Preliminary assessment of Hunga Tonga-Hunga Ha'apai volcanic eruption and tsunami in Tonga using the World Bank's GRADE methodology
Frequently Asked Questions – FAQs

Background: Following the Hunga Tonga-Hunga Ha'apai (HTHH) volcanic eruption and tsunami in Tonga on January 15, 2022, the Ministry of Finance requested the World Bank to carry out a remote assessment of the damages using the Global RApid post-disaster Damage Estimation (GRADE) methodology.

General Questions - Report and Findings

1. ***Who produced this report****?*

   The assessment was conducted by the GFDRR's Global Program for Disaster Risk Analytics that includes the World Bank's Disaster-Resilience Analytics and Solutions (D-RAS) team. This is a team of technical experts that provides advisory and analytical services and develops custom-built tools and solutions in the area of disaster risk management. This work was funded through the Global Facility for Disaster Reduction and Recovery (GFDRR).

2. ***How was the assessment conducted in the context of COVID-19 restrictions in place in Tonga?***

   The GRADE approach is a remote, desk-based, rapid damage assessment method deployed soon after a disaster. The approach adopts evolving and innovative natural hazard risk modeling technologies to fulfill post-event damage assessment requirements rapidly. The methodology underpinning the assessment is freely available at https://www.gfdrr.org/sites/default/files/publication/DRAS_web_04172018.pdf.

   Due to the travel restrictions related to the global COVID-19 pandemic, local published datasets were referenced and incorporated, to the extent possible.

3. ***What are the key findings of this report?***

   - The **total cost of direct economic damages to buildings, infrastructure, and agriculture is approximately (US$90 million/TOP 208 million) and equivalent to approximately 18.5% of GDP**. Given large uncertainties in the direct and indirect effects of the ashfall over the next months and harvesting season, as well as the potential costs of ash clean-up efforts in the private and public sectors , damages are likely greater than those estimated.
   - **The spatial distribution of damages was highly variable with some outer islands experiencing close to complete destruction (Atata, Mango) and others (Vava'u group) experiencing minimal damage from ashfall.** Tongatapu and 'Eua experienced severe tsunami damage in some locations and were also covered by around 20 mm of ash causing disruption and impacting water supply for families that rely on rainwater for their water supply.

4. ***What is included in the estimates of economic damages?***

   The cost of damage to residential buildings (US$14.9 million/TOP 33.8 million) includes damage to housing units and settlement infrastructure but not relocation. The cost of damage to non-residential buildings (US$28.8 million/TOP 65.3 million) includes damages to sectors such as tourism, health facilities, schools, public administrative buildings, religious buildings, commercial office and private sector buildings. The cost of infrastructure damage (US$20.9 million/TOP 47.4 million) includes damages to sectors transport, power and water, wharfs, ports and airports, and the submarine cable. The cost of agriculture, forestry and fishing (US$20.9 million/TOP 47.4 million) refers to damages to crops and livestock and fishery sector.

Most of this economic damage is related to the impact of the tsunami, except for agriculture and infrastructure sectors. The GRADE assessment also estimates the cost of ash clean up to be approximately $4.9M and this is mostly within Tongatapu.

In line with other assessments done by the Government of Tonga and the Bank's GRADE approach, these numbers also represent the replacement value to damage structures as opposed to building back better to a higher standard of a building code.

5. ***What is the main benefit of this type of assessment?***

The main benefit is the speed at which the damage estimation can be produced, and the ability to conduct the assessment remotely. Within **14-21 days** of an event, stakeholders can have access to estimates and spatial distribution of damages. This can support the development of post-disaster recovery and reconstruction strategies, and inform appropriate, timely, and efficient courses of action. The GRADE approach and outputs are particularly useful in the current context, to support quantification of the spatial extent and severity of a disaster's physical impact.

For the HTHH volcanic eruption and tsunami, as of February 10, 2022, this is the first report to produce a preliminary estimate of damages based on scientific, economic and engineering data and analysis, which could inform disaster recovery and reconstruction processes.

Technical Questions – Assessment and Methodology

6. ***What data was used in this assessment?***

GRADE is based on an open loss modeling approach developed by the World Bank's Disaster-Resilience Analytics and Solutions (D-RAS) team, that includes:

- Analysis of satellite/aerial imagery from NZDF/ADF and other ground collected reconnaissance data
- Remote-sensing imagery (UNOSAT, COPERNICUS, DigitalGlobe, Google, OSM, MapAction),
- Exposure data (CATDAT), Historical Loss Data (PDNAs, IDAs, etc.), Vulnerability assessments
- Data shared such as the Tongatapu Multi Hazard Disaster Risk Assessment 2021, By GoT, and ADB; and risk information shared by GNS Science, New Zealand
- Information coming out of early assessments, as well as social media data

7. ***How certain/uncertain are the figures presented?***

The assessment carries a significant degree of reliability. The GRADE method has supported assessments for 25 disasters over the past seven years, with "like for like" field estimations accuracy (when compared with subsequent and more-detailed post-disaster analyses, such as the Post-disaster Damage and Needs Assessment (PDNA)). The results are calibrated against an inflow of consequence data (remote sensing, drone footage, social media videos, early assessments, crowdsourced info). However, GRADE's outputs are still estimates arising from remote-based calculations that are influenced and updated from available ground-based data. While there is confidence in the *overall* economic estimates and distribution of damage, the confidence level at the individual asset level is low. Overall, the results are influenced by availability, accuracy, vintage, socioeconomic/political sensitivities of baseline exposure, and the flow of damage data during the early post-disaster period.

8. ***How can this complement government or other assessments?***

   The GRADE assessment can inform and serve as inputs to Government-led damage and loss assessment processes. It can provide decision-makers with a first order of the disaster's impact in order to gauge the magnitude of the event's consequences, provide information on differential geographic impacts, and inform on relative public versus private sector damages. Furthermore, the assessment can contribute to baseline information needed for the design of rehabilitation and reconstruction-recovery plans. In this way, the results could support the design of a short-term plan to re-establish affected services and to stabilize conditions of affected populations through temporary measures. It can also provide information for investment plans and for intervention strategies for the recovery and reconstruction of damaged infrastructure.

9. ***What are some limitations of this assessment?***

   Economic losses such as the impacts of business interruption and land value are not captured. The assessment looks mainly at the direct physical damage to buildings and infrastructure, which is crucial information needed in order to quantify and plan reconstruction efforts.

10. ***Has this assessment been used for other countries; is it standard practice of the World Bank to conduct these kinds of assessments? Can you give examples of how other countries used this kind of assessment?***

    Every disaster is unique, and the World Bank does not conduct a rapid assessment for each disaster; rather it focuses on cases where it can provide added value to government counterparts. These critical damage estimations can be done rapidly, remotely, and with high levels of accuracy without complicating the situation on the ground. This has proven particularly valuable over the past years. The COVID-19 pandemic has sparked a greater demand for GRADE, with 10 GRADEs conducted over the past 12 months alone.

    The GRADE approach has been successfully used for 25 disasters over the past 7 years, including **Vanuatu** (after Tropical Cyclone Harold in 2020), **Fiji** (after Tropical Cyclone Yasa in 2020), **Croatia** (after the earthquake in 2020), **Myanmar** (after the monsoon floods in 2019), Indonesia (after the Central Sulawesi earthquake and tsunami in September 2018), **Madagascar** (after Cyclone Enawo in March 2017 and Cyclone Awa in January 2018), **Haiti** (after Hurricane Matthew in October 2016), Ecuador (after the earthquake on April 16, 2016), **Nepal** (after the earthquake in 2015), **Dominica** (after cyclone Maria in September 2017) and **Guatemala** (after the Fuego volcanic eruption in 2018).

    GRADE assessments help countries to identify preliminary financing needs and post-disaster recovery strategies. For example, after Cyclone Enawo in **Madagascar** (March 2017), the outputs from GRADE provided swift assessments that informed the preparation and implementation of disaster relief and emergency response strategies, improving the effectiveness of the response. Also, after Hurricane Matthew in **Haiti** (October 2016), the outputs helped develop the rapid PDNA, which, in turn, was used by the International Monetary Fund (IMF) to determine whether it should trigger its post-crisis mechanism for the country. More recently, following the Tropical Cyclone Yasa in **Fiji** (December 2020), the GRADE assessment helped to leverage financing from the Crisis Response Window.