REPORT OF THE TASK TEAM ON TSUNAMI PROCEDURES FOR VOLCANIC CRISES

Recommendation ICG/CARIBE-EWS-XI.3 decided to establish an ICG/CARIBE-EWS Task Team to identify the procedures to follow for volcanic crises. The Task Team provided an interim report at ICG/CARIBE EWS XII, XIII, XIV and XV, and through this document provides a final report that includes a procedure for review and approval by Member States

This is the final report of the Task Team on Tsunami procedures for volcanic crises.

Background

Volcanic unrest of Kick'em-Jenny during the week of 13th July 2015, prompted a discussion at the 11th session of the ICG/CARIBE EWS about the potential for tsunami waves created by volcanic crises and the related response from warning centers, emergency management and public services, in particular with respect to the potential tsunami threat. Recommendation ICG/CARIBE-EWS-XI.3 recommended to establish an ICG/CARIBE-EWS Task Team to identify the procedures to follow for volcanic crises. The Task Team on Tsunami procedures for volcanic crises was created in 2016.

Recommendation ICG/CARIBE-EWS-XI.2 suggested that the ICG identify volcano observatories as the primary entities responsible for determining the potential of a volcano-induced tsunami threat.

Recommendation ICG/CARIBE-EWS-XIII.6 decided that Caribe Wave 19 will propose a scenario with a local event associated with an underwater volcanic eruption at the Kick'em Jenny submarine volcano northwest Grenada in southern Lesser Antilles

Recommendation ICG/CARIBE-EWS-XIV.6 noted that for the first time a volcano source was tested and feedback was gathered on the experimental volcano products to be issued by PTWC

Recommendation ICG/CARIBE-EWS-XV.5 suggests that the CARIBE WAVE 23 exercise consist of 3 scenarios including a volcanic eruption of one of the volcanoes of the Lesser Antilles.

Narrative summary

During the inter-sessional period, the volcano TT has:

- Worked on standard and formatted messages that could be issued by volcano observatories and/or institutes responsible for monitoring volcanoes in case of a potentially tsunamigenic event ;
- Worked on the draft of a Memorandum of Understanding (MoU) that could be signed between the TSP and volcano observatories and/or institutes responsible for monitoring volcanoes ;
- Collaborated with the CARIBEWAVE23 TT to prepare Mount Pelée scenario ;
- Elaborated the specific messages issued towards the TSP by the Seismological and Volcanological Observatory of Martinique (OVSM/IPGP) regarding the Mount Pelée scenario as reported in the Caribe Wave handbook.

- Presented the recent advance in the implementation of tsunami procedures in case of volcano crises to the LACSC meeting (Quito, Sept. 22), to the Cuban Geological Convention (La Havane, April 23) and to the SSA meeting (Puerto. Rico, April 23)

Standard and formatted text messages issued by volcano observatories in case of a potentially tsunamigenic event

Recent volcanic crisis in the Caribbean show that there are two different cases where the TSP needs to issue messages towards the NTWC:
- in the case of a volcanic activity showing phenomena potentially tsunamigenic for if a tsunami is observed;
- in the case of an escalation of volcanic activity to be able to advise MS.

In both cases, this information originates from the volcano observatory in charge of the monitoring of an unrest volcano. In both cases, this might correspond to a change in the volcano activity level.

Constraints on these bulletins are standard formatted information, basic information on the volcano (name, location, eruptive activity stage), information on the potential or occurring tsunami (location, time, amplitude, validity of the observation).

Furthermore, keeping in mind that this information is sent at the beginning of a volcano crisis, when all the staff of the volcano observatory is involved in emergency tasks (and is probably lacking expertise both in the field of tsunami and in the CARIBE-EWS), it is important for volcano observatories to have bulletins for tsunami as simple as possible and as similar as possible to Volcano Observatory Notice for Aviation (VONA) bulletins, which are also issued when there is a change in the volcano activity level.
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Our TT propose a Volcano Observatory Notice for Tsunami Thread (VONUT), derived from VONA, and constructed with the following fields:

VOLCANO OBSERVATORY NOTICE FOR TSUNAMI THREAT

(1) VOLCANO OBSERVATORY NOTICE FOR TSUNAMI THREAT-VONUT	
(2) Issued: Universal (Z) date and time (YYYYMMDD/ HHMMZ):	
(3) Volcano: Name and number (per Smithsonian database at http://volcano.si.edu/):	Pre-filled
(4) Current Aviation Colour Code: **GREEN, YELLOW, ORANGE, OR RED** in upper case bold font	
(5) Previous Aviation Colour Code: Lower case font, not bold	
(6) Source: Name of Volcano Observatory (volcanological agency)	Pre-filled
(7) Notice Number: year-VONUT number (e.g. 2010-1)	
(8) Volcano Location: Latitude, longitude in NOTAM format (deg min N or S deg min W or E, e.g. 4701N 0513W)	Pre-filled

VOLCANO OBSERVATORY NOTICE FOR TSUNAMI THREAT

(9) Area: Regional descriptor	Pre-filled
(10) Summit Elevation: nnnnn FT (nnnn M)	Pre-filled
(11) Volcanic Activity Summary: Concise statement that describes activity at the volcano. If known, time of onset and duration of eruptive activity are specified (local and UTC).	
(12) Sea sector of the impact (North/South, East, West) "UNKNOWN" if no data available	
(13) Name of the sea (Caribbean, Atlantic, Dominique Channel, etc) "UNKNOWN" if no data available	
(14) Closest tide gauge stations Indicate name and url (from IOC web site: https://www.ioc-sealevelmonitoring.org/station.php?code=) of tide gauges at less than 100 km. A map of tide gauge locations and name is Annex 4.	Pre-filled
(15) Remarks: Optional; brief comments on related topics such as monitoring data, observatory actions, volcano's previous activity, sea level disturbance observed, etc.	
(16) Contacts: Names, phone numbers (voice and fax), email addresses.	Pre-filled
(17) Next Notice: "A new VONUT will be issued if conditions change significantly or the colour code changes." "Final notice" if final notice for an event. URLs of Websites where the latest volcanic information is posted are included.	

Memorandum of Understanding (MoU) that could be signed between the TSP and volcano observatories

We also prepared the draft of a MoU, based on the MoU signed by volcano observatories with the Civil Aviation for issuing VONA. This MoU might be used by volcano observatories as guiding procedures. It contains an introduction to be signed by volcano observatories, the list and the coordinates to which volcano observatories have to send their VONUT (hence towards TSPs and relevant stakeholders), the VONUT itself and 3 annexes : (1) a table with Volcano level of alert color codes, (2) a schematic representation of volcanic sources of tsunamis, and (3) a local map with tide gauges within 100 km.

It still has to be improved and discussed with people in charge of volcano observatories.

Mount Pelée CARIBEWAVE23 scenario

The chair of our TT has been invited by CARIBEWAVE23 TT as an expert to prepare the Mount Pelée (Martinique) scenario and the messages issued by the Seismological and Volcanological Observatory of Martinique (OVSM/IPGP).

CW23 scenario was based on a moderate flank collapse, which occurs on the southwestern flank of Mount Pelée volcano, at the beginning of an explosive eruption. This scenario is based on previous studies on Mount Pelée flank collapses, which have been identified in the topography and by offshore submarine deposits, and on a recent study where laboratory experiments are compared to numerical modeling for Mount Pelée flank collapses (Poulain et al., 2023).

Two VONUT messages were issued by the OVSM/IPGP. The first one was issued 30 min before the beginning of the exercise to simulate a change in the volcano activity level from orange to red. This first message can be assimilated to a watch message towards the TSP, so that it begins to closely monitor sea level stations in the vicinity of the volcano.

The second one was issued by OVSM/IPGP 5 min before the beginning of the exercise to inform the TSP of the occurrence of a large dome collapse that has reached the Caribbean Sea.

After discussion with EMIZA, the French regional Disaster Manager Organization, we would like to add two remarks to the CCW23 survey:

- in the messages from the TSP, a link to a direct source of information, i.e., to the volcano observatory web page is missing. As it is provided in the VONUT by the volcano observatory, we suggest to the TSP to include it in its text messages in the case of a volcanic event.

- EMIZA expressed its interest, as a table exercise, to simulate at the same time the beginning of a volcanio eruption and a tsunami. They hope that other CW exercises based on volcanic eruption will be planned.

Recommendations

Tsunami procedures for volcanic crises

The Intergovernmental Coordination Group for the for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS),

Considering the report of TT for tsunami procedures for volcanic crises,

Noting the list of potentially threatening volcanoes and the list volcano observatories and institutes responsible for monitoring volcanoes for the Caribbean established by the TT,

Noting the draft of a Memorandum of Understanding (MoU) established by the TT to be used between the TSP and the volcano observatories and/or institutes responsible for monitoring volcanoes,

Recognizing the use of Volcano Notice for Tsunami Threat (VONUT) during CARIBEWAVE23 between the volcano observatory of Martinique and the TSP,

Suggests that the TSP includes the VONUT messages in its procedures to activate its alert system,

Recommends that ICG/CARIBE-EWS (WG3 ?) initiate contacts with the identified volcano observatories and/or institutes responsible for monitoring volcanoes threatening the Caribbean basin, to implement the MoU et the VONUT.

Noting the 2020-2021 eruption of the La Soufrière volcano in Saint Vincent and the Grenadines, La Palma eruption in 2021, the increasing level of volcanic activity at Soufrière of Guadeloupe, and the Hunga Tonga Hunga Ha'apai eruption and tsunami in 2022,

recommends that WG1 maintain a specific watch on sea level networks around active volcanoes, continues the activities of its group to advise on the installation of temporary sea level sensor networks around volcanoes when volcanic activity increases, continues its evaluation and actions towards the use of GNSS-R in real time, to increase the sea level station network.

Further recommends that WG2 continue to investigate volcanic sources in the Caribbean and impulse numerical modelling based on volcanic sources.

Further recommends that WG3 develop contacts with Caribbean and Atlantic volcano observatories and/or institutes responsible for monitoring volcanoes, with the objective to establish communication procedures between them and the TSP, possibly using our drafted MoU.

Further recommends that WG4 help improve public awareness on tsunamis generated by volcanic activity.

Noting the interest expressed by MS for CARIBEWAVE exercises based on volcano eruption,

Considering the on-going implementation of communication procedures between the TSP and volcano observatories and/or institutes responsible for monitoring volcanoes,

Acknowledging the on-going changes made by the TSP to modify its procedures to activate its alert system in case of non-seismic event and its experimental text products,

Recommends that volcanic eruptions and/or landslides as a source of tsunamis in the Caribbean basin continue to be considered for future CARIBEWAVE exercises,

Considering the report of the Ad Hoc Team on Tsunami Generated by Volcanoes (TGV) presented at TOWS 2023,

Recommends that volcano list and volcano observatory list for the Caribbean established by the TT and the Volcano Notice for Tsunami Threat (VONUT) used during CARIBWAVE23 exercise be shared with the Ad Hoc Team on Tsunamis Generated by Volcanoes (TGV Team) of TOWS-WG Task Team on Tsunami Watch Operations (TT-TWO),