Covered Area Rainfall Event

(4/10/2023 to 6/10/2023)

British Virgin Islands

Excess Rainfall

Event Briefing

13 October 2023

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1 INTRODUCTION

This event briefing describes the impact of rainfall in the British Virgin Islands, which was associated with a Covered Area Rainfall Event (CARE), starting on 4 October and ending on 6 October 2023. The Rainfall Index Loss (RIL) for the CARE in the British Virgin Islands was above the attachment point of the country's Excess Rainfall policy and a payout of US$552,297.17 is due.

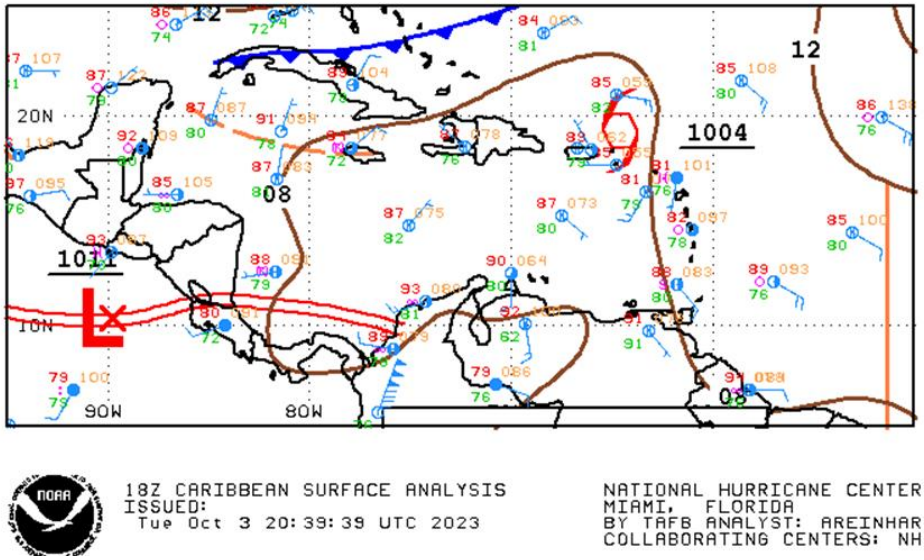
2 EVENT DESCRIPTION

On 23 September at 2100UTC, the US National Hurricane Center (NHC) reported that a tropical storm (TS) formed in the central tropical Atlantic Ocean, and it was named Philippe. Its centre was sited near latitude 15.6° North, longitude 39.7° West, about 1400 mi (2300 km) E of the Leeward Islands. The system proceeded with estimated forward velocity of 14 mph (22 km/h) towards the west. The minimum central pressure was 1005 mb and the maximum sustained winds were estimated at 40 mph (65 km/h).

During the next three days, the tropical storm proceeded with the same forward velocity and direction over the tropical Atlantic Ocean. The strong environmental wind shear and the entrainment of dry air hindered the intensification of the system, and the maximum sustained winds remained constant at about 50 mph (85 km/h). Moreover, the shear caused a marked asymmetry of the storm, with the convective bursts shifted well to the east of the system centre. From 27 September to 2 October, the intensity of the storm remained unvaried, but its forward velocity decreased and the storm started to meander to the east of the northern Leeward Islands.

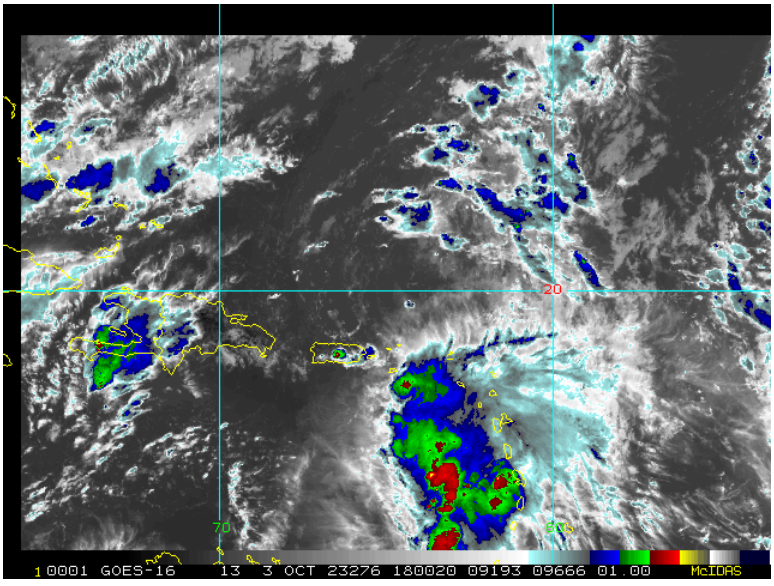
On 2 October at 2200UTC, the centre of Philippe made landfall on the island of Barbuda (Antigua and Barbuda). The intensity and sheared shape of the tropical storm were unchanged, while it increased its forward velocity, moving west-northwest at 7mph (11 km/h) along the western periphery of a mid-level high pressure area over the central Atlantic Ocean.

In the next 20 hours, TS Philippe passed just east of Anguilla and Sint Maarten, heading northwestward at 10 mph (17 km/h), and on 3 October at 1800UTC its centre was located near latitude 19.0° North, longitude 64.4° West, about 17 mi (27 km) N of Anegada Island, British Virgin Islands (Figure 1 and 2). As in the previous hours, most of the stronger convection was over the southern and eastern portions of the storm (Figure 2), and the British Virgin Islands was affected by heavy rains a few hours later, from 4 October at 0000UTC (Figure 3a).



3 October at 1800UTC

Figure 1 Surface analysis over the Caribbean area on 3 October, 2023 at 1800UTC. Source: US National Hurricane Center[1]



3 October at 1800UTC

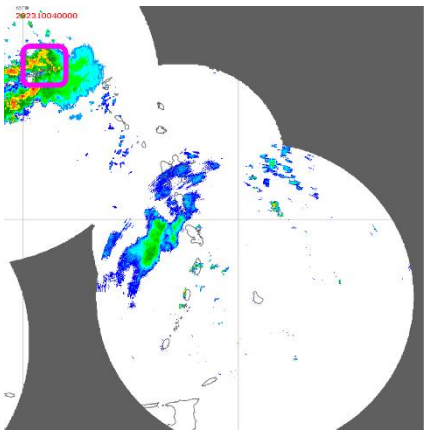
Figure 2 Satellite imagery on 3 October, 2023 at different times as indicated by the labels from the thermal infrared channel enhanced with colour. Blue/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the red/yellow colours represent very high altitude 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].

1 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 3 October 2023, available at: *https://www.nhc.noaa.gov/tafb/CAR_18Z.gif*

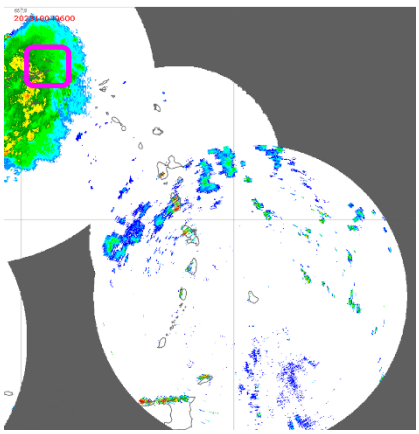
2 RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://rammb-data.cira.colostate.edu/tc_realtime/storm.asp?storm_identifier=al172023

In the next six hours, TS Philippe lost organization and its centre moved away from the British Virgin Islands, proceeding north-northwest toward the north Atlantic Ocean. Despite the long distance from the storm's centre, the British Virgin Islands continued to experience moderate to locally heavy rains for the entire day, 4 October, even when the centre of the storm moved north of those islands, as seen from the radar imagery (Figure 3).

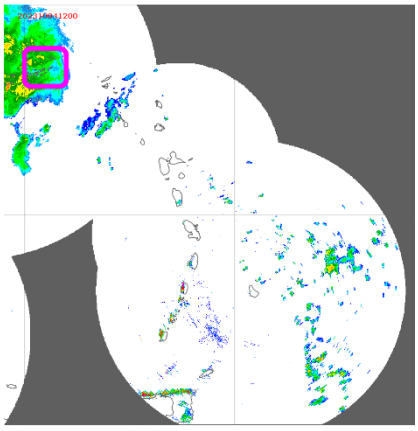
On 5 October at 0600UTC, the centre of TS Philippe was sited near latitude 24.2° North, longitude 65.9° West, about 400 mi (640 km) NNW of the British Virgin Islands. At this time, the precipitation associated with Philippe began to gradually diminish over the British Virgin Islands, and at 1200UTC it ceased.



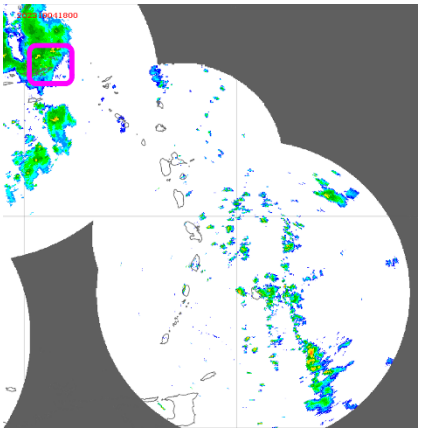
a) 4 October at 0000UTC



b) 4 October at 0600UTC



c) 4 October at 1200UTC



d) 4 October at 1800UTC

Figure 3 Radar imagery on 4 October at different times as indicated by 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. A pink square indicates the British Virgin Islands. Source: Barbados Radar Composite[3].

3 Barbados Radar Composite, available on 4 October 2023 at: *https://www.barbadosweather.org/BMS_Radar_Composite_Resp.php#*

3 IMPACTS

At the time of writing this report, information available on the effects of excess rainfall in the British Virgin Islands, due to the passage of Tropical Storm Philippe, consisted of reports from residents about major flooding in several parts of the country, including the capital Road Town and surrounding communities. The tropical storm led to closure of schools and businesses as well as power outages.[4]

Figure 4 -Vehicles partially submerged and flooded streets

In a press conference held by the British Virgin Islands' Premier and Minister of Finance on October 6, he indicated that due to the passage of Tropical Storm Philippe, some homes and businesses were affected by the heavy rainfall and flooding. The preliminary impacts included flooding in the Road Town, Huntums Ghut, Pasea, Sea Cows Bay and West End.[5]

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15[6], detected the occurrence of precipitation over the British Virgin Islands and the

[4] BVI News: PHOTOS: TS Philippe brings floods, infrastructural damage (bvinews.com)

[5] Government of the Virgin Islands: Statement by Premier Wheatley - Update on Various Matters | Government of the Virgin Islands

6 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.

surrounding waters during the period 2 to 6 October 2023. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 5. The CARE for the British Virgin Islands was activated on 4 October and lasted until 6 October. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[7] and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in the British Virgin Islands was 2 – 6 October.

CMORPH reported total accumulated values of precipitation higher than 280 mm over the entire territory of the British Virgin Islands. The maximum values, between 360 mm and 400 mm, were shown over the central area of Virgin Gorda, while lower values, between 280 mm and 320 mm, were shown over the islands of Tortola and Anegada.

IMERG reported total accumulated values of precipitation higher than 320 mm over the entire territory of the British Virgin Islands, with increasing values moving from south to north. In particular, the values ranged between 320 mm and 400 mm over Tortola, between 360 mm and 400 mm over Virgin Gorda and reached the maximum, between 400 mm and 440 mm, over Anegada.

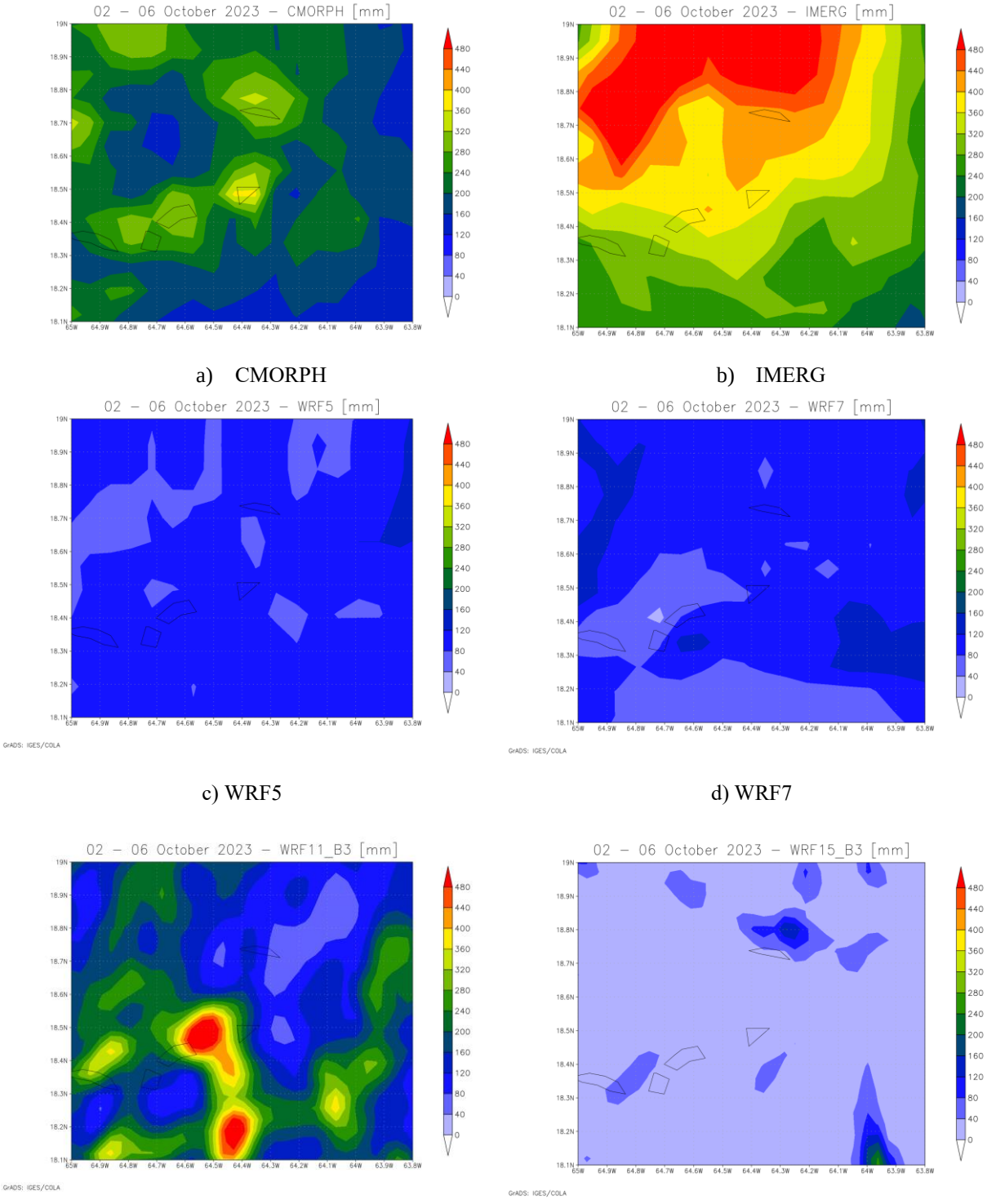
WRF5 showed total accumulated values of precipitation between 80 mm and 120 mm over the entire country.

WRF7 showed total accumulated values of precipitation between 80 mm and 120 mm over both Anegada and Virgin Gorda and over the southern side of Tortola. Lower values, between 40 mm and 80 mm, were shown over the remainder of the country.

WRF11 showed total accumulated values of precipitation higher than 120 mm over Tortola and Virgin Gorda, with increasing values moving from west to east over Tortola and moving east to west over Virgin Gorda. The maximum values, between 440 mm and 480 mm, were shown along the eastern coast of Tortola. Lower accumulated values were shown over Anegada.

WRF15 simulated total accumulated values of precipitation greater than 40 mm along the northern coast of Anegada, while lower accumulated values were shown over the remainder of the country.

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) IMERG

c) WRF5

d) WRF7

e) WRF11

f) WRF15

Figure 5 Total accumulated precipitation during the period 2-6 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/VGB/CARE_1_2023/daily_prec_short.mp4

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

The Rainfall Index Loss (RIL) was above the loss threshold for the British Virgin Islands for CMORPH, IMERG, WRF5, WRF7 and WRF11. The RIL was the highest for CMORPH.

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs from CMORPH, IMERG, WRF5, WRF7 and WRF11. The RIL_{FINAL} was greater than the attachment point of the Excess Rainfall policy for the British Virgin Islands, and therefore the policy was triggered. Therefore, a payout of US$552,297.17 is due to the Government of the British Virgin Islands under the Excess Rainfall policy.

The Wet Season Trigger (WST) component of the XSR3.0 model did not identify this CARE as a "Wet Season" event[8]. Therefore no payout is due under the Wet Season Trigger endorsement of the British Virgin Islands' Excess Rainfall policy.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for the CARE that started on 4 October and ended on 6 October 2023, produced government losses which were above the attachment point of the British Virgin Islands Excess Rainfall policy. Final calculations show that a payout of US$552,297.17 is due.

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

8 The WST endorsement provides coverage for rainfall events that occur when soil is oversaturated (usually due to previous rainfall in a relatively short period of time). 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.

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.