



NWS Tsunami Hotwash
January 19, 2022

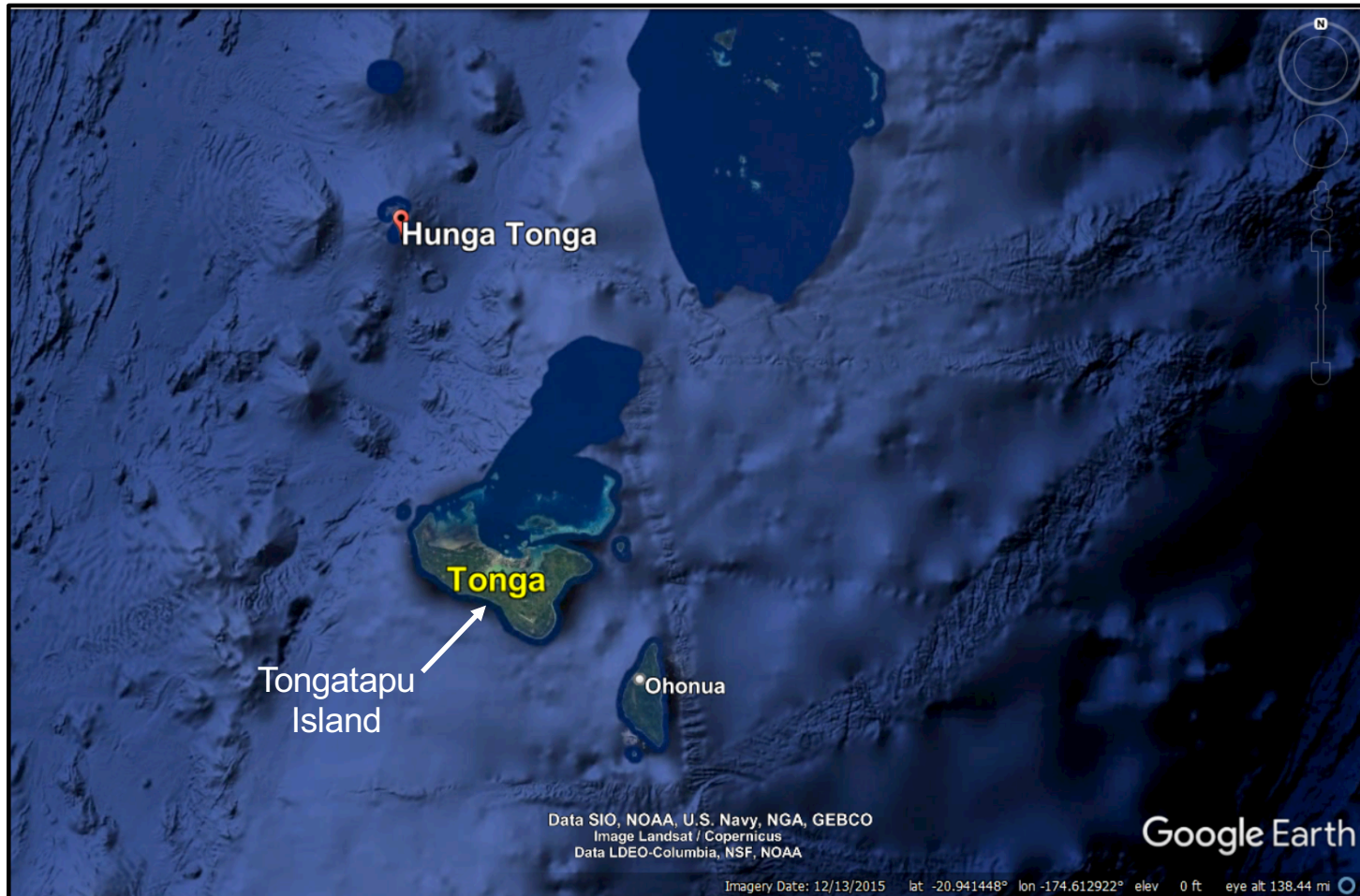
PTWC Response to 1/15/22 Tonga Volcanic Tsunami

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Geographic Awareness



Hunga Tonga is about 70 km north of the main island of Tonga



Sea level gauge on Tongatapu



Pacific Sea Level Network

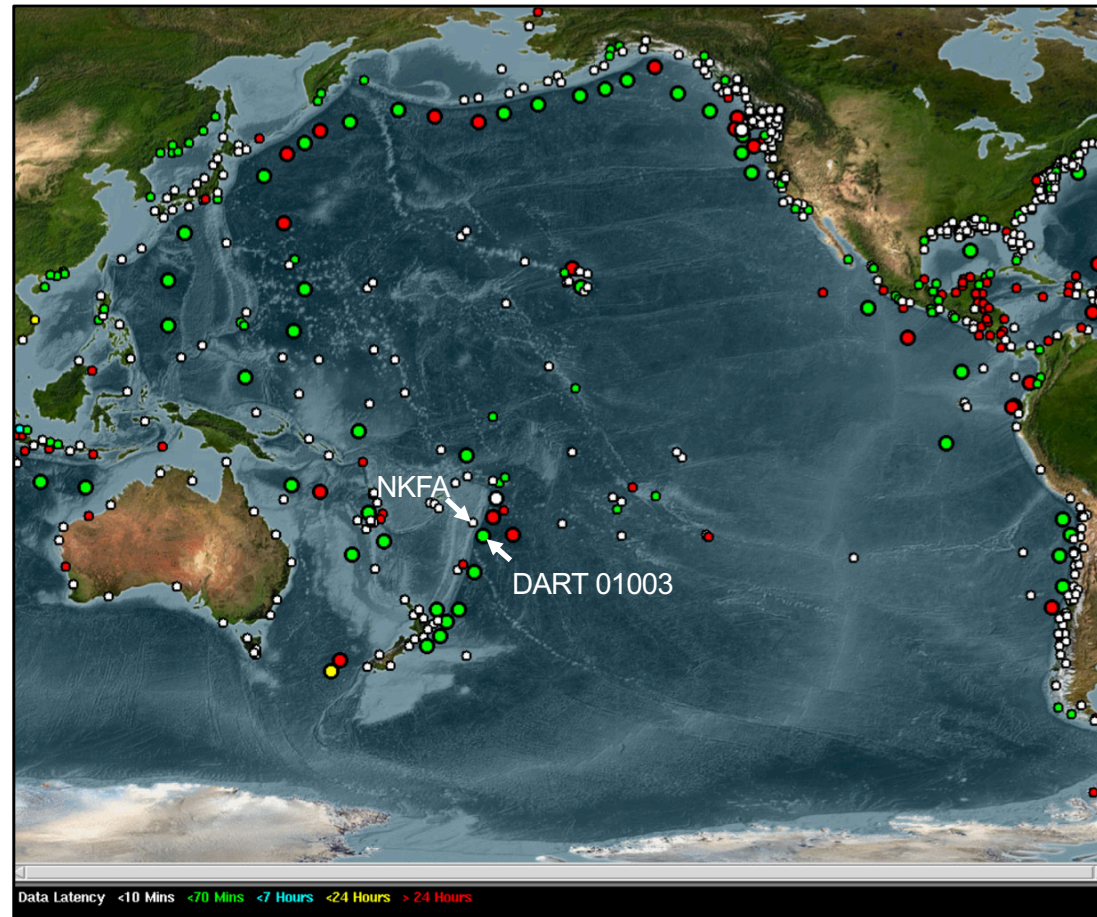


Small circles are coastal gauges

Large circles are deep-ocean DART gauges

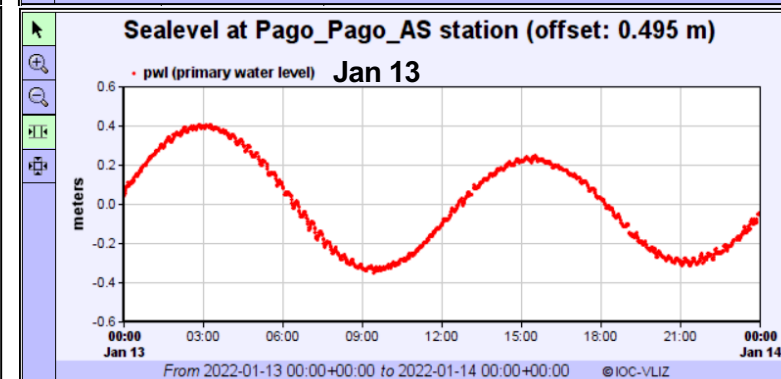
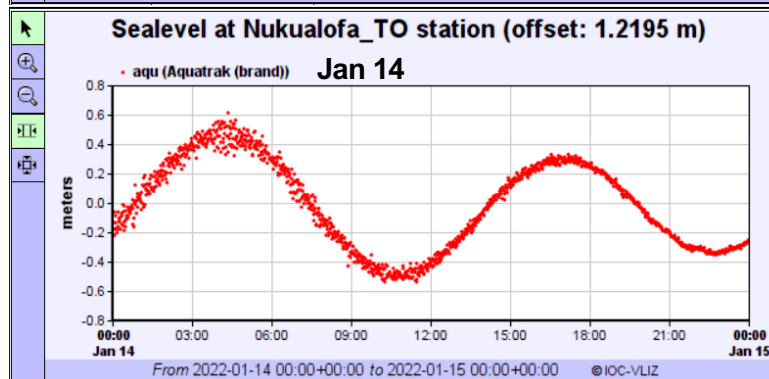
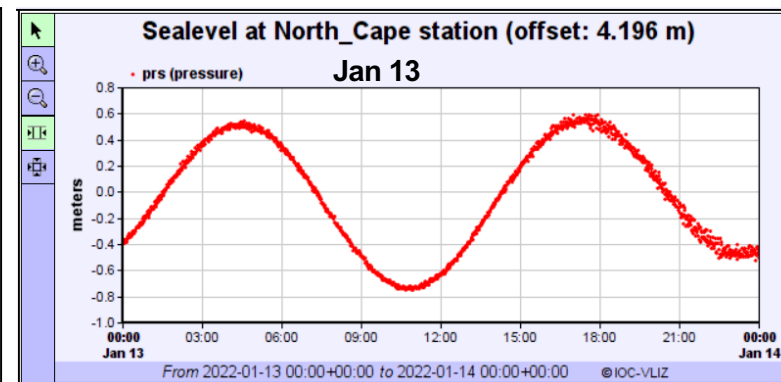
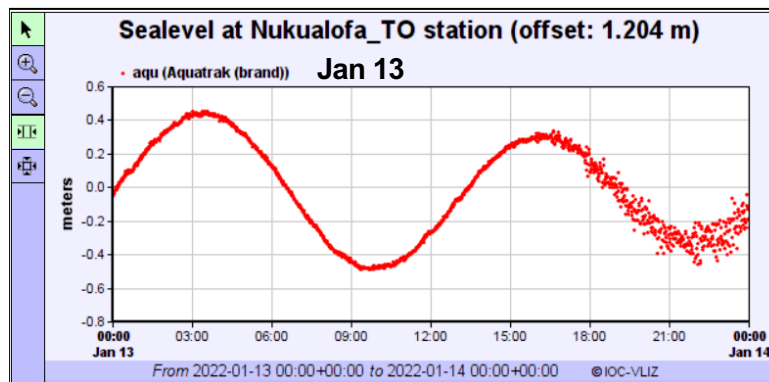
White and green mean the gauge is functioning normally.

Red mean the gauge is not functioning.



Pre-Event

- January 13 and 14 - Volcanic activity at Hunga Tonga caused small sea-level oscillations observed in Tonga and New Zealand.





Pre-Event

- **PTWC (Dailin Wang) implements the tsunami detector on the sea level gauge at Nukualofa, Tonga. The detector rings PTWC alarms if a signal above a certain amplitude is detected.**

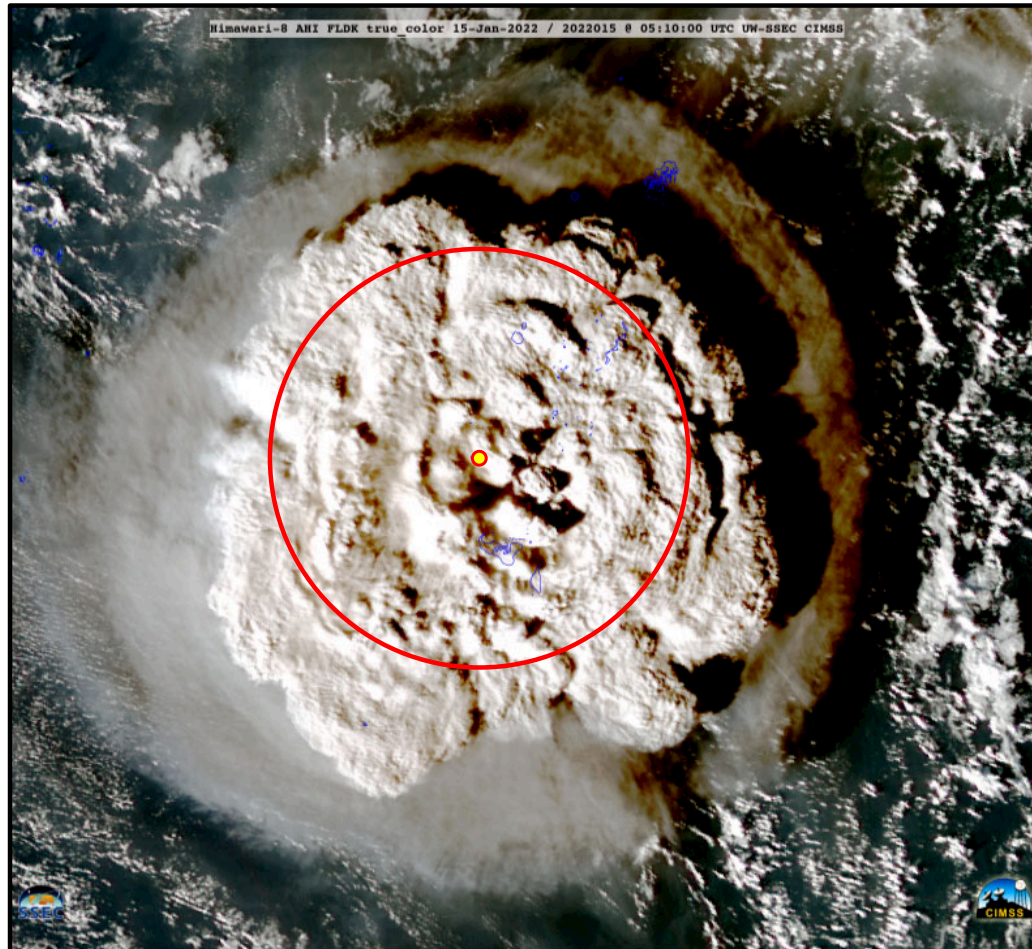
Ash Cloud from Hunga Tonga



**Ash Cloud from
the Hunga
Tonga eruption.**

**Yellow dot is
Hunga Tonga**

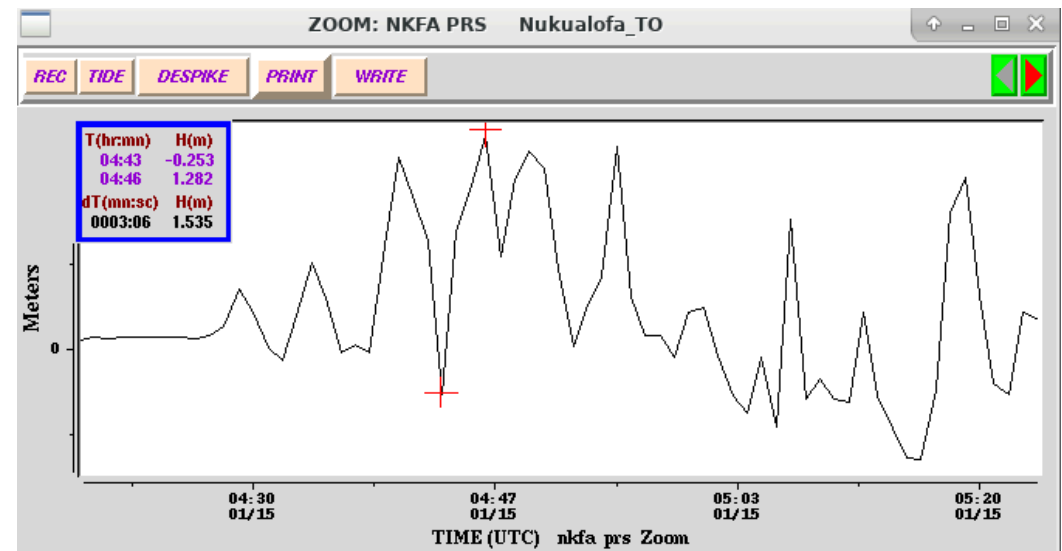
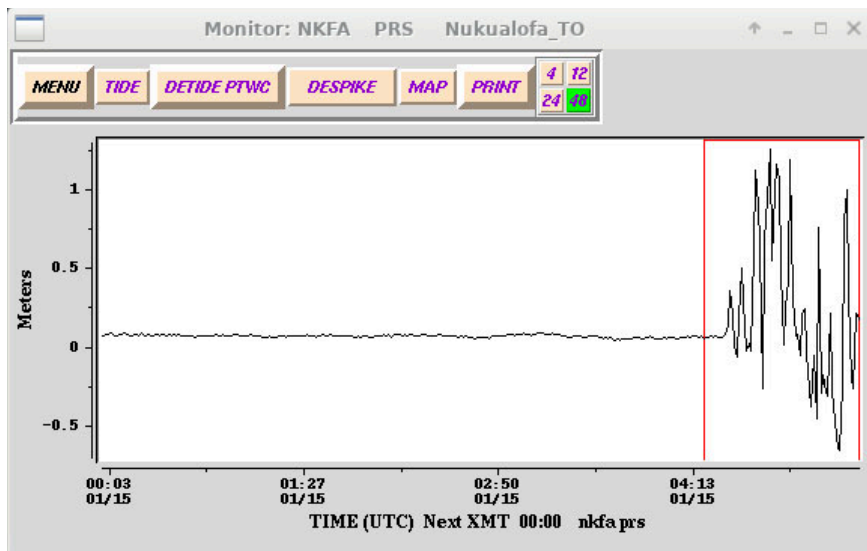
**Circle has 150
km radius**



**Eruption occurred at
04:14:45 UTC
(USGS)**

Tsunami arrival at Nuku`alofa

- Tsunami signal at Nuku`alofa following the explosive eruption of Hunga Tonga



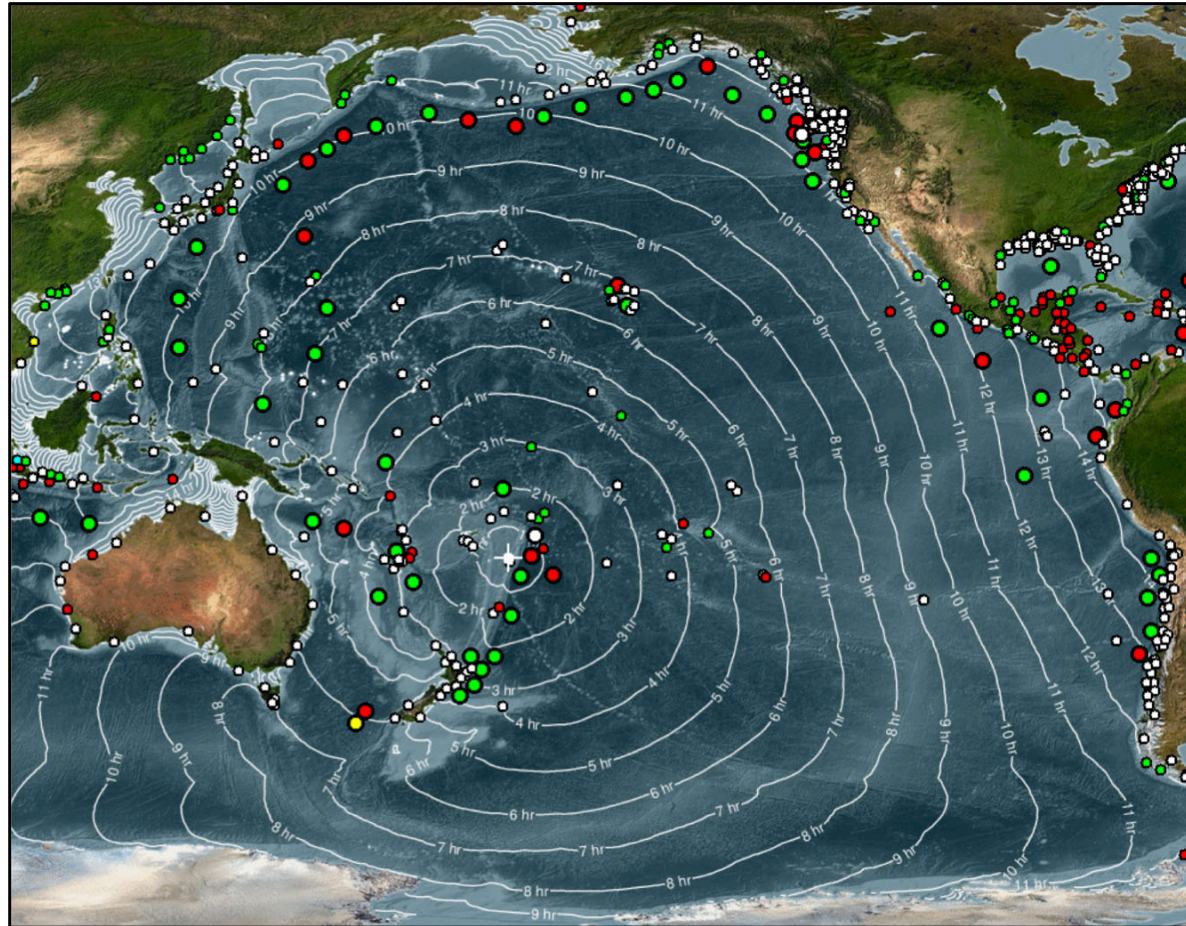
Timeline of Events



Time (UTC)	Elapsed	Event
04:15	-	Eruption begins
04:26	00:00	PTWC estimated time of tsunami generation
04:46	00:04	Nuku`alofa tsunami detector triggers PTWC alarm
		Maximum signal at Nuku`alofa is 80 cm
		Pacific ETAs computed

Tsunami Travel Times

Hourly
Contours

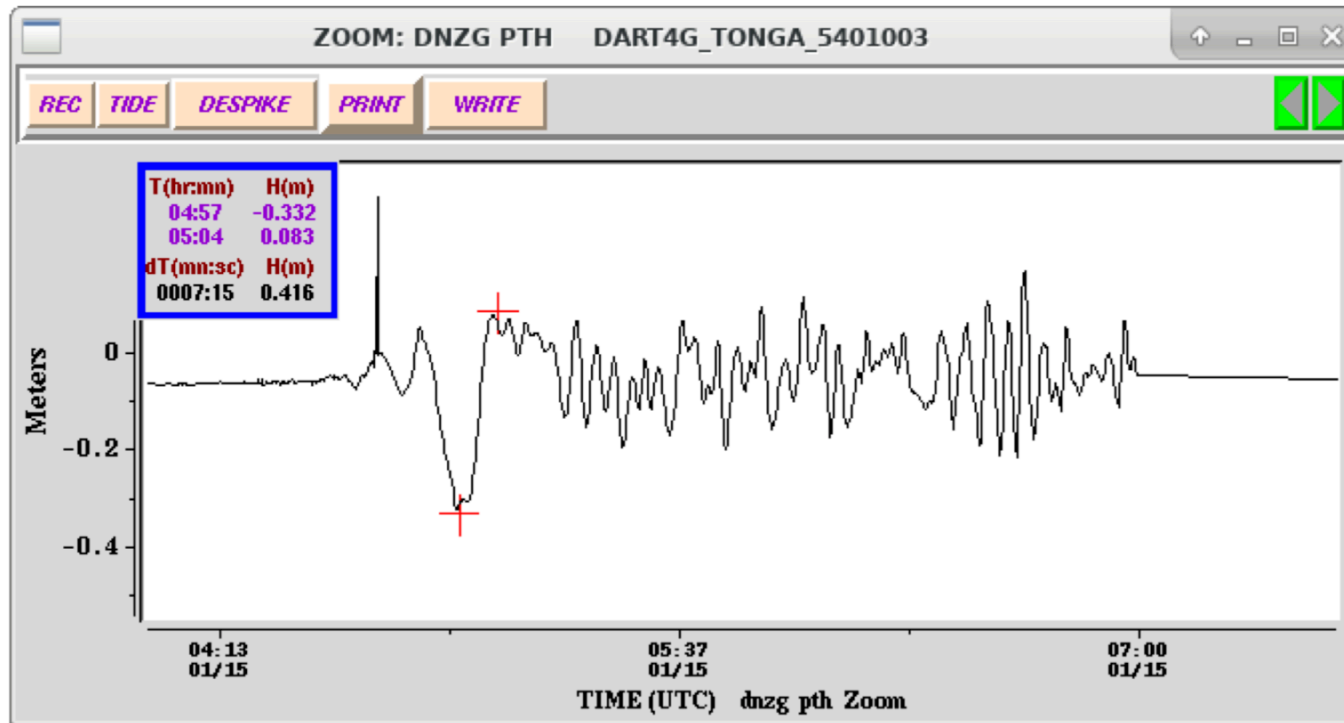




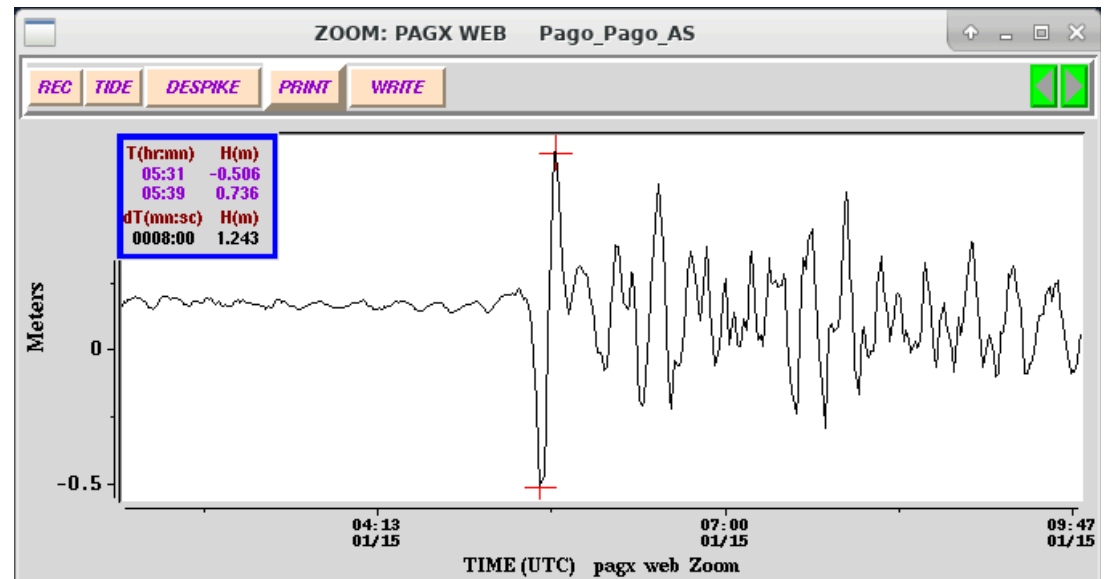
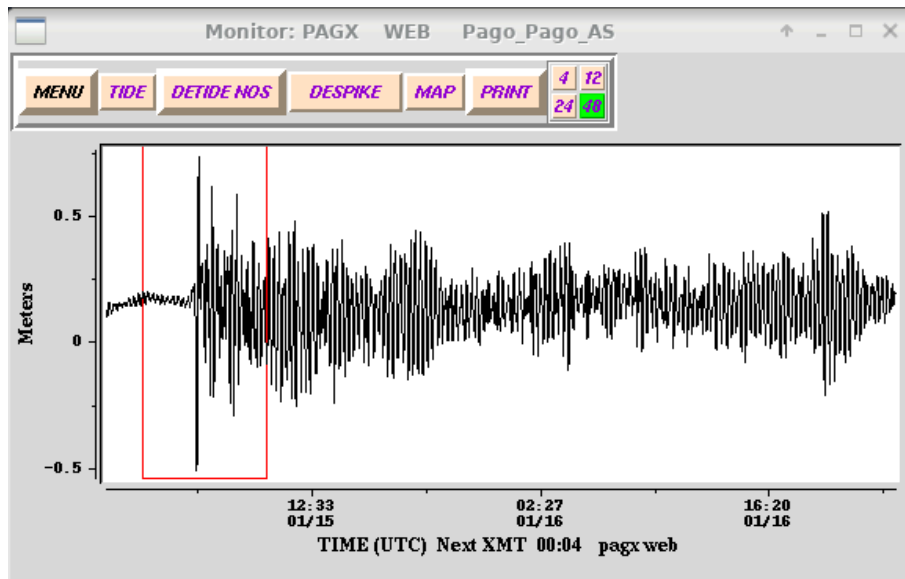
Timeline of Events

Time (UTC)	Elapsed	Event
04:15	-	Eruption begins
04:26	00:00	PTWC estimated time of tsunami generation
04:46	00:04	Nuku`alofa tsunami detector triggers PTWC alarm
		Maximum signal at Nuku`alofa is 80 cm
		Pacific ETAs computed
04:57	00:14	0.20m on DART 01003
05:31	01:31	0.62m on gauge at Pago Pago, Am. Samoa
		Call Pago Pago FO – we will issue Advisory
05:33	01:06	DART 51245 triggers
05:49	01:22	Advisory 1 issued for American Samoa (procedure and text modified manually for volcano source)

Tsunami arrival at DART 01003



Tsunami arrival at American Samoa

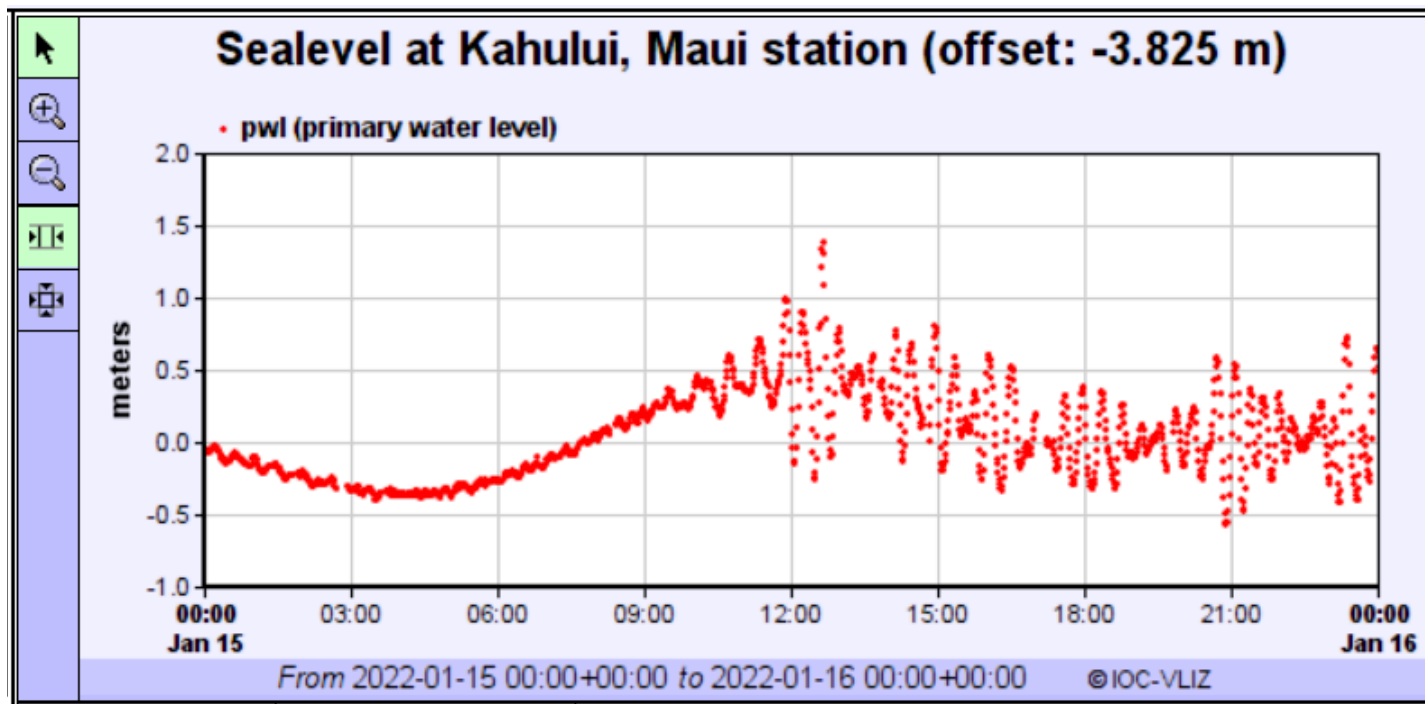


Timeline of Events



Time (UTC)	Elapsed	Event
06:07	01:41	Issued Am. Samoa Advisory #2 with observations
06:23	01:56	Issued Pacific Product #1 – Threat to 1000 km (improvised product and dissemination)
06:36	02:09	Upgraded Am. Samoa to Warning (Product #3)
07:20	02:53	Issued Pacific Product #2 – Threat to coasts with ETA within 3 hours
07:39	03:12	Warning for American Samoa is cancelled
08:02	03:35	Issued Information Statement to Hawaii (no threat, Product #1))
08:09	03:43	Issued Information Statement to Guam/CNMI

Tsunami arrival in Hawaii



Timeline of Events



Time (UTC)	Elapsed	Event
08:52	04:25	Issued Pacific Threat Message #3 (ETA in 3 hrs)
10:43	06:16	Upgraded Hawaii to Advisory (Product #2)
11:50	07:23	Hawaii Advisory #3
12:32	08:06	Hawaii Advisory #4
12:46	08:19	Pacific Message #4 (ETA in 3 hrs)
13:33	09:07	Hawaii Advisory #5
14:32	10:05	Pacific Message #5
15:24	10:58	Hawaii Advisory #6
16:34	12:08	Hawaii Advisory #7

Timeline of Events



Time (UTC)	Elapsed	Event
17:52	13:26	Hawaii Advisory Cancelled
19:30	15:04	Information Statement for the Caribbean
19:36	15:10	Information Statement for Puerto Rico
02:46	22:20	Final Pacific Threat Message (#12)



Forecast by Scaling to January 15 Observations

SEA LEVEL GUAGE	LAT	LON	TIME	METERS	SCALE							
					1.50	1.25	1.00	0.75	0.50	0.25	0.10	
DART_01003	23.4S	173.4W	442	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NUKUALOFA_TO	21.1S	175.2W	516	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
PAGO_PAGO_AS	14.3S	170.7W	531	0.62	0.93	0.78	0.62	0.47	0.31	0.16	0.06	
DART_01002	29.7S	175.0W	542	0.10	0.15	0.13	0.10	0.08	0.05	0.03	0.01	
APIA_UPOLU_WS	13.8S	171.8W	551	0.17	0.26	0.21	0.17	0.13	0.09	0.04	0.02	
DART_01001	36.0S	177.7W	612	0.07	0.11	0.09	0.07	0.05	0.04	0.02	0.01	
SUVA_VITI_LEVU_FJ	18.1S	178.4E	633	0.26	0.39	0.33	0.26	0.20	0.13	0.07	0.03	
FONGAFALE_TV	8.5S	179.2E	735	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
LIFOU_NEW_CALEDONIA	20.9S	167.3E	746	0.89	1.34	1.11	0.89	0.67	0.45	0.22	0.09	
TUBUAI_PF	23.3S	149.5W	800	0.33	0.50	0.41	0.33	0.25	0.17	0.08	0.03	
PAPEETE_TAHITI	17.5S	149.6W	811	0.27	0.41	0.34	0.27	0.20	0.14	0.07	0.03	
VAIRAO_FP_FR	17.8S	149.3W	813	0.43	0.65	0.54	0.43	0.32	0.22	0.11	0.04	
HUAHINE_PF	16.7S	151.0W	813	0.53	0.80	0.66	0.53	0.40	0.27	0.13	0.05	
THIO_NEW_CALEDONIA	21.6S	166.2E	819	0.57	0.86	0.71	0.57	0.43	0.29	0.14	0.06	
OUVEA_NEW_CALEDONIA	20.5S	166.6E	823	0.39	0.59	0.49	0.39	0.29	0.20	0.10	0.04	
LUGANVILLE_VU	15.5S	167.2E	826	0.37	0.56	0.46	0.37	0.28	0.19	0.09	0.04	
OUIINNE_NEW_CALEDONI	22.0S	166.7E	826	1.13	1.70	1.41	1.13	0.85	0.57	0.28	0.11	
DART_01004	36.1S	178.6E	829	0.11	0.17	0.14	0.11	0.08	0.06	0.03	0.01	
EAST_CAPE_NZ	37.6S	178.2E	834	0.26	0.39	0.33	0.26	0.20	0.13	0.07	0.03	



Forecast by Scaling to January 15 Observations

SEA LEVEL GUAGE	LAT	LON	TIME	METERS	SCALE							
					1.50	1.25	1.00	0.75	0.50	0.25	0.10	
DART_01003	23.4S	173.4W	442	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NUKUALOFA_TO	21.1S	175.2W	516	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
KINGSTON_NORFOLK_IS	29.1S	168.0E	840	0.78	1.17	0.98	0.78	0.59	0.39	0.20	0.08	
GREAT_BARRIER_IS_NZ	36.2S	175.5E	849	0.70	1.05	0.88	0.70	0.53	0.35	0.18	0.07	
RAROTONGA_CK	21.2S	159.8W	853	0.90	1.35	1.13	0.90	0.68	0.45	0.23	0.09	
OWENGA_CHATHAM_NZ	44.0S	176.4W	902	0.44	0.66	0.55	0.44	0.33	0.22	0.11	0.04	
HIENGHENE_NEW_CALED	20.7S	164.9E	910	0.45	0.68	0.56	0.45	0.34	0.23	0.11	0.05	
NORTH_CAPE_NZ	34.4S	173.0E	917	0.69	1.04	0.86	0.69	0.52	0.35	0.17	0.07	
JOHNSTON_US	16.7N	169.5W	924	0.11	0.17	0.14	0.11	0.08	0.06	0.03	0.01	
VANUATU	17.8S	168.3E	924	1.41	2.12	1.76	1.41	1.06	0.71	0.35	0.14	
HILO_HAWAII	19.7N	155.1W	929	0.10	0.15	0.13	0.10	0.08	0.05	0.03	0.01	
HIVA_OA_MARQUESAS	9.8S	139.0W	1026	0.53	0.80	0.66	0.53	0.40	0.27	0.13	0.05	
RIKITEA_PF	23.1S	135.0W	1038	0.21	0.32	0.26	0.21	0.16	0.11	0.05	0.02	
WAKE_US	19.3N	166.6E	1041	0.13	0.20	0.16	0.13	0.10	0.07	0.03	0.01	
SPRING_BAY_AU	42.5S	147.9E	1041	0.35	0.53	0.44	0.35	0.26	0.18	0.09	0.04	
NUKU_HIVA_MARQUESAS	8.9S	140.1W	1055	0.67	1.01	0.84	0.67	0.50	0.34	0.17	0.07	
NAWILIWILI_KAUAI	22.0N	159.4W	1057	0.31	0.47	0.39	0.31	0.23	0.16	0.08	0.03	
HONOLULU_OAHU	21.3N	157.9W	1112	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NAURU	0.5S	166.9E	1118	0.15	0.23	0.19	0.15	0.11	0.08	0.04	0.02	



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SEA LEVEL GUAGE	LAT	LON	TIME	METERS	SCALE							
					1.50	1.25	1.00	0.75	0.50	0.25	0.10	
DART_01003	23.4S	173.4W	442	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NUKUALOFA_TO	21.1S	175.2W	516	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
MAKAI_PIER_WAIMANAL	21.3N	157.7W	1128	0.28	0.42	0.35	0.28	0.21	0.14	0.07	0.03	
KAWAIHAE_HAWAII	20.0N	155.8W	1132	0.37	0.56	0.46	0.37	0.28	0.19	0.09	0.04	
GOLD_COAST_SAND_BYP	27.9S	153.4E	1135	0.70	1.05	0.88	0.70	0.53	0.35	0.18	0.07	
BARBERS_PT_HI	21.3N	158.1W	1135	0.19	0.29	0.24	0.19	0.14	0.10	0.05	0.02	
GISBORNE_EASTLAND_N	38.7S	178.0E	1141	0.68	1.02	0.85	0.68	0.51	0.34	0.17	0.07	
MIDWAY	28.2N	177.4W	1144	0.22	0.33	0.28	0.22	0.17	0.11	0.06	0.02	
HONOKOHAU_HI	19.7N	156.0W	1145	0.34	0.51	0.43	0.34	0.26	0.17	0.09	0.03	
TWOFOLD_BAY_AU	37.1S	149.9E	1205	0.67	1.01	0.84	0.67	0.50	0.34	0.17	0.07	
PORT_KEMBLA_AU	34.5S	150.9E	1206	0.39	0.59	0.49	0.39	0.29	0.20	0.10	0.04	
CHRISTMAS_KI	2.0N	157.5W	1209	0.20	0.30	0.25	0.20	0.15	0.10	0.05	0.02	
KAHULUI_MAUI	20.9N	156.5W	1228	0.83	1.25	1.04	0.83	0.62	0.42	0.21	0.08	
JACKSON_BAY_NZ	44.0S	168.6E	1233	0.91	1.37	1.14	0.91	0.68	0.46	0.23	0.09	
HANAIEI_HI	22.2N	159.5W	1233	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
LIHOU_REEF_AU	17.1S	152.1E	1241	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
DAVAO_PH	7.2N	125.7E	1328	0.22	0.33	0.28	0.22	0.17	0.11	0.06	0.02	
LOMBRUM_MANUS_IS_PG	2.0S	147.4E	1344	0.20	0.30	0.25	0.20	0.15	0.10	0.05	0.02	
CHICHIJIMA_JP	27.1N	142.2E	1344	0.74	1.11	0.93	0.74	0.56	0.37	0.19	0.07	



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					1.50	1.25	1.00	0.75	0.50	0.25	0.10	
DART_01003	23.4S	173.4W	442	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NUKUALOFA_TO	21.1S	175.2W	516	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
ATKA_AK	52.2N	174.2W	1358	0.22	0.33	0.28	0.22	0.17	0.11	0.06	0.02	
KUSHIRO_JP	43.0N	144.4E	1411	0.40	0.60	0.50	0.40	0.30	0.20	0.10	0.04	
TAREKUKURE_WHARF_SB	6.7S	156.4E	1430	0.20	0.30	0.25	0.20	0.15	0.10	0.05	0.02	
DART_46403	52.7N	156.8W	1431	0.06	0.09	0.08	0.06	0.05	0.03	0.02	0.01	
VODOPADNAYA_RU	51.7N	158.0E	1434	0.45	0.68	0.56	0.45	0.34	0.23	0.11	0.05	
KING_COVE_AK	55.1N	162.3W	1449	0.32	0.48	0.40	0.32	0.24	0.16	0.08	0.03	
DUTCH_HBR_UNALASKA	53.9N	166.5W	1452	0.09	0.14	0.11	0.09	0.07	0.05	0.02	0.01	
ISHIGAKIJIMA_JP	24.3N	124.2E	1509	0.15	0.23	0.19	0.15	0.11	0.08	0.04	0.02	
DART_46409	55.3N	148.6W	1520	0.04	0.06	0.05	0.04	0.03	0.02	0.01	0.00	
OMAEZAKI_HONSHU_JP	34.6N	138.2E	1526	0.71	1.07	0.89	0.71	0.53	0.36	0.18	0.07	
NIKOLSKI_AK	52.9N	168.9W	1528	0.36	0.54	0.45	0.36	0.27	0.18	0.09	0.04	
EASTER_CL	27.2S	109.4W	1530	0.32	0.48	0.40	0.32	0.24	0.16	0.08	0.03	
TOSASHIMIZU_SHIKOKU	32.8N	133.0E	1537	0.93	1.40	1.16	0.93	0.70	0.47	0.23	0.09	
SAIPAN_US	15.2N	145.7E	1627	0.11	0.17	0.14	0.11	0.08	0.06	0.03	0.01	
KUSHIMOTO_JP	33.5N	135.8E	1629	0.96	1.44	1.20	0.96	0.72	0.48	0.24	0.10	
PATACHE_CL	20.8S	70.2W	1633	0.15	0.23	0.19	0.15	0.11	0.08	0.04	0.02	
ABURATSU_JP	31.6N	131.4E	1642	0.65	0.98	0.81	0.65	0.49	0.33	0.16	0.07	



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					1.50	1.25	1.00	0.75	0.50	0.25	0.10	
DART_01003	23.4S	173.4W	442	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NUKUALOFA_TO	21.1S	175.2W	516	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
MAZATLAN_MX	23.2N	106.4W	1649	0.24	0.36	0.30	0.24	0.18	0.12	0.06	0.02	
ACAPULCO_MX	16.8N	99.9W	1707	0.13	0.20	0.16	0.13	0.10	0.07	0.03	0.01	
MERA_JP	34.9N	139.8E	1714	0.53	0.80	0.66	0.53	0.40	0.27	0.13	0.05	
HALEIWA_HI	21.6N	158.1W	1717	0.41	0.62	0.51	0.41	0.31	0.21	0.10	0.04	
ESPERANCE_AU	33.9S	121.9E	1721	0.17	0.26	0.21	0.17	0.13	0.09	0.04	0.02	
BURNIE_TASMANIA_AU	41.1S	145.9E	1721	0.26	0.39	0.33	0.26	0.20	0.13	0.07	0.03	
ZIHUATANEJO_MX	17.6N	101.6W	1724	0.46	0.69	0.58	0.46	0.35	0.23	0.12	0.05	
HENSLUNG_COVE_CA	54.2N	133.0W	1731	0.23	0.35	0.29	0.23	0.17	0.12	0.06	0.02	
WINTER_HARBOUR_CA	50.5N	128.0W	1740	0.28	0.42	0.35	0.28	0.21	0.14	0.07	0.03	
VERNADSKY_UK	65.2S	64.3W	1740	0.28	0.42	0.35	0.28	0.21	0.14	0.07	0.03	
OFUNATO_HONSHU_JP	39.0N	141.8E	1744	0.29	0.44	0.36	0.29	0.22	0.15	0.07	0.03	
YAKUTAT_AK	59.5N	139.7W	1748	0.22	0.33	0.28	0.22	0.17	0.11	0.06	0.02	
LEGASPI_PH	13.1N	123.8E	1749	0.13	0.20	0.16	0.13	0.10	0.07	0.03	0.01	
BAHIA_MANSA_CL	40.6S	73.7W	1815	1.03	1.55	1.29	1.03	0.77	0.52	0.26	0.10	
PUERTO_VALLARTA_MX	20.7N	105.2W	1820	0.39	0.59	0.49	0.39	0.29	0.20	0.10	0.04	
QUINTERO_CL	32.8S	71.5W	1846	0.52	0.78	0.65	0.52	0.39	0.26	0.13	0.05	
ANTARCTICA_BASE_PRA	62.5S	59.7W	1851	0.27	0.41	0.34	0.27	0.20	0.14	0.07	0.03	



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					1.50	1.25	1.00	0.75	0.50	0.25	0.10	
DART_01003	23.4S	173.4W	442	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NUKUALOFA_TO	21.1S	175.2W	516	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
TALCAHUANO_CL	36.7S	73.1W	1858	0.35	0.53	0.44	0.35	0.26	0.18	0.09	0.04	
SANTACRUZ_GALAPAGOS	0.7S	90.3W	1903	0.75	1.13	0.94	0.75	0.56	0.38	0.19	0.08	
CORRAL_CL	39.9S	73.4W	1909	0.80	1.20	1.00	0.80	0.60	0.40	0.20	0.08	
PUERTO_MADERO_MX	14.7N	92.4W	1914	0.21	0.32	0.26	0.21	0.16	0.11	0.05	0.02	
TALARA_PE	4.6S	81.3W	1918	0.34	0.51	0.43	0.34	0.26	0.17	0.09	0.03	
PORTLAND_AU	38.3S	141.6E	1934	0.15	0.23	0.19	0.15	0.11	0.08	0.04	0.02	
HAKODATE_JP	41.8N	140.7E	1936	0.33	0.50	0.41	0.33	0.25	0.17	0.08	0.03	
DART_32402	26.7S	74.0W	1936	0.09	0.14	0.11	0.09	0.07	0.05	0.02	0.01	
BUCALEMU_CL	34.6S	72.0W	1937	0.52	0.78	0.65	0.52	0.39	0.26	0.13	0.05	
COQUIMBO_CL	30.0S	71.3W	1939	1.08	1.62	1.35	1.08	0.81	0.54	0.27	0.11	
PORT_NAPIER_NZ	39.5S	176.9E	1943	0.35	0.53	0.44	0.35	0.26	0.18	0.09	0.04	
PUERTO_MELINKA_CL	43.9S	73.7W	1947	0.11	0.17	0.14	0.11	0.08	0.06	0.03	0.01	
WELLINGTON_NZ	41.3S	174.8E	1950	0.18	0.27	0.23	0.18	0.14	0.09	0.05	0.02	
QUEPOS_CR	9.4N	84.2W	1953	0.11	0.17	0.14	0.11	0.08	0.06	0.03	0.01	
PICHIDANGUI_CL	32.1S	71.5W	2012	0.71	1.07	0.89	0.71	0.53	0.36	0.18	0.07	
TALTAL_CL	25.4S	70.5W	2012	0.49	0.74	0.61	0.49	0.37	0.25	0.12	0.05	
TOCOPILLA_CL	22.1S	70.2W	2015	0.51	0.77	0.64	0.51	0.38	0.26	0.13	0.05	



Forecast by Scaling to January 15 Observations

SEA LEVEL GUAGE	LAT	LON	TIME	METERS	SCALE							
					1.50	1.25	1.00	0.75	0.50	0.25	0.10	
DART_01003	23.4S	173.4W	442	0.12	0.18	0.15	0.12	0.09	0.06	0.03	0.01	
NUKUALOFA_TO	21.1S	175.2W	516	0.82	1.23	1.03	0.82	0.62	0.41	0.21	0.08	
COCOS_ISLAND_CR	5.6N	87.0W	2030	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.00	
BALTRA_GALAPAGS_EC	0.4S	90.3W	2048	0.40	0.60	0.50	0.40	0.30	0.20	0.10	0.04	
PUERTO_ANGEL_MX	15.7N	96.5W	2053	0.38	0.57	0.48	0.38	0.29	0.19	0.10	0.04	
PORT_ALEXANDER_AK	56.2N	134.6W	2056	0.34	0.51	0.43	0.34	0.26	0.17	0.09	0.03	
PISAGUA_CL	19.6S	70.2W	2058	0.26	0.39	0.33	0.26	0.20	0.13	0.07	0.03	
LA_LIBERTAD_EC	2.2S	80.9W	2103	0.60	0.90	0.75	0.60	0.45	0.30	0.15	0.06	
CHANARAL_CL	26.4S	70.6W	2114	1.74	2.61	2.18	1.74	1.31	0.87	0.44	0.17	
CHUUK_FM	7.5N	151.9E	2124	0.06	0.09	0.08	0.06	0.05	0.03	0.02	0.01	
MEJILLONES_CL	23.1S	70.5W	2148	0.74	1.11	0.93	0.74	0.56	0.37	0.19	0.07	
MATARANI_PE	17.0S	72.1W	2224	0.48	0.72	0.60	0.48	0.36	0.24	0.12	0.05	
ARICA_CL	18.5S	70.3W	2234	1.22	1.83	1.53	1.22	0.92	0.61	0.31	0.12	
LAZARO_CARDENAS_MX	17.9N	102.2W	2235	0.19	0.29	0.24	0.19	0.14	0.10	0.05	0.02	
CALLAO_LA-PUNTA_PE	12.1S	77.2W	2634	0.79	1.19	0.99	0.79	0.59	0.40	0.20	0.08	



NWS Tsunami Hotwash
January 19, 2022

Thank You
