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اللجنة الدولية الحكومية لعلوم المحيطات

政府间海洋学委员会

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IOC Circular Letter No 2877
(Available in English only)

IOC/VR/BA/ah
31 January 2022

- To :** Tsunami National Contacts (TNCs),
National Tsunami Warning Centres (NTWCs),
Tsunami Warning Focal Points (TWP) of the Intergovernmental Coordination Group
of the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)
- cc. :** Official National Coordinating Bodies for liaison with the IOC,
Permanent Delegates/Observer Missions to UNESCO of IOC ICG/PTWS Member States
Directors of UNESCO and IOC Regional Offices in the Asia/Pacific Region
Permanent Observers to ICG/PTWS
Director Pacific Tsunami Warning Center (PTWC)
Director, Northwest Pacific Tsunami Advisory Center (NWPTAC)
Director, South China Sea Advisory Center (SCSTAC)
Director, International Tsunami Information Center (ITIC)
ICG/PTWS Officers

Subject: Post-event assessment of the Hunga-Tonga Hunga-Ha'apai volcanic eruption and tsunami of 15 January 2022

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

Upon detection of the explosion and the measures of coastal and deep-ocean sea level gauges, the Pacific Tsunami Warning and Mitigation System (PTWS) coordinated by UNESCO/IOC entered into action. Tonga National Tsunami Warning Centre (NTWC) hosted at the Tonga Meteorological Centre issued a tsunami warning at 4:31 UTC. Fiji, Vanuatu, New Zealand, and Samoa NTWCs issued tsunami advisories at 6:35, 7:35, 7:41 and 8:45 UTC, respectively. The United States issued a tsunami advisory warning for American Samoa at 5:48 UTC, for Hawaii at 10:43 UTC and for the Pacific Coast of North America (United States and Canada) at 12:53 UTC. Across the Pacific, several other PTWS Member States issued tsunami advisories and/or warnings.

The Pacific Tsunami Warning Center (PTWC) in Hawaii (USA) issued an initial threat bulletin for the entire Pacific Ocean at 6:23 UTC, two hours after the time of the eruption and after receiving real-time sea-level data from Nuku'alofa, Tonga sea level station, indicating that a tsunami was generated. The message indicated that "hazardous tsunami waves from this eruption are possible

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within 1,000 km of the volcano along the coasts of Tonga, Niue, Fiji, Wallis and Futuna, American Samoa, Samoa and Kermadec Islands". Due to the nature of the event, PTWC was not able to issue the first tsunami messages through its normal communications channels, and it could only forecast estimated arrival times but not expected tsunami heights. However, in subsequent messages, as sea level readings became available, PTWC was able to provide more detailed estimates and re-enable its message dissemination system to provide an efficient response from the whole Pacific Tsunami Warning System.

Altogether, 12 tsunami threat bulletins were issued by the PTWC over a 20-hour time span and 117 tsunami wave measurements were reported from 26 countries. The maximum amplitudes were recorded in Tonga (with waves greater than 1 meter in amplitude), in Chile, in New Caledonia and in Vanuatu. Many countries experienced waves greater than 0.3 meter in amplitude, which typically triggers marine advisories recommending to citizens to stay out of the water as strong currents and/or unusual waves may occur.

The gigantic explosion obliterated the subaerial remnants of the island, generating an atmospheric disturbance that extended into the stratosphere and that was observed by international satellites. The resulting shockwaves were measured as they traversed the globe. In some regions, the coupling of the air wave with the ocean surface generated small 'tsunami' waves that were observed on coastal gauges in the Caribbean and across the Atlantic in the Azores and Madeira and as far as Cabo Verde, as well as in the Indian Ocean in Mauritius.

Previous volcanic eruptions on the island occurred in March 2009 and November-December 2014, however none of them generated measurable tsunamis. The volcanic activity resumed in December 2021. On 13 January 2022, the Tonga NTWC issued a tsunami marine warning after a smaller volcanic eruption. The ensuing gigantic explosion hours later was unprecedented.

This is the first time that the PTWC had to respond to such an event since the system is primarily focused on earthquake-generated tsunamis causing nearly 90% of the world's historical tsunamis.

In 2015 at its 8th session, the IOC Working Group on Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS-WG) decided to adopt an IOC all-ICG¹ Post-Event Assessment Questionnaire to be triggered when there is a tsunami threat of more than 1 m-amplitude forecast in one or more countries of a region. The decision to trigger the post-event questionnaire is taken by the regional Tsunami Information Centre (TIC) in consultation with the ICG Steering Group and Secretariat concerned taking into consideration whether the tsunami resulted in a national response in one or more countries.

For the 15 January 2022 Hunga Tonga-Hunga Ha'apai volcanic explosion and shockwave, no amplitude forecast was possible during the event since it was not triggered by an earthquake. However, observations of more than 1 m amplitude waves were measured in several countries and tsunami advisories or warnings were issued by more than one country, thus meeting the existing formal criteria for triggering the assessment. Further consultation by the International Tsunami Information Centre and the Technical Secretary of the ICG for the Pacific Tsunami Warning and Mitigation System with the PTWS Steering Committee in the week following the event indicated consensus to proceed with the dissemination of the post-event assessment.

An editable copy of the "IOC Post-Event Survey Questionnaire for the 15 January 2022 Hunga-Tonga Hunga-Ha'apai volcanic eruption and tsunami" that is made available online at <https://www.surveymonkey.com/r/PTWS-PEA-15jan22> is attached to this letter. TNCs, NTWCs and TWFPs are kindly requested to provide one national consolidated response to the online questionnaire for their country by 15 February 2022. The responses received will be compiled and made public through a publication to be released by 1 April 2022.

¹ Intergovernmental Coordination Groups that pilot the four regional Tsunami Warning and Mitigation Systems

I am counting on your active participation in this assessment and remain,

Yours sincerely,

[signed]

Vladimir Ryabinin
Executive Secretary

Attachment: Editable copy of the online IOC Post-Event Survey Questionnaire for the 15 January 2022 Hunga Tonga-Hunga Ha'apai volcanic eruption and tsunami (*PDF- English only*)