CCRIF SPC
The Caribbean Catastrophe Risk Insurance Facility

Covered Area Rainfall Event (29/06/2024 to 01/07/2024)

Excess Rainfall

Event Briefing

Trinidad and Tobago - Trinidad

10 July 2024

Registered Office: CCRIF SPC c/o Sagicor Insurance Managers Ltd., 198 North Church Street
2nd Floor Sagicor House, P.O. Box 1087, Grand Cayman KY1-1102, Cayman Islands
Email: ccrif@ccrif.org | Website: ccrif.org | Twitter: @ccrif_pr | Facebook: CCRIF SPC

1 INTRODUCTION

This event briefing describes the impact of rainfall on Trinidad, which was associated with a Covered Area Rainfall Event (CARE) starting on 29 June and ending on 1 July 2024. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was below the attachment point of Trinidad and Tobago'sExcess Rainfall policy for Trinidad, and therefore no payout is due to the Government of Trinidad and Tobago[1].

A CARE was not activated by rainfall during this period for Tobago.

2 EVENT DESCRIPTION

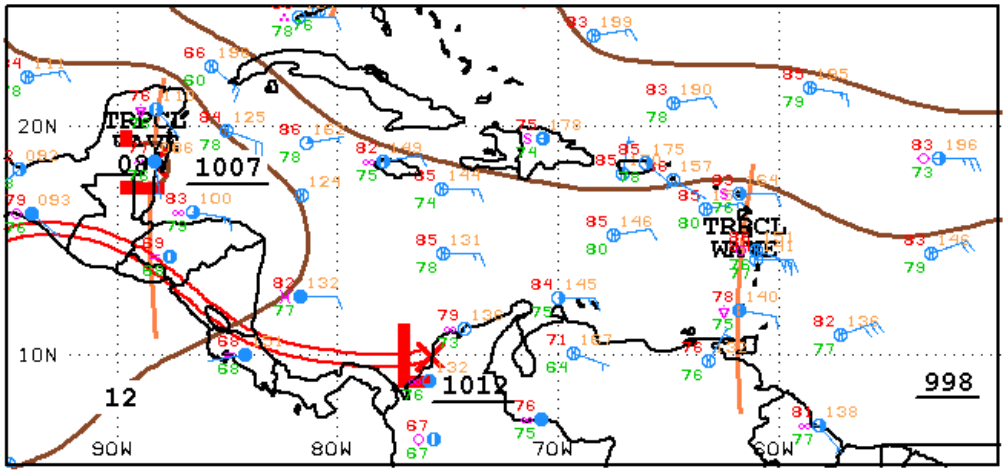
On 29 June at 1200UTC, a tropical wave was moving across the Lesser Antilles, with axis along longitude 61°West/62°West from latitude 19°North southward into NE Venezuela. The tropical wave proceeded westward at 11 to 17 mph (19 to 28 km/h) (Figure 1a). Clusters of thunderstorms associated with moderate to isolated heavy rainfall were active mainly on the eastern side of the wave axis, from latitude 8°North to 13°North, between longitudes 57°West and 63°West, including Trinidad and Tobago and the surrounding waters.

On the same day, the US National Hurricane Center (NHC) reported that a tropical storm formed in the central tropical Atlantic Ocean, and it was named Beryl. The system proceeded westward with estimated forward velocity of 18 mph (30 km/h), along the southern periphery of a strong subtropical ridge. In the next 30 hours, the tropical storm rapidly intensified due to the low wind shear, the high moisture content and the warm surface temperature over the tropical Atlantic. Thus, on 29 June at 2100UTC it became a hurricane and on 30 June at 1530UTC, it evolved into a Category 4 hurricane, as reported by NHC. At this time, the centre of Beryl was sited near latitude 10.8° North, longitude 54.9° West, about 350 mi (565 km) ESE of Barbados, and it continued towards the Windward Islands with unvaried forward velocity. The maximum sustained winds were estimated at 130 mph (215 km/h) and the minimum central pressure at 962 mb.

During the final hours of 30 June and the first hours of 1 July, despite the environmental conditions that remained supportive for the intensification of the hurricane, an eyewall replacement cycle hindered the further strengthening of the system. Indeed, a new outer eye formed outside the small inner core, weakening the latter and gradually becoming dominant. For this reason, when Beryl started to affect the Windward Islands with tropical-storm conditions, during the first hours of 1 July, it had weakened to a Category 3 hurricane, with maximum sustained winds estimated at 120 mph (195 km/h). During this time, Beryl passed over the waters between Barbados and Trinidad and Tobago (Figures 1b and 2). At its closest distance from Trinidad, at 1200UTC, the centre of Beryl was sited near latitude 12° North, longitude 60.5° West, about 117 mi (188km) NE of Port-of-Spain, Trinidad and Tobago (Figure 1b). The moderate precipitation associated with the southern periphery of the hurricane affected Trinidad during the entire period between 0900UTC and 1500UTC, as visible from the radar maps (Figure 3).

[1] The Government of Trinidad and Tobago has two Excess Rainfall policies: one for the island of Trinidad and one for Tobago.

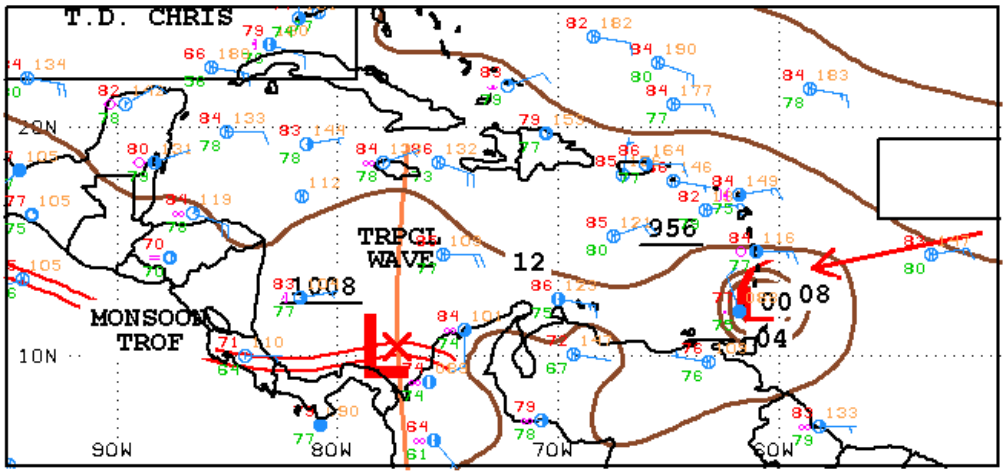
At 1200UTC, Hurricane Beryl strengthened again, due to the completion of the eye replacement cycle and became a Category 4 hurricane again. It continued to proceed north-northwestward heading towards Grenada, where it made landfall at 1500UTC. Hurricane Beryl then moved away from the southern Windward Islands, proceeding west-northwestwards at almost 20 mph (31km/h), towards the central Caribbean Sea.



12Z CARIBBEAN SURFACE ANALYSIS
ISSUED:
Sat Jun 29 14:20:02 UTC 2024

NATIONAL HURRICANE CENTER
MIAMI, FLORIDA
BY TAFB ANALYST: GR
COLLABORATING CENTERS: NHC OPC

a) 29 June at 1200UTC

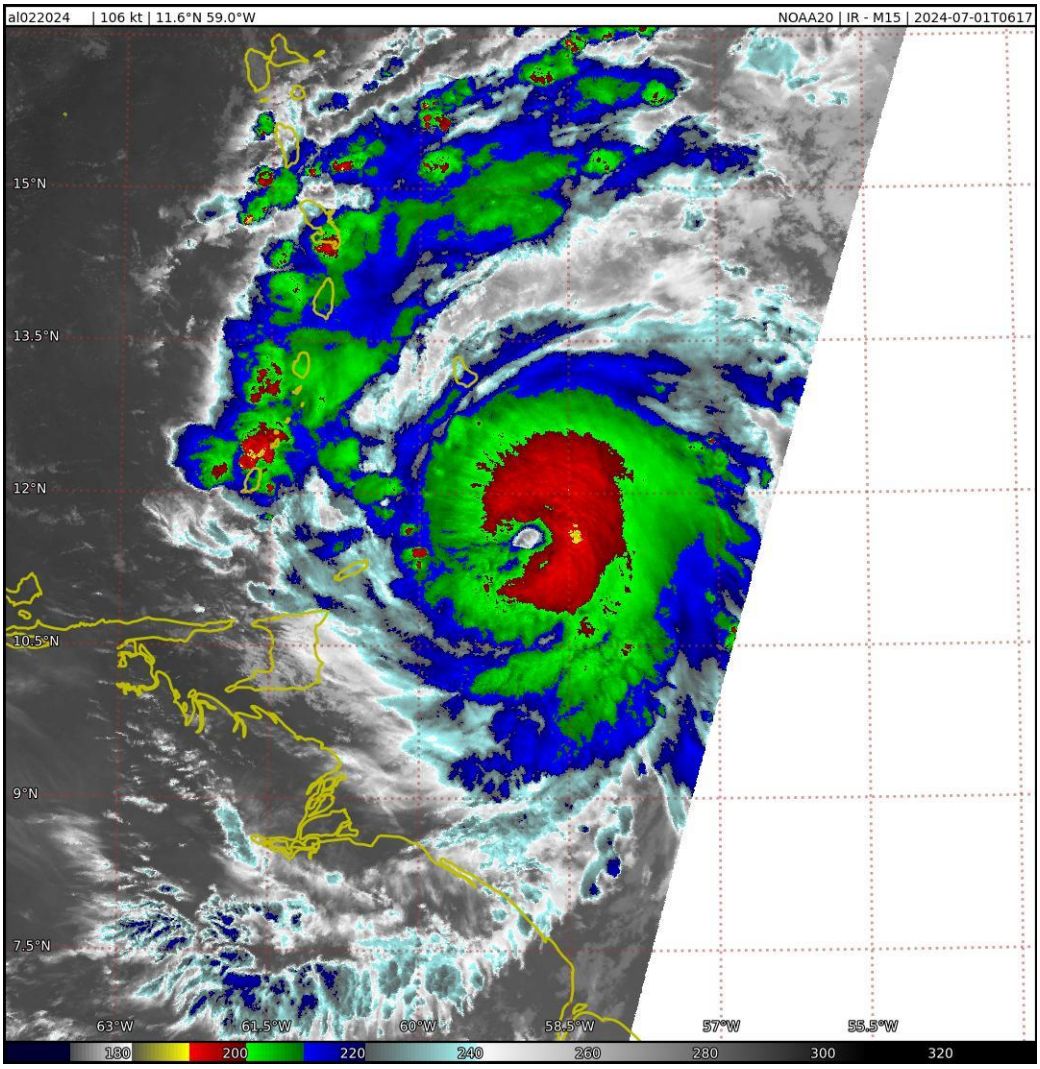


12Z CARIBBEAN SURFACE ANALYSIS
ISSUED:
Mon Jul 1 16:38:19 UTC 2024

NATIONAL HURRICANE CENTER
MIAMI, FLORIDA
BY TAFB ANALYST: PC
COLLABORATING CENTERS: NHC OPC

b) 01 July at 1200UTC

Figure 1 Surface analysis over the Caribbean area on 29 June and 1 July 2024 at 1200UTC. Source: US National Hurricane Center[2]

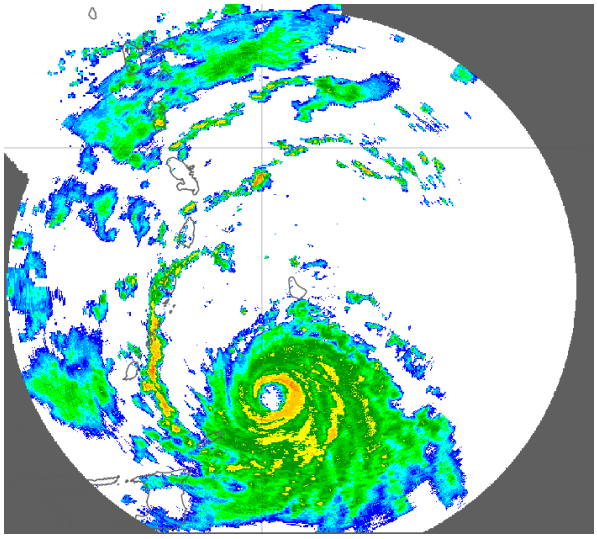


01 July at 0617UTC

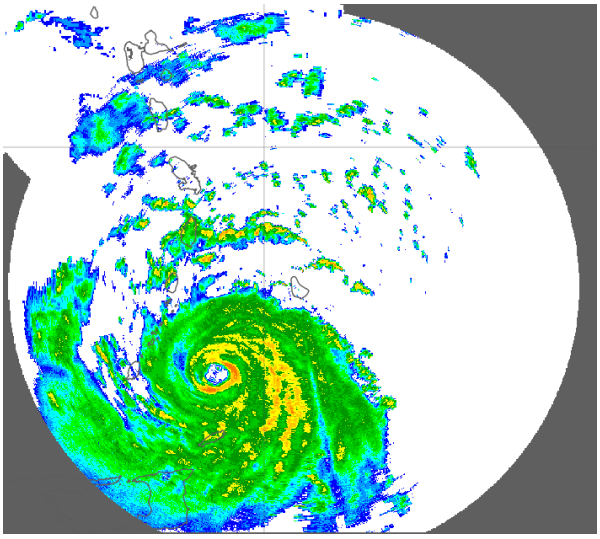
Figure 2 Satellite imagery on 1 July, 2024 at 0617UTC from the thermal infrared channel enhanced with colour. Blue/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the red/yellow colours represent very high altitude clouds (top cloud lower than -70°C). High altitude clouds indicate strong convection associated with intense precipitation. Source: NOAA, National Environmental Satellite, Data and Information Service[3].

2 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: 29 June and 1 July 2024, available at: *https://www.nhc.noaa.gov/tafb/CAR_12Z.gif*

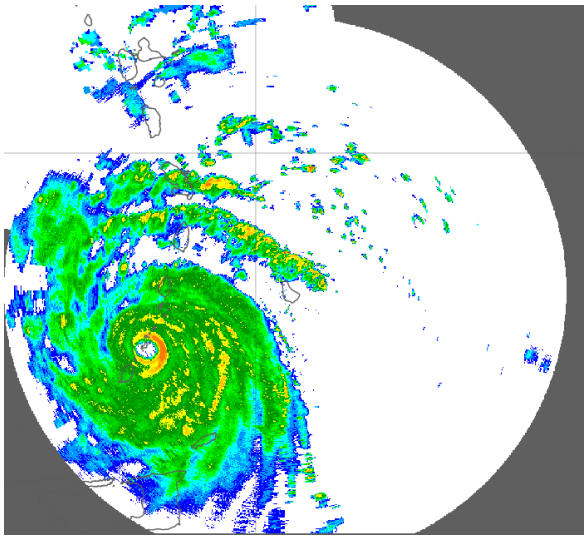
3 RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://rammb-data.cira.colostate.edu/tc_realtime/storm.asp?storm_identifier=al022024



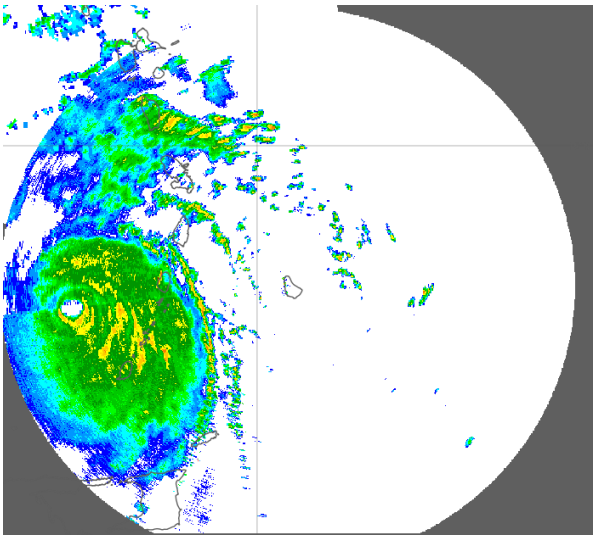
a) 1 July at 0900UTC



b) 1 July at 1200UTC



c) 1 July at 1500UTC



d) 1 July at 1800UTC

Figure 3. Radar imagery on 1 July, 2024, 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. Source: Barbados Radar Composite[4].

4 Barbados Radar Composite, available on 1July at:
https://www.barbadosweather.org/BMS_Radar_Composite_Resp.php#

3 IMPACTS

At the time of writing this report, several sources of information reported damage or losses in Trinidad due to this Covered Area Rainfall Event during the indicated period.

Several parts of the country, particularly the northern side of Trinidad were left with no electricity and experienced flooding in areas[5].

Figure 4 Flooded areas. Left: photo taken from City Gate Flood Video / Right: floods in Port of Spain (Faith Ayoung[6])

The Ministry of Rural Development and Local Government (RDLG) reported no flooding in other areas of the country. One landslide was reported within the Diego Martin Borough Corporation. [7]

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15[8], detected the occurrence of precipitation over Trinidad and the surrounding waters

5 Trinidad and Tobago Loop News: Power cuts, flooding reported in North Trinidad | Loop Trinidad & Tobago (loopnews.com)

6 Trinidad and Tobago Newsday: Many engineers, but no flood solutions - Trinidad and Tobago Newsday

7 Trinidad and Tobago Loop News: Major river levels remain stable at present | Loop Trinidad & Tobago (loopnews.com)

8 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

during the period 27 June to 01 July 2024. Each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 4. A CARE for Trinidad was activated on 29 June and lasted until 01 July. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[9] and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in Trinidad was 27 June to 01 July.

CMORPH reported total accumulated values of precipitation between 50 mm and 75 over the northeastern portion of Trinidad, while lower values were reported over the rest of the island, entirely covering the southern and western areas.

IMERG reported total accumulated values of precipitation higher than 75 mm over the eastern and northern portions of Trinidad, with maximum values, between 125 mm and 150 mm, over limited areas in the county of Sangre Grande. Lower values were reported over the rest of the island.

WRF5 reported total accumulated values of precipitation with a similar geographic distribution and intensity to that of IMERG. Additionally, values between 100 mm and 125 mm were reported over the northwestern edge of the island.

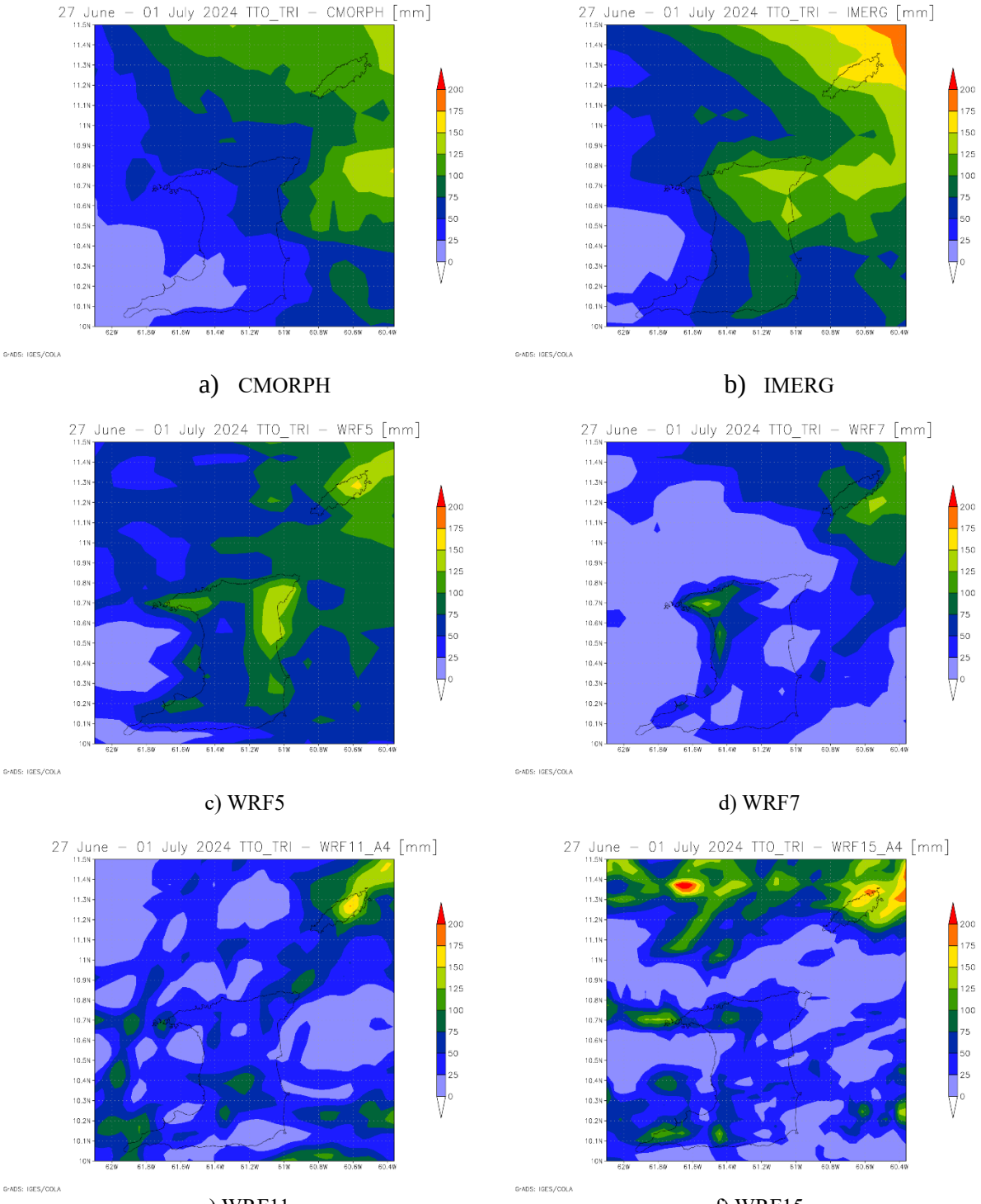
WRF7 reported total accumulated values of precipitation higher than 75 mm over limited areas in the western and northern portions of Trinidad, with localized maximum values between 125 mm and 150 mm, near Port of Spain. Lower values were reported over the rest of the island.

WRF11 reported total accumulated values of precipitation between 75 mm and 100 mm over small areas in the south-central and southwestern parts of Trinidad. Lower values were reported over the remainder of the island.

WRF15 reported accumulated values of precipitation higher than 75 mm, with localized peaks between 100 mm and 125 mm, over limited regions in the southwestern and northwestern portions of Trinidad. Lower values were reported over the rest of the island.

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.

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.



a) CMORPH

b) IMERG

c) WRF5

d) WRF7

e) WRF11

f) WRF15

Figure 4 Total accumulated precipitation during the period 27 June – 01 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/TTO/TTO_TRI/CARE_1_2024/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/TTO/TTO_TRI/CARE_1_2024/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was below the loss threshold for the Excess Rainfall policy for Trinidad for all the data sources used by XSR3.0: CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15. The RIL was the highest for IMERG. However, a Disaster Alert declaration with code 52063 was issued by Relief Web for Trinidad and Tobago from ReliefWeb related to Hurricane Beryl. Because of the Disaster Alert, the final RIL was calculated for this CARE, even though the RILs for the six data sources were below the threshold.

The final RIL (RIL_{FINAL}) was calculated as the average of the six RILs from CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15. 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 Trinidad, and thus this policy was not triggered. Therefore, no payout is due under this Excess Rainfall policy to the Government of Trinidad and Tobago.

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 the Excess Rainfall policy for Trinidad.

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 this Excess Rainfall policy.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for the Covered Area Rainfall Event (CARE) for Trinidad was below the attachment point of Trinidad and Tobago's Excess Rainfall policy for Trinidad, and therefore no payout is due. This CARE did not activate the Wet Season Trigger or

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 island. 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).

Localized Event Trigger endorsement of this Excess Rainfall policy and therefore no payout under either endorsement 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.