTHH Volcano in Tonga.*

For a Tsunami Threat Message:

*The Pacific Tsunami Warning Center has issued a Tsunami Threat Message regarding a tsunami from the HTHH Volcano in Tonga.*

Lastly, for this interim service, PTWC messages will also appear on the tsunami.gov website but will reference a magnitude 1.0 earthquake at the site of HTHH volcano. It will require much more work to modify the website to reflect a volcano source.

***Sample Products***

A sample Tsunami Information Statement, Initial Tsunami Threat Message, Supplemental Tsunami Threat Message, and Final Tsunami Threat Message are given in Appendix I.

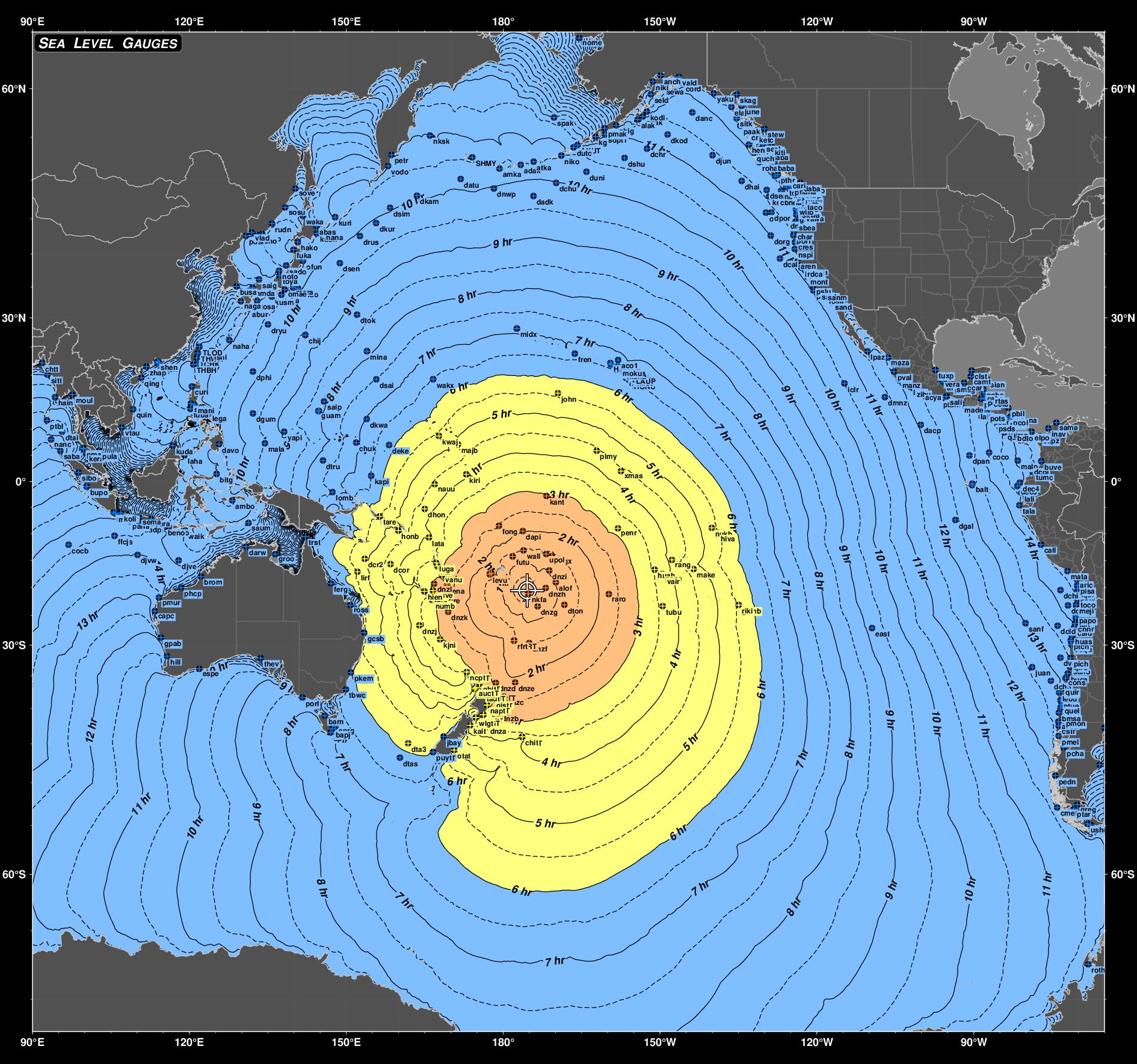


Figure 1. Estimated tsunami travel times from HTHH across the Pacific. On this map are noted the specific coastal and deep-ocean (DART) gauge locations annotated by their respective four-letter code as noted in Table 1.

Table 1. Readings of the maximum tsunami wave amplitude recorded on coastal and deep-ocean (DART) sea level gauges across the Pacific Ocean. Maximum amplitudes were typically measured as half of the trough-to-crest of the largest single wave on each gauge after the tidal component has been removed. In some cases, the maximum amplitude may be the absolute value of the difference between the largest peak or trough and undisturbed sea level at the time. Additional readings may be added to this list. Estimated travel times (ETTs) are the estimated times in hours and minutes for a tsunami wave to travel from HTHH to each gauge.

| **GAUGE NAME** | **CODE** | **ETT** | **LAT** | **LON** | **AMPLITUDE** | |
| --- | --- | --- | --- | --- | --- | --- |
| **NUKUALOFA\_TO** | **nkfa** | 0017 | 21.1S | 175.2W | **0.82M** | 2.7FT |
| **DART 01003** | **dnzg** | 0042 | 23.4S | 173.4W | **0.12M** | 0.4FT |
| **PAGO\_PAGO\_AS** | **pago** | 0126 | 14.3S | 170.7W | **0.62M** | 2.0FT |
| **DART 01002** | **dnzf** | 0126 | 29.7S | 175.0W | **0.10M** | 0.3FT |
| **APIA\_UPOLU\_WS** | **upol** | 0136 | 13.8S | 171.8W | **0.17M** | 0.5FT |
| **SUVA\_VITI\_LEVU\_FJ** | **viti** | 0142 | 18.1S | 178.4E | **0.26M** | 0.9FT |
| **DART 01001** | **dnze** | 0208 | 36.0S | 177.7W | **0.07M** | 0.2FT |
| **RAROTONGA\_CK** | **raro** | 0215 | 21.2S | 159.8W | **0.90M** | 3.0FT |
| **DART 01004** | **dnzd** | 0227 | 36.1S | 178.6E | **0.11M** | 0.4FT |
| **EAST\_CAPE\_NZ** | **lott** | 0244 | 37.6S | 178.2E | **0.26M** | 0.8FT |
| **FONGAFALE\_TV** | **fong** | 0249 | 8.5S | 179.2E | **0.12M** | 0.4FT |
| **LIFOU\_NEW\_CALEDONIA** | **lifo** | 0255 | 20.9S | 167.3E | **0.89M** | 2.9FT |
| **GISBORNE\_EASTLAND\_N** | **gist** | 0304 | 38.7S | 178.0E | **0.68M** | 2.2FT |
| **OUVEA\_NEW\_CALEDONIA** | **ouve** | 0306 | 20.5S | 166.6E | **0.39M** | 1.3FT |
| **OUINNE\_NEW\_CALEDONI** | **ouin** | 0313 | 22.0S | 166.7E | **1.13M** | 3.7FT |
| **VANUATU** | **vanu** | 0313 | 17.8S | 168.3E | **1.41M** | 4.6FT |
| **THIO\_NEW\_CALEDONIA** | **thio** | 0319 | 21.6S | 166.2E | **0.57M** | 1.9FT |
| **KINGSTON\_NORFOLK\_IS** | **kjni** | 0320 | 29.1S | 168.0E | **0.78M** | 2.6FT |
| **HIENGHENE\_NEW\_CALED** | **hien** | 0321 | 20.7S | 164.9E | **0.45M** | 1.5FT |
| **GREAT\_BARRIER\_IS\_NZ** | **gbit** | 0326 | 36.2S | 175.5E | **0.70M** | 2.3FT |
| **NORTH\_CAPE\_NZ** | **ncpt** | 0327 | 34.4S | 173.0E | **0.69M** | 2.3FT |
| **LUGANVILLE\_VU** | **luga** | 0328 | 15.5S | 167.2E | **0.37M** | 1.2FT |
| **HUAHINE\_PF** | **huah** | 0337 | 16.7S | 151.0W | **0.53M** | 1.8FT |
| **TUBUAI\_PF** | **tubu** | 0337 | 23.3S | 149.5W | **0.33M** | 1.1FT |
| **PORT\_NAPIER\_NZ** | **napt** | 0340 | 39.5S | 176.9E | **0.35M** | 1.2FT |
| **VAIRAO\_FP\_FR** | **vair** | 0347 | 17.8S | 149.3W | **0.43M** | 1.4FT |
| **PAPEETE\_TAHITI** | **pape** | 0347 | 17.5S | 149.6W | **0.27M** | 0.9FT |
| **WELLINGTON\_NZ** | **wlgt** | 0401 | 41.3S | 174.8E | **0.18M** | 0.6FT |
| **OWENGA\_CHATHAM\_NZ** | **chit** | 0419 | 44.0S | 176.4W | **0.44M** | 1.4FT |
| **CHRISTMAS\_KI** | **xmas** | 0425 | 2.0N | 157.5W | **0.20M** | 0.7FT |
| **NAURU** | **nauu** | 0429 | 0.5S | 166.9E | **0.15M** | 0.5FT |
| **NUKU\_HIVA\_MARQUESAS** | **nukb** | 0521 | 8.9S | 140.1W | **0.67M** | 2.2FT |
| **HIVA\_OA\_MARQUESAS** | **hiva** | 0531 | 9.8S | 139.0W | **0.53M** | 1.8FT |
| **LIHOU\_REEF\_AU** | **lirf** | 0531 | 17.1S | 152.1E | **0.12M** | 0.4FT |
| **RIKITEA\_PF** | **riki** | 0534 | 23.1S | 135.0W | **0.21M** | 0.7FT |
| **JOHNSTON\_US** | **john** | 0538 | 16.7N | 169.5W | **0.11M** | 0.4FT |
| **TAREKUKURE\_WHARF\_SB** | **tare** | 0547 | 6.7S | 156.4E | **0.20M** | 0.6FT |
| **GOLD\_COAST\_SAND\_BYP** | **gcsb** | 0553 | 27.9S | 153.4E | **0.70M** | 2.3FT |
| **JACKSON\_BAY\_NZ** | **jbay** | 0629 | 44.0S | 168.6E | **0.91M** | 3.0FT |
| **HONOKOHAU\_HI** | **hkhu** | 0631 | 19.7N | 156.0W | **0.34M** | 1.1FT |
| **TWOFOLD\_BAY\_AU** | **tbwc** | 0632 | 37.1S | 149.9E | **0.67M** | 2.2FT |
| **WAKE\_US** | **wake** | 0632 | 19.3N | 166.6E | **0.13M** | 0.4FT |
| **KAWAIHAE\_HAWAII** | **kawa** | 0638 | 20.0N | 155.8W | **0.37M** | 1.2FT |
| **BARBERS\_PT\_HI** | **brpt** | 0639 | 21.3N | 158.1W | **0.19M** | 0.6FT |
| **NAWILIWILI\_KAUAI** | **nawi** | 0640 | 22.0N | 159.4W | **0.31M** | 1.0FT |
| **HILO\_HAWAII** | **hilo** | 0642 | 19.7N | 155.1W | **0.10M** | 0.3FT |
| **HONOLULU\_OAHU** | **hono** | 0642 | 21.3N | 157.9W | **0.12M** | 0.4FT |
| **MAKAI\_PIER\_WAIMANAL** | **maka** | 0643 | 21.3N | 157.7W | **0.28M** | 0.9FT |
| **HALEIWA\_HI** | **hale** | 0643 | 21.6N | 158.1W | **0.41M** | 1.3FT |
| **HANALEI\_HI** | **hanl** | 0646 | 22.2N | 159.5W | **0.82M** | 2.7FT |
| **KAHULUI\_MAUI** | **kahu** | 0655 | 20.9N | 156.5W | **0.83M** | 2.7FT |
| **PORT\_KEMBLA\_AU** | **pkem** | 0659 | 34.5S | 150.9E | **0.39M** | 1.3FT |
| **MIDWAY** | **midw** | 0711 | 28.2N | 177.4W | **0.22M** | 0.7FT |
| **SPRING\_BAY\_AU** | **sprg** | 0720 | 42.5S | 147.9E | **0.35M** | 1.1FT |
| **CHUUK\_FM** | **chuk** | 0725 | 7.5N | 151.9E | **0.06M** | 0.2FT |
| **LOMBRUM\_MANUS\_IS\_PG** | **lomb** | 0742 | 2.0S | 147.4E | **0.20M** | 0.7FT |
| **SAIPAN\_US** | **saip** | 0812 | 15.2N | 145.7E | **0.11M** | 0.4FT |
| **PORTLAND\_AU** | **porl** | 0903 | 38.3S | 141.6E | **0.15M** | 0.5FT |
| **EASTER\_CL** | **east** | 0911 | 27.2S | 109.4W | **0.32M** | 1.0FT |
| **CHICHIJIMA\_JP** | **chij** | 0933 | 27.1N | 142.2E | **0.74M** | 2.4FT |
| **MERA\_JP** | **mera** | 1025 | 34.9N | 139.8E | **0.53M** | 1.7FT |
| **BURNIE\_TASMANIA\_AU** | **barn** | 1033 | 41.1S | 145.9E | **0.26M** | 0.8FT |
| **KUSHIRO\_JP** | **kush** | 1038 | 43.0N | 144.4E | **0.40M** | 1.3FT |
| **OFUNATO\_HONSHU\_JP** | **ofun** | 1038 | 39.0N | 141.8E | **0.29M** | 1.0FT |
| **DART 46403** | **dshu** | 1042 | 52.7N | 156.8W | **0.06M** | 0.2FT |
| **OMAEZAKI\_HONSHU\_JP** | **omae** | 1046 | 34.6N | 138.2E | **0.71M** | 2.3FT |
| **NIKOLSKI\_AK** | **niko** | 1052 | 52.9N | 168.9W | **0.36M** | 1.2FT |
| **ATKA\_AK** | **atka** | 1059 | 52.2N | 174.2W | **0.22M** | 0.7FT |
| **VODOPADNAYA\_RU** | **vodo** | 1102 | 51.7N | 158.0E | **0.45M** | 1.5FT |
| **LEGASPI\_PH** | **lega** | 1102 | 13.1N | 123.8E | **0.13M** | 0.4FT |
| **ABURATSU\_JP** | **abur** | 1110 | 31.6N | 131.4E | **0.65M** | 2.1FT |
| **DART 46409** | **dkod** | 1120 | 55.3N | 148.6W | **0.04M** | 0.1FT |
| **TOSASHIMIZU\_SHIKOKU** | **tosa** | 1121 | 32.8N | 133.0E | **0.93M** | 3.0FT |
| **HAKODATE\_JP** | **hako** | 1121 | 41.8N | 140.7E | **0.33M** | 1.1FT |
| **KUSHIMOTO\_JP** | **kusm** | 1122 | 33.5N | 135.8E | **0.96M** | 3.1FT |
| **DUTCH\_HBR\_UNALASKA** | **dutc** | 1123 | 53.9N | 166.5W | **0.09M** | 0.3FT |
| **DAVAO\_PH** | **davo** | 1128 | 7.2N | 125.7E | **0.22M** | 0.7FT |
| **KING\_COVE\_AK** | **kgak** | 1153 | 55.1N | 162.3W | **0.32M** | 1.1FT |
| **ISHIGAKIJIMA\_JP** | **ishi** | 1157 | 24.3N | 124.2E | **0.15M** | 0.5FT |
| **ESPERANCE\_AU** | **espe** | 1205 | 33.9S | 121.9E | **0.17M** | 0.6FT |
| **HENSLUNG\_COVE\_CA** | **hens** | 1217 | 54.2N | 133.0W | **0.23M** | 0.8FT |
| **MAZATLAN\_MX** | **maza** | 1217 | 23.2N | 106.4W | **0.24M** | 0.8FT |
| **PUERTO\_VALLARTA\_MX** | **pval** | 1219 | 20.7N | 105.2W | **0.39M** | 1.3FT |
| **LAZARO\_CARDENAS\_MX** | **laza** | 1219 | 17.9N | 102.2W | **0.19M** | 0.6FT |
| **WINTER\_HARBOUR\_CA** | **wiha** | 1225 | 50.5N | 128.0W | **0.28M** | 0.9FT |
| **PORT\_ALEXANDER\_AK** | **paak** | 1226 | 56.2N | 134.6W | **0.34M** | 1.1FT |
| **ZIHUATANEJO\_MX** | **zihu** | 1227 | 17.6N | 101.6W | **0.46M** | 1.5FT |
| **ACAPULCO\_MX** | **acap** | 1236 | 16.8N | 99.9W | **0.13M** | 0.4FT |
| **YAKUTAT\_AK** | **yaku** | 1247 | 59.5N | 139.7W | **0.22M** | 0.7FT |
| **BAHIA\_MANSA\_CL** | **bmsa** | 1302 | 40.6S | 73.7W | **1.03M** | 3.4FT |
| **CORRAL\_CL** | **corr** | 1304 | 39.9S | 73.4W | **0.80M** | 2.6FT |
| **PUERTO\_ANGEL\_MX** | **ptan** | 1304 | 15.7N | 96.5W | **0.38M** | 1.2FT |
| **TALCAHUANO\_CL** | **talc** | 1313 | 36.7S | 73.1W | **0.35M** | 1.2FT |
| **PUERTO\_MELINKA\_CL** | **pmel** | 1321 | 43.9S | 73.7W | **0.11M** | 0.4FT |
| **BUCALEMU\_CL** | **buca** | 1322 | 34.6S | 72.0W | **0.52M** | 1.7FT |
| **SANTACRUZ\_GALAPAGOS** | **sant** | 1324 | 0.7S | 90.3W | **0.75M** | 2.5FT |
| **QUINTERO\_CL** | **qtro** | 1330 | 32.8S | 71.5W | **0.52M** | 1.7FT |
| **PICHIDANGUI\_CL** | **pich** | 1333 | 32.1S | 71.5W | **0.71M** | 2.3FT |
| **DART 32402** | **dcld** | 1340 | 26.7S | 74.0W | **0.09M** | 0.3FT |
| **BALTRA\_GALAPAGS\_EC** | **balt** | 1340 | 0.4S | 90.3W | **0.40M** | 1.3FT |
| **COQUIMBO\_CL** | **coqu** | 1344 | 30.0S | 71.3W | **1.08M** | 3.5FT |
| **PUERTO\_MADERO\_MX** | **made** | 1358 | 14.7N | 92.4W | **0.21M** | 0.7FT |
| **COCOS\_ISLAND\_CR** | **coco** | 1401 | 5.6N | 87.0W | **0.01M** | 0.0FT |
| **CHANARAL\_CL** | **chnr** | 1404 | 26.4S | 70.6W | **1.74M** | 5.7FT |
| **TALTAL\_CL** | **talt** | 1410 | 25.4S | 70.5W | **0.49M** | 1.6FT |
| **MEJILLONES\_CL** | **meji** | 1421 | 23.1S | 70.5W | **0.74M** | 2.4FT |
| **TALARA\_PE** | **tala** | 1425 | 4.6S | 81.3W | **0.34M** | 1.1FT |
| **TOCOPILLA\_CL** | **toco** | 1431 | 22.1S | 70.2W | **0.51M** | 1.7FT |
| **CALLAO\_LA-PUNTA\_PE** | **call** | 1431 | 12.1S | 77.2W | **0.79M** | 2.6FT |
| **PATACHE\_CL** | **pata** | 1439 | 20.8S | 70.2W | **0.15M** | 0.5FT |
| **QUEPOS\_CR** | **quep** | 1445 | 9.4N | 84.2W | **0.11M** | 0.4FT |
| **PISAGUA\_CL** | **pisa** | 1445 | 19.6S | 70.2W | **0.26M** | 0.9FT |
| **LA\_LIBERTAD\_EC** | **lali** | 1445 | 2.2S | 80.9W | **0.60M** | 2.0FT |
| **MATARANI\_PE** | **mata** | 1445 | 17.0S | 72.1W | **0.48M** | 1.6FT |
| **ARICA\_CL** | **aric** | 1451 | 18.5S | 70.3W | **1.22M** | 4.0FT |
| **ANTARCTICA\_BASE\_PRA** | **prat** |  | 62.5S | 59.7W | **0.27M** | 0.9FT |
| **VERNADSKY\_UK** | **vern** |  | 65.2S | 64.3W | **0.28M** | 0.9FT |

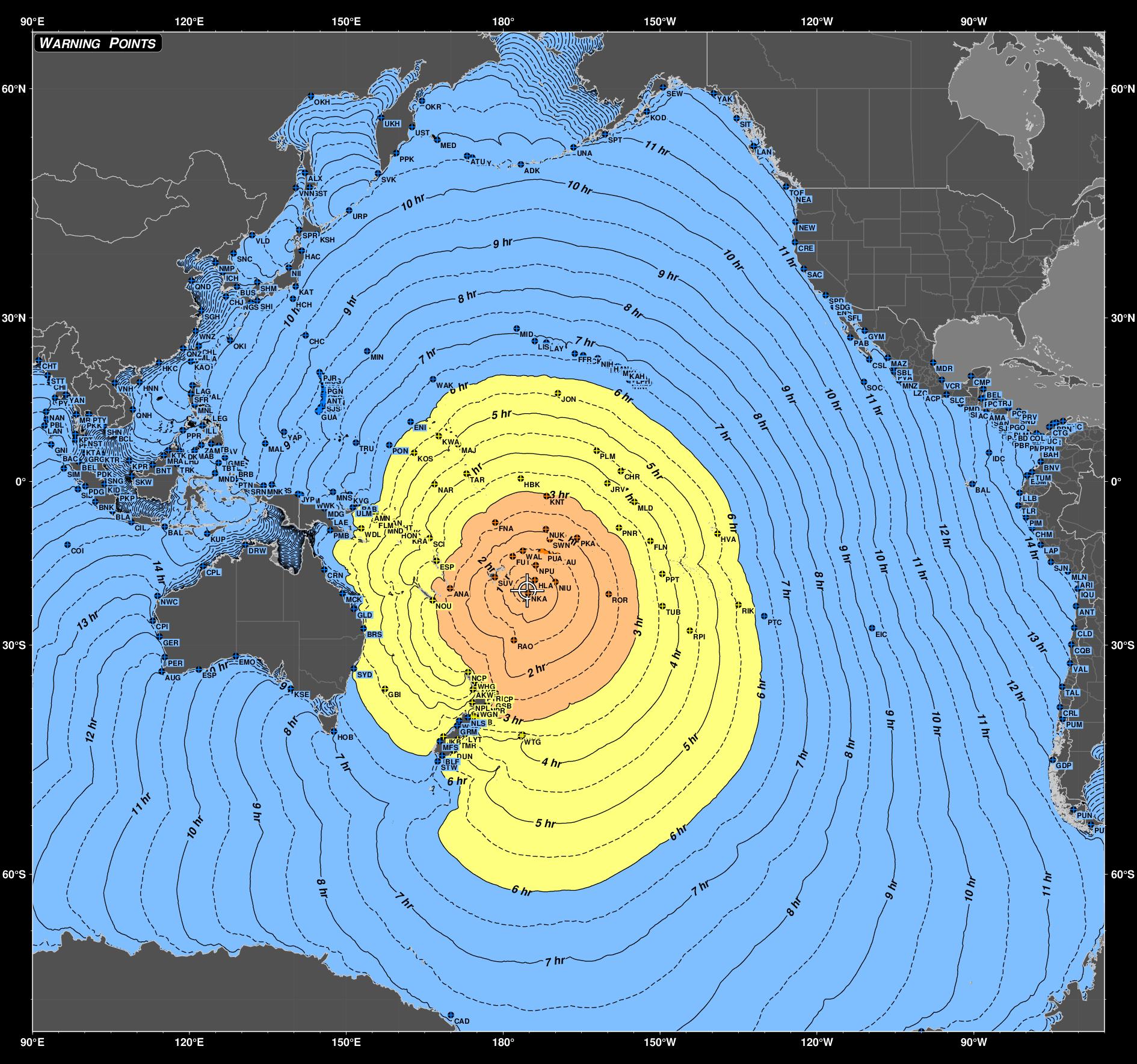


Figure 2. Estimated tsunami travel times from HTHH across the Pacific. On this map are noted the specific Tsunami Warning Point locations annotated by their four-letter code, as noted in Table 2, for each PTWS Member State.

Table 2. Estimated tsunami travel times from HTHH to each of the PTWS Warning Points referred to in PTWC products. Warning Points are listed in increasing travel time order. This list of Warning Points may be revised as needed.

| **ESTIMATED**  **TRAVEL TIME**  **HR:MN:SC** | **COUNTRY**  **OR**  **TERRITORY** | **WARNING\_POINT** | **CODE** | **LATITUDE**  **+=NORTH**  **-=SOUTH** | **LONGITUDE**  **0-180=EAST**  **180-360=WEST** |
| --- | --- | --- | --- | --- | --- |
| 00:10:36 | TONGA | NUKUALOFA | NKA | -21.020 | 184.770 |
| 00:36:55 | TONGA | HOLEVA | HLA | -18.643 | 186.088 |
| 01:01:03 | NIUE | NIUE\_ISLAND | NIU | -19.000 | 190.000 |
| 01:05:53 | TONGA | NIUATOPUTAPU | NPU | -15.942 | 186.233 |
| 01:22:59 | AMERICAN\_SAMOA | PAGO\_PAGO | PAG | -14.300 | 189.300 |
| 01:25:41 | WALLIS\_AND\_FUTUNA | FUTUNA\_ISLAND | FUT | -14.296 | 181.840 |
| 01:29:38 | WALLIS\_AND\_FUTUNA | WALLIS\_ISLAND | WAL | -13.250 | 183.750 |
| 01:36:00 | SAMOA | APIA | API | -13.800 | 188.200 |
| 01:39:38 | KERMADEC\_ISLANDS | RAOUL\_ISLAND | RAO | -29.210 | 182.060 |
| 01:42:10 | FIJI | SUVA | SUV | -18.137 | 178.425 |
| 02:07:12 | TOKELAU | NUKUNONU\_ISLAND | NUK | -9.160 | 188.170 |
| 02:09:33 | COOK\_ISLANDS | PUKAPUKA\_ISLAND | PKA | -10.800 | 194.140 |
| 02:15:03 | COOK\_ISLANDS | RAROTONGA | ROR | -21.200 | 200.200 |
| 02:38:15 | VANUATU | ANATOM\_ISLAND | ANA | -20.160 | 169.850 |
| 02:40:09 | TUVALU | FUNAFUTI\_ISLAND | FNA | -7.880 | 178.500 |
| 02:44:15 | NEW\_ZEALAND | LOTTIN\_POINT | LTP | -37.534 | 178.190 |
| 02:59:19 | KIRIBATI | KANTON\_ISLAND | KNT | -2.820 | 188.330 |
| 03:04:33 | NEW\_ZEALAND | GISBORNE | GSB | -38.667 | 178.017 |
| 03:13:01 | NEW\_ZEALAND | NORTH\_CAPE | NCP | -34.400 | 173.300 |
| 03:14:04 | NEW\_ZEALAND | MOUNT\_MAUNGANUI | MGN | -37.624 | 176.173 |
| 03:14:13 | COOK\_ISLANDS | PENRYN\_ISLAND | PNR | -8.880 | 202.160 |
| 03:21:41 | NEW\_ZEALAND | PORT\_TAURANGA | PTR | -37.651 | 176.174 |
| 03:22:13 | HOWLAND\_AND\_BAKER | HOWLAND\_ISLAND | HBK | 0.550 | 183.380 |
| 03:26:12 | VANUATU | ESPERITU\_SANTO | ESP | -15.110 | 167.290 |
| 03:26:25 | NEW\_ZEALAND | EAST\_CAPE | ECP | -37.667 | 178.500 |
| 03:29:21 | NEW\_ZEALAND | WHANGAREI | WHG | -35.805 | 174.514 |
| 03:35:28 | NEW\_CALEDONIA | NOUMEA | NOU | -22.300 | 166.500 |
| 03:36:22 | FRENCH\_POLYNESIA | TUBUAI | TUB | -23.340 | 210.490 |
| 03:38:23 | KIRIBATI | FLINT\_ISLAND | FLN | -11.400 | 208.180 |
| 03:40:21 | NEW\_ZEALAND | NAPIER | NPR | -39.474 | 176.910 |
| 03:46:37 | NEW\_ZEALAND | KAINGAROA\_CHATHAM | KNG | -43.725 | 183.729 |
| 03:47:17 | FRENCH\_POLYNESIA | PAPEETE | PPT | -17.533 | 210.433 |
| 03:53:52 | JARVIS\_ISLAND | JARVIS\_ISLAND | JRV | -0.370 | 199.950 |
| 03:59:51 | KIRIBATI | MALDEN\_ISLAND | MLD | -3.940 | 205.100 |
| 04:01:39 | NEW\_ZEALAND | WELLINGTON | WEL | -41.270 | 174.837 |
| 04:09:57 | NEW\_ZEALAND | PICTON | PIC | -41.280 | 174.000 |
| 04:15:44 | NEW\_ZEALAND | WAITANGI\_CHATHAM | WTG | -43.941 | 183.429 |
| 04:16:25 | NEW\_ZEALAND | MARLBOROUGH\_SOUNDS | MLB | -41.091 | 174.387 |
| 04:18:20 | FRENCH\_POLYNESIA | RAPA\_ITI | RPI | -27.600 | 215.700 |
| 04:19:26 | SOLOMON\_ISLANDS | SANTA\_CRUZ\_ISLAND | SCI | -10.850 | 165.950 |
| 04:25:10 | KIRIBATI | CHRISTMAS\_ISLAND | CHR | 1.980 | 202.520 |
| 04:26:33 | PALMYRA\_ISLAND | PALMYRA\_ISLAND | PLM | 5.900 | 197.900 |
| 04:28:57 | NAURU | NAURU | NAR | -0.518 | 166.900 |
| 04:29:26 | SOLOMON\_ISLANDS | KIRAKIRA | KRA | -10.360 | 161.940 |
| 04:30:56 | NEW\_ZEALAND | AUCKLAND\_EAST | AKE | -36.700 | 175.000 |
| 04:37:11 | NEW\_ZEALAND | AUCKLAND\_WEST | AKW | -37.100 | 174.200 |
| 04:54:01 | MARSHALL\_ISLANDS | MAJURO | MAJ | 7.117 | 171.370 |
| 04:58:04 | KIRIBATI | TARAWA\_ISLAND | TAR | 1.500 | 173.000 |
| 05:02:03 | SOLOMON\_ISLANDS | AUKI | AUK | -8.750 | 160.620 |
| 05:11:36 | SOLOMON\_ISLANDS | HONIARA | HON | -9.290 | 159.960 |
| 05:16:29 | SOLOMON\_ISLANDS | GHATERE | GHT | -7.770 | 159.170 |
| 05:18:16 | NEW\_ZEALAND | NEW\_PLYMOUTH | NPL | -39.053 | 174.069 |
| 05:24:10 | NEW\_ZEALAND | WANGANUI | WGN | -39.946 | 174.980 |
| 05:25:23 | NEW\_ZEALAND | DUNEDIN | DUN | -45.883 | 170.514 |
| 05:27:46 | NEW\_ZEALAND | GREAT\_BARRIER\_IS | GBI | -37.018 | 157.414 |
| 05:28:51 | FRENCH\_POLYNESIA | HIVA\_OA | HVA | -10.000 | 221.000 |
| 05:29:09 | MARSHALL\_ISLANDS | KWAJALEIN | KWA | 8.700 | 167.700 |
| 05:29:40 | KOSRAE | KOSRAE\_ISLAND | KOS | 5.500 | 163.000 |
| 05:29:41 | SOLOMON\_ISLANDS | MUNDA | MND | -8.380 | 157.210 |
| 05:30:18 | SOLOMON\_ISLANDS | PANGGOE | PAN | -6.870 | 157.160 |
| 05:33:25 | SOLOMON\_ISLANDS | FALAMAE | FLM | -7.360 | 155.560 |
| 05:34:07 | FRENCH\_POLYNESIA | RIKITEA | RIK | -23.100 | 225.000 |
| 05:36:14 | NEW\_ZEALAND | LYTTELTON | LYT | -43.617 | 172.717 |
| 05:37:44 | JOHNSTON\_ISLAND | JOHNSTON\_ISLAND | JON | 16.738 | 190.475 |
| 05:48:38 | NEW\_ZEALAND | MILFORD\_SOUND | MFS | -44.626 | 167.877 |
| 05:51:14 | PAPUA\_NEW\_GUINEA | KIETA | KIE | -6.070 | 155.630 |
| 05:51:55 | PAPUA\_NEW\_GUINEA | AMUN | AMN | -5.960 | 154.690 |
| 05:52:52 | PAPUA\_NEW\_GUINEA | WOODLARK\_ISLAND | WDL | -9.000 | 152.900 |
| 06:01:17 | NEW\_ZEALAND | WESTPORT | WSP | -41.752 | 171.583 |
| 06:02:32 | AUSTRALIA | BRISBANE | BRS | -27.220 | 153.300 |
| 06:08:34 | AUSTRALIA | SYDNEY | SYD | -33.860 | 151.450 |
| 06:10:45 | PAPUA\_NEW\_GUINEA | RABAUL | RAB | -4.180 | 152.270 |
| 06:14:37 | PITCAIRN | PITCAIRN\_ISLAND | PTC | -25.080 | 229.920 |
| 06:16:03 | NEW\_ZEALAND | GREYMOUTH | GRM | -42.450 | 171.210 |
| 06:16:21 | POHNPEI | POHNPEI\_ISLAND | PON | 7.000 | 158.218 |
| 06:20:59 | NEW\_ZEALAND | TIMARU | TMR | -44.387 | 171.269 |
| 06:21:44 | NEW\_ZEALAND | JACKSON\_BAY | JKB | -43.962 | 168.588 |
| 06:22:43 | NEW\_ZEALAND | NELSON | NLS | -41.260 | 173.266 |
| 06:28:25 | MARSHALL\_ISLANDS | ENIWETOK | ENI | 11.400 | 162.300 |
| 06:32:56 | WAKE\_ISLAND | WAKE\_ISLAND | WAK | 19.300 | 166.600 |
| 06:39:04 | PAPUA\_NEW\_GUINEA | PORT\_MORESBY | PMB | -9.340 | 146.940 |
| 06:39:38 | HAWAII | NAWILIWILI | NAW | 21.951 | 200.646 |
| 06:41:08 | NEW\_ZEALAND | STEWART\_ISLAND | STW | -47.293 | 167.505 |
| 06:41:52 | HAWAII | HILO | HIL | 19.700 | 204.900 |
| 06:41:55 | HAWAII | HONOLULU | HON | 21.300 | 202.100 |
| 06:43:25 | NORTHWEST\_HAWAII | NECKER | NCK | 23.575 | 195.300 |
| 06:44:33 | NORTHWEST\_HAWAII | FRENCH\_FRIGATE | FFR | 23.868 | 193.701 |
| 06:45:31 | NORTHWEST\_HAWAII | NIHOA | NIH | 23.060 | 198.078 |
| 06:46:22 | PAPUA\_NEW\_GUINEA | ULAMONA | ULM | -5.000 | 151.250 |
| 06:46:45 | PAPUA\_NEW\_GUINEA | LAE | LAE | -6.760 | 147.030 |
| 06:53:54 | NORTHWEST\_HAWAII | LISIANSKI | LIS | 26.063 | 186.040 |
| 06:54:57 | HAWAII | KAHULUI | KAH | 20.898 | 203.528 |
| 06:56:46 | PAPUA\_NEW\_GUINEA | KAVIENG | KVG | -2.530 | 150.690 |
| 06:56:54 | NORTHWEST\_HAWAII | LAYSAN | LAY | 25.776 | 188.256 |
| 07:10:13 | MIDWAY\_ISLAND | MIDWAY\_ISLAND | MID | 28.200 | 182.600 |
| 07:16:26 | AUSTRALIA | CAIRNS | CRN | -16.740 | 145.790 |
| 07:16:45 | AUSTRALIA | HOBART | HOB | -43.270 | 147.650 |
| 07:19:33 | PAPUA\_NEW\_GUINEA | MADANG | MDG | -5.170 | 145.840 |
| 07:29:50 | PAPUA\_NEW\_GUINEA | MANUS\_ISLAND | MNS | -2.030 | 147.490 |
| 07:33:21 | CHUUK | CHUUK\_ISLAND | TRU | 7.445 | 151.845 |
| 07:36:18 | NEW\_ZEALAND | BLUFF | BLF | -46.566 | 168.333 |
| 07:49:24 | AUSTRALIA | GLADSTONE | GLD | -23.820 | 151.440 |
| 07:51:43 | ANTARCTICA | CAPE\_ADARE | CAD | -71.000 | 170.000 |
| 07:57:46 | PAPUA\_NEW\_GUINEA | WEWAK | WWK | -3.520 | 143.650 |
| 08:10:11 | MINAMITORISHIMA | MINAMITORISHIMA | MIN | 24.300 | 154.000 |
| 08:10:46 | NORTHERN\_MARIANAS | SAIPAN | SAI | 15.300 | 145.800 |
| 08:15:42 | GUAM | GUAM | GUA | 13.436 | 144.652 |
| 08:19:01 | PAPUA\_NEW\_GUINEA | VANIMO | VNM | -2.580 | 141.340 |
| 08:22:44 | INDONESIA | JAYAPURA | JYP | -2.410 | 140.760 |
| 09:00:03 | YAP | YAP\_ISLAND | YAP | 9.500 | 138.100 |
| 09:10:16 | INDONESIA | WARSA | WRS | -0.620 | 135.790 |
| 09:11:02 | CHILE | EASTER\_ISLAND | EIC | -27.150 | 250.550 |
| 09:17:45 | AUSTRALIA | MACKAY | MCK | -21.060 | 149.270 |
| 09:29:08 | INDONESIA | MANOKWARI | MNK | -0.810 | 134.210 |
| 09:31:06 | JAPAN | CHICHI\_JIMA | CHC | 27.050 | 142.250 |
| 09:59:20 | INDONESIA | SORONG | SRN | -0.810 | 131.130 |
| 10:01:28 | PALAU | MALAKAL | MAL | 7.300 | 134.500 |
| 10:15:18 | JAPAN | KATSUURA | KAT | 35.110 | 140.330 |
| 10:17:34 | ANTARCTICA | THURSTON\_ISLAND | THR | -72.000 | 260.000 |
| 10:19:01 | INDONESIA | BEREBERE | BRB | 2.460 | 128.690 |
| 10:19:21 | JAPAN | HACHIJO\_JIMA | HCH | 33.130 | 139.820 |
| 10:33:12 | INDONESIA | PATANI | PTN | 0.430 | 128.760 |
| 10:38:20 | JAPAN | KUSHIRO | KSH | 42.900 | 144.330 |
| 10:39:16 | RUSSIA | URUP\_ISLAND | URP | 46.120 | 150.540 |
| 10:40:51 | INDONESIA | GEME | GME | 4.590 | 126.800 |
| 10:52:18 | PHILIPPINES | DAVAO | DAV | 6.850 | 125.650 |
| 10:57:01 | INDONESIA | TABUKAN\_TENGAH | TBT | 3.600 | 125.600 |
| 10:58:27 | JAPAN | HACHINOHE | HAC | 40.500 | 141.500 |
| 11:02:27 | PHILIPPINES | LEGASPI | LEG | 13.200 | 123.800 |
| 11:03:20 | MEXICO | SOCORRO | SOC | 18.800 | 249.000 |
| 11:10:27 | RUSSIA | MEDNNY\_ISLAND | MED | 54.720 | 167.430 |
| 11:11:08 | PHILIPPINES | PALANAN | PAL | 17.150 | 122.610 |
| 11:13:58 | INDONESIA | MANADO | MND | 1.600 | 124.900 |
| 11:16:43 | JAPAN | NOBEOKA | NOB | 32.500 | 131.800 |
| 11:19:07 | JAPAN | SHIMIZU | SHI | 32.800 | 133.000 |
| 11:19:53 | RUSSIA | UST\_KAMCHATSK | UST | 56.120 | 162.580 |
| 11:20:21 | MEXICO | PUNTA\_ABREOJOS | PAB | 26.680 | 246.380 |
| 11:22:12 | RUSSIA | PETROPAVLOVSK | PPK | 53.230 | 159.580 |
| 11:22:54 | PHILIPPINES | COTABUTO\_CITY | CTB | 7.250 | 124.170 |
| 11:25:19 | MEXICO | ENSENADA | ENS | 31.830 | 243.220 |
| 11:32:00 | MEXICO | CABO\_SAN\_LUCAS | CSL | 22.840 | 250.020 |
| 11:34:47 | TAIWAN | HUALIEN | HUA | 24.000 | 121.700 |
| 11:35:28 | TAIWAN | TAITUNG | TTG | 22.700 | 121.200 |
| 11:39:18 | RUSSIA | SEVERO\_KURILSK | SVK | 50.830 | 156.070 |
| 11:47:13 | RUSSIA | OSTROV\_KARAGINSKIY | OKR | 58.800 | 164.500 |
| 11:57:46 | JAPAN | OKINAWA | OKI | 26.200 | 127.800 |
| 12:03:09 | PHILIPPINES | LAOAG | LAG | 18.200 | 120.600 |
| 12:04:00 | TAIWAN | CHILUNG | CHL | 25.200 | 121.800 |
| 12:06:02 | MEXICO | MANZANILLO | MNZ | 19.100 | 255.700 |
| 12:11:46 | PHILIPPINES | SAN\_FERNANDO | SFR | 16.600 | 120.300 |
| 12:15:46 | MEXICO | MAZATLAN | MAZ | 23.170 | 253.560 |
| 12:16:37 | PHILIPPINES | MAIMBUNG | MAB | 5.900 | 121.000 |
| 12:17:12 | PHILIPPINES | ZAMBOANGA | ZAM | 7.000 | 122.300 |
| 12:17:33 | TAIWAN | KAOHSIUNG | KAO | 22.500 | 120.300 |
| 12:19:09 | MEXICO | PUERTO\_VALLARTA | PVA | 20.650 | 254.750 |
| 12:19:21 | MEXICO | LAZARO\_CARDENAS | LZC | 17.900 | 257.800 |
| 12:21:02 | CHILE | GOLFO\_DE\_PENAS | GDP | -47.100 | 285.110 |
| 12:34:44 | MEXICO | SAN\_BLAS | SBL | 21.500 | 254.700 |
| 12:36:00 | MEXICO | ACAPULCO | ACP | 16.900 | 260.100 |
| 12:38:10 | JAPAN | NAGASAKI | NGS | 32.700 | 129.700 |
| 12:45:45 | JAPAN | SAPPORO | SPR | 43.500 | 141.000 |
| 12:51:26 | CHILE | PUNTA\_ARENAS | PUN | -53.200 | 289.100 |
| 12:53:34 | MEXICO | GUAYMAS | GYM | 27.850 | 249.150 |
| 13:02:22 | CHILE | CORRAL | CRL | -39.770 | 286.460 |
| 13:05:38 | JAPAN | NIIGATA | NII | 38.000 | 139.000 |
| 13:07:22 | RUSSIA | GASTELLO | GST | 49.100 | 143.000 |
| 13:13:31 | CHILE | TALCAHUANO | TAL | -36.700 | 286.900 |
| 13:15:38 | PHILIPPINES | PUERTO\_PRINCESA | PPR | 9.800 | 118.800 |
| 13:21:02 | INDONESIA | TARAKAN | TRK | 3.300 | 117.600 |
| 13:21:59 | RUSSIA | VLADIVOSTOK | VLD | 42.750 | 132.000 |
| 13:28:36 | PHILIPPINES | ILOILO | ILL | 10.700 | 122.500 |
| 13:29:47 | CHILE | VALPARAISO | VAL | -33.000 | 288.400 |
| 13:36:57 | DPR\_OF\_KOREA | SINCHANG | SNC | 40.130 | 128.470 |
| 13:40:17 | ECUADOR | BALTRA\_ISLAND | BAL | -0.500 | 269.700 |
| 13:44:01 | CHILE | COQUIMBO | CQB | -29.930 | 288.650 |
| 13:45:51 | MEXICO | SALINA\_CRUZ | SLC | 16.500 | 264.800 |
| 13:47:00 | REPUBLIC\_OF\_KOREA | CHEJU\_ISLAND | CHJ | 33.500 | 127.000 |
| 13:57:42 | MEXICO | PUERTO\_MADERO | PMD | 14.790 | 267.470 |
| 13:58:34 | GUATEMALA | SIPICATE | SIP | 13.900 | 268.770 |
| 13:58:43 | CHILE | CALDERA | CLD | -27.100 | 289.200 |
| 14:00:40 | COSTA\_RICA | ISLA\_DEL\_COCO | IDC | 5.536 | 272.919 |
| 14:04:50 | JAPAN | SHIMANE | SHM | 35.750 | 133.000 |
| 14:05:46 | TAIWAN | HOMEL | HML | 24.200 | 120.400 |
| 14:07:26 | MALAYSIA | SANDAKAN | SDK | 5.900 | 118.100 |
| 14:07:57 | VIETNAM | QUI\_NHON | QNH | 13.700 | 109.200 |
| 14:16:14 | CHINA | HAINAN\_ISLAND | HNN | 18.750 | 110.500 |
| 14:17:43 | PERU | TALARA | TLR | -4.630 | 278.530 |
| 14:20:32 | CHILE | ANTOFAGASTA | ANT | -23.320 | 289.570 |
| 14:23:51 | RUSSIA | VANINO | VNN | 49.050 | 140.350 |
| 14:26:58 | EL\_SALVADOR | ACAJUTLA | ACJ | 13.600 | 270.200 |
| 14:27:13 | COSTA\_RICA | CABO\_SAN\_ELENA | CSE | 10.850 | 273.960 |
| 14:27:55 | PERU | SAN\_JUAN | SJN | -15.330 | 284.760 |
| 14:28:44 | PERU | LA\_PUNTA | LAP | -12.100 | 282.800 |
| 14:30:42 | PHILIPPINES | MANILA | MNL | 14.600 | 121.000 |
| 14:33:41 | ECUADOR | LA\_LIBERTAD | LLB | -2.190 | 278.770 |
| 14:38:18 | CHINA | WENZHOU | WNZ | 27.800 | 121.200 |
| 14:39:14 | NICARAGUA | CORINTO | COR | 12.500 | 272.800 |
| 14:39:34 | NICARAGUA | PUERTO\_SANDINO | SAN | 12.200 | 273.200 |
| 14:41:25 | CHILE | IQUIQUE | IQU | -20.200 | 289.900 |
| 14:42:44 | REPUBLIC\_OF\_KOREA | BUSAN | BUS | 35.050 | 129.100 |
| 14:44:51 | COSTA\_RICA | PUERTO\_QUEPOS | PQP | 9.400 | 275.800 |
| 14:47:11 | PERU | MOLLENDO | MLN | -17.080 | 288.000 |
| 14:47:41 | COSTA\_RICA | CABO\_MATAPALO | CMP | 8.350 | 276.710 |
| 14:48:42 | NICARAGUA | SAN\_JUAN\_DL\_SUR | SJS | 11.200 | 274.100 |
| 14:50:44 | CHILE | ARICA | ARI | -18.500 | 289.700 |
| 14:53:11 | PERU | CHIMBOTE | CHM | -9.000 | 281.170 |
| 14:54:48 | PANAMA | PUNTA\_BURICA | PBR | 8.020 | 277.150 |
| 14:58:01 | MALAYSIA | LAHAD\_DATU | LHD | 4.900 | 118.400 |
| 15:00:36 | CHILE | PUERTO\_MONTT | PUM | -41.500 | 287.000 |
| 15:02:11 | CHINA | QUANZHOU | QNZ | 24.800 | 118.800 |
| 15:04:37 | PERU | PIMENTAL | PIM | -6.900 | 279.980 |
| 15:10:53 | CHINA | HONG\_KONG | HKC | 22.300 | 114.200 |
| 15:12:02 | ECUADOR | ESMERELDAS | ESM | 1.170 | 280.210 |
| 15:12:33 | HONDURAS | AMAPALA | AMA | 13.230 | 272.360 |
| 15:19:47 | RUSSIA | UST\_KAHYRYUZOVO | UKH | 57.100 | 156.700 |
| 15:28:50 | COLOMBIA | TUMACO | TUM | 1.820 | 281.140 |
| 15:30:17 | MEXICO | SAN\_FELIPE | SFL | 31.000 | 245.200 |
| 15:38:42 | PANAMA | PUNTA\_MALA | PML | 7.480 | 280.050 |
| 15:49:01 | COLOMBIA | BAHIA\_SOLANO | BAH | 6.300 | 282.600 |
| 15:49:45 | RUSSIA | ALEXANDROVSK\_SAK | ALX | 50.900 | 142.100 |
| 15:51:40 | PANAMA | PUERTO\_PINA | PPN | 7.390 | 281.950 |
| 16:06:28 | MALAYSIA | KOTA\_KINABALU | KTK | 6.000 | 116.000 |
| 16:12:37 | COLOMBIA | BUENAVENTURA | BNV | 3.800 | 282.800 |
| 16:16:10 | RUSSIA | OKHOTSK | OKH | 59.300 | 143.250 |
| 16:36:51 | BRUNEI | MUARA | MRA | 5.000 | 115.100 |
| 16:54:06 | INDONESIA | KEPULAUAN\_RIAU | KPR | 4.000 | 108.500 |
| 17:13:14 | MALAYSIA | BINTULU | BNT | 3.200 | 113.000 |
| 17:39:29 | CHILE | PUERTO\_WILLIAMS | PUW | -54.900 | 292.400 |
| 18:01:06 | PANAMA | BALBOA\_HEIGHTS | BHP | 9.000 | 280.400 |
| 18:06:01 | CHINA | SHANGHAI | SGH | 31.200 | 122.300 |
| 18:54:38 | VIETNAM | VINH | VNH | 18.600 | 105.700 |
| 19:46:30 | REPUBLIC\_OF\_KOREA | INCHON | ICH | 37.300 | 126.400 |
| 21:37:03 | INDONESIA | SINGKAWANG | SKW | 1.000 | 109.000 |
| 21:42:29 | VIETNAM | BAC\_LIEU | BCL | 9.300 | 105.800 |
| 21:52:22 | DPR\_OF\_KOREA | NAMPHO | NMP | 38.750 | 125.000 |
| 22:12:03 | CHINA | QINGDAO | QND | 36.000 | 120.400 |
| 22:20:17 | MALAYSIA | K\_TERENGGANU | KTR | 5.300 | 103.200 |
| 25:50:38 | SINGAPORE | SINGAPORE | SNG | 1.200 | 103.800 |
| 25:52:13 | INDONESIA | PANGKALPINANG | PKP | -2.100 | 106.100 |
| 28:06:17 | THAILAND | NK\_SI\_THAMMARAT | NST | 8.400 | 100.000 |
| 29:27:38 | CAMBODIA | SIHANOUKVILLE | SHN | 10.600 | 103.600 |
| 29:50:05 | INDONESIA | KUALA\_INDRAGIRI | KID | -0.500 | 103.750 |
| 30:00:18 | THAILAND | PRA\_KHIRI\_KHAN | PKK | 11.800 | 99.800 |
| 31:55:49 | THAILAND | PATTAYA | PTY | 12.800 | 100.850 |

**Annex I. Sample Products**

***Tsunami Information Statement***. The following is a sample Tsunami Information Statement that might be issued for small non-hazardous tsunami waves coming from HTHH, such as those that were observed on January 13 and 14, 2022. A Tsunami Information Statement might also be issued in the case of a noteable eruptive event at HTHH that has not produced tsunami waves. Note that the “TEST” language sprinkled throughout the message would be absent in an actual product.

ZCZC WEPA42 PHEB 041630

TIBPAC

TEST...TSUNAMI INFORMATION STATEMENT NUMBER 1...TEST

NWS PACIFIC TSUNAMI WARNING CENTER HONOLULU HI

1630 UTC FRI MAR 4 2022

...THIS MESSAGE IS FOR TEST PURPOSES ONLY...

...TEST PTWC TSUNAMI INFORMATION STATEMENT TEST...

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

THIS IS A TEST MESSAGE. THIS STATEMENT IS ISSUED FOR INFORMATION

ONLY IN SUPPORT OF THE UNESCO/IOC PACIFIC TSUNAMI WARNING AND

MITIGATION SYSTEM AND IS MEANT FOR NATIONAL AUTHORITIES IN EACH

COUNTRY OF THAT SYSTEM.

THIS IS A TEST MESSAGE. NATIONAL AUTHORITIES WILL DETERMINE THE

APPROPRIATE LEVEL OF ALERT FOR EACH COUNTRY AND MAY ISSUE

ADDITIONAL OR MORE REFINED INFORMATION.

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

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TEST... VOLCANIC ACTIVITY IN TONGA HAS OCCURRED ...TEST

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TEST... PRELIMINARY VOLCANO PARAMETERS ...TEST

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\* ACTIVITY TIME 1530 UTC MAR 4 2022

\* COORDINATES 20.5 SOUTH 175.4 WEST

\* LOCATION TONGA

TEST... EVALUATION ...TEST

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\* THIS IS A TEST MESSAGE. VOLCANIC ACTIVITY OCCURRED IN THE

TONGA ISLANDS REGION AT 1530 UTC ON FRIDAY MARCH 4 2022.

\* THIS IS A TEST MESSAGE. BASED ON ALL AVAILABLE DATA... THERE

IS NO TSUNAMI THREAT FROM THIS VOLCANIC ACTIVITY.

TEST... RECOMMENDED ACTIONS ...TEST

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\* THIS IS A TEST MESSAGE. NO ACTION IS REQUIRED.

TEST... TSUNAMI OBSERVATIONS ...TEST

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\* THIS IS A TEST MESSAGE. THE FOLLOWING ARE TSUNAMI WAVE

OBSERVATIONS FROM COASTAL AND/OR DEEP-OCEAN SEA LEVEL GAUGES

AT THE INDICATED LOCATIONS. THE MAXIMUM TSUNAMI AMPLITUDE IS

MEASURED WITH RESPECT TO THE NORMAL TIDE LEVEL.

GAUGE TIME OF MAXIMUM WAVE

COORDINATES MEASURE TSUNAMI PERIOD

GAUGE LOCATION LAT LON (UTC) AMPLITUDE (MIN)

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NUKUALOFA TO 21.1S 175.2W 1622 0.03M/ 0.1FT 04

TEST... NEXT UPDATE AND ADDITIONAL INFORMATION ...TEST

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\* THIS IS A TEST MESSAGE. THIS WILL BE THE ONLY STATEMENT

ISSUED FOR THIS EVENT UNLESS ADDITIONAL DATA ARE RECEIVED OR

THE SITUATION CHANGES.

\* THIS IS A TEST MESSAGE. FURTHER INFORMATION ABOUT THIS EVENT

MAY BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF HAWAII... AMERICAN

SAMOA... GUAM... AND CNMI SHOULD REFER TO PACIFIC TSUNAMI

WARNING CENTER MESSAGES SPECIFICALLY FOR THOSE PLACES THAT

CAN BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF CALIFORNIA...

OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD

ONLY REFER TO U.S. NATIONAL TSUNAMI WARNING CENTER MESSAGES

THAT CAN BE FOUND AT WWW.TSUNAMI.GOV.

THIS IS A TEST MESSAGE. DO NOT TAKE ACTION BASED ON THIS TEST

MESSAGE.

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NNNN

***Initial Tsunami Threat Message.*** The following is a sample initial Tsunami Threat Message that might be issued following the detection of potentially hazardous tsunami waves on the nearest sea level gauge(s) to HTHH. In this example, based upon the tsunami amplitude observed at Nuku`alofa, the forecast is for gauge amplitudes that are 0.5 times the size of the amplitudes observed on January 15, 2022. The initial areal extent of the threat has been limited to three hours of tsunami travel time from HTHH. Note that the “TEST” language sprinkled throughout the message would be absent in an actual product.

ZCZC WEPA40 PHEB 041555

TSUPAC

TEST...TSUNAMI MESSAGE NUMBER 1...TEST

NWS PACIFIC TSUNAMI WARNING CENTER HONOLULU HI

1555 UTC FRI MAR 4 2022

...THIS MESSAGE IS FOR TEST PURPOSES ONLY...

...TEST PTWC TSUNAMI THREAT MESSAGE TEST...

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

THIS IS A TEST MESSAGE. THIS MESSAGE IS ISSUED FOR INFORMATION

ONLY IN SUPPORT OF THE UNESCO/IOC PACIFIC TSUNAMI WARNING AND

MITIGATION SYSTEM AND IS MEANT FOR NATIONAL AUTHORITIES IN EACH

COUNTRY OF THAT SYSTEM.

THIS IS A TEST MESSAGE. NATIONAL AUTHORITIES WILL DETERMINE THE

APPROPRIATE LEVEL OF ALERT FOR EACH COUNTRY AND MAY ISSUE

ADDITIONAL OR MORE REFINED INFORMATION.

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

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TEST... VOLCANIC ACTIVITY IN TONGA GENERATED A TSUNAMI ...TEST

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TEST... PRELIMINARY VOLCANO PARAMETERS ...TEST

-------------------------------------------

\* ACTIVITY TIME 1530 UTC MAR 4 2022

\* COORDINATES 20.5 SOUTH 175.4 WEST

\* LOCATION TONGA

TEST... EVALUATION ...TEST

--------------------------

\* THIS IS A TEST MESSAGE. VOLCANIC ACTIVITY OCCURRED IN THE

TONGA ISLANDS AT 1530 UTC ON FRIDAY MARCH 4 2022.

TEST... TSUNAMI THREAT FORECAST ...TEST

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\* THIS IS A TEST MESSAGE. HAZARDOUS TSUNAMI WAVES FROM THIS

VOLCANIC ACTIVITY ARE POSSIBLE ALONG SOME COASTS OF

TONGA... NIUE... AMERICAN SAMOA... WALLIS AND FUTUNA...

SAMOA... KERMADEC ISLANDS... FIJI... TOKELAU... COOK

ISLANDS... VANUATU... TUVALU... NEW ZEALAND... KIRIBATI...

HOWLAND AND BAKER... NEW CALEDONIA... FRENCH POLYNESIA...

JARVIS ISLAND... SOLOMON ISLANDS... PALMYRA ISLAND...

NAURU... MARSHALL ISLANDS... KOSRAE... JOHNSTON ISLAND...

PAPUA NEW GUINEA... AUSTRALIA... PITCAIRN... POHNPEI...

WAKE ISLAND... HAWAII AND NORTHWEST HAWAII

\* THIS IS A TEST MESSAGE. BASED UPON THE INITIAL

OBSERVATIONS... THIS TSUNAMI IS FORECAST TO BE ABOUT 0.5

TIMES THE SIZE OF THE JANUARY 15 2022 TSUNAMI FROM THE SAME

VOLCANO IN TONGA.

\* THIS IS A TEST MESSAGE. THE FOLLOWING ARE FORECAST MAXIMUM

TSUNAMI AMPLITUDES RELATIVE TO NORMAL SEA LEVEL AT COASTAL

GAUGES WITHIN CURRENT THREAT AREA. THE FORECAST FOR EACH

GAUGE IS BASED UPON SCALING THE MAXIMUM TSUNAMI AMPLITUDE

MEASURED ON THAT GAUGE FOR THE JANUARY 15 2022 TSUNAMI USING

THE SCALE FACTOR GIVEN ABOVE. TSUNAMI WAVES ALONG OTHER

COASTS IN THE REGION OF EACH GAUGE MAY BE LARGER OR SMALLER

THAN AT THE GAUGE. A SIMILAR SCALING OF ANY KNOWN JANUARY 15

IMPACTS ALONG THOSE COASTS CAN BE USED AS A GUIDE.

COORDINATES FIRST WAVE FORECAST MAX

GAUGE LOCATION LAT LON ETA (UTC) TSUNAMI AMPLITUDE

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NUKUALOFA TO 21.1S 175.2W 03/04 1548 0.41M/ 1.34FT

DART 5401003 23.4S 173.4W 03/04 1612 0.10M/ 0.34FT

DART 5401002 29.7S 175.0W 03/04 1655 0.05M/ 0.16FT

PAGO PAGO AS 14.3S 170.7W 03/04 1656 0.31M/ 1.02FT

APIA UPOLU WS 13.8S 171.8W 03/04 1706 0.09M/ 0.28FT

SUVA VITI LEVU FJ 18.1S 178.4E 03/04 1712 0.13M/ 0.43FT

DART 5401001 36.0S 177.7W 03/04 1737 0.04M/ 0.11FT

RAROTONGA CK 21.2S 159.8W 03/04 1745 0.45M/ 1.48FT

DART 5501004 36.1S 178.6E 03/04 1757 0.05M/ 0.18FT

EAST CAPE NZ 37.5S 178.2E 03/04 1814 0.13M/ 0.43FT

FONGAFALE TV 8.5S 179.2E 03/04 1819 0.06M/ 0.20FT

MARE NEW CALEDONIA F 21.5S 167.9E 03/04 1822 0.38M/ 1.23FT

LIFOU NEW CALEDONIA 20.9S 167.3E 03/04 1825 0.44M/ 1.46FT

TEST... RECOMMENDED ACTIONS ...TEST

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\* THIS IS A TEST MESSAGE. GOVERNMENT AGENCIES RESPONSIBLE FOR

THREATENED COASTAL AREAS SHOULD TAKE ACTION TO INFORM AND

INSTRUCT ANY COASTAL POPULATIONS AT RISK IN ACCORDANCE WITH

THEIR OWN EVALUATION... PROCEDURES AND THE LEVEL OF THREAT.

\* THIS IS A TEST MESSAGE. PERSONS LOCATED IN THREATENED COASTAL

AREAS SHOULD STAY ALERT FOR INFORMATION AND FOLLOW

INSTRUCTIONS FROM NATIONAL AND LOCAL AUTHORITIES.

TEST... ESTIMATED TIMES OF ARRIVAL ...TEST

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\* THIS IS A TEST MESSAGE. ESTIMATED TIMES OF ARRIVAL -ETA- OF

THE INITIAL TSUNAMI WAVE FOR PLACES WITHIN THE THREAT

REGION. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE

MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND

THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION REGION COORDINATES ETA(UTC)

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NUKUALOFA TONGA 21.0S 175.2W 1540 03/04

HOLEVA TONGA 18.6S 173.9W 1606 03/04

NIUE ISLAND NIUE 19.0S 170.0W 1631 03/04

NIUATOPUTAPU TONGA 15.9S 173.8W 1635 03/04

PAGO PAGO AMERICAN SAMOA 14.3S 170.7W 1652 03/04

FUTUNA ISLAND WALLIS AND FUTUN 14.3S 178.2W 1655 03/04

WALLIS ISLAND WALLIS AND FUTUN 13.2S 176.2W 1659 03/04

APIA SAMOA 13.8S 171.8W 1706 03/04

RAOUL ISLAND KERMADEC ISLANDS 29.2S 177.9W 1709 03/04

SUVA FIJI 18.1S 178.4E 1712 03/04

NUKUNONU ISLAND TOKELAU 9.2S 171.8W 1737 03/04

PUKAPUKA ISLAND COOK ISLANDS 10.8S 165.9W 1739 03/04

RAROTONGA COOK ISLANDS 21.2S 159.8W 1745 03/04

ANATOM ISLAND VANUATU 20.2S 169.9E 1808 03/04

FUNAFUTI ISLAND TUVALU 7.9S 178.5E 1810 03/04

LOTTIN POINT NEW ZEALAND 37.5S 178.2E 1814 03/04

KANTON ISLAND KIRIBATI 2.8S 171.7W 1829 03/04

TEST... POTENTIAL IMPACTS ...TEST

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\* THIS IS A TEST MESSAGE. A TSUNAMI IS A SERIES OF WAVES. THE

TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR.

THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE

INITIAL WAVE.

\* THIS IS A TEST MESSAGE. IMPACTS CAN VARY SIGNIFICANTLY FROM

ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND

THE SHAPE AND ELEVATION OF THE SHORELINE.

\* THIS IS A TEST MESSAGE. IMPACTS CAN ALSO VARY DEPENDING UPON

THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI

WAVES.

\* THIS IS A TEST MESSAGE. PERSONS CAUGHT IN THE WATER OF A

TSUNAMI MAY DROWN... BE CRUSHED BY DEBRIS IN THE WATER... OR

BE SWEPT OUT TO SEA.

TEST... TSUNAMI OBSERVATIONS ...TEST

------------------------------------

\* THIS IS A TEST MESSAGE. THE FOLLOWING ARE TSUNAMI WAVE

OBSERVATIONS FROM COASTAL AND/OR DEEP-OCEAN SEA LEVEL GAUGES

AT THE INDICATED LOCATIONS. THE MAXIMUM TSUNAMI AMPLITUDE IS

MEASURED WITH RESPECT TO THE NORMAL TIDE LEVEL.

GAUGE TIME OF MAXIMUM WAVE

COORDINATES MEASURE TSUNAMI PERIOD

GAUGE LOCATION LAT LON (UTC) AMPLITUDE (MIN)

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NUKUALOFA TO 21.1S 175.2W 1550 0.39M/ 1.3FT 04

TEST... NEXT UPDATE AND ADDITIONAL INFORMATION ...TEST

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\* THIS IS A TEST MESSAGE. THE NEXT MESSAGE WILL BE ISSUED IN

ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

\* THIS IS A TEST MESSAGE. FURTHER INFORMATION ABOUT THIS EVENT

MAY BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF HAWAII... AMERICAN

SAMOA... GUAM... AND CNMI SHOULD REFER TO PACIFIC TSUNAMI

WARNING CENTER MESSAGES SPECIFICALLY FOR THOSE PLACES THAT

CAN BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF CALIFORNIA...

OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD

ONLY REFER TO U.S. NATIONAL TSUNAMI WARNING CENTER MESSAGES

THAT CAN BE FOUND AT WWW.TSUNAMI.GOV.

THIS IS A TEST MESSAGE. DO NOT TAKE ACTION BASED ON THIS TEST

MESSAGE.

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NNNN

***Sample Supplemental Tsunami Threat Message***. The following is a sample supplemental Tsunami Threat Message that might be issued as part of a sequence of messages following the observation of potentially hazardous tsunami waves from HTHH. In this example representing the third message issued an hour and 45 minutes after the event, tsunami waves have now been observed at Nuku`alofa, Apia, and Pago Pago. Based on the maximum amplitudes from those gauges, the forecast for gauges is now 0.8 times the amplitudes observed on January 15, 2022. The areal extent of the threat has been extended to six hours of tsunami travel time from HTHH. Note that the “TEST” language sprinkled throughout the message would be absent in an actual product.

ZCZC WEPA40 PHEB 041715

TSUPAC

TEST...TSUNAMI MESSAGE NUMBER 3...TEST

NWS PACIFIC TSUNAMI WARNING CENTER HONOLULU HI

1715 UTC FRI MAR 4 2022

...THIS MESSAGE IS FOR TEST PURPOSES ONLY...

...TEST PTWC TSUNAMI THREAT MESSAGE TEST...

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

THIS IS A TEST MESSAGE. THIS MESSAGE IS ISSUED FOR INFORMATION

ONLY IN SUPPORT OF THE UNESCO/IOC PACIFIC TSUNAMI WARNING AND

MITIGATION SYSTEM AND IS MEANT FOR NATIONAL AUTHORITIES IN EACH

COUNTRY OF THAT SYSTEM.

THIS IS A TEST MESSAGE. NATIONAL AUTHORITIES WILL DETERMINE THE

APPROPRIATE LEVEL OF ALERT FOR EACH COUNTRY AND MAY ISSUE

ADDITIONAL OR MORE REFINED INFORMATION.

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

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TEST... VOLCANIC ACTIVITY IN TONGA GENERATED A TSUNAMI ...TEST

--------------------------------------------------------------

TEST... PRELIMINARY VOLCANO PARAMETERS ...TEST

-------------------------------------------

\* ACTIVITY TIME 1530 UTC MAR 4 2022

\* COORDINATES 20.5 SOUTH 175.4 WEST

\* LOCATION TONGA

TEST... EVALUATION ...TEST

--------------------------

\* THIS IS A TEST MESSAGE. VOLCANIC ACTIVITY OCCURRED IN THE

TONGA ISLANDS AT 1530 UTC ON FRIDAY MARCH 4 2022.

TEST... TSUNAMI THREAT FORECAST...UPDATED ...TEST

-------------------------------------------------

\* THIS IS A TEST MESSAGE. HAZARDOUS TSUNAMI WAVES FROM THIS

VOLCANIC ACTIVITY ARE POSSIBLE ALONG SOME COASTS OF

TONGA... NIUE... AMERICAN SAMOA... WALLIS AND FUTUNA...

SAMOA... KERMADEC ISLANDS... FIJI... TOKELAU... COOK

ISLANDS... VANUATU... TUVALU... NEW ZEALAND... KIRIBATI...

HOWLAND AND BAKER... NEW CALEDONIA... FRENCH POLYNESIA...

JARVIS ISLAND... SOLOMON ISLANDS... PALMYRA ISLAND...

NAURU... MARSHALL ISLANDS... KOSRAE... JOHNSTON ISLAND...

PAPUA NEW GUINEA... AUSTRALIA... PITCAIRN... POHNPEI...

WAKE ISLAND... HAWAII... NORTHWEST HAWAII... MIDWAY

ISLAND... CHUUK... ANTARCTICA... MINAMITORISHIMA...

NORTHERN MARIANAS... GUAM... INDONESIA... YAP... CHILE AND

JAPAN

\* THIS IS A TEST MESSAGE. BASED UPON THE INITIAL

OBSERVATIONS... THIS TSUNAMI IS FORECAST TO BE ABOUT 0.8

TIMES THE SIZE OF THE JANUARY 15 2022 TSUNAMI FROM THE SAME

VOLCANO IN TONGA.

\* THIS IS A TEST MESSAGE. THE FOLLOWING ARE FORECAST MAXIMUM

TSUNAMI AMPLITUDES RELATIVE TO NORMAL SEA LEVEL AT COASTAL

GAUGES WITHIN CURRENT THREAT AREA. THE FORECAST FOR EACH

GAUGE IS BASED UPON SCALING THE MAXIMUM TSUNAMI AMPLITUDE

MEASURED ON THAT GAUGE FOR THE JANUARY 15 2022 TSUNAMI USING

THE SCALE FACTOR GIVEN ABOVE. TSUNAMI WAVES ALONG OTHER

COASTS IN THE REGION OF EACH GAUGE MAY BE LARGER OR SMALLER

THAN AT THE GAUGE. A SIMILAR SCALING OF ANY KNOWN JANUARY 15

IMPACTS ALONG THOSE COASTS CAN BE USED AS A GUIDE.

COORDINATES FIRST WAVE FORECAST MAX

GAUGE LOCATION LAT LON ETA (UTC) TSUNAMI AMPLITUDE

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NUKUALOFA TO 21.1S 175.2W 03/04 1548 0.66M/ 2.15FT

DART 5401003 23.4S 173.4W 03/04 1612 0.17M/ 0.55FT

DART 5401002 29.7S 175.0W 03/04 1655 0.08M/ 0.26FT

PAGO PAGO AS 14.3S 170.7W 03/04 1656 0.50M/ 1.63FT

APIA UPOLU WS 13.8S 171.8W 03/04 1706 0.14M/ 0.45FT

SUVA VITI LEVU FJ 18.1S 178.4E 03/04 1712 0.21M/ 0.68FT

DART 5401001 36.0S 177.7W 03/04 1737 0.06M/ 0.18FT

RAROTONGA CK 21.2S 159.8W 03/04 1745 0.72M/ 2.36FT

DART 5501004 36.1S 178.6E 03/04 1757 0.09M/ 0.29FT

EAST CAPE NZ 37.5S 178.2E 03/04 1814 0.21M/ 0.68FT

FONGAFALE TV 8.5S 179.2E 03/04 1819 0.10M/ 0.31FT

MARE NEW CALEDONIA F 21.5S 167.9E 03/04 1822 0.60M/ 1.97FT

LIFOU NEW CALEDONIA 20.9S 167.3E 03/04 1825 0.71M/ 2.34FT

GISBORNE EASTLAND NZ 38.7S 178.0E 03/04 1834 0.54M/ 1.78FT

OUVEA NEW CALEDONIA 20.5S 166.6E 03/04 1836 0.31M/ 1.02FT

VANUATU 17.8S 168.3E 03/04 1842 1.13M/ 3.70FT

OUINNE NEW CALEDONIA 22.0S 166.7E 03/04 1842 0.90M/ 2.97FT

THIO NEW CALEDONIA F 21.6S 166.2E 03/04 1848 0.46M/ 1.50FT

KINGSTON NORFOLK IS 29.1S 168.0E 03/04 1850 0.62M/ 2.05FT

HIENGHENE NEW CALEDO 20.7S 164.9E 03/04 1851 0.36M/ 1.18FT

GREAT BARRIER IS NZ 36.2S 175.5E 03/04 1856 0.56M/ 1.84FT

NORTH CAPE NZ 34.4S 173.0E 03/04 1856 0.55M/ 1.81FT

LUGANVILLE VU 15.5S 167.2E 03/04 1857 0.30M/ 0.97FT

TUBUAI PF 23.3S 149.5W 03/04 1906 0.26M/ 0.87FT

HUAHINE PF 16.7S 151.0W 03/04 1907 0.42M/ 1.39FT

PORT NAPIER NZ 39.5S 176.9E 03/04 1910 0.28M/ 0.92FT

VAIRAO FP FR 17.8S 149.3W 03/04 1916 0.34M/ 1.13FT

PAPEETE TAHITI 17.5S 149.6W 03/04 1917 0.22M/ 0.71FT

WELLINGTON NZ 41.3S 174.8E 03/04 1931 0.14M/ 0.47FT

OWENGA CHATHAM NZ 44.0S 176.4W 03/04 1949 0.35M/ 1.15FT

CHRISTMAS KI 2.0N 157.5W 03/04 1955 0.16M/ 0.52FT

NAURU 0.5S 166.9E 03/04 1958 0.12M/ 0.39FT

NUKU HIVA MARQUESAS 8.9S 140.1W 03/04 2051 0.54M/ 1.76FT

LIHOU REEF AU 17.1S 152.1E 03/04 2100 0.10M/ 0.31FT

HIVA OA MARQUESAS 9.8S 139.0W 03/04 2101 0.42M/ 1.39FT

RIKITEA PF 23.1S 135.0W 03/04 2104 0.17M/ 0.55FT

JOHNSTON US 16.7N 169.5W 03/04 2107 0.09M/ 0.29FT

TAREKUKURE WHARF SB 6.7S 156.4E 03/04 2116 0.16M/ 0.52FT

GOLD COAST SAND BYPA 27.9S 153.4E 03/04 2122 0.56M/ 1.84FT

TEST... RECOMMENDED ACTIONS ...TEST

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\* THIS IS A TEST MESSAGE. GOVERNMENT AGENCIES RESPONSIBLE FOR

THREATENED COASTAL AREAS SHOULD TAKE ACTION TO INFORM AND

INSTRUCT ANY COASTAL POPULATIONS AT RISK IN ACCORDANCE WITH

THEIR OWN EVALUATION... PROCEDURES AND THE LEVEL OF THREAT.

\* THIS IS A TEST MESSAGE. PERSONS LOCATED IN THREATENED COASTAL

AREAS SHOULD STAY ALERT FOR INFORMATION AND FOLLOW

INSTRUCTIONS FROM NATIONAL AND LOCAL AUTHORITIES.

TEST... ESTIMATED TIMES OF ARRIVAL ...TEST

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\* THIS IS A TEST MESSAGE. ESTIMATED TIMES OF ARRIVAL -ETA- OF

THE INITIAL TSUNAMI WAVE FOR PLACES WITHIN THE THREAT

REGION. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE

MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND

THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION REGION COORDINATES ETA(UTC)

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NUKUALOFA TONGA 21.0S 175.2W 1540 03/04

HOLEVA TONGA 18.6S 173.9W 1606 03/04

NIUE ISLAND NIUE 19.0S 170.0W 1631 03/04

NIUATOPUTAPU TONGA 15.9S 173.8W 1635 03/04

PAGO PAGO AMERICAN SAMOA 14.3S 170.7W 1652 03/04

FUTUNA ISLAND WALLIS AND FUTUN 14.3S 178.2W 1655 03/04

WALLIS ISLAND WALLIS AND FUTUN 13.2S 176.2W 1659 03/04

APIA SAMOA 13.8S 171.8W 1706 03/04

RAOUL ISLAND KERMADEC ISLANDS 29.2S 177.9W 1709 03/04

SUVA FIJI 18.1S 178.4E 1712 03/04

NUKUNONU ISLAND TOKELAU 9.2S 171.8W 1737 03/04

PUKAPUKA ISLAND COOK ISLANDS 10.8S 165.9W 1739 03/04

RAROTONGA COOK ISLANDS 21.2S 159.8W 1745 03/04

ANATOM ISLAND VANUATU 20.2S 169.9E 1808 03/04

FUNAFUTI ISLAND TUVALU 7.9S 178.5E 1810 03/04

LOTTIN POINT NEW ZEALAND 37.5S 178.2E 1814 03/04

KANTON ISLAND KIRIBATI 2.8S 171.7W 1829 03/04

GISBORNE NEW ZEALAND 38.7S 178.0E 1834 03/04

NORTH CAPE NEW ZEALAND 34.4S 173.3E 1843 03/04

MOUNT MAUNGANUI NEW ZEALAND 37.6S 176.2E 1844 03/04

PENRYN ISLAND COOK ISLANDS 8.9S 157.8W 1844 03/04

PORT TAURANGA NEW ZEALAND 37.7S 176.2E 1851 03/04

HOWLAND ISLAND HOWLAND AND BAKE 0.6N 176.6W 1852 03/04

ESPERITU SANTO VANUATU 15.1S 167.3E 1856 03/04

EAST CAPE NEW ZEALAND 37.7S 178.5E 1856 03/04

WHANGAREI NEW ZEALAND 35.8S 174.5E 1859 03/04

NOUMEA NEW CALEDONIA 22.3S 166.5E 1905 03/04

TUBUAI FRENCH POLYNESIA 23.3S 149.5W 1906 03/04

FLINT ISLAND KIRIBATI 11.4S 151.8W 1908 03/04

NAPIER NEW ZEALAND 39.5S 176.9E 1910 03/04

KAINGAROA CHATH NEW ZEALAND 43.7S 176.3W 1916 03/04

PAPEETE FRENCH POLYNESIA 17.5S 149.6W 1917 03/04

JARVIS ISLAND JARVIS ISLAND 0.4S 160.1W 1923 03/04

MALDEN ISLAND KIRIBATI 3.9S 154.9W 1929 03/04

WELLINGTON NEW ZEALAND 41.3S 174.8E 1931 03/04

PICTON NEW ZEALAND 41.3S 174.0E 1939 03/04

WAITANGI CHATHA NEW ZEALAND 43.9S 176.6W 1945 03/04

MARLBOROUGH SOU NEW ZEALAND 41.1S 174.4E 1946 03/04

RAPA ITI FRENCH POLYNESIA 27.6S 144.3W 1948 03/04

SANTA CRUZ ISLA SOLOMON ISLANDS 10.9S 165.9E 1949 03/04

CHRISTMAS ISLAN KIRIBATI 2.0N 157.5W 1955 03/04

PALMYRA ISLAND PALMYRA ISLAND 5.9N 162.1W 1956 03/04

NAURU NAURU 0.5S 166.9E 1958 03/04

KIRAKIRA SOLOMON ISLANDS 10.4S 161.9E 1959 03/04

AUCKLAND EAST NEW ZEALAND 36.7S 175.0E 2000 03/04

AUCKLAND WEST NEW ZEALAND 37.1S 174.2E 2007 03/04

MAJURO MARSHALL ISLANDS 7.1N 171.4E 2024 03/04

TARAWA ISLAND KIRIBATI 1.5N 173.0E 2028 03/04

AUKI SOLOMON ISLANDS 8.8S 160.6E 2032 03/04

HONIARA SOLOMON ISLANDS 9.3S 160.0E 2041 03/04

GHATERE SOLOMON ISLANDS 7.8S 159.2E 2046 03/04

NEW PLYMOUTH NEW ZEALAND 39.1S 174.1E 2048 03/04

WANGANUI NEW ZEALAND 39.9S 175.0E 2054 03/04

DUNEDIN NEW ZEALAND 45.9S 170.5E 2055 03/04

GREAT BARRIER I NEW ZEALAND 37.0S 157.4E 2057 03/04

HIVA OA FRENCH POLYNESIA 10.0S 139.0W 2058 03/04

KWAJALEIN MARSHALL ISLANDS 8.7N 167.7E 2059 03/04

KOSRAE ISLAND KOSRAE 5.5N 163.0E 2059 03/04

MUNDA SOLOMON ISLANDS 8.4S 157.2E 2059 03/04

PANGGOE SOLOMON ISLANDS 6.9S 157.2E 2100 03/04

FALAMAE SOLOMON ISLANDS 7.4S 155.6E 2103 03/04

RIKITEA FRENCH POLYNESIA 23.1S 135.0W 2104 03/04

LYTTELTON NEW ZEALAND 43.6S 172.7E 2106 03/04

JOHNSTON ISLAND JOHNSTON ISLAND 16.7N 169.5W 2107 03/04

MILFORD SOUND NEW ZEALAND 44.6S 167.9E 2118 03/04

KIETA PAPUA NEW GUINEA 6.1S 155.6E 2121 03/04

AMUN PAPUA NEW GUINEA 6.0S 154.7E 2121 03/04

WOODLARK ISLAND PAPUA NEW GUINEA 9.0S 152.9E 2122 03/04

TEST... POTENTIAL IMPACTS ...TEST

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\* THIS IS A TEST MESSAGE. A TSUNAMI IS A SERIES OF WAVES. THE

TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR.

THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE

INITIAL WAVE.

\* THIS IS A TEST MESSAGE. IMPACTS CAN VARY SIGNIFICANTLY FROM

ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND

THE SHAPE AND ELEVATION OF THE SHORELINE.

\* THIS IS A TEST MESSAGE. IMPACTS CAN ALSO VARY DEPENDING UPON

THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI

WAVES.

\* THIS IS A TEST MESSAGE. PERSONS CAUGHT IN THE WATER OF A

TSUNAMI MAY DROWN... BE CRUSHED BY DEBRIS IN THE WATER... OR

BE SWEPT OUT TO SEA.

TEST... TSUNAMI OBSERVATIONS ...TEST

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\* THIS IS A TEST MESSAGE. THE FOLLOWING ARE TSUNAMI WAVE

OBSERVATIONS FROM COASTAL AND/OR DEEP-OCEAN SEA LEVEL GAUGES

AT THE INDICATED LOCATIONS. THE MAXIMUM TSUNAMI AMPLITUDE IS

MEASURED WITH RESPECT TO THE NORMAL TIDE LEVEL.

GAUGE TIME OF MAXIMUM WAVE

COORDINATES MEASURE TSUNAMI PERIOD

GAUGE LOCATION LAT LON (UTC) AMPLITUDE (MIN)

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PAGO PAGO AS 14.3S 170.7W 1620 0.49M/ 1.6FT 08

APIA UPOLU WS 13.8S 171.8W 1702 0.14M/ 0.5FT 10

NUKUALOFA TO 21.1S 175.2W 1710 0.61M/ 2.0FT 04

TEST... NEXT UPDATE AND ADDITIONAL INFORMATION ...TEST

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\* THIS IS A TEST MESSAGE. THE NEXT MESSAGE WILL BE ISSUED IN

ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

\* THIS IS A TEST MESSAGE. FURTHER INFORMATION ABOUT THIS EVENT

MAY BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF HAWAII... AMERICAN

SAMOA... GUAM... AND CNMI SHOULD REFER TO PACIFIC TSUNAMI

WARNING CENTER MESSAGES SPECIFICALLY FOR THOSE PLACES THAT

CAN BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF CALIFORNIA...

OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD

ONLY REFER TO U.S. NATIONAL TSUNAMI WARNING CENTER MESSAGES

THAT CAN BE FOUND AT WWW.TSUNAMI.GOV.

THIS IS A TEST MESSAGE. DO NOT TAKE ACTION BASED ON THIS TEST

MESSAGE.

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***Sample Final Tsunami Threat Message***. The following is a sample final Tsunami Threat Message that might be issued once tsunami wave amplitudes have fallen below the minimum threat level of 0.3 m on all or most gauges across the Pacific. In this example that represents a Pacific-wide tsunami, the final message is number 17 issued about 15 hours after the event. based upon the tsunami amplitude observed at Nuku`alofa, the forecast is for gauge amplitudes that are 0.5 times the size of the amplitudes observed on January 15, 2022. The initial areal extent of the threat has been limited to three hours of tsunami travel time from HTHH. Note that the “TEST” language sprinkled throughout the message would be absent in an actual product.

ZCZC WEPA40 PHEB 050618

TSUPAC

TEST...TSUNAMI MESSAGE NUMBER 17...TEST

NWS PACIFIC TSUNAMI WARNING CENTER HONOLULU HI

0618 UTC FRI MAR 5 2022

...THIS MESSAGE IS FOR TEST PURPOSES ONLY...

...TEST PTWC FINAL TSUNAMI THREAT MESSAGE TEST...

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

THIS IS A TEST MESSAGE. THIS MESSAGE IS ISSUED FOR INFORMATION

ONLY IN SUPPORT OF THE UNESCO/IOC PACIFIC TSUNAMI WARNING AND

MITIGATION SYSTEM AND IS MEANT FOR NATIONAL AUTHORITIES IN EACH

COUNTRY OF THAT SYSTEM.

THIS IS A TEST MESSAGE. NATIONAL AUTHORITIES WILL DETERMINE THE

APPROPRIATE LEVEL OF ALERT FOR EACH COUNTRY AND MAY ISSUE

ADDITIONAL OR MORE REFINED INFORMATION.

\*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\* NOTICE \*\*\*\*\*

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TEST... VOLCANIC ACTIVITY IN TONGA GENERATED A TSUNAMI ...TEST

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TEST... PRELIMINARY VOLCANO PARAMETERS ...TEST

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\* ACTIVITY TIME 1530 UTC MAR 4 2022

\* COORDINATES 20.5 SOUTH 175.4 WEST

\* LOCATION TONGA

TEST... EVALUATION ...TEST

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\* THIS IS A TEST MESSAGE. VOLCANIC ACTIVITY OCCURRED IN THE

TONGA ISLANDS AT 1530 UTC ON FRIDAY MARCH 4 2022.

\* THIS IS A TEST MESSAGE. BASED ON ALL AVAILABLE DATA... THE

TSUNAMI THREAT FROM THIS VOLCANIC ACTIVITY HAS NOW PASSED.

TEST... TSUNAMI THREAT FORECAST...UPDATED ...TEST

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\* THIS IS A TEST MESSAGE. THE TSUNAMI THREAT HAS NOW LARGELY

PASSED.

TEST... RECOMMENDED ACTIONS ...TEST

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\* THIS IS A TEST MESSAGE. GOVERNMENT AGENCIES RESPONSIBLE FOR

ANY IMPACTED COASTAL AREAS SHOULD MONITOR CONDITIONS AT THE

COAST TO DETERMINE IF AND WHEN IT IS SAFE TO RESUME NORMAL

ACTIVITIES.

\* THIS IS A TEST MESSAGE. PERSONS LOCATED NEAR IMPACTED COASTAL

AREAS SHOULD STAY ALERT FOR INFORMATION AND FOLLOW

INSTRUCTIONS FROM LOCAL AUTHORITIES.

\* THIS IS A TEST MESSAGE. REMAIN OBSERVANT AND EXERCISE NORMAL

CAUTION NEAR THE SEA.

TEST... POTENTIAL IMPACTS ...TEST

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\* THIS IS A TEST MESSAGE. MINOR SEA LEVEL FLUCTUATIONS OF UP TO

0.3 METERS ABOVE AND BELOW THE NORMAL TIDE MAY CONTINUE OVER

THE NEXT FEW HOURS.

TEST... NEXT UPDATE AND ADDITIONAL INFORMATION ...TEST

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\* THIS IS A TEST MESSAGE. THIS WILL BE THE FINAL STATEMENT

ISSUED FOR THIS EVENT UNLESS NEW INFORMATION IS RECEIVED OR

THE SITUATION CHANGES.

\* THIS IS A TEST MESSAGE. FURTHER INFORMATION ABOUT THIS EVENT

MAY BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF HAWAII... AMERICAN

SAMOA... GUAM... AND CNMI SHOULD REFER TO PACIFIC TSUNAMI

WARNING CENTER MESSAGES SPECIFICALLY FOR THOSE PLACES THAT

CAN BE FOUND AT WWW.TSUNAMI.GOV.

\* THIS IS A TEST MESSAGE. COASTAL REGIONS OF CALIFORNIA...

OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD

ONLY REFER TO U.S. NATIONAL TSUNAMI WARNING CENTER MESSAGES

THAT CAN BE FOUND AT WWW.TSUNAMI.GOV.

THIS IS A TEST MESSAGE. DO NOT TAKE ACTION BASED ON THIS TEST

MESSAGE.

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