



# Covered Area Rainfall Event (05/11/2023 to 07/11/2023)

## Excess Rainfall

### Event Briefing

## Belize

**15 November 2023**

## 1 INTRODUCTION

This event briefing describes the impact of rainfall on Belize, which was associated with a Covered Area Rainfall Event (CARE), from November 05, 2023, to November 07, 2023. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was below the attachment point of the Excess Rainfall policy of this country, and therefore no payout is due to the Government of Belize.

## 2 EVENT DESCRIPTION

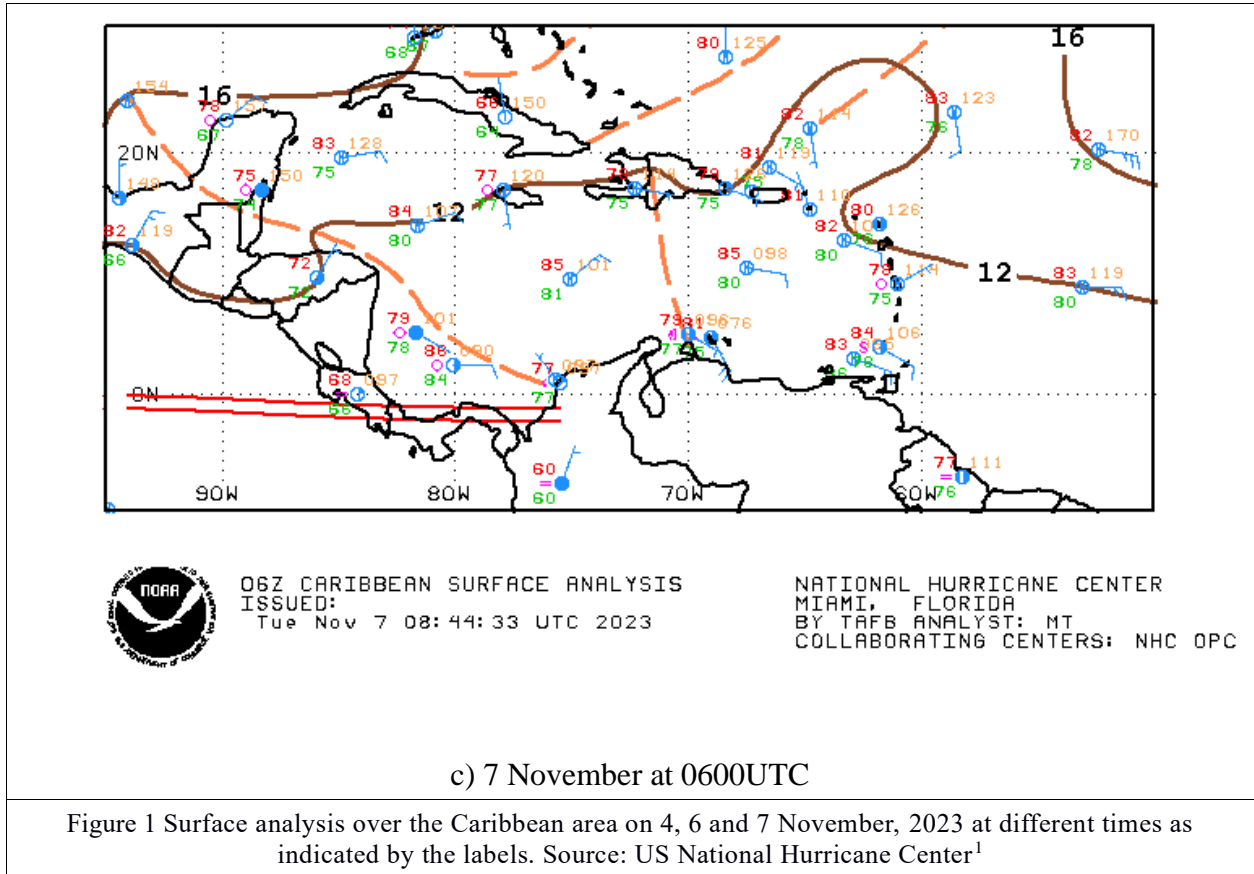
On 3 and 4 November, a low-pressure system embedded in the monsoon trough was located in the west-central Caribbean Sea or close to the coast of northern Nicaragua, near latitude 14°North, longitude from 79.5° to 83° West with a central pressure of 1007 mb (Figure 1a). Moreover, the broad low-pressure system was also interacting with a surface trough to the north and a stationary front in the far NW Caribbean Sea. Numerous heavy showers and scattered thunderstorms flared up from 14°North to 19°Northwest of 77°West, including the Gulf of Honduras. The associated heavy rainfall affected also Belize, mainly between 0000UTC and 0600UTC, due to the diurnal heating.

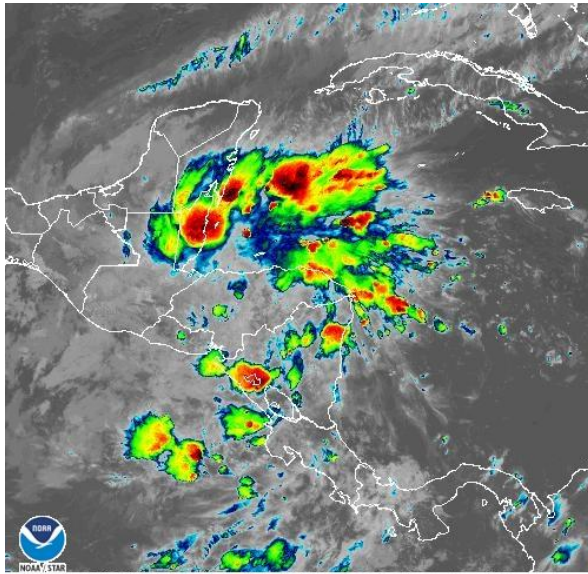
On 5 November at 0000UTC, the weather situation was mostly unchanged, but for the low-pressure system, which moved inland near the Costa Rica-Nicaragua border. The surface trough extended northward from the area of low pressure to near latitude 20°North longitude 85°West (Figure 1a). Scattered heavy showers and isolated thunderstorms occurred during the entire day from northeastern Nicaragua, eastern Honduras and Belize, northward across the Gulf of Honduras to near latitude 20°North, as indicated by the satellite imagery (Figure 2a and 2b).

On 6 November, the low-pressure system moved eastward, over the northern coast of Colombia, thus leaving Central America, while the broad surface trough persisted in the vicinity of Honduras' Caribbean coast or further inland (Figure 1b). The combination of the surface trough and the left instability fed the convection mainly in Belize and offshore. Showers and thunderstorms spread over Belize and the interior of Honduras and Nicaragua, mainly from 1200UTC to 1800UTC.

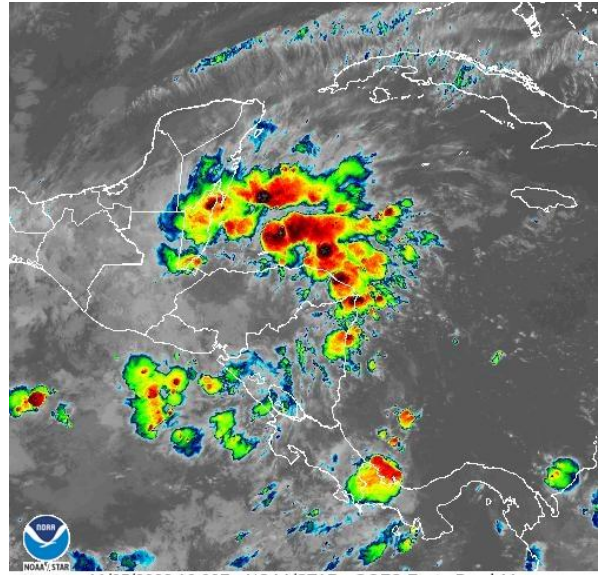
On 7 November, a NW-to-SE oriented surface trough was present along latitude 12° North and longitude 81°West to the east of Nicaragua and eastern Honduras, toward the NW corner of the Yucatan Peninsula (Figure 1c). It supported widely scattered moderate to isolated intense convective activity from latitude 10°North to 18° North between longitudes 75°West and 93°West. Over Belize, moderate to locally heavy rainfall occurred mainly between 0000UTC and 1200UTC. Afterwards, the surface trough weakened and the associated precipitation ceased over Belize.







a) 5 November at 0000UTC



b) 5 November at 1200UTC

Figure 2 Satellite imagery on 5 November, 2023 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  $-50^{\circ}\text{C}$  and  $-70^{\circ}\text{C}$ ), while the red/yellow colours represent very high-altitude clouds (top cloud lower than  $-70^{\circ}\text{C}$ ). High altitude clouds indicate strong convection associated with intense precipitation. Source: NOAA, National Environmental Satellite, Data and Information Service<sup>2</sup>.

### 3 IMPACTS

At the time of writing this report, information related to damage or loss in Belize due to this Covered Area Rainfall Event during the indicated period is limited. The National Meteorological Service of Belize reported flooding in some areas, including the Cayo District. The Ministry of Natural Resources, Petroleum and Mining stated that a flood warning was in effect for the Belize River. Also, a flood alert was in effect for the Moho River at Blue Creek and Jordan. The Ministry of Education, Culture and Science and Technology suspended classes of all levels on November 7.<sup>3</sup>



Figure 3 Screenshot of Macal River where the bridge was impassable. (Source: Elihu Yacab/Facebook live)

### 4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15<sup>4</sup>, detected the occurrence of precipitation over Belize and the surrounding waters during the period 3 to 7 November 2023. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 4. The

<sup>3</sup> Loop News: [Excessive rain causes rivers to rise and floods in parts of Belize | Loop Caribbean News \(loopnews.com\)](https://loopnews.com/news/excessive-rain-causes-rivers-to-rise-and-floods-in-parts-of-belize/)

<sup>4</sup> 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](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

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.

CARE for Belize was activated on 5 November and lasted until 7 November. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation<sup>5</sup> and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in Belize was 3-7 November.

CMORPH reported total accumulated values of precipitation higher than 200 mm along the south and central coast of Belize, with maximum values, between 250 mm and 300 mm, south of Belize City. Lower values were shown over the remainder of the country.

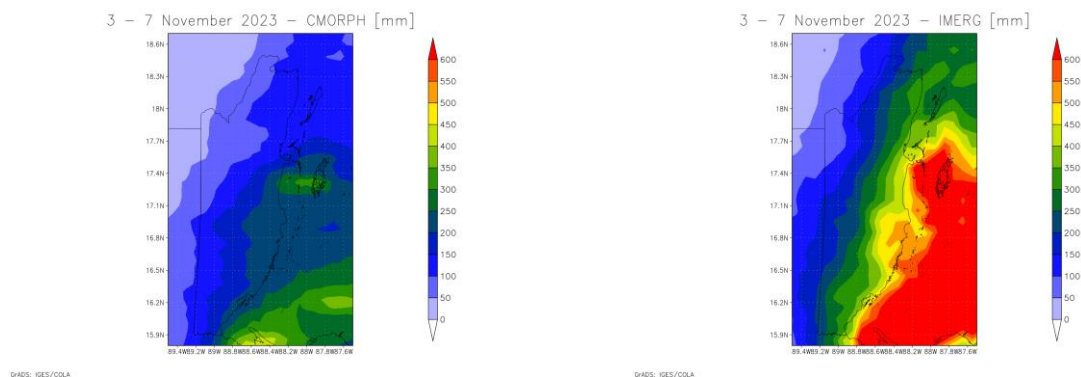
IMERG reported total accumulated values of precipitation higher than 200 mm over most of Belize, with increasing values from northwest to southeast. Values higher than 450 mm were shown along the south and central coast, with maximum values, between 500 mm and 550 mm, along the coast in the district of Stann Creek. Lower values were shown over the remainder of the country.

WRF5 showed total accumulated values of precipitation higher than 200 mm along the central coast of Belize. The maximum values, between 250 mm and 300 mm, were reported over Belize City and to the north of Dangriga. Lower values were shown over the remainder of the country.

WRF7 showed total accumulated values of precipitation lower than 150 mm over all of Belize.

WRF11 showed total accumulated values of precipitation higher than 200 mm over the northern and central portions of Belize. The maximum values, between 550 mm and 600 mm, were shown over Belize inland in the department of Cayo. Values lower than 200 mm were shown over the remainder of the country.

WRF15 showed total accumulated values of precipitation higher than 200 mm over the eastern central portion of Belize, with maximum values, between 450 mm and 500 mm, along the border between Belize and Stann Creek districts. Lower values were shown over the remainder of the country.



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5 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.

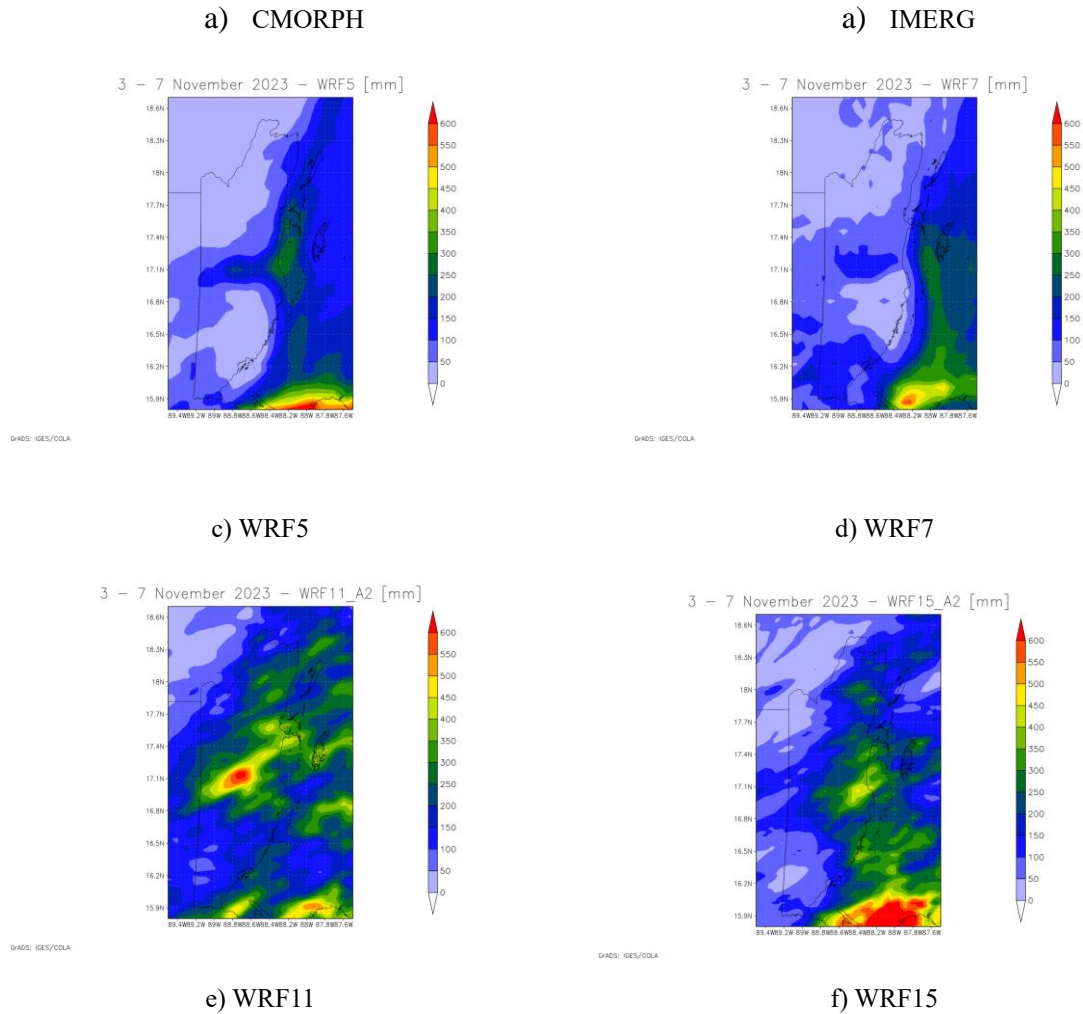


Figure 4 Total accumulated precipitation during the period 3-7 November, 2023 estimated by CMORPH (a), IMERG (b), WRF5 (c), WRF7 (d), WRF11 (e), WRF15 (f). Source: CCRIF SPC

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\\_2\\_2023/daily\\_prec\\_short.mp4](https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_2_2023/daily_prec_short.mp4)

[https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE\\_2\\_2023/daily\\_prec\\_long.mp4](https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_2_2023/daily_prec_long.mp4)

The Rainfall Index Loss (RIL) was above the loss threshold for Belize for five data sources used by XSR3.0: CMORPH, IMERG, WRF5, WRF11 and WRF15. The RIL was the highest for IMERG.

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The final RIL ( $RIL_{FINAL}$ ) was calculated as the average of the five RILs from CMORPH, IMERG, WRF5, WRF11 and WRF15. The  $RIL_{FINAL}$  was greater than zero and therefore this CARE qualified as a loss event. However, the  $RIL_{FINAL}$  was below the attachment point of Belize’s Excess Rainfall policy, and therefore the policy was not triggered. Therefore, no payout is due under the Excess Rainfall policy to the Government of Belize.

The Wet Season Trigger (WST) component of the XSR3.0 model did not identify this CARE as a “Wet Season” event<sup>6</sup>. Therefore, no payout is due under the Wet Season Trigger endorsement of Excess Rainfall policy of Belize.

The Localized Event Trigger (LET) component of the XSR3.0 model did not identify this CARE as a localized event<sup>7</sup>. 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 the Covered Area Rainfall Event (CARE) for Belize was below the attachment point of the Excess Rainfall policy for this country, and therefore no payout is due. This CARE did not activate the Wet Season Trigger or Localized Event Trigger endorsements of the Excess Rainfall policy and therefore no payout under either endorsement is due.

For additional information, please contact CCRIF SPC at: [pr@ccrif.org](mailto:pr@ccrif.org)

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<sup>6</sup> The WST endorsement provides a fixed payout for rainfall events that happen when the soil is already saturated and has limited absorption ability. The WST endorsement 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.

<sup>7</sup> 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).

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## DEFINITIONS

<b><i>Active Exposure Cell Percentage Threshold</i></b>	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.
<b><i>Active Exposure Grid Cells</i></b>	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.
<b><i>Aggregate Rainfall #1</i></b>	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.
<b><i>Aggregate Rainfall #2</i></b>	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.
<b><i>Calculation Agent</i></b>	Entity charged with undertaking the primary calculation of the Rainfall Index Loss.
<b><i>CMORPH-based Maximum Aggregate Rainfall #1</i></b>	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.
<b><i>CMORPH-based Maximum Aggregate Rainfall #2</i></b>	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.
<b><i>CMORPH-based Covered Area Rainfall Parameters</i></b>	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.

<b><i>Rainfall Aggregation Period #1</i></b>	The number of hours over which the Aggregate Rainfall #1 is computed for all XSR Exposure Grid Cells during a Covered Area Rainfall Event.
<b><i>Rainfall Aggregation Period #2</i></b>	The number of hours over which the Aggregate Rainfall #2 is computed for all XSR Exposure Grid Cells during a Covered Area Rainfall Event.
<b><i>Rainfall Index Loss</i></b>	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.
<b><i>WRF5 Model</i></b>	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.
<b><i>WRF7 Model</i></b>	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.
<b><i>XSR Rainfall Model</i></b>	The computer model used to calculate the Rainfall Index Loss, as described in the Attachment entitled ‘Calculation of Rainfall Index Loss and Policy Payment’.
<b><i>XSR Exposure Grid Cells</i></b>	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.
<b><i>XSR Grid Cell Exposure Value</i></b>	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.