

# Covered Area Rainfall Event (19/10/2024 to 21/10/2024)

## Excess Rainfall

### Event Briefing

### Belize

**30 October 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 19 October 2024 and ending on 21 October 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.

## 2 EVENT DESCRIPTION

On 19 October at 0600 UTC, the US National Hurricane Center (NHC) reported that a tropical disturbance developed into a tropical storm approximately 120 mi (190 km) off the coast of Belize and was named Nadine. The system proceeded westward with an estimated forward velocity of 20 mph (32 km/h), under favourable conditions including warm sea surface temperatures of around 29°C and low atmospheric wind shear, which supported its gradual strengthening.

At 0900 UTC, Nadine, now a tropical storm, was centred near latitude 17.4°North, longitude 87.1°West, about 80 mi (130 km) E of Belize City. Scattered to numerous strong convective activity was observed within 207 mi (333 km) from the centre, leading to the onset of heavy rainfall across northern Belize.

At 1200 UTC Nadine rapidly approached the coast of Belize. Satellite imagery showed a well-organized system with numerous strong convective rainbands surrounding the centre, indicative of significant precipitation potential (Figure 1a)

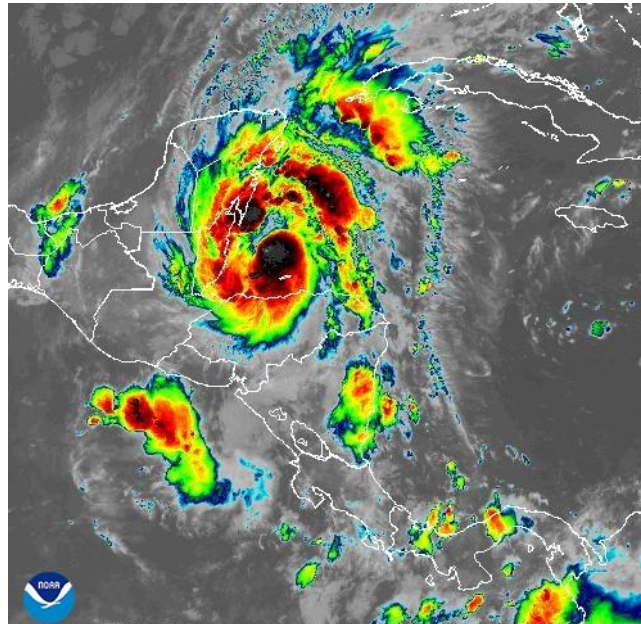
Four hours later, around 1600UTC, Nadine made landfall near Belize City. Its centre was located near latitude 17.6°North, longitude 88.5°West, moving westward at 8 mph (13 km/h). The rainfall intensified, with convective rainbands extending up to 250 mi (402 km) from the centre, leading to heavy and persistent downpours over most of Belize.

In the afternoon and evening of 19 October, after landfall, Nadine moved inland, spreading heavy rainfall over northern Belize and into northern Guatemala. NHC reported that at 1800 UTC, the system centre was near latitude 17.6°North, longitude 88.5°West, with an estimated central pressure of 1003 mb (Figure 2).

After 6 hours, on 20 October at 0000 UTC, Nadine weakened to a tropical depression, due to the land interaction, as it moved over northern Guatemala, and at 1500UTC, it dissipated over southern Mexico. Nevertheless, significant rainfall continued over Belize, northern Guatemala, and the southern states of Mexico for the entire day (Figure 1b), with the system or its remnants supporting the development of isolated thunderstorms, producing moderate to locally heavy rainfall over localized areas.

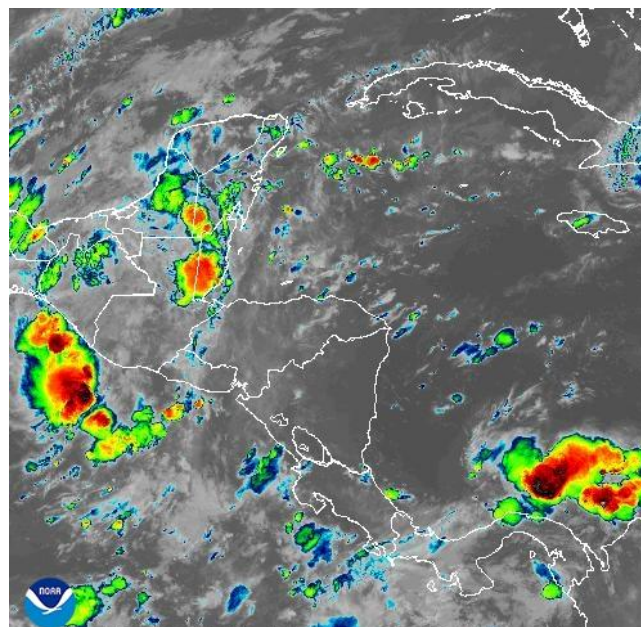
During 21 October, the remnants of Tropical Storm Nadine continued to produce some precipitation over Belize, northern Guatemala, and southern Mexico. Despite the intermittent and

moderate intensity, this rainfall contributed to the already saturated soil conditions and prolonged the risk of flooding over these countries. (Figure 2c).



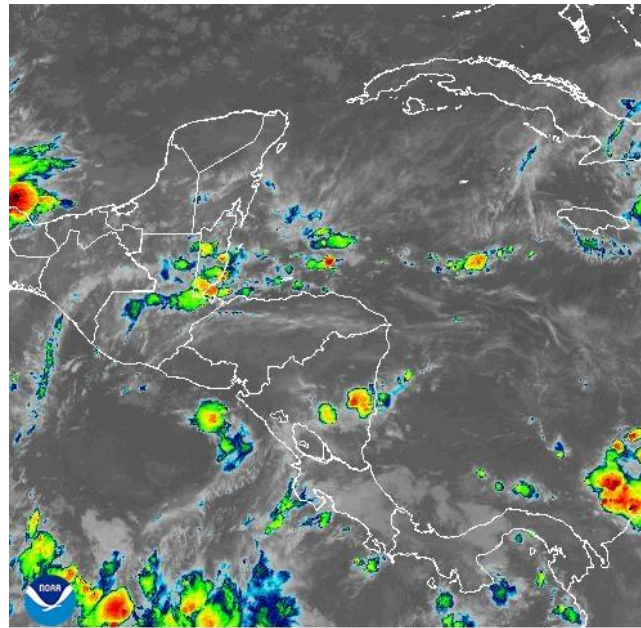
10/19/2024 11:50Z - NOAA/STAR - GOES-East - Band 11

a) 19 October at 1150 UTC



10/20/2024 11:50Z - NOAA/STAR - GOES-East - Band 11

b) 20 October at 1150 UTC



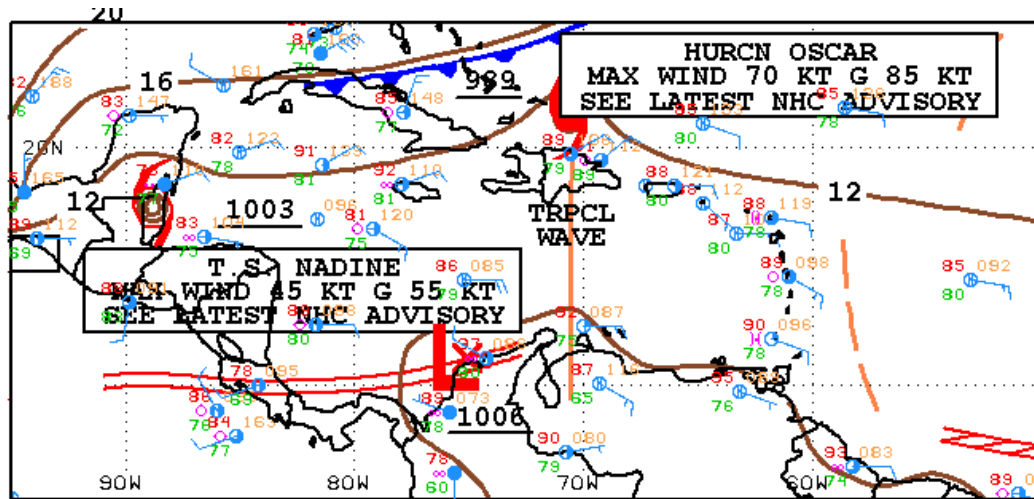
10/21/2024 11:50Z - NOAA/STAR - GOES-East - Band 11

21 October 1150 UTC

Figure 1. Satellite imagery from (a) 19 October 2024 at 1150 UTC, (b) 20 October 2024 at 1150 UTC, and c) 21 October 2024 at 1150 UTC. 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<sup>1</sup>.

<sup>1</sup> RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: <https://cdn.star.nesdis.noaa.gov/GOES16/ABI/SECTOR/car/11/>

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18Z CARIBBEAN SURFACE ANALYSIS  
ISSUED:  
Sat Oct 19 20:26:02 UTC 2024

NATIONAL HURRICANE CENTER  
MIAMI, FLORIDA  
BY TAFB ANALYST: BA  
COLLABORATING CENTERS: NHC OPC

19 October at 1800UTC

Figure 2. Surface analysis over the Caribbean Sea area on (a) 19 October 2024 at 1800 UTC. Source: US National Hurricane Center<sup>2</sup>

### 3 REPORTED IMPACTS

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

The low-lying bridge that connects San Ignacio and Santa Elena was impassable on October 19, due to the floodwaters caused by the intense rainfall from Tropical Storm Nadine.<sup>3</sup>

<sup>2</sup> National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: 19 October 2024, available at: [https://www.nhc.noaa.gov/tafb/CAR\\_18Z.gif](https://www.nhc.noaa.gov/tafb/CAR_18Z.gif)

<sup>3</sup> Channel 5 Belize: [Tropical Storm Nadine Impacts Old Capital and Western Belize - Channel 5 Belize](#)



Figure 3 Strong winds and heavy rainfall due to Tropical Storm Nadine in Belize.

## 4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR3.0 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 17 to 21 October 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 19 October and lasted until 21 October. 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 XSR3.0 model for the loss estimate based on the accumulated precipitation in Belize was 17 to 21 October 2024.

**CMORPH** CMORPH reported total accumulated values of precipitation between 150 mm and 200 mm over part of the eastern Belize in the provinces of Stann Creek and Cayo. Values lower than 200 mm were reported over the rest of the

<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

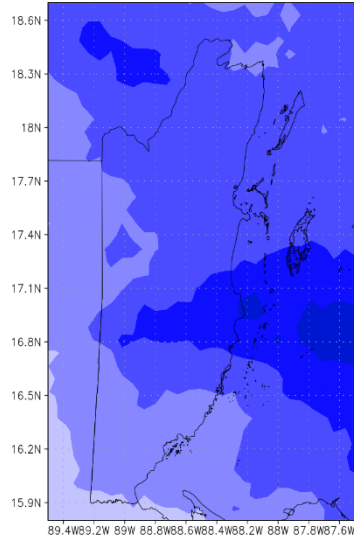
WRF7, WRF11 and WRF15 Models: the Weather Research and Forecasting Model weather model <https://www.mmm.ucar.edu/weather-research-and-forecasting-model>. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [<http://rda.ucar.edu/datasets/ds083.2/>]).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

<sup>5</sup> 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.

country.

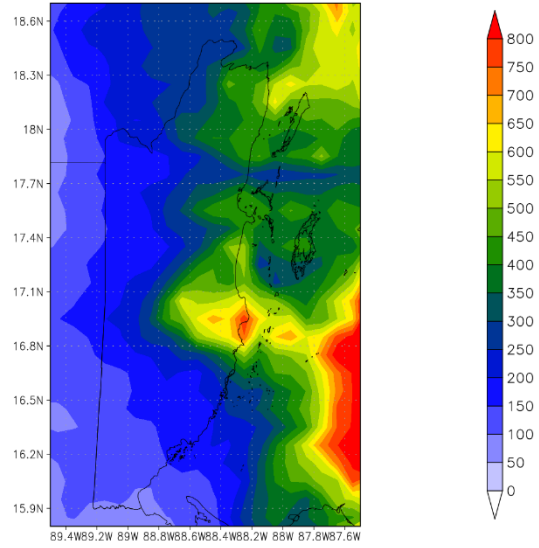
- IMERG      IMERG reported total accumulated values of precipitation with values higher than 350 mm extending to central eastern and northeastern Belize. With the highest values between 600 mm and 800 mm in the province of Stann Creek.
- WRF5        WRF5 showed total accumulated precipitation values higher than 250 mm only in the central and the northeaster areas of Belize. Lower values were reported over the rest of the country.
- WRF7        WRF7 reported total accumulated values of precipitation higher than 50 mm over all the country with the highest values, between 150 mm and 200 mm, in some small areas located especially in the provinces of Orange Walk, Belize, Cayo and Toledo.
- WRF11      WRF11 showed total accumulated precipitation values higher than 50 mm over most of Belize, with the maximum values, between 250 mm and 350 mm over localized areas in the provinces of Stann Creek and Corozal.
- WRF15      WRF15 showed a geographic distribution of total accumulated precipitation values similar to that of WRF11, but with higher values. Indeed, values of total accumulated precipitation higher than 150 were reported over most of the country, and the maximum values, located over central and northern Belize, ranged between 350 mm and 450 mm.

17 – 21 October 2024 – CMORPH [mm]



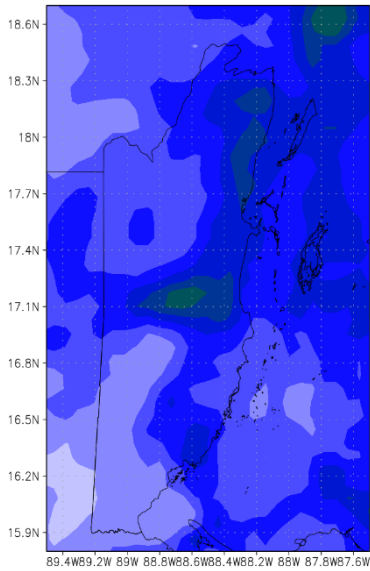
a) CMORPH

17 – 21 October 2024 – IMERG [mm]



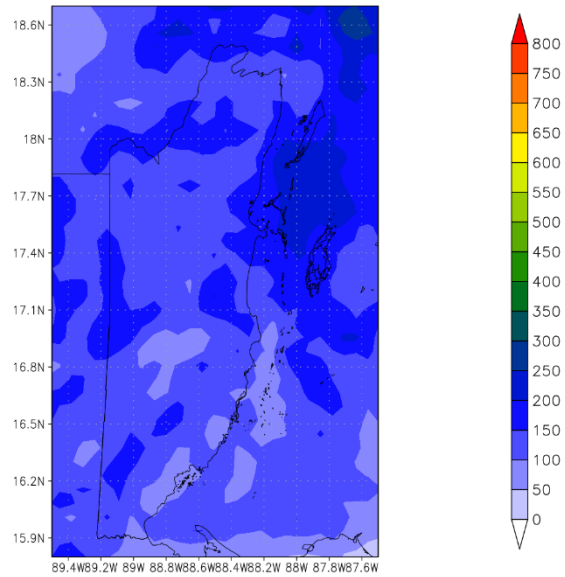
b) IMERG

17 – 21 October 2024 – WRF5 [mm]



c) WRF5

17 – 21 October 2024 – WRF7 [mm]



d) WRF7



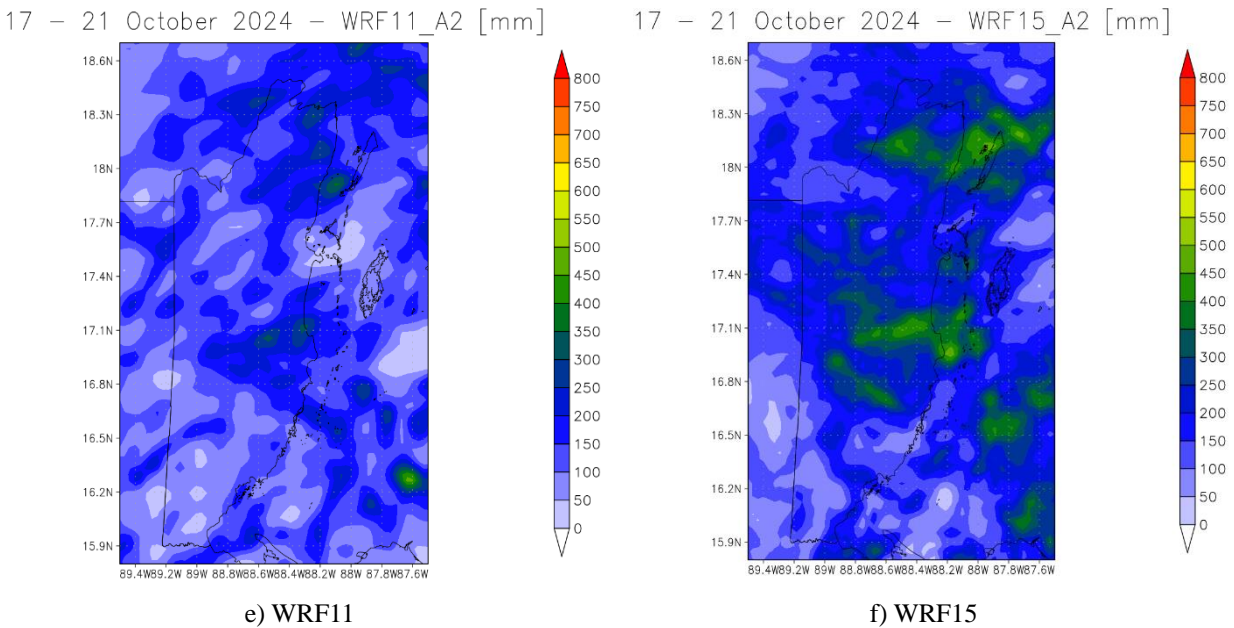


Figure 5. Total accumulated precipitation during the period 17 – 21 October, 2024 estimated by CMORPH (a), IMERG (b), WRF5 (c), WRF7 (d), WRF11 (e), WRF15 (f). Source: CCRIF SPC

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\\_2\\_2024/daily\\_prec\\_short.mp4](https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_2_2024/daily_prec_short.mp4)

[https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE\\_2\\_2024/daily\\_prec\\_long.mp4](https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_2_2024/daily_prec_long.mp4)

The Rainfall Index Loss (RIL) was above the loss threshold for Belize for four of the data sources used by XSR3.0: IMERG, WRF5, WRF7 and WRF15. The RIL was the highest for IMERG. No Disaster Alert declaration was issued by ReliefWeb for Belize related to the heavy rainy events of these days<sup>6</sup>.

The final RIL ( $RIL_{FINAL}$ ) was calculated as the average of the four RILs above the threshold: IMERG, WRF5, WRF7 and WRF15.

The  $RIL_{FINAL}$  was below the attachment point of Belize’s Excess Rainfall policy and therefore the policy was not triggered. Therefore, a payout is not due to the Government of Belize under its

<sup>6</sup> A disaster Alert declaration in this case would not have any impact, nor on the policy activation neither on the RIL computation. Indeed, the CARE was already activated due to the  $RIL_{IMERG}$  greater than the Country Loss Threshold and at least two 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  $RIL_{IMERG}$  and all values greater than the Country Loss Threshold among  $RIL_{WRF5}$ ,  $RIL_{WRF7}$ ,  $RIL_{WRF11}$  and  $RIL_{WRF15}$

Excess Rainfall policy.

The Wet Season Trigger (WST) endorsement of the XSR3.0 model did not identify this CARE as a “Wet Event”<sup>7</sup>. Therefore, no payment is due under the Wet Season Trigger endorsement of Belize’s Excess Rainfall policy.

The Localized Event Trigger (LET) component of the XSR3.0 model did not identify this CARE as a localized event<sup>8</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 this Covered Area Rainfall Event (CARE) was below the attachment point of Belize’s Excess Rainfall policy and therefore no payout is due.

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

<sup>7</sup> 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.

A Wet Event (WE) is any period of consecutive days, during which the Wet Index (WI) is equal or greater than 1.

<sup>8</sup> The LET is designed to cover rainfall events that affect only a small portion of the country. 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).

## 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.