Covered Area Rainfall Events (23/10/2023 to 24/10/2023))

Excess Rainfall

Event Briefing

Sint Maarten

5 November 2023

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1 INTRODUCTION

This event briefing describes the impact of rainfall on Sint Maarten, which was associated with a Covered Area Rainfall Event (CARE), from October 23, 2023 to October 24, 2023. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was below the attachment point of the country's Excess Rainfall policy, and therefore no payout is due to the Government of Sint Maarten.

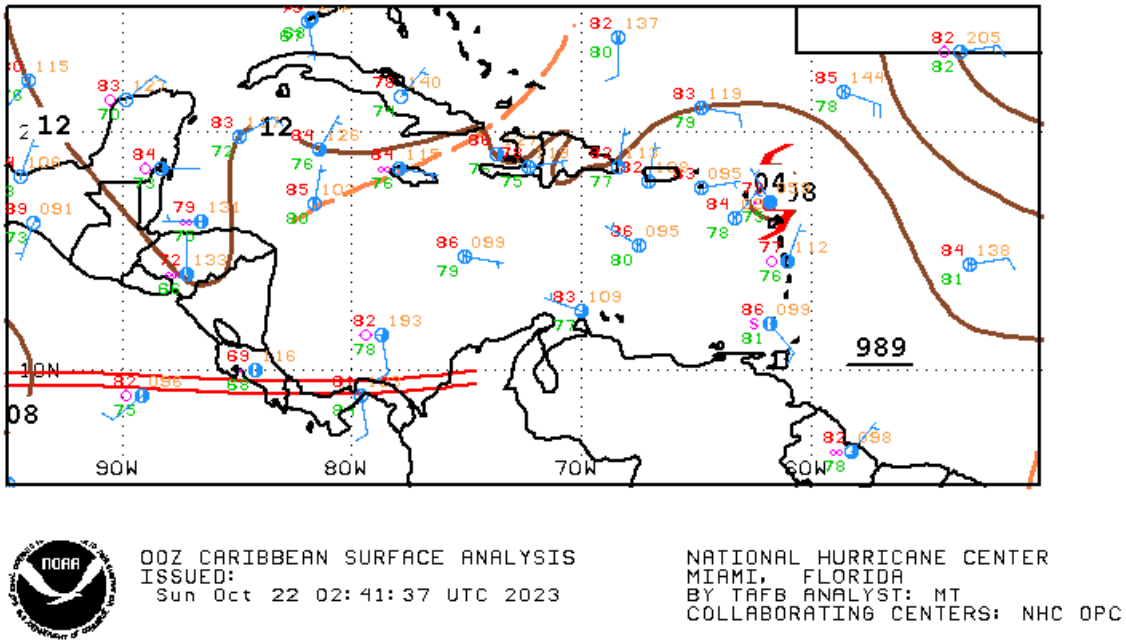
2 EVENT DESCRIPTION

On 18 October at 2100UTC, the US National Hurricane Center (NHC) reported that a tropical storm (TS) formed in the central tropical Atlantic Ocean, about 625 mi (1005 km) E of the Windward Islands, and it was named Tammy. The system proceeded with estimated forward velocity of 23 mph (37 km/h) towards the west. The minimum central pressure was 1007 mb and the maximum sustained winds were estimated at 40 mph (65 km/h).

During the next two days, the tropical storm proceeded westward over the tropical Atlantic Ocean with progressively slower forward velocity. Tammy was embedded in an environment of high oceanic heat content, due to the warm sea surface temperature. However, the moderate vertical wind shear allowed only a modest strengthening of the storm. On 20 October at 1400UTC, NHC upgraded Tammy to a Category 1 hurricane, with estimated maximum sustained winds at 75 mph (120 km/h) and minimum central pressure of 992 mb. At this time, the centre of Tammy was located near latitude 14.1° North, longitude 58.5° West, about 90 mi (150 km) NE of Barbados. Hurricane Tammy presented a closed eye and a large curved band that wrapped around the eastern and southern portions of the circulation.

During the next 24 hours, Tammy moved west-northwest at almost 7 mph (11 km/h), passing about 100 mi (160 km) E of Martinique and Saint Lucia and about 50 mi (80 km) E of Dominica. On 21 October at 1200UTC, Hurricane Tammy turned northwest with nearly the same forward velocity (9 mph, 15 km/h) and during the next 12 hours continued to cross the waters just east of the Leeward Islands.

On 22 October at 0000UTC, Tammy's centre of circulation was sited near latitude 17.5° North, longitude 61.6° West, about 15 mi (25 km) ESE of Barbuda (Antigua and Barbuda) and about 100 mi (161 km) SE of Sint Maarten (Figure 1). The NHC reported a slight intensification of the hurricane, with the estimated maximum sustained winds increasing to 85 mph (140 km/h) and minimum central pressure of 989 mb. The infrared satellite imagery showed that the hurricane had a relatively small and well-organized central area of thunderstorms surrounding the circulation centre and a prominent trailing convective band to the south (Figure 2a).The eyewall had become more pronounced although it was open on the south side. At this time, the western border of the convective central mass of the hurricane approached Anguilla and Sint Maarten (Figure 2a), spreading moderate to locally intense rainfall over these countries. One hour later, at 0115UTC, Tammy made landfall on Barbuda, passing along the eastern coast of the island.



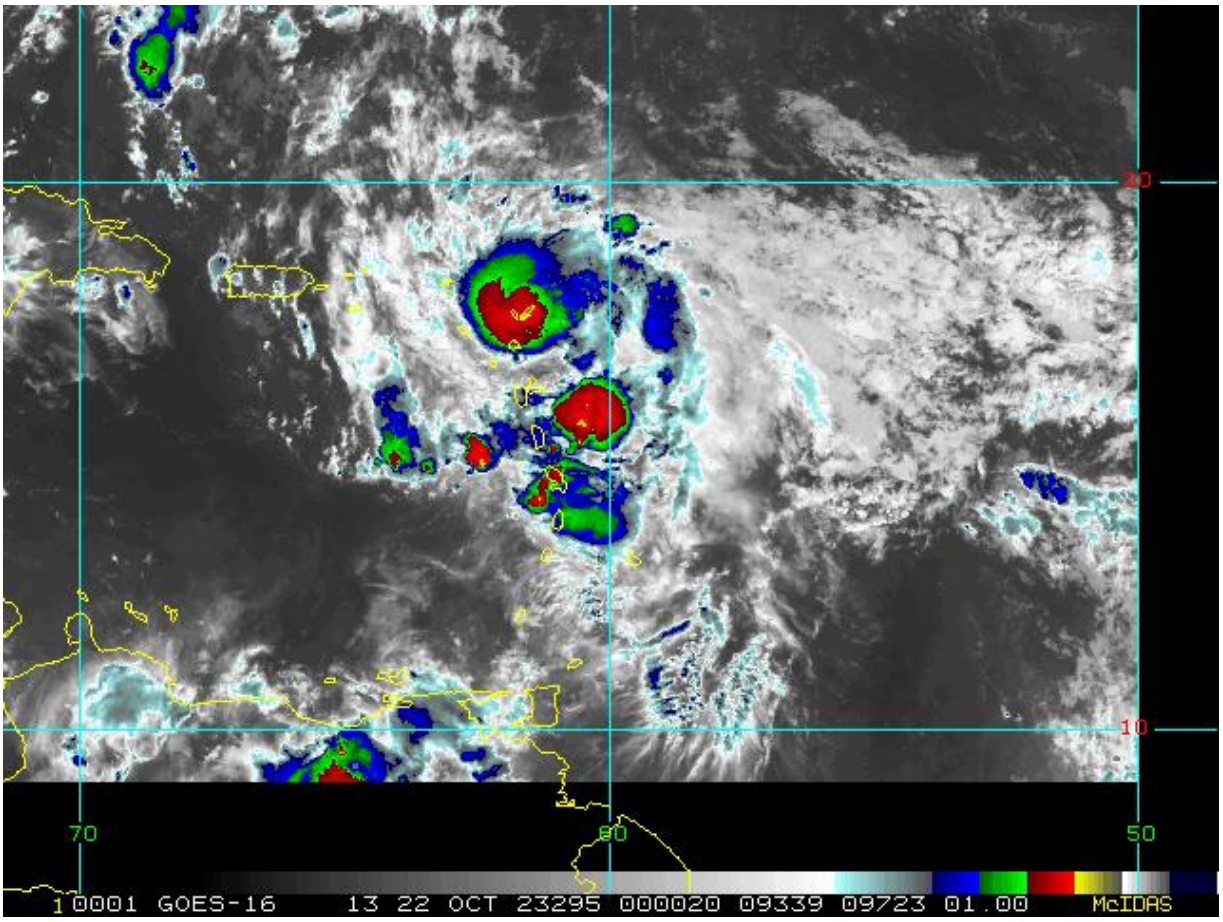
22 October at 0000UTC

Figure 1 Surface analysis over the Caribbean area on 22 October, 2023 at 1200UTC. Source: US National Hurricane Center[1]

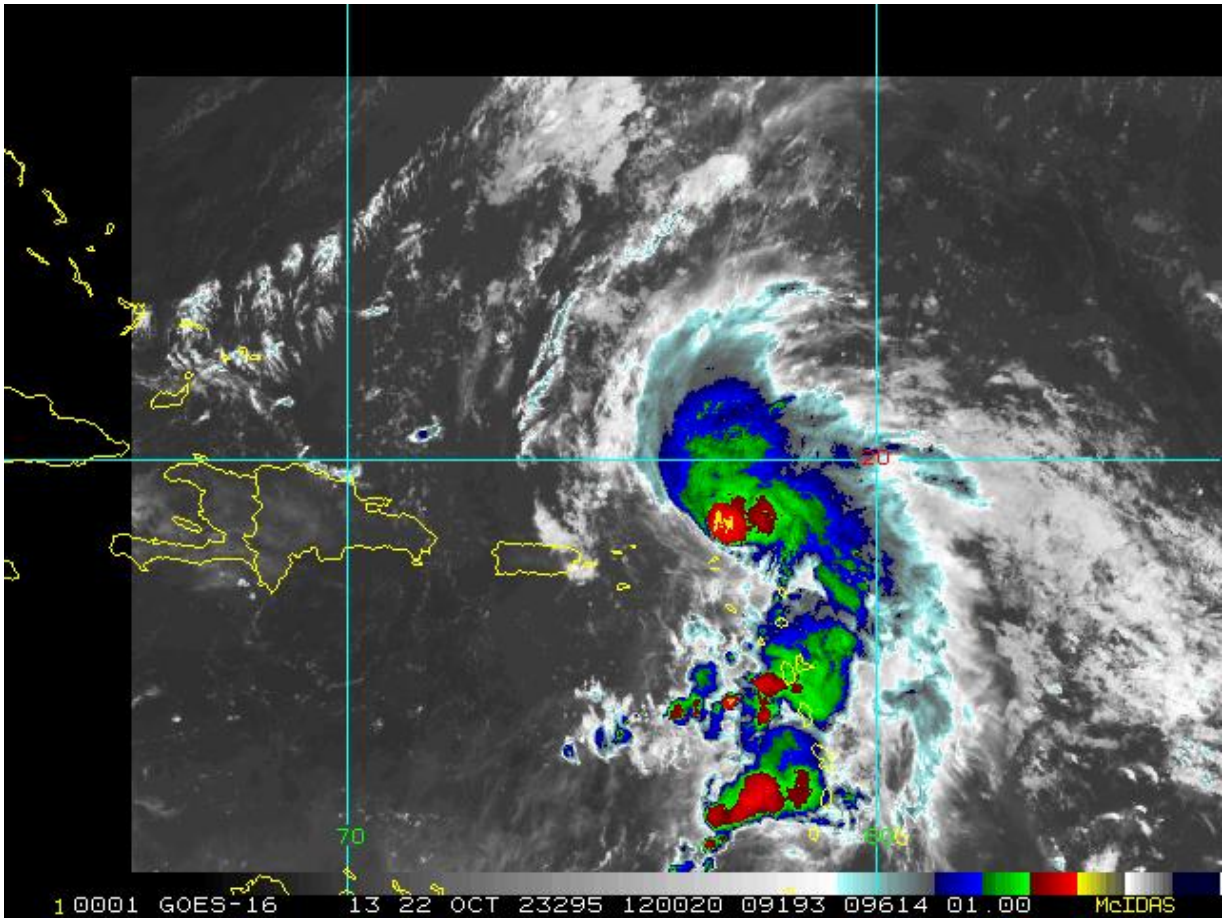
Hurricane Tammy then proceeded north-northwestward at an almost unchanged forward velocity (10 mph, 17 km/h) and at 1200UTC, its centre was located near latitude 18.9° North, longitude 62.5° West, about 60 mi (25 km) NE of Anguilla and 68 mi (109 km) NE of Sint Maarten. The shape and intensity of the hurricane was unvaried. Despite the short distance of the hurricane centre from Anguilla and Sint Maarten, the associated precipitation ceased over these countries, due to the small size of the inner core (Figure 2b).

In the following hours, Tammy moved away from the northern Leeward Islands, proceeding at almost unvaried forward velocity (9 mph, 15 km/h) towards northwest over the northern Atlantic Ocean.

1 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 22 October 2023, available at: *https://www.nhc.noaa.gov/tafb/CAR_00Z.gif*



a) 22 October at 0000UTC



b) 22 October at 1200UTC

Figure 2 Satellite imagery on 22 October, 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°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[2].

3 IMPACTS

At the time of writing this event brief, no information was available related to damage or loss in Sint Maarten due to this Covered Area Rainfall Event

2 RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://rammb-data.cira.colostate.edu/tc_realtime/storm.asp?storm_identifier=al202023

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15[3], detected the occurrence of precipitation over Sint Maarten and the surrounding waters during the period 21 to 24 October 2023. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 4. The CARE for Sint Maarten was activated on 23 October and lasted until 24 October. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[4] and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in Sint Maarten was 21 – 24 October.

CMORPH reported total accumulated values of precipitation higher than 90 mm over most of Sint Maarten. Lower values, between 60 mm and 90 mm, were shown along the western coast.

IMERG reported total accumulated values of precipitation between 60 mm and 90 mm over most of the country. Higher values, between 90 mm and 120 mm, were shown over the northeastern edge of Sint Maarten.

WRF5 showed total accumulated values of precipitation between 90 mm and 120 mm over the entire territory of Sint Maarten.

WRF7 showed total accumulated values of precipitation between 120 mm and 150 mm over the entire territory of Sint Maarten.

WRF11 showed total accumulated values of precipitation higher than 90 mm over most of Sint Maarten, with increasing values from west to east that reached between 300 mm and 330 mm over the eastern portion of the country.

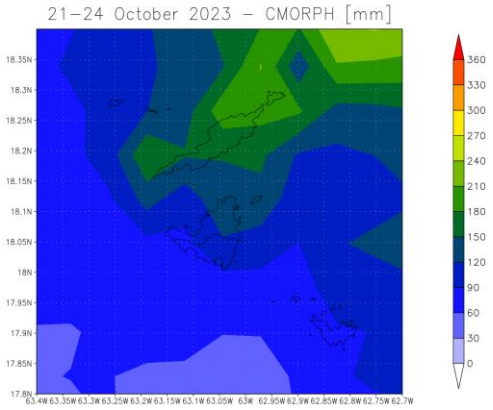
WRF15 showed total accumulated values of precipitation between 30 mm and 60 mm over most of the country. Lower amounts were shown over the northwestern and north-central edges of Sint Maarten.

3 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

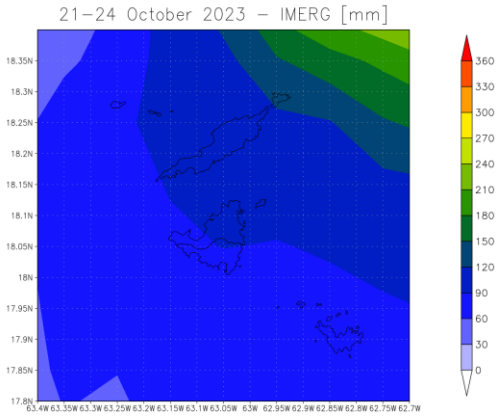
IMERG Model: The satellite-based rainfall estimation model developed by NASA, expressed in mm, derived by aggregating the IMERG 30-minute Rainfall Data at 10km spatial resolution and available at *https://jsimpsonhttps.pps.eosdis.nasa.gov/imerg/late*. Further details in the Definitions section of this reportWRF5,

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.

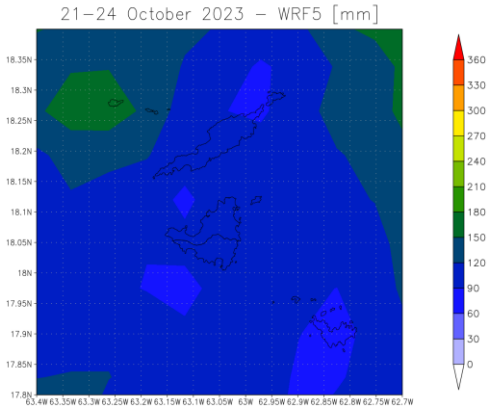
4 The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.



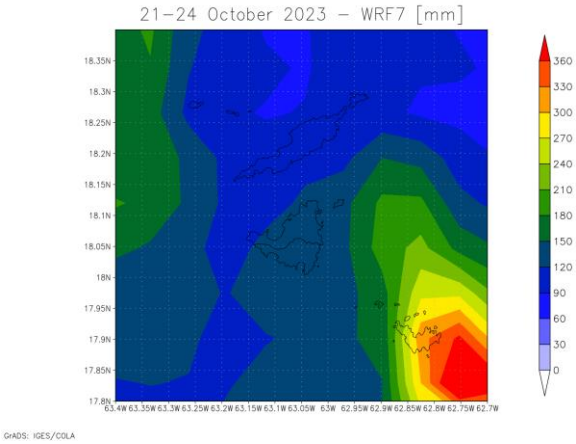
a) CMORPH



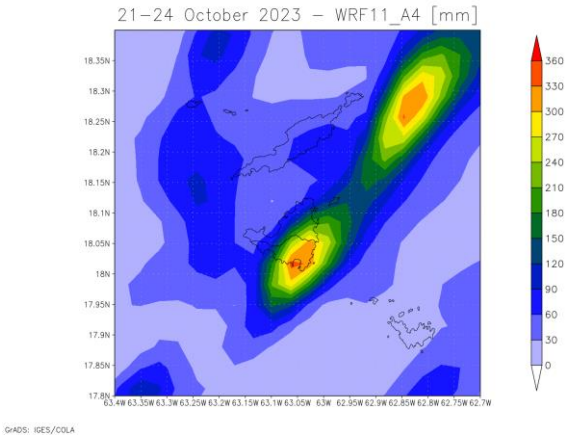
a) IMERG



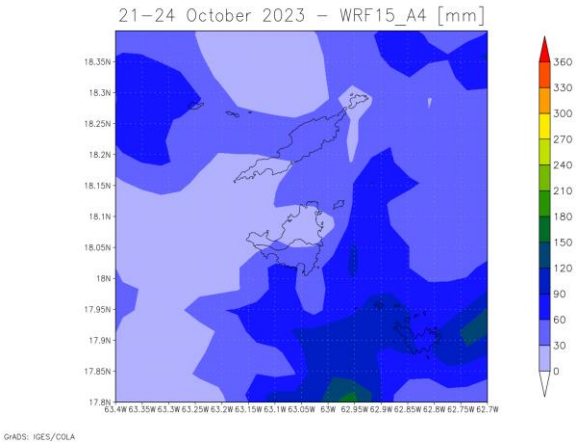
c) WRF5



d) WRF7



e) WRF11



f) WRF15

Figure 4 Total accumulated precipitation during the period 21-24 October, 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/SXM/CARE_1_2023/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/SXM/CARE_1_2023/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Sint Maarten for five data sources used by XSR3.0: CMORPH, IMERG, WRF5, WRF7 and WRF11. The RIL was the highest for WRF11.

The final RIL (RIL_{FINAL}) was calculated as the average of the five RILs from CMORPH, IMERG, WRF5, WRF7 and WRF11. 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 the Excess Rainfall policy for Sint Maarten, thus the policy was not triggered. Therefore, no payout is due under the Excess Rainfall policy to the Government of Sint Maarten.

The Wet Season Trigger (WST) component of the XSR3.0 model did not identify this CARE as a "Wet Season" event[5]. Therefore no payout is due under the Wet Season Trigger endorsement of Sint Maarten's Excess Rainfall policy.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for the Covered Area Rainfall Event (CARE) for Sint Maarten 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 endorsement of the Excess Rainfall policy and therefore no payout under this endorsement is due.

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

[5] 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.

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.