

GITA-18: COMPREHENSIVE SATELLITE DETECTED BUILDING DAMAGE ASSESSMENT OVERVIEW AS OF 28 FEBRUARY 2018

Version 1.0

UNOSAT Activation: TC20180209TON

28 February 2018

Geneva, Switzerland

Overview

Tropical cyclone GITA-18 originated as a monsoon in the southern Pacific on the 9 February 2018 and gained intensity while moving to Samoa and Tonga islands. On Monday 12 February GITA-18 made landfall on Tonga as a tropical cyclone of category 4, severely affecting Tongatapu and 'Eua Islands, and continued west towards the Fiji Islands, which also have been significantly hit. The cyclone has caused the loss of 2 people and has affected more than 80 thousand people in Tonga, who were exposed to wind speeds higher than 120 km/h, with peaks of 231 km/h. According to [Tonga National Emergency Management Office report](#) and the [9th Situational Report](#) as of the 26 February 2018, 205 families are still in 44 evacuation centres, 41 in Tongatapu and 3 in 'Eua. In addition 69 primary schools in Tongatapu and 'Eua have received relief supplies from UNICEF. Further assessments are still required in terms of WASH and the food security needs on both islands.

On Monday 12 January 2018 UNITAR-UNOSAT on behalf of UN OCHA Regional Office for Asia and Pacific (ROAP) activated the International Charter on Space and Major Disasters to support the planning and coordination of emergency response operations with satellite analysis in Tonga. The Project Manager (PM) nominated for this [Charter Call](#) is UNITAR-UNOSAT, which along with Copernicus Emergency Management Service are supporting the emergency by providing satellite-derived value-added analysis & mapping products in the islands of 'Eua and Tongatapu.

Consequently, and with the purpose of improving the coordination and reduce duplication of efforts during emergency response operations, UNITAR-UNOSAT developed a GDACS' Satellite Mapping and Coordination System platform ([SMCS](#)) for this specific event. This coordination tool supports the humanitarian community with updated information about the on-going and planned satellite imagery analysis delivered by different agencies or mapping groups. Summary of the comprehensive satellite derived analyses are compiled in the present document.

Satellite-Detected Building Damage Assessment: Methodology and considerations

In response to the emergency caused by GITA-18, UNITAR-UNOSAT and Copernicus EMS performed building damage assessment analyses using pre- and post-event satellite data. In the present document, UNITAR-UNOSAT compiles the main results of these analyses in one map in order to present a comprehensive building damage overview covering the most affected areas. The table below provides satellite detected damage statistics Tongatapu Island. Figures are based upon analysis of satellite imagery acquired on the 13th, 14th, 15th, 16th and 21st of February 2018, as well as pre-event baseline data from [OpenStreetMap contributors](#). It is important to note that building damage estimates are based exclusively on satellite imagery analysis and it has not been validated on the field.

Table 1 – UNITAR-UNOSAT Preliminary Satellite-Detected Building Damage Assessment – GITA-18 as of 28 February 2018

District	Pre-event buildings (baseline)	Damaged buildings	Percentage of damaged buildings	Analysis extent	Agency or Mapping group	Links
Kolovai	1,303	299	22.9	Fahefa, Teeki, Masilamea, Kala'au, Foui, Kolovai, Kanokupolu, Ha'atafu	COPERNICUS EMS	Fahefa and surroundings Kolovai and surroundings
Kolofo'ou	5,788	1,273	22.0	Nuku'alofa East, Popua	UNITAR-UNOSAT & COPERNICUS EMS	Eastern part of Nuku-alofa
Kolomotu'a	4,898	1,505	30.7	Sia'atoutai, Puke, Hofoa, Kolomotu'a, Havelu, Nuku'alofa West	COPERNICUS EMS	Western Part of Nuku-alofa
Lapaha	2,105	963	45.7	Nukuleka, Makaunga, Talafo'ou, Manuka, Navutoka, Hoi, Kolonga, Afa, Niutoua, Mua	UNITAR-UNOSAT	Nukuleka, Hoi, Mua & Alaki Makaunga, Kolonga, Niutoua and surroundings
Nukunuku	1,985	593	29.9	Nukunuku, Matafonua, Fatai, Lakepa, 'Utulau, Ha'alalo, Houma, Vaotu'u, Matahao	UNITAR-UNOSAT & COPERNICUS EMS	Fatai and surroundings Houma and surroundings
Tatakamotonga	2,333	910	39.0	Alaki, Holonga, Pelehake, Fatumu, Havelutiku, Lavengatonga, Hamula, Nakolo, Fa'amotu	UNITAR-UNOSAT	Fatumu, Haveluliku and Pelehake Fua'amotu
Vaini	3,965	2,162	54.5	Malapo, Vaini, Longoteme, Folaha, Nukuhetulu, Veitongo, Ha'ateiho, Pea, Liahona	UNITAR-UNOSAT & COPERNICUS EMS	Holonga, Malapo, Vaini, Longoteme and Fohala Veitongo and surroundings
Total	22,377	7,705	34.4	Togatapu	UNITAR-UNOSAT & COPERNICUS EMS	UNITAR-UNOSAT COPERNICUS EMS

*Pre-event buildings provided by OpenStreetMap contributors

Disclaimers and considerations:

- Pre-event buildings (baseline)** and further pre baseline data were provided by OpenStreetMap contributors as of 12 February 2018. The percentage of damaged buildings could be influenced by the completeness of this data. Please note that UNITAR-UNOSAT considered this baseline data.
- Damaged buildings** refers to the results of satellite-derived analysis that used pre- and post-event data to identify the potentially affected structures. This analysis was performed over cloud free areas and within the extent of the satellite image.
- Percentage of damaged buildings** refers to the number of damaged buildings in relation to the total number of pre-event buildings, while taking in account the following two considerations:
 - Cloud cover.** In certain areas, the percentage of cloud cover was not available or not provided. In the "NA" case, the percentage of damaged buildings was computed with the total number of pre-event buildings of the island or territory. On the contrary, if the cloud cover was provided, the percentage of damaged buildings was computed only with the total number of pre-event buildings within the cloud-free area.

$$\frac{\text{Damaged buildings}}{\text{Pre event buildings}} * 100 \quad \text{or} \quad \frac{\text{Damaged buildings}}{\text{Pre event buildings} - \text{Buildings under cloud cover}} * 100$$

- Analysis extent.** The percentage of damaged buildings was computed with the total number of pre-event buildings within the image extent.

$$\frac{\text{Damaged buildings}}{\text{Pre event buildings}} * 100 \quad \text{or} \quad \frac{\text{Damaged buildings}}{\text{Pre event buildings} - \text{Buildings outside analysis extent}} * 100$$

For further information, please contact directly the pertinent mapping group: [UNITAR-UNOSAT](#) or [Copernicus EMS](#).

This document is part of an on-going satellite monitoring program of UNITAR-UNOSAT for the GITA-18 Tropical cyclone in support of international humanitarian assistance and created to respond to the needs of UN agencies and their partners. Please send feedback to UNITAR-UNOSAT at the contact information below.

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Tongatapu Island

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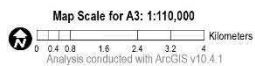


Comprehensive Building Damage Assessment & Related Density in Tongatapu Island, Tonga

This map illustrates comprehensive building damage assessment and related density in Tongatapu island by district as detected by Pleiades and WorldView-2 satellite imagery following the passage of the tropical cyclone GITA-18. The UNITAR-UNOSAT analysis combined with Copernicus EMS analysis identified about 7,700 potentially damaged structures across the Tongatapu Island. According to the pre-event building footprints provided by Humanitarian Open Street Map, this represents 34% of the total number of structures / buildings. The most affected districts in terms of percentage of damage are Vaini & Lapaha, with an estimate of 55% and 46% of damage. This is a preliminary analysis and has not yet been validated in the field. Please send ground feedback to UNITAR-UNOSAT.

Legend

- Populated place
- Visible damage
- Road
- District boundary
- Damage density level**
- High damage density
- Low damage density



Coordinate System: WGS 1984 UTM Zone 15
 Projection: Transverse Mercator
 Datum: WGS 1984
 Units: Meter



Satellite Data (Post): Pleiades
 Imagery Dates: 14, 15, 16 & 21/02/2018
 Resolution: 50 cm
 Copyright: CNES 2018 Distribution Airbus/Defence and Space

Source: Airbus Defence and Space
 Satellite Data (Post & Pre): WorldView-2 & WorldView-3
 Imagery Date: 13/02/2018 / 12/01/2018 (12/02/2018)
 Resolution: 50 cm
 Copyright: DigitalGlobe, Inc.

Source: USGS-HDDS
 Road data & building footprints: OpenStreetMap contributors
 Imagery Date: 13/02/2018 / 12/01/2018 (12/02/2018)
 Analysis: UNITAR - UNOSAT
 Production: UNITAR - UNOSAT

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