Covered Area Rainfall Event

(5/10/2022 to 7/10/2022)
Trinidad and Tobago – Trinidad

(5/10/2022 to 8/10/2022)
Trinidad and Tobago – Tobago

Excess Rainfall

Event Briefing

13 October 2022

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1 INTRODUCTION

This event briefing describes the impact of rainfall in Trinidad and Tobago, which was associated with two Covered Area Rainfall Events (CAREs), one starting on 5 October and ending on 7 October 2022 for Trinidad, and other starting on 5 October and ending on 8 October 2022 for Tobago. The Rainfall Index Loss (RIL) for the CARE in Trinidad was above the attachment point of Trinidad and Tobago's excess rainfall policy for Trinidad and a payout of USD$5,115,781.97 is due. IFor the CARE in Tobago, the Rainfall Index Loss (RIL) was above the attachment point of Trinidad and Tobago's excess rainfall policy for Tobago and a payout of USD$726,932.36 is due. The total payout amount for Trinidad and Tobago is USD$5,842,714.33.

2 EVENT DESCRIPTION

On 5 October at 0600UTC, an Atlantic Ocean tropical wave was along longitude 60° West, from latitude 17° North southward, located approximately 60 mi (100 km) east of the southern Windward Islands. Also, a low pressure system with minimum pressure of 1007 mb was along the wave axis near latitude 12° North, longitude 60° West. This combined system moved westward at 15 mph (24 km/h), towards Trinidad and Tobago (Figure 1a).

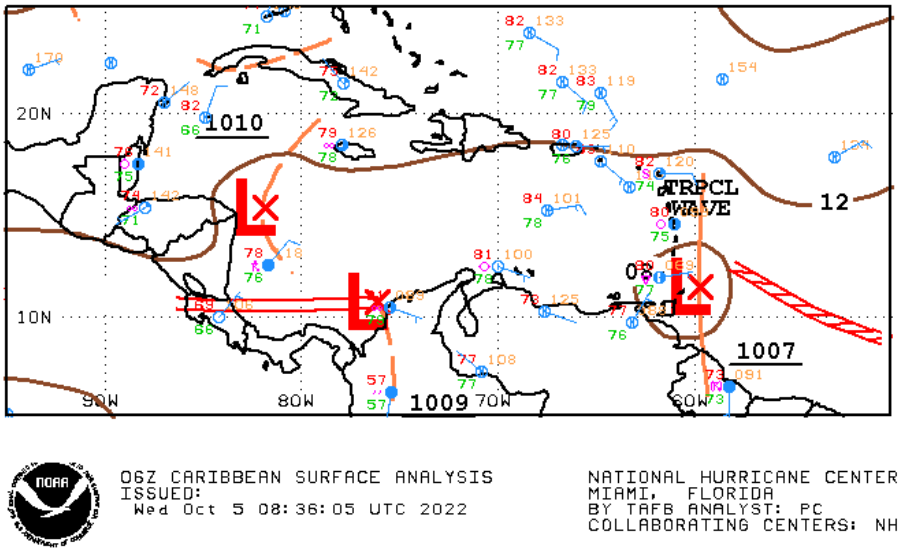
Satellite imagery showed numerous moderate to scattered strong convection in clusters over a large area, from the Venezuela-Guyana coast to latitude 13° North, between longitude 57° West and 60° West. This area covered parts of the Atlantic Ocean, inland areas and the coastal plains of Guyana and Venezuela, and the extreme southeastern Caribbean Sea (Figure 2). The associated moderate to locally intense precipitation started to affect Trinidad and Tobago and the surrounding waters from this time, as shown by the radar imagery (Figure 3).

Six hours later, at 1200UTC, the tropical wave was along longitude 62° West, from latitude 17° North southward, passing over the southern Windward Islands (Figure 1b). Heavy thunderstorm activity was ongoing over the extreme southeastern Caribbean Sea, and particularly over Trinidad and Tobago.

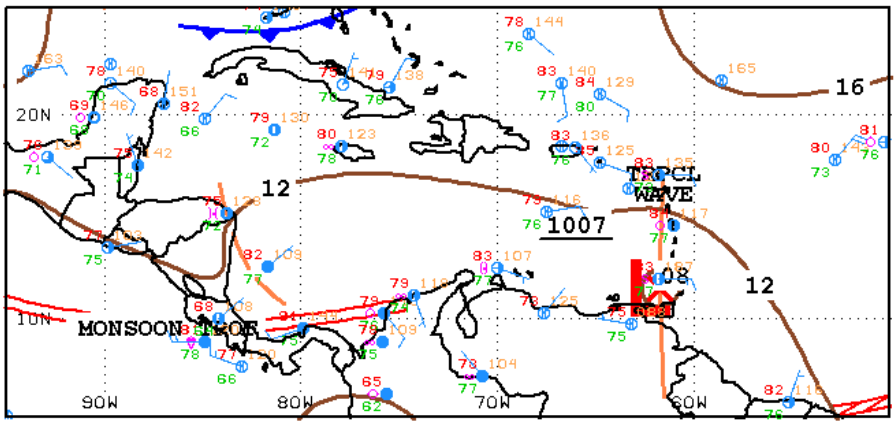
At 1800UTC, the tropical wave had crossed the Windward Islands and was in the far southeastern Caribbean Sea along longitude 63° West from the coast of Venezuela northward to latitude 18° North. The low pressure system was still embedded in this structure, with a minimum pressure of 1006 mb. Although the combined system was moving away from the southern Windward Islands, it was still producing an extended area of showers and thunderstorms over the southern Caribbean Sea. Heavy rainfall with localized flooding was affecting Trinidad and Tobago.

During the next few hours, the tropical wave continued to move westwards, heading for the northern Colombia, but it left an area of high instability over the southern Windward Islands. Due to this, moderate to locally intense precipitation persisted over Trinidad and Tobago for the remainder of 5 October and the next day, 6 October, until 1800UTC.

On 7 October, the tropical wave crossed the southern Caribbean Sea and at 1500UTC, and became Tropical Storm Julia, when it was off the coast of the Guajira Peninsula, Colombia. Julia continued to strengthen and on 8 October it developed into a hurricane, in the vicinity of the Nicaragua coast.It then made landfall on Nicaragua, spreading hurricane conditions over portions of this country, crossed Nicaragua and emerged over the Pacific Ocean. It finally dissipated over Guatemala on 10 October.



a) 5 October at 0600 UTC



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b) 5 October at 1200 UTC

Figure 1 Surface analysis over the Caribbean area on 5 October 2022 at 0600UTC (a) and 1200UTC (b). Source: US National Hurricane Center[1]

1 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 5 October 2022, available at: https://www.nhc.noaa.gov/tafb/CAR_06Z.gif, https://www.nhc.noaa.gov/tafb/CAR_12Z.gif

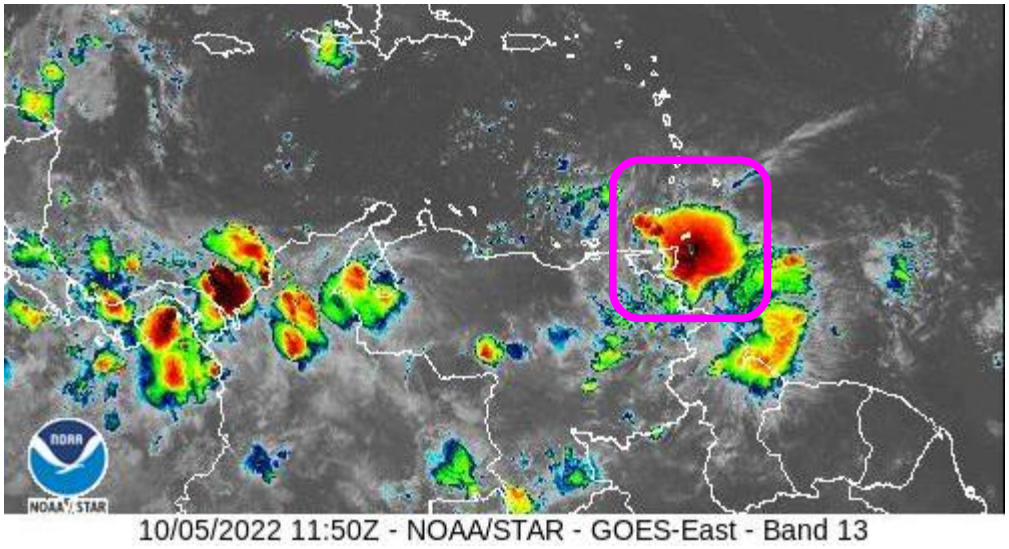
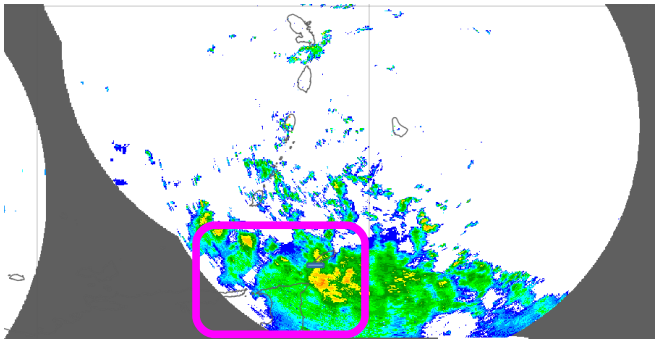
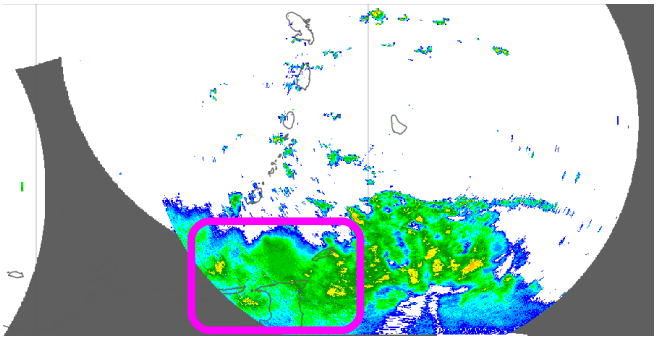


Figure 2 Satellite imagery on 5 October at 1150UTC from thermal infrared channel enhanced with colour. Blue/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the red/yellow colours represent very high altitude clouds (top cloud lower than -70°C). High altitude clouds indicate strong convection associated with intense precipitation. Trinidad and Tobago is surrounded by a purple square. Source: NOAA, National Environmental Satellite, NESDIS[2]

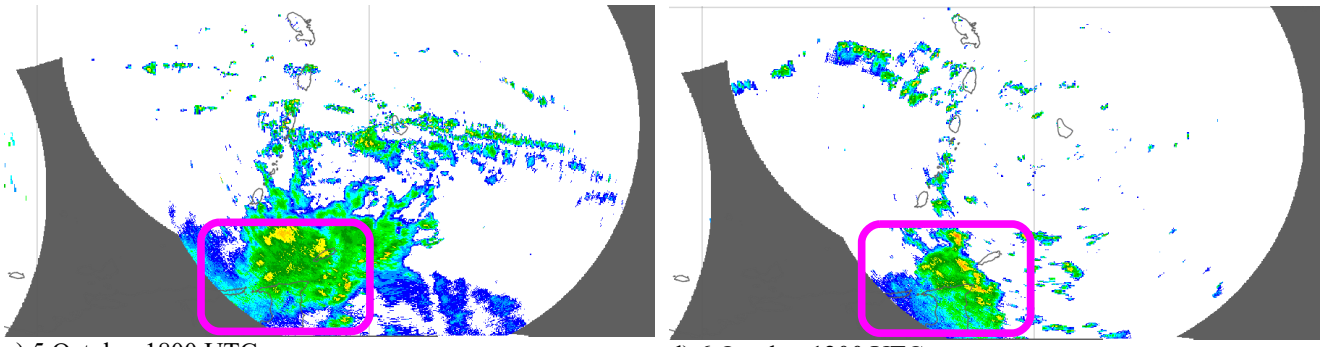


a) 5 October 1200 UTC



b) 5 October 1500 UTC

2 NEDSDIS Online Archive, NOAA Satellite and Information Service, available at: https://www.star.nesdis.noaa.gov/GOES/sector.php?sat=G16&sector=nsa



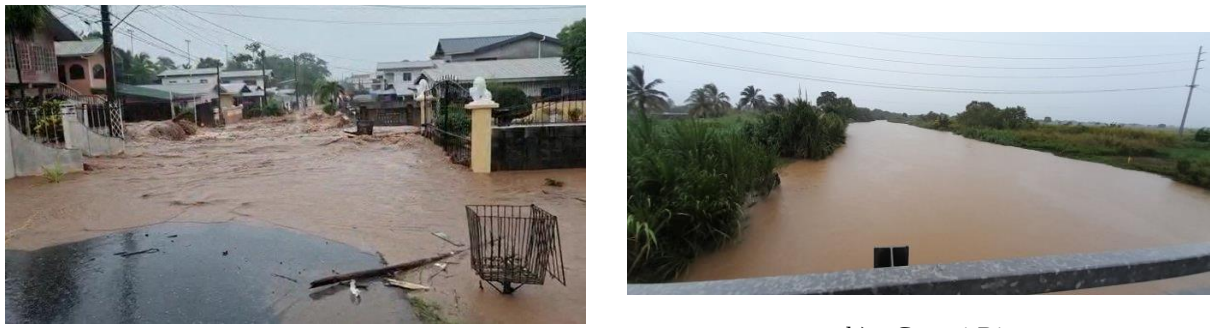
c) 5 October 1800 UTC d) 6 October 1200 UTC

Figure 3 Radar imagery on 5 and 6 October at different times as indicated in the labels, from the radar composite over the Caribbean and Central America region. Blue/green colours represent low to moderate rainfall, while the yellow/red colours represent intense and very intense precipitation. The purple square highlights the location of Tobago Island. Source: Barbados Radar Composite[3].

3 IMPACTS

Trinidad and Tobago's Office of Disaster Preparedness and Management received reports of flooding in East and Central Trinidad and some other areas. The heavy rain caused widespread flooding along the nation's major roadways, and at least one bridge and many schools were closed. Also, some river levels increased and the local authorities (Trinidad and Tobago Meteorological Service) released the corresponding river warnings.

The Ministry of Rural Development and Local Government reported 18 landslides and 11 accidents due to wind damage. Hunters Search and Rescue team reported that one person lost his life who was one of two people swept away by flood waters[4].



a) Floods in East and Central Trinidad b) Caroni River

Figure 4 Damages in Trinidad and Tobago

3 Barbados Radar Composite, available on 5 and 6 October at: *https://www.barbadosweather.org/BMS_Radar_Composite_Resp.php#*

[4] Trinidad and Tobago – One Missing After Flash Floods https://floodlist.com/america/trinidad-floods-october-2022

4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[5], WRF5 and WRF7[6], detected the occurrence of precipitation over Trinidad and Tobago and the surrounding waters during the period 3-8 October 2022. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below. The CAREs for Trinidad and for Tobago were activated on 5 October and lasted for the period 5-7 October in Trinidad and for the period 5-8 in Tobago. The CAREs were activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[7], thus the periods considered by the XSR 2.5 model for the loss estimate based on the accumulated precipitation were respectively 3-7 October for Trinidad and 3-8 October for Tobago.

CMORPH reported total accumulated amounts of precipitation between 80 mm and 240 mm over Trinidad and between 80 mm and 200 mm over Tobago. In Trinidad the maximum rainfall amounts, ranging between 220 mm and 240 mm, were shown over the northeast area of the island. CMORPH is the model that reported the highest rain amounts (between 100 mm and 160 mm) on the east coast, the area with the highest exposure. In Tobago the maximum rainfall amounts, ranging between 180 mm and 200 mm, were shown in the southern part of the island, also the area with the highest exposure.

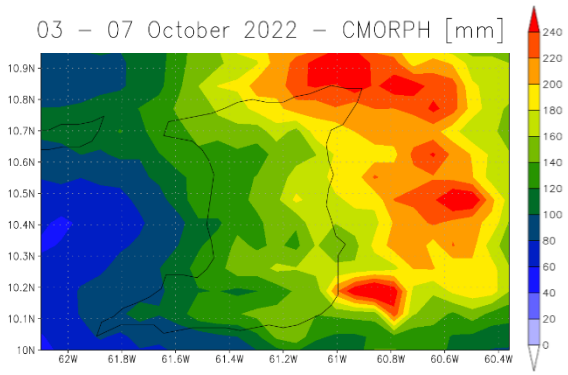
WRF5 showed total accumulated values of precipitation up to 220 mm over Trinidad, and between 100 mm and 240 mm over Tobago. The maximum values in Trinidad, between 180 mm and 220 mm, were reported along the eastern coast. In Tobago the maximum rainfall values were shown in the eastern part of the island, ranging between 220 mm and 240 mm.

WRF7 simulated total accumulated values of rainfall under 140 mm over Trinidad and under 80 mm over Tobago. The maximum rainfall amounts in Trinidad, between 120 mm and 140 mm, were reported over the central western part of the island. In Tobago the highest precipitation values were reported in the southern area with a range between 60 mm and 80 mm.

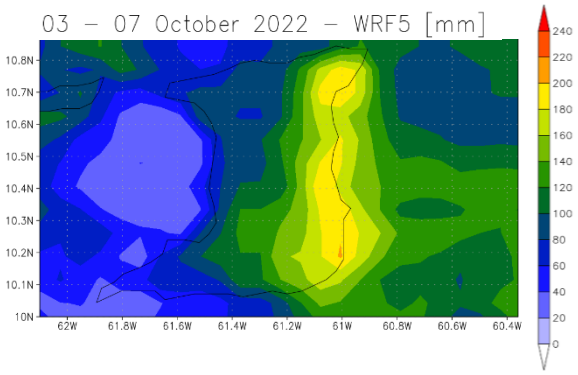
5 CMORPH Model: the satellite-based rainfall precipitation estimates provided by the NOAA Climate Prediction Center (CPC) using the so-called Morphing Technique *http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph_description.html*. Further details in the Definitions section of this report.

6 WRF5 and WRF7 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 in the Definitions section of this report.

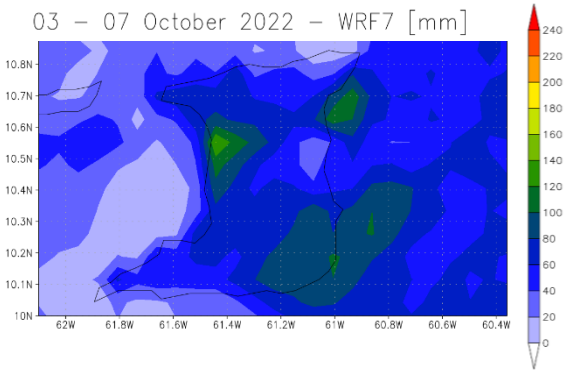
7 The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.



a) CMORPH

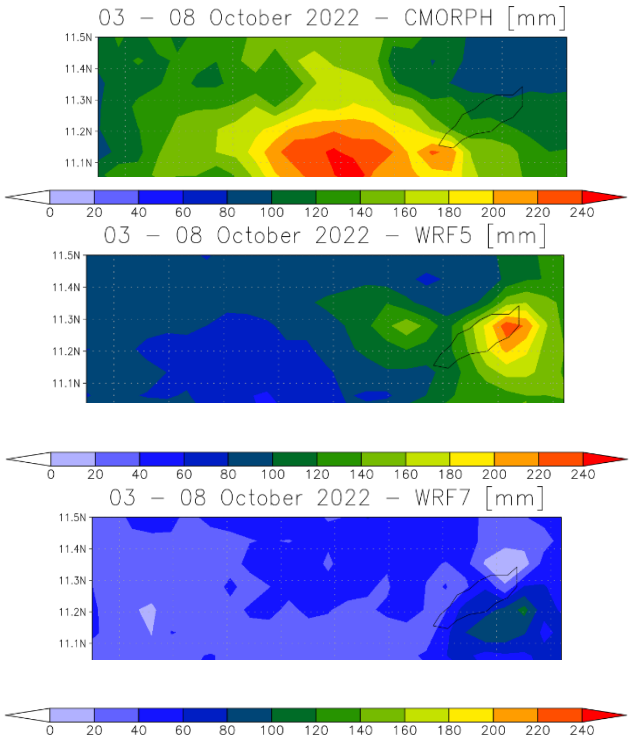


b) WRF5



c) WRF7

Figure 5 Total accumulated precipitation during the period 3-7 October, 2022 estimated by CMORPH (a), WRF5 (b) and WRF7 (c) over Trinidad Island. Source: CCRIF SPC



a) CMORPH

b) WRF5

c) WRF7

Figure 6 Total accumulated precipitation during the period 3-8 October, 2022 estimated by CMORPH (a), WRF5 (b) and WRF7 (c) over Tobago Island. Source: CCRIF SPC

Daily rainfall maps by CMORPH, WRF5 and WRF7 over the exposure map of XSR 2.5 are not included here and they can be downloaded at the following links for 12-hour aggregation and 48-hour aggregation respectively:

For Trinidad:

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/TTO/TTO_TRI/CARE_4_2022/daily_prec_short.mp4
https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/TTO/TTO_TRI/CARE_4_2022/daily_prec_long.mp4

For Tobago:

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/TTO/TTO_TOB/CARE_6_2022/daily_prec_short.mp4
https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/TTO/TTO_TOB/CARE_6_2022/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Trinidad for the three data sources used by XSR2.5. The RIL was the highest for CMORPH, due to the larger amount of accumulated precipitation presented over the east coast, the area characterized by the highest exposure for Trinidad. The final RIL (RIL_{FINAL}) was calculated as the average of the three RILs from CMORPH, WRF5 and WRF7.

The Rainfall Index Loss (RIL) was above the loss threshold for Tobago for two of the data sources used by XSR2.5: CMORPH and WRF5. The associated RIL was larger for CMORPH, because this is the model that reported the maximum amounts of accumulated precipitation over the southern part of the island where the maximum exposure is located. The final RIL (RIL_{FINAL}) was calculated as the average of the two RILs for the CMORPH and WRF5 data sources.

5 TRIGGER POTENTIAL

For Trinidad, the Rainfall Index Loss calculated for the CARE that started on 5 October and ended on 7 October 2022, produced government losses which were above the attachment point of Trinidad and Tobago's Excess Rainfall policy for Trinidad. Final calculations show that a payout of US$5,115,781.97 is due.

In the case of Tobago, the Rainfall Index Loss calculated for the CARE that started on 5 October and ended on 8 October 2022, produced government losses which were also above the attachment point of Trinidad and Tobago's Excess Rainfall policy for Tobago. Final calculations show that a payout of US$726,932.36 is due.

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

DEFINITIONS

Active Exposure Cell Percentage Threshold	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.
Active Exposure Grid Cells	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.
Aggregate Rainfall #1	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.
Aggregate Rainfall #2	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.
Calculation Agent	Entity charged with undertaking the primary calculation of the Rainfall Index Loss.
CMORPH-based Maximum Aggregate Rainfall #1	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.
CMORPH-based Maximum Aggregate Rainfall #2	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.