

Covered Area Rainfall Event (16/11/2024 to 18/11/2024)

Excess Rainfall

Event Briefing

Belize

27 November 2024

1 INTRODUCTION

This event briefing describes the impact of rainfall on Belize, which was associated with a Covered Area Rainfall Event (CARE) starting on 16 November 2024 and ending on 18 November 2024. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was below the attachment point of Belize’s Excess Rainfall policy, therefore no payout is due to the Government of Belize on its Excess Rainfall policy. However, the Wet index was greater than 1 therefore, a payout of US\$ 805,794.00 was made, under the Wet Season Trigger endorsement of the Belize’s Excess Rainfall policy, to the Government of Belize.

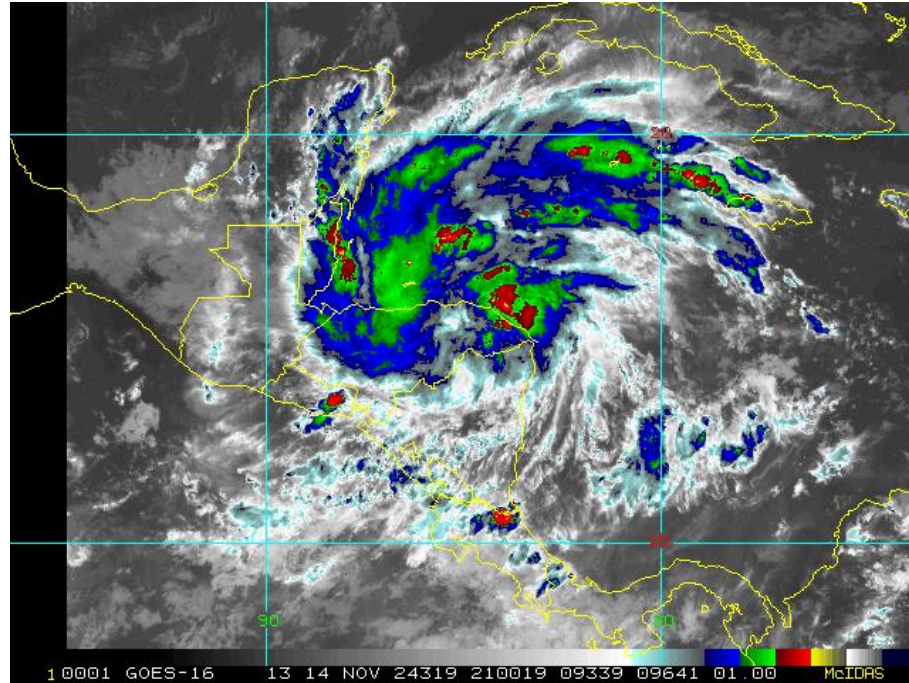
2 EVENT DESCRIPTION

On 14 November 2024 at 1800UTC, the National Hurricane Center (NHC) reported that a tropical storm formed just east of Honduras, and it was named Sara. The centre of the tropical cyclone was located near latitude 15.7° North and longitude 82.9° West, about 50 mi (85 km) NE of Cabo Gracias a Dios on the Nicaragua/Honduras border. Satellite images depicted a large convective band to the northwest of the centre of Sara and that reached Belize (Figure 1a). The associated moderate to locally intense precipitation affected the country mostly in the late hours of 14 November (Figure 1a)

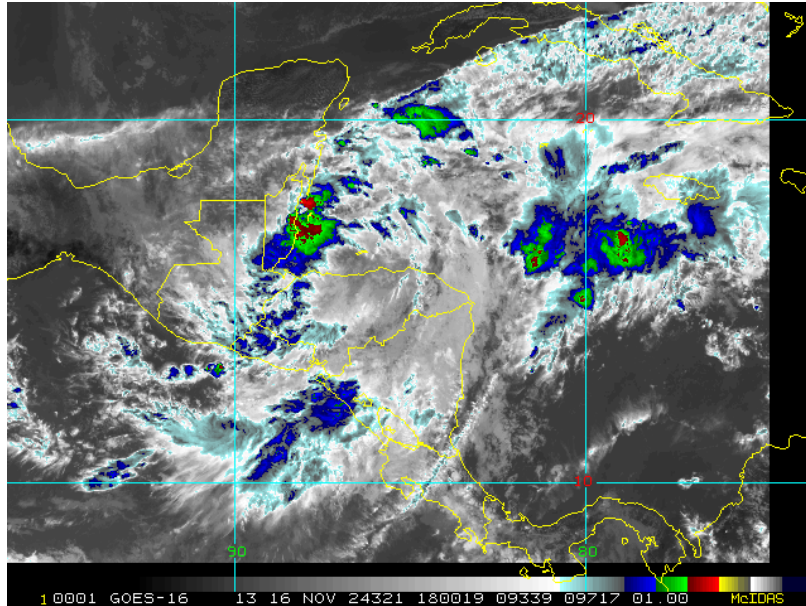
The cyclone was initially steered by a mid-level ridge to the north, resulting in it progressing westward at 12 mph (19 km/h) towards Central America. However, during the following two days, 15 and 16 November, Sara decreased its forward motion and turned west-northwest, passing almost parallel to the northern coast of Honduras, heading towards Belize City, Belize. During this period, Sara maintained almost unvaried intensity, despite the convective structure gradually losing organization. On 16 November at 1800UTC, Tropical Storm Sara was located near latitude 16.3° North, longitude 86.8° West, about 125mi (200 km) SE of Belize City, Belize. It presented maximum sustained winds of 45 mph (72 km/h) and a minimum central pressure of 1002 mb (Figure 2). The satellite imagery revealed a disorganized convective structure, with a broken curved band on the northwest side, located over Belize, and low convection near the centre of circulation (Figure 1b). The convective rainband spread moderate to locally intense rainfall over most of Belize, particularly over the coastal regions, mainly during the late hours of the day.

During the first 12 hours of 17 November, Sara remained a poorly organized tropical storm, with the most significant banding features in the northern semicircle well away from the low-level centre. The system maintained a slow forward motion of 5 mph (7 km/h) towards the west-northwest, heading towards Belize. Despite the close proximity to Belize, the strongest winds (less intense than tropical-storm-force) and the most active convection remained generally confined offshore, affecting marginally the coastal area of northern Belize. At 1400UTC, Tropical Storm Sara made landfall near Belize City, with maximum sustained winds of 40 mph (65 km/h) and a minimum central pressure of 1003 mb. The satellite imagery showed a burst of convection near the low-level centre, which moved inland and crossed central Belize from east to west, leaving the country at 1800UTC (Figure 1c). At the same time, Sara weakened into a tropical depression.

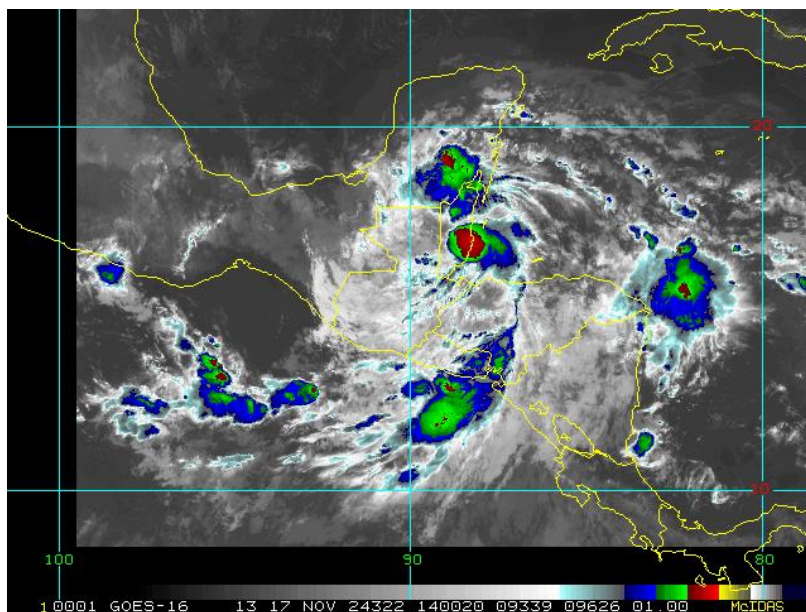
During the late hours of 17 November and the first hours of 18 November, the depression moved inland, crossing Guatemala and eventually degenerated into a trough of low pressure over the Yucatán Peninsula on 18 November at 0900 UTC. Although the system weakened, a burst of convection developed over northern Belize and affected the area with moderate to intense precipitation between 0300UTC and 0600UTC of 18 November.



a) 14 November at 2100UTC



b) 16 November at 1800UTC



c) 17 November at 1400UTC

Figure 1 Satellite imagery on 14, 16 and 17 November 2024, at different times as indicated in the labels from the thermal infrared channel enhanced with colour. Blue/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the red/yellow colours represent very high altitude clouds (top cloud lower than -70°C). High altitude clouds indicate strong convection associated with intense precipitation. Source: NOAA, National Environmental Satellite, Data and Information Service ¹.

¹ RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://rammb-data.cira.colostate.edu/tc_realtime/storm.asp?storm_identifier=al192024

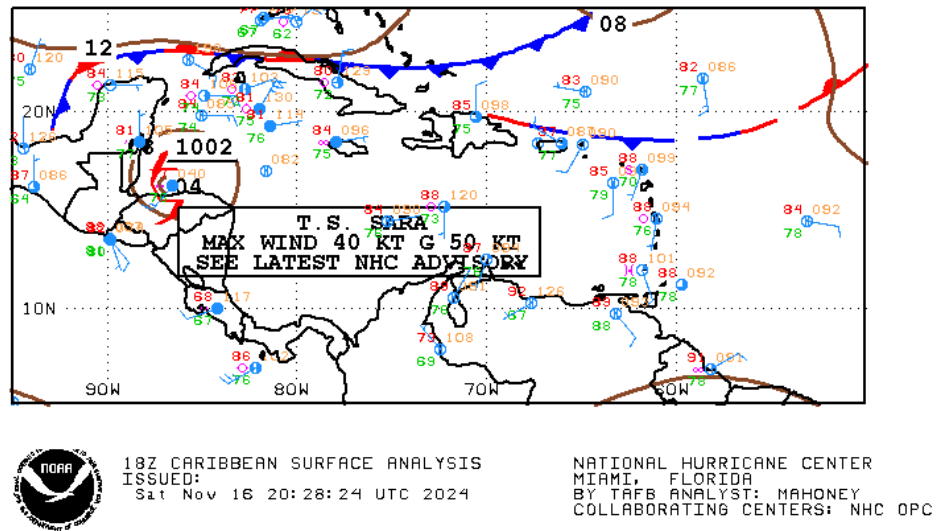


Figure 2 Surface analysis over the Caribbean area on 16 November 2024 at 1800 UTC. Source: US National Hurricane Center²

3 REPORTED IMPACTS

At the time of writing this report, there was little information about damages in Belize due to this Covered Area Rainfall Event during the indicated period.

Tropical Storm Sara caused flooding in different areas causing partial blockades on roads and bridges. The Prime Minister visited some of the affected areas.³



Figure 3 Flooding area and blocked road

² National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 16 November 2024, available at: https://www.nhc.noaa.gov/tafb/CAR_18_Z.gif

³ [Government of Belize Press Office Facebook page](#)

Authorities reported no casualties, water levels continued to increase and were monitored. By November 18 at least 162 people were evacuated to 10 different official shelters and 3 private shelters. Authorities were prioritizing water, sanitation, and hygiene (WASH) needs, particularly in the South and Cayo districts, while health teams monitored water quality in shelters⁴.

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15⁵, detected the occurrence of precipitation over the Belize and the surrounding waters during the period 14 to 18 November 2024. Each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 5. A CARE for Belize was activated on 16 November and lasted until 18 November. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation⁶ and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in Belize was 14 to 18 November 2024.

CMORPH	CMORPH reported total accumulated values of precipitation higher than 150 mm over the central area among the districts of Cayo, Belize and Stann Creek. Lower values were reported for the rest of the country.
IMERG	IMERG reported total accumulated values of precipitation higher than 200 mm over the districts of Cayo, Belize, Stann Creek and Corozal. Lower values were reported for the rest of the country.
WRF5	WRF5 showed total accumulated values of precipitation higher than 150 mm for the northern part of Belize, while lower values than 90 mm were reported for the southern area.

⁴ [Central America: Tropical Storm Sara - Flash Update No. 2 \(as of 18 November 2024\) - Honduras | ReliefWeb](#)

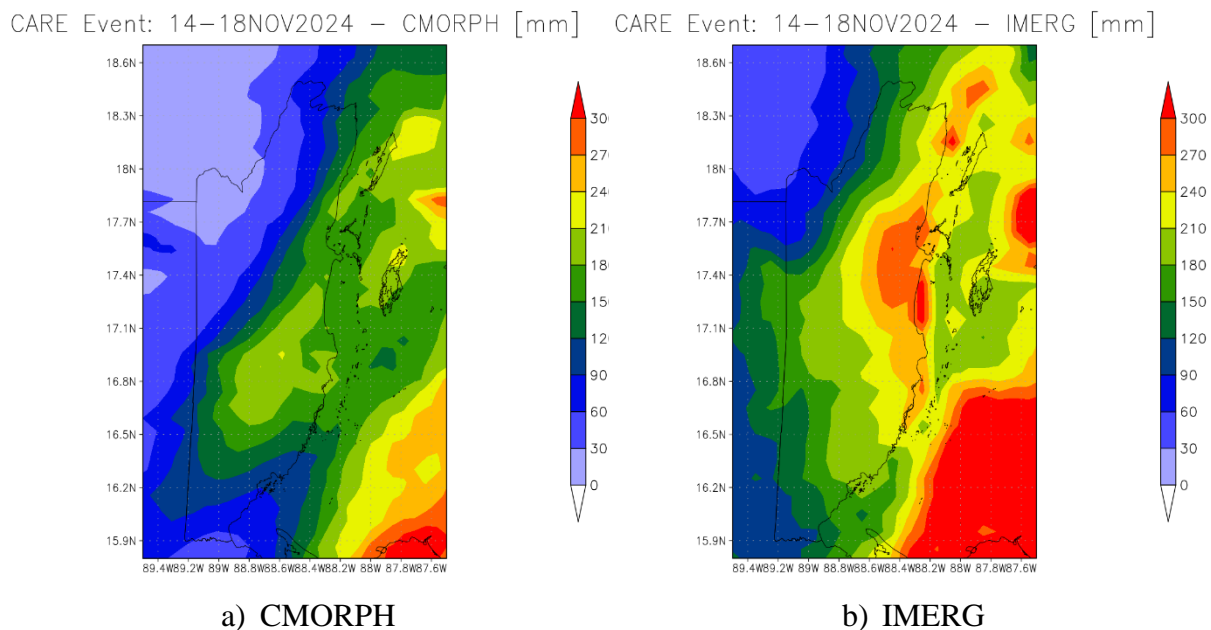
⁵ CMORPH Model: the satellite-based rainfall precipitation estimates provided by the NOAA Climate Prediction Center (CPC) using the so-called Morphing Technique http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph_description.html. Further details are provided in the Definitions section of this report

IMERG Model: The satellite-based rainfall estimation model developed by NASA, expressed in mm, derived by aggregating the IMERG 30-minute Rainfall Data at 10km spatial resolution and available at <https://jsimpsonhttps.pps.eosdis.nasa.gov/imerg/late>. Further details in the Definitions section of this report

WRF5, WRF7, WRF11 and WRF15 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data <https://www.mmm.ucar.edu/weather-research-and-forecasting-model>. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [<http://rda.ucar.edu/datasets/ds083.2/>]). Further details are provided in the Definitions section of this report.

⁶ The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.

- WRF7** WRF7 reported total accumulated values of precipitation higher than 150 mm over the district of Cayo, while some isolated areas on the northern part of Belize showed values between 120 mm and 150 mm. Lower values were reported for the rest of the country.
- WRF11** WRF11 reported accumulated values of precipitation higher than 240 mm over isolated areas over the central and northern parts of Belize, while values in the range between 150 mm and 240 mm were reported for most of the country.
- WRF15** WRF15 reported accumulated values of precipitation higher than 240 mm over isolated areas on the Cayo, Belize and Corozal districts, while most of the central and northern areas reported values between 150 mm and 240 mm. The southern part of Belize reported lower values than 90 mm.



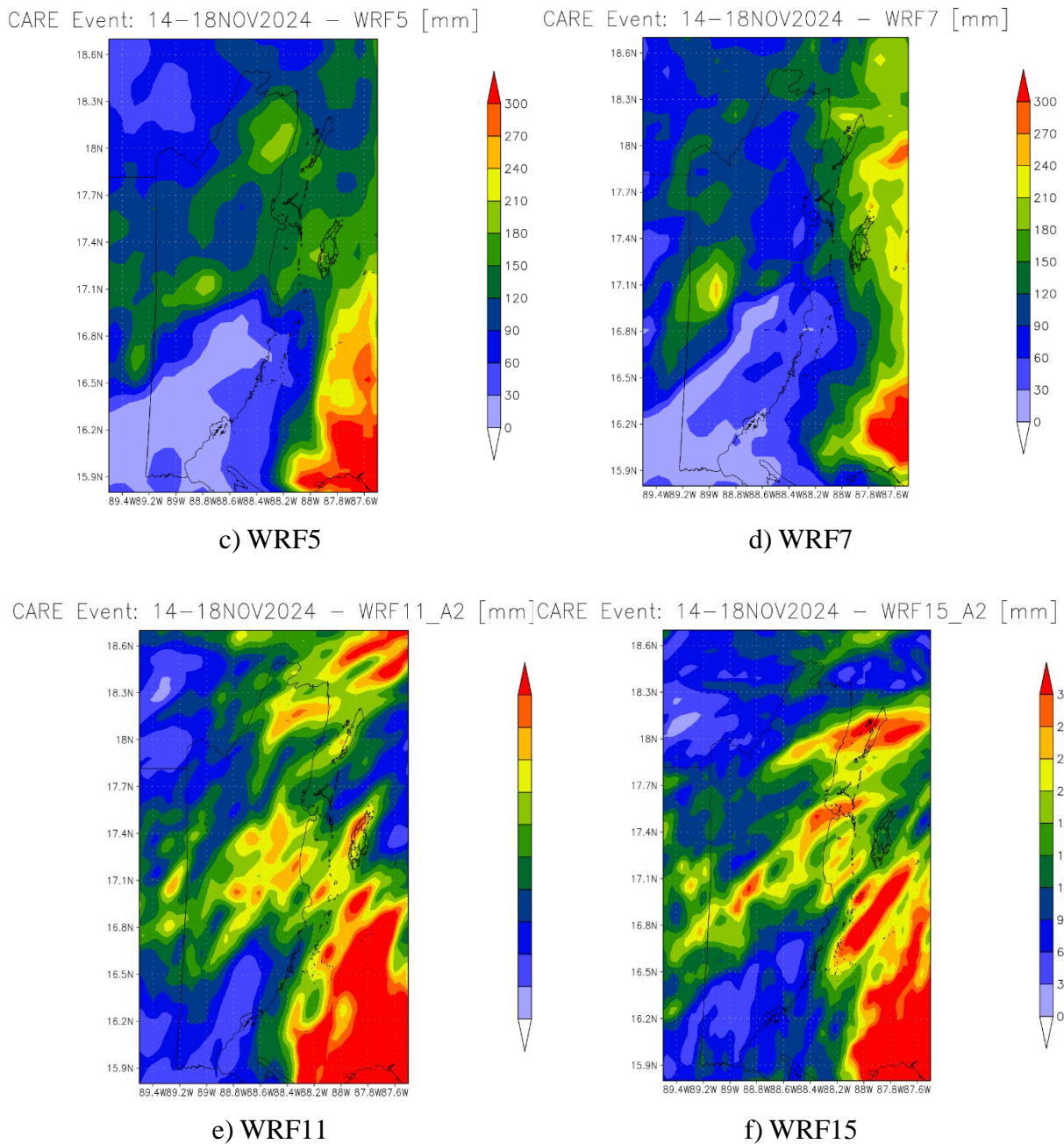


Figure 4 Total accumulated precipitation during the period 14 - 18 November, 2024 estimated by CMORPH (a), IMERG (b), WRF5 (c), WRF7 (d), WRF11 (e), WRF15 (f). Source: CCRIF SPC

Daily rainfall maps by CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15 over the exposure map of XSR 3.0 are not included here and they can be downloaded at the following links for 12-hour aggregation and 48-hour aggregation respectively:

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_4_2024/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_4_2024/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Belize for five of the data sources used by XSR3.0: CMORPH, IMERG, WRF5, WRF7 and WRF15. The RIL was the highest for WRF15. A Disaster Alert declaration was issued by ReliefWeb for Belize related to TC Sara⁷.

The final RIL (RIL_{FINAL}) was calculated as the average of the five RILs from CMORPH, IMERG, WRF5, WRF7, and WRF15. The RIL_{FINAL} was below the attachment point of the Excess Rainfall policy of Belize, therefore the policy was not triggered and a payout is not due to the Government of Belize under the Excess Rainfall policy.

The Wet Season Trigger (WST) endorsement of the XSR3.0 model identified this CARE as a “Wet Season” event⁸. Therefore, a payment is due under the Wet Season Trigger endorsement of the Belize’s Excess Rainfall policy.

The Localized Event Trigger (LET) component of the XSR3.0 model did not identify this CARE as a localized event⁹. Therefore no payout is due under the Local Event Trigger endorsement of Belize’s Excess Rainfall policy.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event (CARE) was below the attachment point of Belize’s Excess Rainfall policy and therefore no payout is due under the main policy.

The Wet Season Trigger (WST) endorsement of the XSR3.0 model identified this CARE as a Wet Season event. The Maximum Wet Index was greater than the WST Activation Threshold, therefore

⁷The disaster Alert declaration in this case did not have any impact, nor on the policy activation neither on the RIL computation. Indeed, the CARE was already activated due to the RIL_{CMORPH} and RIL_{IMERG} greater than the Country Loss Threshold and at least one among RIL_{WRF5} , RIL_{WRF7} , RIL_{WRF11} and RIL_{WRF15} greater than the Country Loss Threshold. In this case the $Final_{RIL}$ is equal to the average of the RIL_{CMORPH} , the RIL_{IMERG} and all values greater than the Country Loss Threshold among RIL_{WRF5} , RIL_{WRF7} , RIL_{WRF11} and RIL_{WRF15}

⁸ The WST endorsement is designed to provide a predetermined payout for rainfall events occurring amidst already saturated soil conditions, effectively capturing the heightened risk of flooding and landslides. It is activated based on two factors: the Wet Index (the average 1-month Standardized Precipitation Index for all grid cells in the country) and Wet Periods (the period of time where the Wet Index exceeds 1, which indicates that the soil is wetter than its long-term average and serves as an indicator of soil saturation). The WST policy endorsement provides a payment when one or more CAREs with a modelled loss greater than zero occur within a Wet Period and the corresponding value of the Wet Index during the Wet Period exceeds a predetermined threshold. Wet season event (WE): any period of consecutive days, during which the Wet Index (WI) is equal or greater than 1.

⁹ The LET is designed to cover rainfall events that affect only a small portion of the island. To determine a qualifying localized event, two conditions must be met: the average precipitation in the 10% of the area with highest precipitation – known as the “Local Exposure” - from (i) either of the satellite datasets (CMORPH or IMERG) and (ii) at least three of the six WRF models must be greater than the local precipitation threshold (LPT).

a fixed payout of US\$805,794 was made to the Government of Belize, under the Wet Season Trigger endorsement of Belize’s Excess Rainfall policy.

The LET component of the XSR3.0 model did not identify this CARE as a localized event. Therefore, no payout is due under the Local Event Trigger endorsement of Belize’s Excess Rainfall policy.

For additional information, please contact CCRIF SPC at: pr@ccrif.org

DEFINITIONS

<i>Active Exposure Cell Percentage Threshold</i>	The percentage of the total number of XSR Exposure Grid Cells within the Covered Area of the Insured, that must be exceeded to trigger a Covered Area Rainfall Event.
<i>Active Exposure Grid Cells</i>	The XSR Exposure Grid Cells for which in the same single day the Aggregate Rainfall #1 value computed using the CMORPH-based Rainfall Estimate equals or exceeds the Rainfall Event Threshold #1 or the Aggregate Rainfall #2 value computed using the CMORPH-based Rainfall Estimate equals or exceeds the Rainfall Event Threshold #2.
<i>Aggregate Rainfall #1</i>	The rainfall amount accumulated over the Rainfall Aggregation Period #1 (as defined in the Schedule) measured in millimeters (mm) in any of the XSR Exposure Grid Cells in the Covered Area of the Insured. For a given day and a Rainfall Aggregation Period #1 of n hours, the Aggregate Rainfall #1 is the maximum amount of rainfall accumulated over any of the n-hour windows that intersect the day itself considering a time interval of 3 hours.
<i>Aggregate Rainfall #2</i>	The rainfall amount accumulated over the Rainfall Aggregation Period #2 (as defined in the Schedule) measured in millimeters (mm) in any of the XSR Exposure Grid Cells in the Covered Area of the Insured. For a given day and a Rainfall Aggregation Period #2 of n hours, the Aggregate Rainfall #2 is the maximum amount of rainfall accumulated over any of the n-hour windows that intersect the day itself considering a time interval of 3 hours.
<i>Calculation Agent</i>	Entity charged with undertaking the primary calculation of the Rainfall Index Loss.
<i>CMORPH-based Maximum Aggregate Rainfall #1</i>	The maximum value during the Covered Area Rainfall Event of the Aggregate Rainfall #1 computed using the CMORPH-based Rainfall Estimates in any given XSR Exposure Grid Cell over the Covered Area of the Insured.
<i>CMORPH-based Maximum Aggregate Rainfall #2</i>	The maximum value during the Covered Area Rainfall Event of the Aggregate Rainfall #2 computed using the CMORPH-based Rainfall Estimates in any given XSR Exposure Grid Cell over the Covered Area of the Insured.

CMORPH-based Covered Area Rainfall Parameters

The CMORPH Model information provided on a continuous basis by the XSR Model Data Reporting Agency used by the Calculation Agent to obtain the CMORPH-based Rainfall Estimates using the XSR Rainfall Model. Parameters are drawn from XSR Exposure Grid Cells within the Covered Area of the Insured, by their respective latitude and longitude. Measurement units and precision of data ingested by the XSR Rainfall Model are identical to those provided by the XSR Model Data Reporting Agency and are further elaborated in the Attachment entitled ‘Calculation of Rainfall Index Loss and Policy Payment’.

CMORPH Model

The satellite-based rainfall estimation model provided by NOAA CPC as described in the Rainfall Estimation Models section of the Policy.

Covered Area

The territory of the Insured as represented in the XSR Rainfall Model.

Covered Area Rainfall Event

Any period of days, with an interruption less than or equals to the Event Tolerance Period, during which the number of Active Exposure Grid Cells is greater than or equal to the product of (a) Active Exposure Cell Percentage Threshold multiplied by (b) the total number of XSR Exposure Grid Cells within the Covered Area.

Country Disaster Alert

An official disaster alert issued by ReliefWeb (<http://reliefweb.int/>) for the country in question for one of the following types of events: tropical cyclone, flood, flash flood and severe local storm. Any disaster alert issued later than seven (7) days after the completion of the Covered Area Rainfall Event (CARE) event will not be considered. The Disaster Alert description issued by ReliefWeb and/or its attached documentation must include specific reference to the CARE dates with a tolerance period of 2 calendar days.

Maximum Aggregate Rainfall #1

The highest value during a Covered Area Rainfall Event of the Aggregate Rainfall #1 amount in any of the XSR Exposure Grid Cells in the Covered Area of the Insured computed.

Maximum Aggregate Rainfall #2

The highest value during a Covered Area Rainfall Event of the Aggregate Rainfall #2 amount in any of the XSR Exposure Grid Cells in the Covered Area of the Insured computed.

Rainfall Event Threshold #1 Aggregate Rainfall #1 level as defined in the Schedule which should be exceeded to trigger an Active Exposure Cell.

Rainfall Event Threshold #2 Aggregate Rainfall #2 level as defined in the Schedule which should be exceeded to trigger an Active Exposure Cell.

Rainfall Aggregation Period #1 The number of hours over which the Aggregate Rainfall #1 is computed for all XSR Exposure Grid Cells during a Covered Area Rainfall Event.

Rainfall Aggregation Period #2 The number of hours over which the Aggregate Rainfall #2 is computed for all XSR Exposure Grid Cells during a Covered Area Rainfall Event.

Rainfall Index Loss For any Covered Area Rainfall Event affecting the Insured, the US Dollar loss calculated by the Calculation Agent using the XSR Rainfall Model, as described in the Attachment entitled ‘Calculation of Rainfall Index Loss and Policy Payment’. The Rainfall Index Loss can only be calculated once the Covered Area Rainfall Event is completed.

WRF5 Model The weather research and forecasting rainfall model by NOAA with Configuration #5 data initialized with and assimilating the data provided by the National Center for Environmental Prediction as described in the Rainfall Estimation Models and in the Input Data to the Rainfall Estimation Models sections of this Attachment.

WRF7 Model The weather research and forecasting rainfall model by NOAA with Configuration #7 data initialized with and assimilating the data provided by the National Center for Environmental Prediction as described in the Rainfall Estimation Models and in the Input Data to the Rainfall Estimation Models sections of this Attachment.

XSR Rainfall Model The computer model used to calculate the Rainfall Index Loss, as described in the Attachment entitled ‘Calculation of Rainfall Index Loss and Policy Payment’.

XSR Exposure Grid Cells The 30 arc-second by 30 arc-second grid of cells each of which is attributed with an XSR Grid Cell Exposure Value greater than zero.

XSR Grid Cell Exposure Value

The value, used to calculate the CMORPH-based Exposure Grid Cell Loss, the WRF5-based Exposure Grid Cell Loss, and the WRF7-based Exposure Grid Cell Loss.