Covered Area Rainfall Event (03/07/2024 to 07/07/2024)

Excess Rainfall

Event Briefing

Jamaica

13 July 2024

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1 INTRODUCTION

This event briefing describes the impact of rainfall on Jamaica, which was associated with a Covered Area Rainfall Event (CARE) starting on 3 July and ending on 7 July 2024. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was above the attachment point of Jamaica's Excess Rainfall policy and therefore, the policy was triggered. A payout of US$ 10,278,753.76 is due to the Government of Jamaica under its Excess Rainfall policy.

2 EVENT DESCRIPTION

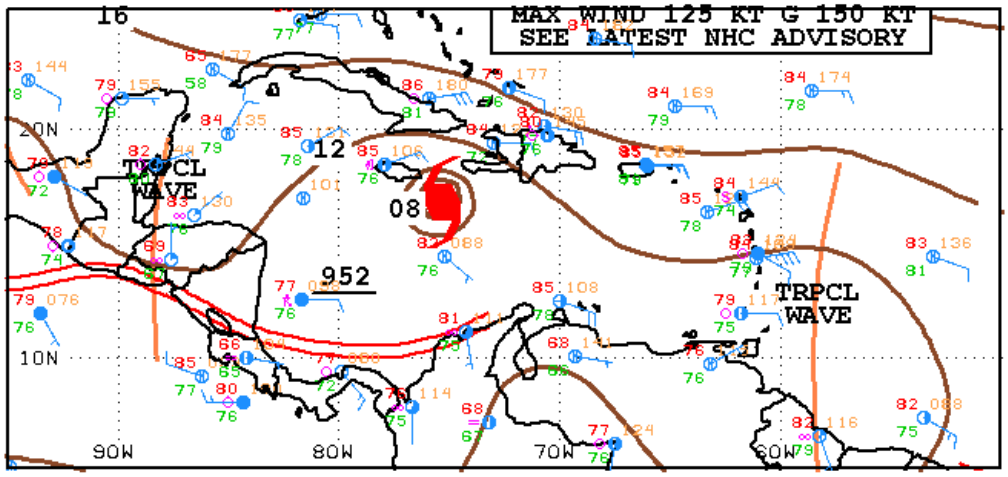
On 30 June at 1530UTC, the US National Hurricane Center (NHC) reported that Tropical Cyclone Beryl evolved into a Category 4 hurricane. At this time, Beryl was getting closer to the Windward Islands, as its centre was sited near latitude 10.8° North, longitude 54.9° West, about 350 mi (565 km) ESE of Barbados. On the next day, 1 July, Hurricane Beryl passed over the southern Lesser Antilles, affecting these islands with tropical-storm conditions. Grenada experienced hurricane conditions for some hours, before and after the hurricane making landfall on Carriacou (Grenada). Hurricane Beryl then moved away from the Windward Islands, heading west-northwestwards at 20 mph (31 km/h) along the southwestern periphery of a strong subtropical ridge oriented ESE-to-WNW sited over the North Atlantic Ocean. On 2 July, Beryl intensified to become a Category 5 hurricane, but during the final hours of the day it weakened again to Category 4, due to the presence of a westerly wind shear over the central Caribbean Sea and the entrainment of dry air in the cyclone circulation.

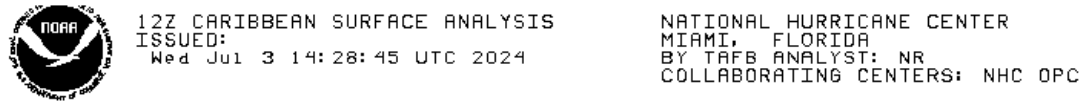
During the first hours of 3 July, Hurricane Beryl passed just south of Haiti, affecting mostly the south of the country with tropical-storm conditions. It continued moving with unvaried forward velocity and direction, heading towards Jamaica. At 1200 UTC, the hurricane's centre was located near latitude 16.9° North, longitude 75.3° West, about 125 mi (200 km) SE of Kingston, Jamaica (Figure 1a). In the next 12 hours, Beryl's centre passed just south of Jamaica. From the satellite images, the hurricane appeared to be experiencing the effects of a moderate northwesterly wind shear. The eye became cloud-filled and the hurricane's cloud pattern was elongated northeast to southwest and ragged (Figure 2a). Nevertheless, very deep convection was present in the eyewall and over the outer rainband to the east of the centre, and the core of the hurricane remained intact (Figure 2a). Consequently, Beryl remained a Category 4 hurricane during the time it was in the vicinity of Jamaica, with maximum sustained winds estimated at approximately 140 mph (225 km/h). The heavy precipitation associated with the northern portion of the hurricane's core affected all of Jamaica progressively from east to west, from 3 July at 1200UTC to 4 July at 0300UTC. The most intense rainfall was experienced along the central and western portions of the southern coast of Jamaica, at about 2100UTC (Figure 2b). At this time the northern eyewall brushed the southern coast, with hurricane conditions occurring within a radius of 45 miles (75 km) from the eye (Figure 2b).

On 4 July at 0600UTC, Beryl moved away from Jamaica as a Category 3 hurricane and proceeded towards the Cayman Islands with unmodified direction and forward velocity.

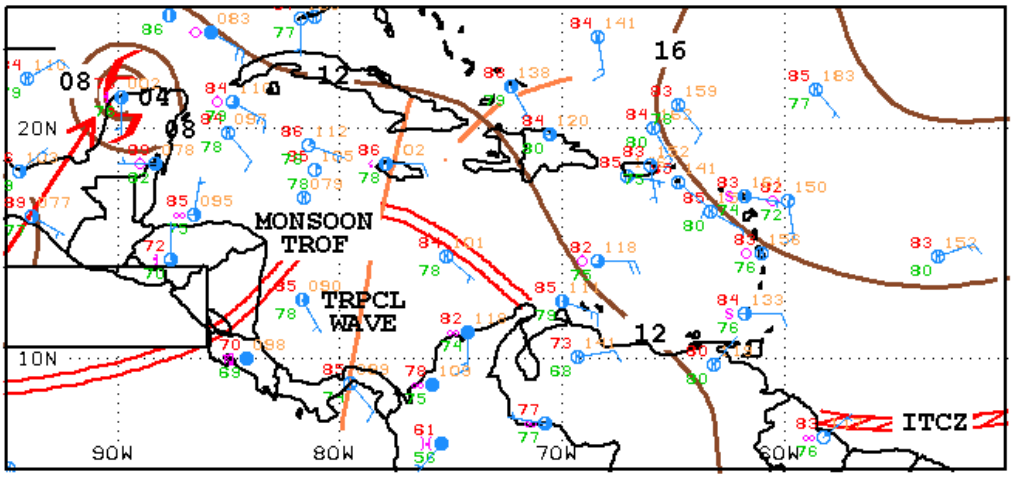
Two days later, on 6 July, when Beryl was already over the Yucatan peninsula, an intense tropical wave passed over Jamaica, supporting the development of scattered moderate to isolated intense

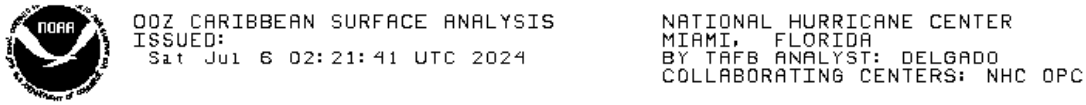
thunderstorms over the country and the surrounding waters (Figure 1b).





a) 03 July at 1200UTC

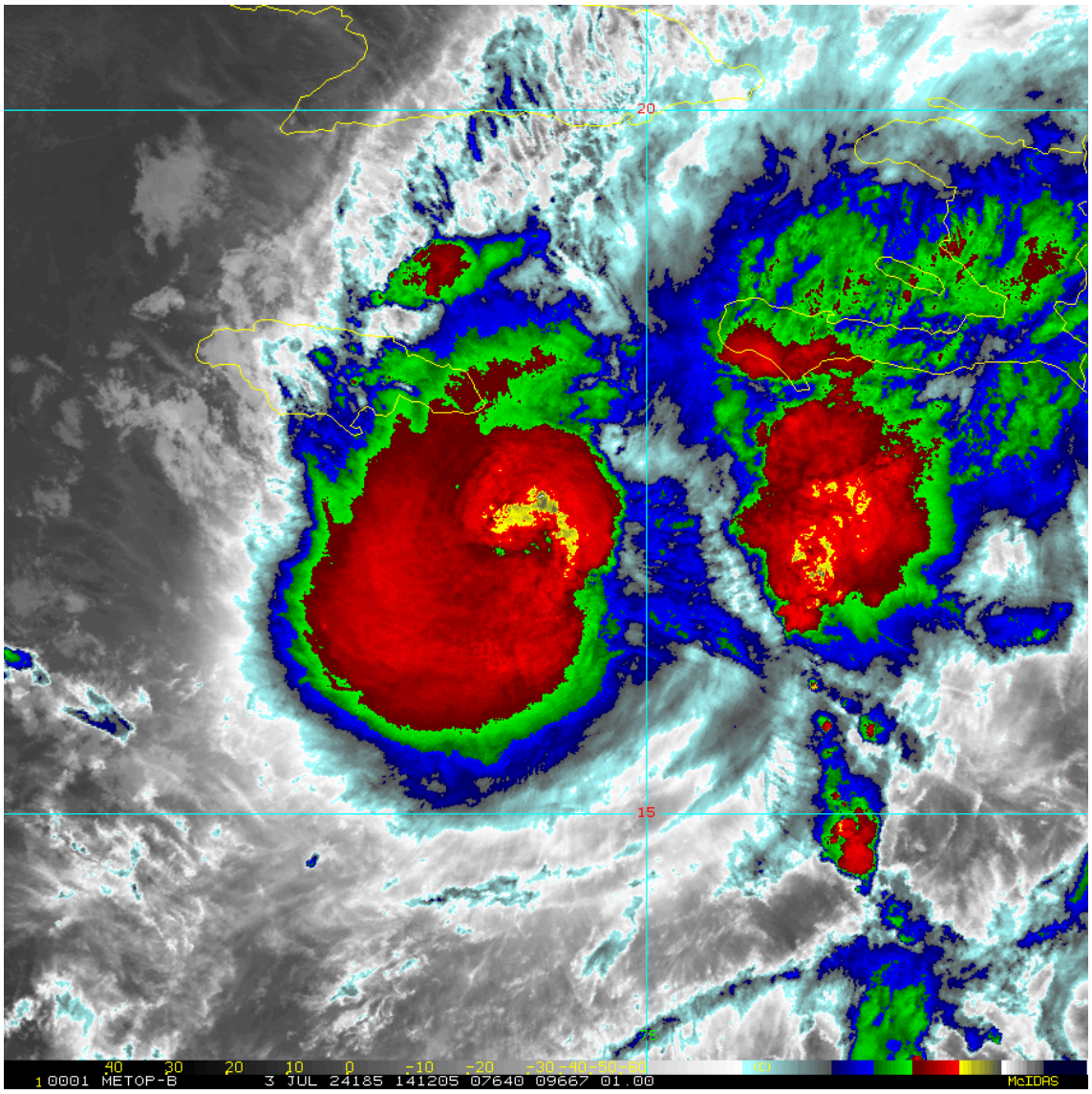




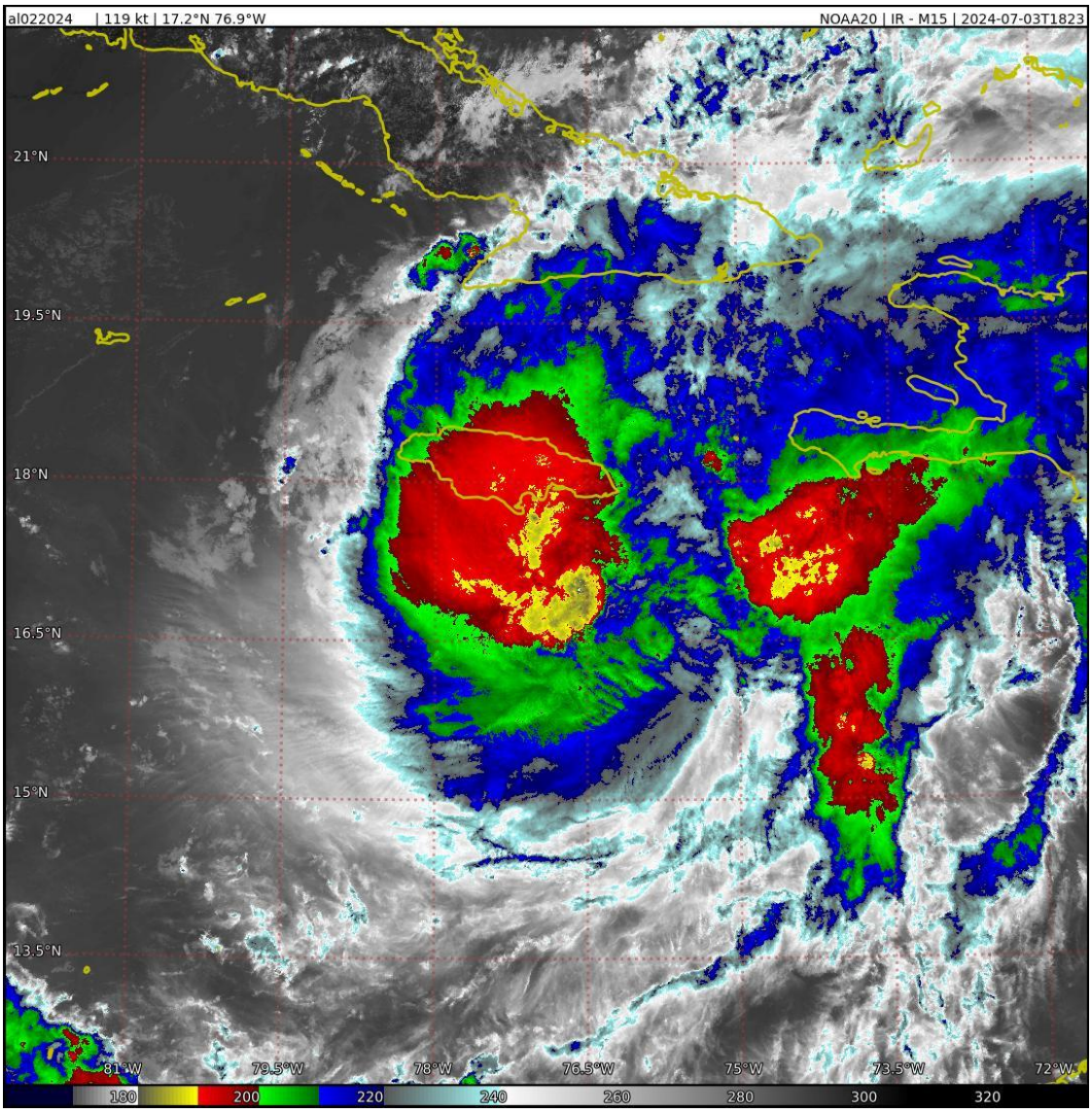
b) 06 July at 0000UTC

Figure 1 Surface analysis over the Caribbean area on 3 July and 6 July 2024 at different times as indicated in the labels. Source: US National Hurricane Center[1]

1 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: 3 July and 6 July 2024, available at: https://www.nhc.noaa.gov/tafb/CAR_12Z.gif, https://www.nhc.noaa.gov/tafb/CAR_00Z.gif



a) 03 July at 1412UTC



b) 03 July at 1823UTC

Figure 2 Satellite imagery on 3 July, 2024 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].

2 RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://rammb-data.cira.colostate.edu/tc_realtime/storm.asp?storm_identifier=al022024

3 REPORTED IMPACTS

At the time of writing this report, the available information on damage in Jamaica due to Hurricane Beryl is shown below.

The hurricane caused widespread damage in Jamaica, primarily in the southwestern areas of the country. About 65 per cent of customers were left without power.

The three major airports were closed by July 3; The Sangster International Airport (SIA) in Montego Bay reopen next day since the Airport Authority of Jamaica indicated that there was no major damage to SIA; the Norman Manly International Airport (NMIA) sustained damage to section of the roof of the passenger pier and this also resulted in debris being scattered on the ramp, the airport remain closed on Thursday to facilitate the necessary corrective actions, reopening by July 5; The Ian Fleming International Airport (IFIA) in Boscobel reopen on July 4 after the necessary inspections despite the minor infrastructural damage in some section, terminal and runaways are all in good order for operations[3]

In Kingston, the capital city, a significant number of roofs were lost due to heavy rainfall and strong winds. Also, houses were damaged and trees uprooted, electricity poles fell down and most roads where inaccessible[4].

Figure 5 Workers saving pieces of fences (Joe Raedle) and flooded streets (Reuters) in Kingston

The Office of Disaster Preparedness and Emergency Management (ODPEM) reported that the main road in Port Royal and Crescent Road towards Spanish Town were blocked due to fallen utility poles[5]. The Jamaican Urban Transit Company helped to transport people during this event.

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and

3 Abc News: Hurricane Beryl leaves widespread damage in Jamaica, targets Mexico and Texas - ABC News (go.com)
All Airports and Aerodromes to Reopen by July 5 – Jamaica Information Service (jis.gov.jm)
4 BBC News: Hurricane Beryl: Many Jamaicans without power after storm thunders through (bbc.com)
5 Jamaica Loop News: ODPEM warns of impassable roads amid Hurricane Beryl | Loop Jamaica (loopnews.com)

WRF15[6], detected the occurrence of precipitation over Jamaica and the surrounding waters during the period 01 to 07 July 2024. Each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 4. A CARE for Jamaica was activated on 03 July and lasted until 07 July. 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 Jamaica was 01 to 07 July.

CMORPH reported total accumulated values of precipitation between 100 mm and 150 mm over most of Jamaica. Higher values, between 150 mm and 200 mm, were reported over some areas along the southern coast and the eastern part of the island.

IMERG reported total accumulated values of precipitation higher than 150 mm over most of Jamaica, with the maximum values, higher than 400 mm, over the area of Old Harbour on the southern coast of Jamaica.

WRF5 showed total accumulated values of precipitation higher than 150 mm over three areas:the eastern side of the island, with maximum values between 400 mm and 450 mm; over the central southern area (over Clarendon and Manchester parishes), with maximum values between 300 mm and 350 mm; and over a limited area in Westmoreland parish, with values between 150 mm and 200 mm. Lower values were reported over the rest of the country.

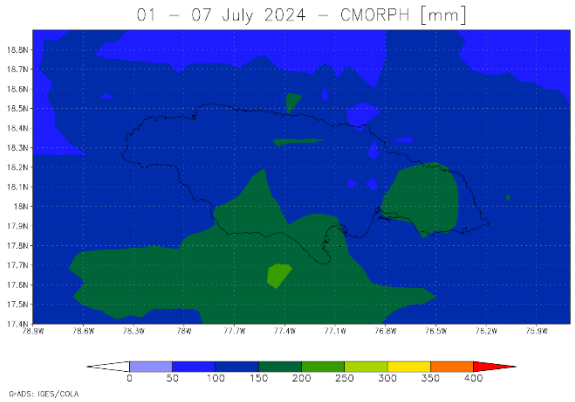
WRF7 reported total accumulated values of precipitation higher than 150 mm over most of Jamaica, with the maximum values, between 350 mm and 400 mm, over the eastern part of the island.

WRF11 showed total accumulated values of precipitation between 200 mm and 300 mm over localized areas in the central and eastern Jamaica. Lower values, between 50 mm and 150 mm, were reported over the rest of the country.

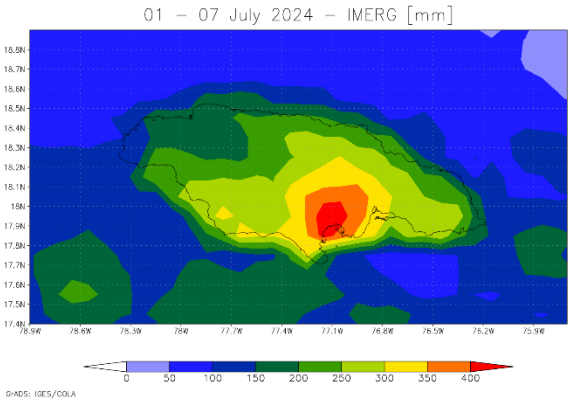
WRF15 reported total accumulated values of precipitation higher than 150 mm over most of Jamaica, with the maximum values, higher than 400 mm, over the eastern side of the island, in particular in the parishes of St. Catherine and Portland.

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.

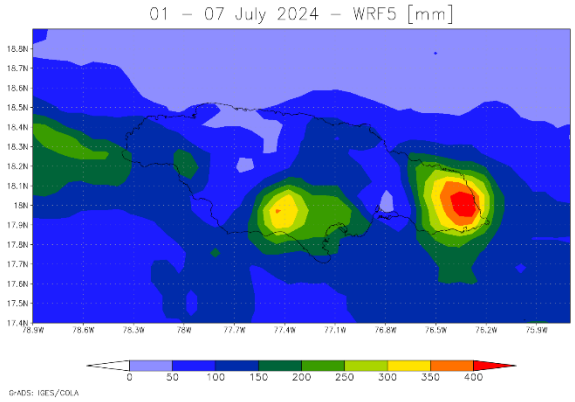
7 The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.



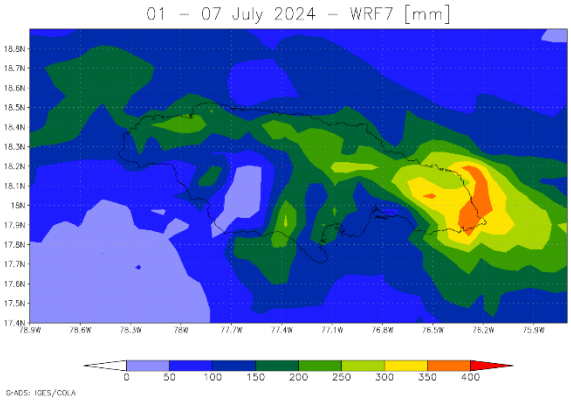
a) CMORPH



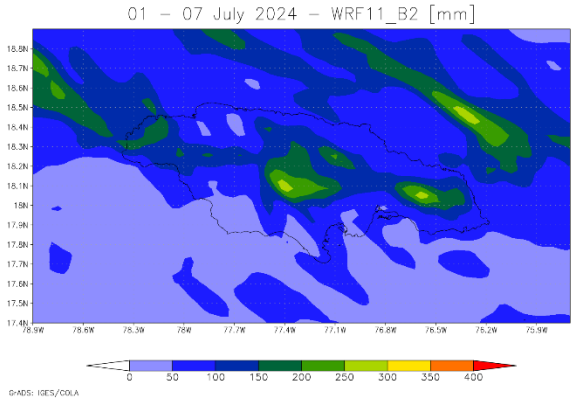
b) IMERG



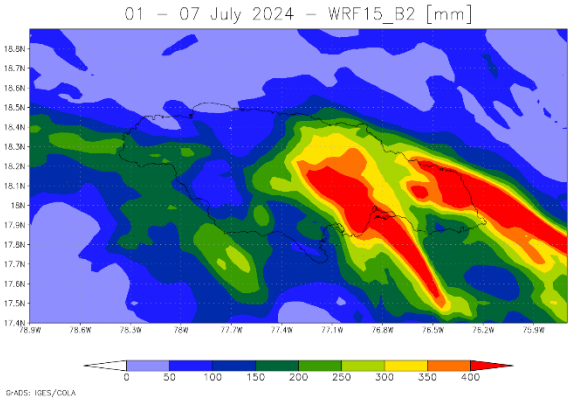
c) WRF5



d) WRF7



e) WRF11



f) WRF15

Figure 6 Total accumulated precipitation during the period 01 – 03 July, 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/JAM/CARE_1_2024/daily_prec_short.mp4
https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/JAM/CARE_1_2024/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Jamaica's Excess Rainfall policy for five data sources used by XSR3.0: CMORPH, IMERG, WRF5, WRF7, and WRF15. The RIL was the highest for WRF15.

The final RIL (RIL_{FINAL}) was calculated as the average of the five RILs from CMORPH, IMERG, WRF5, WRF7, and WRF15. The RIL_{FINAL} was greater than the attachment point of the Excess Rainfall policy for Jamaica and therefore this CARE qualified as a triggering event. Therefore, a payout is due under this Excess Rainfall policy to the Government of Jamaica.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for the Covered Area Rainfall Event (CARE) for Jamaica that started on 03 July and ended on 07 July 2024, produced government losses that were above the attachment point of Jamaica's Excess Rainfall policy and therefore, the policy was triggered. A payout of US$10,278,753.76 is due to the Government of Jamaica under its Excess Rainfall policy.

The Wet Season Trigger (WST) endorsement of the XSR3.0 model did not identify this CARE as a "Wet Season" event[10]. Therefore, no payout is due under the Wet Season Trigger endorsement of Jamaica's Excess Rainfall policy.

The Localized Event Trigger (LET) component of the XSR3.0 model did not identify this CARE as a localized event[11]. Therefore no payout is due under the Local Event Trigger endorsement of Jamaica's Excess Rainfall policy.

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

10 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.
11 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

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.