Covered Area Rainfall Events

(04/06/2022 to 06/06/2022)
The Bahamas - Extreme North

(06/06/2022 to 08/06/2022)
The Bahamas - North

Excess Rainfall

Event Briefing

15 June 2022

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1 INTRODUCTION

The Bahamas was under the influence of Tropical Cyclone Alex, resulting in adverse weather conditions from June 2nd to 8th, 2022. During this period, the heaviest rainfall occurred particularly over The Bahamas - Extreme North, and with a lesser extent over The Bahamas - North.

This event briefing describes the impact of rainfall on The Bahamas - Extreme North and The Bahamas - North[1] regions, which were associated with Covered Area Rainfall Events (CAREs), starting on June 4th and ending on June 6th 2022 for The Bahamas - Extreme North, and for The Bahamas - North starting on June 6th and ending on June 8th. The Rainfall Index Loss (RIL) for both Covered Area Rainfall Events were below the attachment points of the Excess Rainfall policies of both regions (Extreme North and North), and therefore no payouts are due to the Government of The Bahamas.

2 EVENT DESCRIPTION

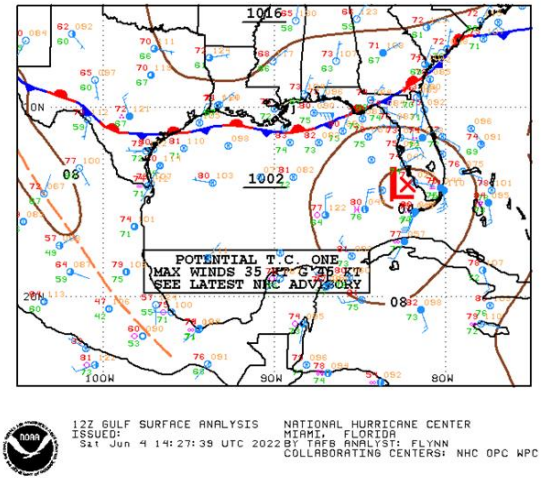
On June 4th, an area of low pressure was moving northeastward across Florida (Figure 1a). The US National Hurricane Center (NHC) was monitoring it as a tropical disturbance, since it could potentially become a tropical storm in the following days. At that time, the disturbance had a poorly-organized shape and the centre of the circulation was not well defined. At 1200 UTC, a cluster of convection occurred near the estimated centre of circulation (26.0°N, 82.2°W), while a quasi-linear band of deep convection extended along the south-north axis approximately 300 to 400 km east of the estimated centre, as visible from the radar imagery in Figure 2a. In the following hours on the same day, the convection became more disorganized, but thunderstorms were still active to the east of the disturbance (Figure 2b, 2c, 2d). Over all of The Bahamas, the associated moderate to locally intense precipitation lasted for the entire day. The heaviest rainfall occurred over The Bahamas - Extreme North, and to a lesser extent over The Bahamas - North (Figure 2).

On the next day, June 5th, the low pressure system became a tropical storm, the first of the Atlantic Hurricane Season 2022, and it was named Alex. At 0900 UTC the centre of circulation was located at 29.1°N, 76.3°W, about 174 mi (280 km) northeast of Great Abaco, (The Bahamas – Extreme North). However, the convection was organized in a small cluster close to the centre of the northeastern quadrant. In the following hours, Alex proceeded quickly toward the northeast heading towards Bermuda and moved away from The Bahamas.

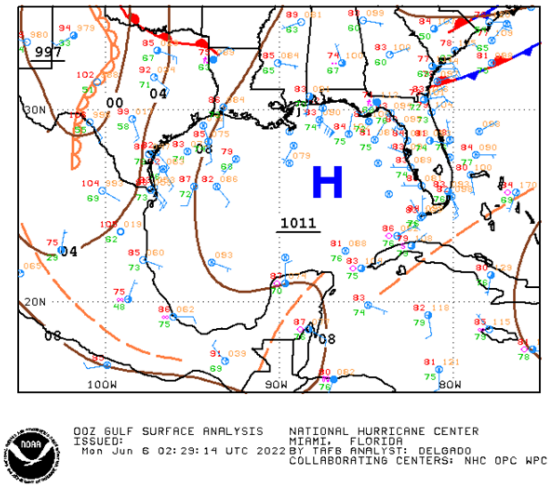
Due to the passage of this area of perturbed weather, a surface trough developed on June 6th over The Bahamas. It extended from Tropical Storm Alex southwestward to the northwest Bahamas, south Florida and into the southeast Gulf of Mexico (Figure 1b). This configuration remained almost unvaried on June 7th and 8th, and it led to the development of scattered moderate to isolated strong thunderstorms from 24°N to 29°N and west of 75°W from June 6th

[1] The Government of The Bahamas has four Excess Rainfall policies: one for The Bahamas SouthEast, one for The Bahamas Central, one for The Bahamas North and one for The Bahamas Extreme North.

to 8th. Moderate to locally intense precipitation occurred over The Bahamas and surrounding waters, with the heaviest rainfall over the waters to the north of Andros Island (The Bahamas - North) from June 6th at 2100 UTC to June 7th at 1500 UTC. The northern region of Andros Island and New Providence (The Bahamas - North) as well as Great Abaco and Grand Bahama Islands (The Bahamas - Extreme North) were also affected by moderate to locally intense precipitation for some hours within this interval.



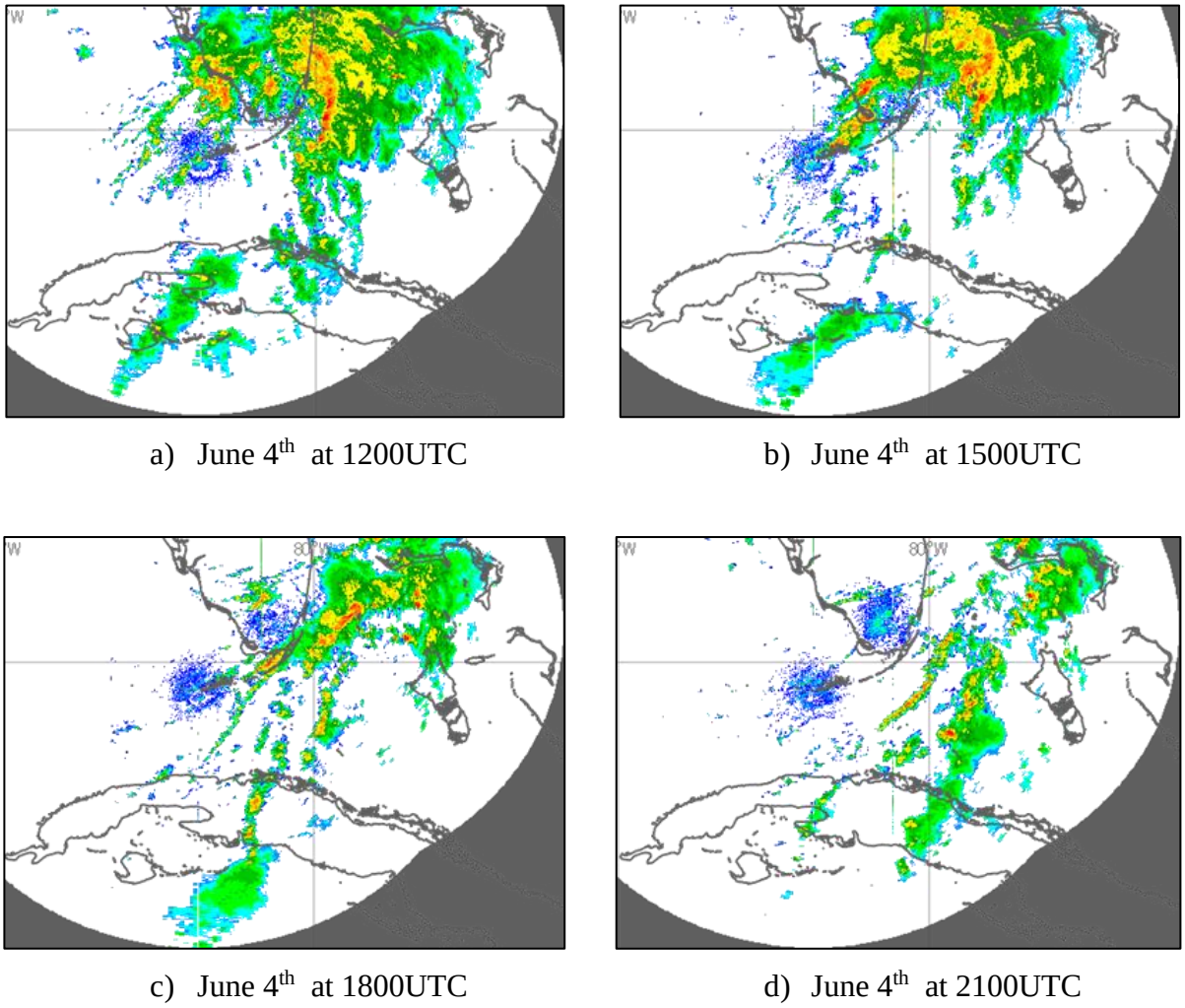
a) June 4th at 1200 UTC



b) June 7th at 0000 UTC

Figure 1 Surface analysis over the Gulf of Mexico area at different times as indicated by the labels. Source: US National Hurricane Center[2]

[2] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, available on June 4th and 7th 2022 at:
https://www.nhc.noaa.gov/tafb/GULF_12Z.gif and
https://www.nhc.noaa.gov/tafb/GULF_00Z.gif



a) June 4th at 1200UTC

b) June 4th at 1500UTC

c) June 4th at 1800UTC

d) June 4th at 2100UTC

Figure 2 Radar imagery on June 4th at 1200 UTC (a) at 1500 UTC (b) at 1800 UTC (c) and at 2100 UTC (d) as indicated in the label 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. Source: Barbados Radar Composite[3].

[3] Barbados Radar Composite, available on June 4th at: https://www.barbadosweather.org/BMS_Radar_Composite_Resp.php#

3 IMPACTS

According to local news[4], at least 140 homes sustained damage from the tropical cyclone, which drenched north western islands (the damaged homes included at least 100 on Grand Bahama and 40 on Bimini); Grand Bahama Minister, Ginger Moxey, indicated that a number of the homes were still damaged from the passage of Hurricane Dorian in 2019.

The administrator for West End Grand Bahama[5], Ricardo Ferguson, mentioned that there were no reports of emergencies even though the weather system drenched the island with heavy rainfall. He also reported that several people, including a family of six, sought refuge in the shelters opened during the tropical storm warning. Mr. Ferguson also indicated that the city of Freeport with its adequate drainage system, had little flooding. Minister Moxey indicated that the Grand Bahama Power Company reported outages throughout the island. Additionally, three hurricane shelters on the island were activated and the Grand Bahama Airport was closed until June 5th, following a safety inspection and security assessments.

Figure 3 Flooding in Grand Bahama on Saturday, June 4, 2022. Source: ewnews.com[6]

4 RAINFALL MODEL OUTPUTS

This report describes two CAREs that occurred during the period June 4th - 8th 2022 over The Bahamas - Extreme North and The Bahamas - North. All three data sources used by the XSR

[4] Ewnews.com. 140 HOMES DAMAGED
[5] GB ADMINISTRATOR: Weather system brought flooding, highlights need to ready shelters Eye Witness News (ewnews.com)

2.5 model, CMORPH[7], WRF5 and WRF7[8], detected the occurrence of precipitation over The Bahamas and the surrounding waters during this period. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below and displayed in Figure 4 and Figure 5 for the two CAREs respectively.

The first CARE was activated for The Bahamas - Extreme North, on June 4th and lasted for the period June 4th - 6th. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[9], thus the period considered by the XSR 2.5 model for the loss estimate based on the accumulated precipitation in The Bahamas – Extreme North was June 2nd - 6th.

The second CARE was activated for The Bahamas - North, on June 6th and lasted for the period June 6th - 8th. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation, thus the period considered by the XSR2.5 model for the loss estimate based on the accumulated precipitation in The Bahamas – North was June 4th - 8th. Table 1 summarizes these intervals for the two CAREs.

Country	CARE activation period	Period considered for the loss estimate by XSR2.5 model
The Bahamas - Extreme North	June 4th - 6th	June 2nd - 6th
The Bahamas - North	June 6th - 8th	June 4th - 8th

CMORPH reported a total amount of precipitation accumulated in the period June 2nd - 6th between 180 mm and 240 mm over Grand Bahama Island (The Bahamas - Extreme North) and between 100 mm and 220 mm over Great Abaco Island (The Bahamas - Extreme North). Lower values were reported elsewhere over The Bahamas. In the period from June 4th to 8th, CMORPH showed the highest amounts of accumulated rainfall over Eleuthera Island (The Bahamas - North), with values between 120 mm and 220 mm. Slightly lower amounts were reported over New Providence (The Bahamas - North), with values between 140 mm and 160 mm, and over the northern edge of Andros Island (The Bahamas - North), with values between 140 mm and 180 mm. For the remainder of The Bahamas - North, the simulated rainfall

[7] 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.

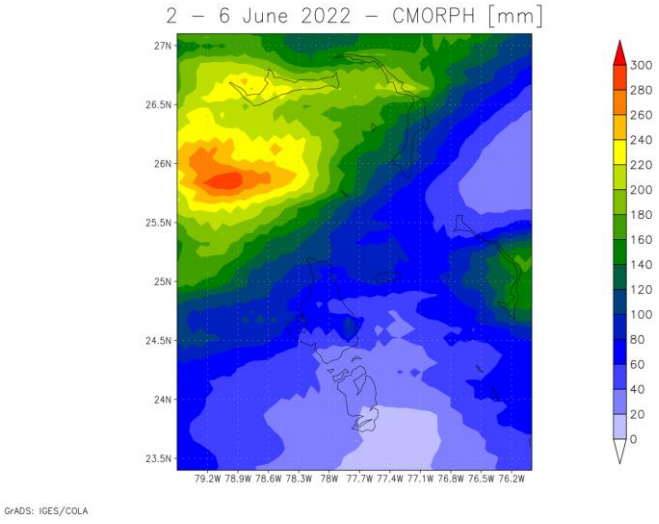
[8] WRF5 and WRF7 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data *https://www.mmm.ucar.edu/weather-research-and-forecasting-model*. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [*http://rda.ucar.edu/datasets/ds083.2/*]). Further details in the Definitions section of this report.

[9] 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.

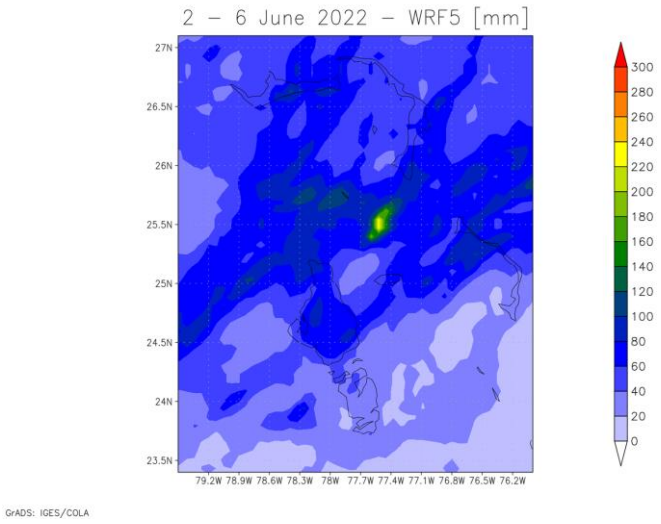
amounts were lower than 100 mm.

WRF5 showed total accumulated values of precipitation generally lower than CMORPH during both periods. During the period June 2nd - 6th, the simulated amounts were higher than 40 mm over The Bahamas - Extreme North, with a peak amount between 100 mm and 120 mm over Grand Bahama. From June 4th to 8th, WRF5 simulated total accumulated values of rainfall higher than 40 mm over the northern area of Andros and Eleuthera Islands and over New Providence (The Bahamas – North). Maximum amounts between 100 mm and 120 mm were reported over the northern edge of Andros Island.

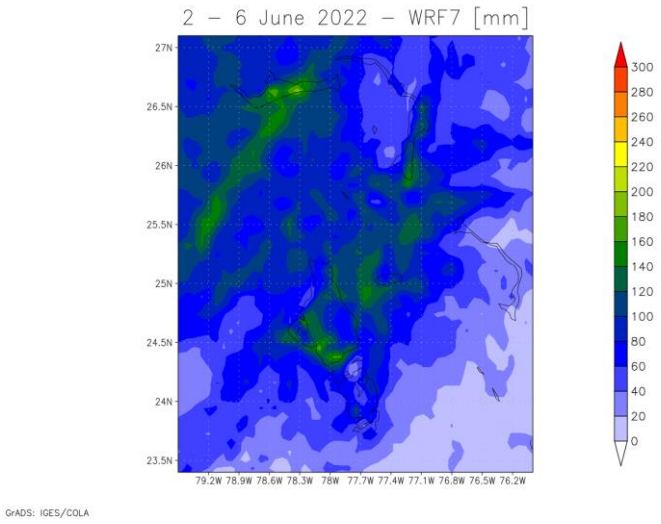
WRF7 simulated total accumulated values of rainfall with a similar pattern to that of WRF5, but with higher amounts during both periods. In the period June 2nd - 6th, the simulated amounts were higher than 60 mm over The Bahamas - Extreme North, with the highest values of precipitation, between 180 mm and 200 mm, over Grand Bahama. From June 4th to 8th, WRF7 reported total accumulated values of rainfall higher than 60 mm over most of Andros Island and New Providence (The Bahamas – North), with maximum amounts between 140 mm and 160 mm over the northern area of Andros Island. For the remainder of The Bahamas - North, the simulated rainfall amounts were lower than 60 mm.



a) CMORPH

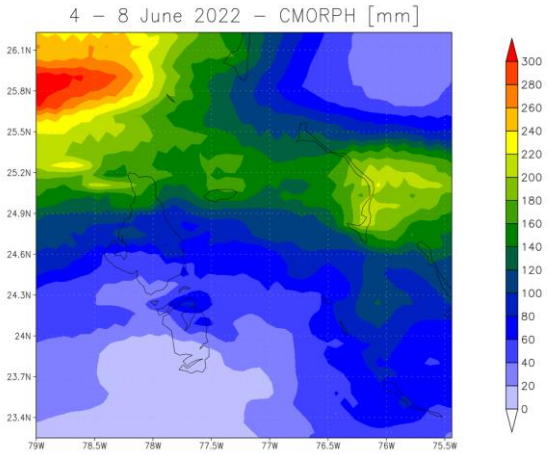


b) WRF5

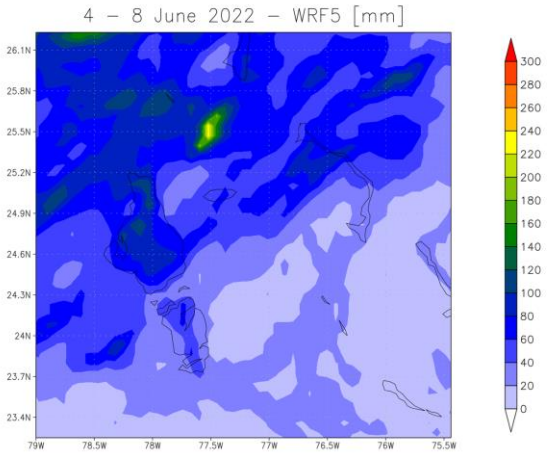


c) WRF7

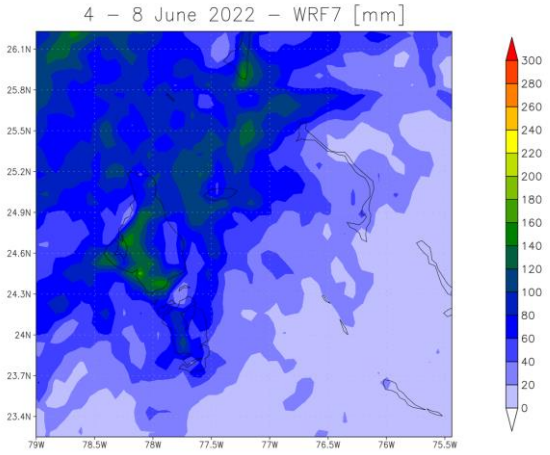
Figure 4 Total accumulated precipitation during the period June 2nd - 6th, 2022, over The Bahamas - Extreme North, estimated by CMORPH (a), WRF5 (b) and WRF7 (c). Source: CCRIF SPC



a) CMORPH



b) WRF5



c) WRF7

Figure 5 Total accumulated precipitation during the period June 4th - 8th, 2022, over The Bahamas - North estimated by CMORPH (a), WRF5 (b) and WRF7 (c). 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 the CARE in The Bahamas - Extreme North:

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BHS/BHS_EN/CARE_1_2022/daily_prec_short.mp4
https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BHS/BHS_EN/CARE_1_2022/daily_prec_long.mp4

For the CARE in The Bahamas - North:

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BHS/BHS_N/CARE_1_2022/daily_prec_short.mp4
https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BHS/BHS_N/CARE_1_2022/daily_prec_long.mp4

For the CARE that occurred in The Bahamas - Extreme North, the Rainfall Index Loss (RIL) was above the loss threshold for this region for two of data sources used by XSR2.5: CMORPH and WRF7. The RIL was the highest for CMORPH, due to the higher values of accumulated precipitation presented over this region.

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs from CMORPH and WRF7. 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 The Bahamas - Extreme North, and therefore the CARE did not trigger a policy payment.

For the CARE that occurred over The Bahamas - North, the Rainfall Index Loss (RIL) was above the loss threshold for this region for two of data sources used by XSR2.5: CMORPH and WRF7. The RIL was the highest for CMORPH, due to the higher values of accumulated reported over this region.

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs from CMORPH and WRF7. 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 of The Bahamas - North, and therefore the CARE did not trigger a policy payment.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for the Covered Area Rainfall Event (CARE) for The Bahamas - Extreme North was below the attachment point of the Excess Rainfall policy for this subregion of The Bahamas, and therefore no payout is due.

Similarly, the Rainfall Index Loss calculated for the Covered Area Rainfall Event (CARE) for The Bahamas - North was below the attachment point of the Excess Rainfall policy for this subregion and therefore no payout 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.