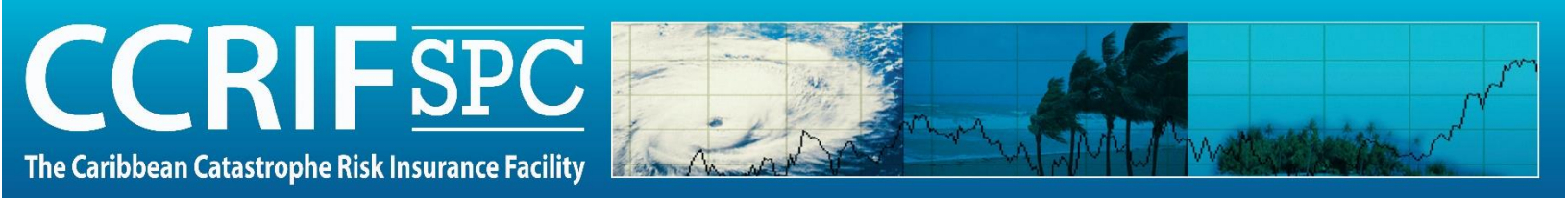

Covered Area Rainfall Event (18/08/2021 to 20/08/2021)

Excess Rainfall

Event Briefing

Trinidad and Tobago - Trinidad

28 August 2021

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1 INTRODUCTION

Trinidad was under the influence of two tropical waves and the presence of the Inter Tropical Convergence Zone resulting in adverse weather conditions that occurred primarily between August 17 and August 20, 2021. During this period, Trinidad was affected by periods of intense rainfall and thunderstorm activity.

The Government of Trinidad and Tobago has two separate Excess Rainfall policies – one for Trinidad and one for Tobago.

This event briefing describes the impact of rainfall on Trinidad, which was associated with a Covered Area Rainfall Event (CARE), starting on 18 August and ending on 20 August 2021. The Rainfall Index Loss (RIL) indicated government losses above the attachment point of Trinidad's excess rainfall policy. Final calculations show that a payout of US$2,381,463.63 is due to the Government.

The Excess Rainfall policy for Tobago was not triggered by this event and therefore no payout is due on this policy.

2 EVENT DESCRIPTION

From 17 August to 20 August 2021, the passage of two tropical waves over the south-east Caribbean Sea and the presence of the inter-tropical convergence zone (ITCZ) over the waters of Guyana led to the development of showers and thunderstorms in an area between the waters of Guyana and Venezuela. Most of the thunderstorm activity occurred on 18 August from 0600 UTC to 2100UTC from latitude 8 North to 12 North and between longitude 55 West and 65 West, due to the passage of the first and more intense tropical wave embedded in the ITCZ line (Figure 1). During this period, the island of Trinidad was continuously affected by moderate to intense rainfall due to the consecutive passage of several thunderstorms (Figure 2). Some localized showers were also reported over Trinidad on 17, 19 and 20 August mostly from 1800 UTC to 2200 UTC, corresponding to the afternoon hours in local time, due to the diurnal convection.

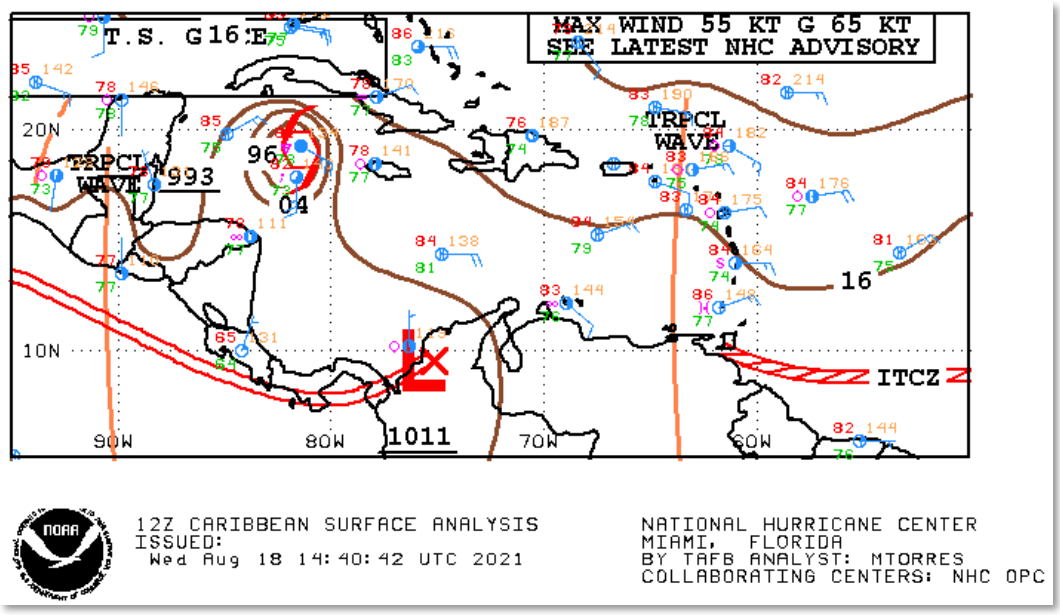
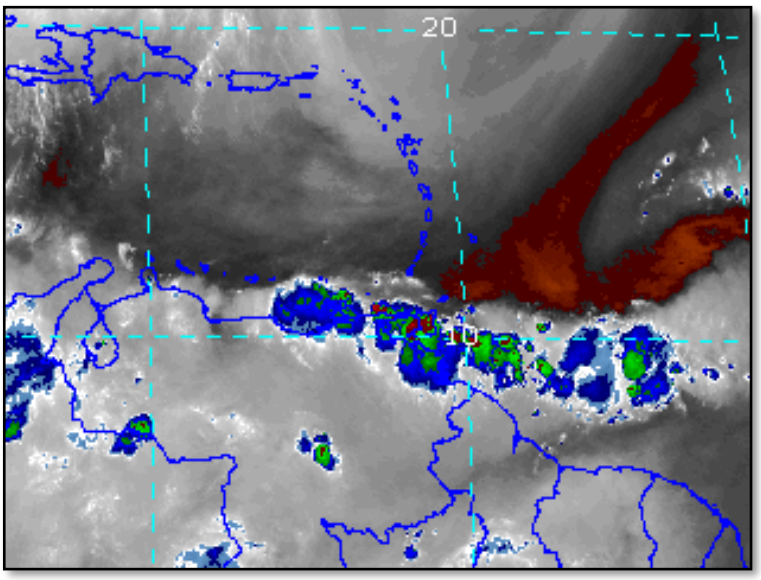
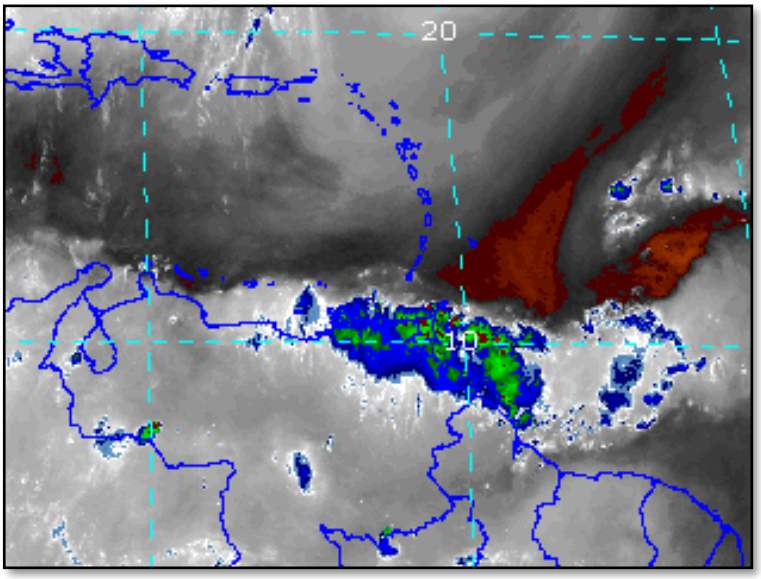


Figure 1 Surface analysis over the Caribbean area on 18 August at 1200UTC, showing the intertropical convergence zone (ITCZ) over the Guyana waters and the tropical wave in its westward movement passing over the eastern Caribbean Sea. Source: US National Hurricane Center[1]

[1] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 18 August 2021, available at: *https://www.nhc.noaa.gov/tafb/CAR_12Z.gif*



a) 18 August 2021 at 1200 UTC



b) 18 August 2021 at 1500 UTC

Figure 2 Satellite imagery at different times as indicated in the labels from thermal infrared channel enhanced with colour. Violet/cyan/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the grey/blue colours represent very high altitude clouds (top cloud lower than -70°C). High altitude clouds indicate strong convection associated with intense precipitation.
Source: NOAA Satellite and Information Service[2].

[2] RAMSDIS Online Archive, NOAA Satellite and Information Service, available at:
https://rammb.cira.colostate.edu/ramsdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304_20210817150020.gif
https://rammb.cira.colostate.edu/ramsdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304_20210817210020.gif

3 IMPACTS

According to local media reports, the most affected areas were: Penal/Debe (overflowed river) Mayaro/Rio Claro, Siparia, San Juan/Laventille, Diego Martin, Sangre Grande and Tunapuna/Piarco Regional Corporations of Trinidad. The majority of the reports indicated flooding and impassable roads as a result of the rainfall.

At the time of writing this report, the following information had been published in the local news[3]:

- In Penal/Debe the Curamata River overflowed along several points.
- Across central Trinidad, floods were reported in Claxton Bay, Couva, Freeport, Chase Village, Chaguanas, Endeavour, Jerningham Junction, Cunupia, Edingburgh 500, Caparo, Tabaqite, and Las Lomas.
- In the northen part of Trinidad, flash floods were reported in Tunapuna, Arouca, O'Mera, Sangre Grande, Coalmine, El Soccorro, Morvant, Port of Spain, and Diego Martin.
- Floods were reported in low-lying areas of Sangre Grande such as Guaico, La Vega, and Oropouche.
- Landslides were reported along the North Coast Road, Curepe, and Siparia.

Due to the ITCZ the Trinidad and Tobago Meteorological Service activated the Adverse Weather Alert (yellow or second level) and the Riverine Flooding Alert (orange level)[4].

Figure 3 shows some of rainfall damage caused by this adverse weather in Trinidad.

[3] Guardian Media, review date: 27 August 2021, available at: '*Flooding ongoing across much of Trinidad*'
[4] Trinidad and Tobago Newsday, review date: 27 August 2021, available at: '*ITCZ causes street, flash flooding in east Trinidad*'

Figure 3 Some of the rainfall damage caused by the adverse weather period in Trinidad in August, 2021. Source: Guardian, Newsday and FloodList

4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[5], WRF5 and WRF7[6], detected the occurrence of precipitation over Nicaragua and the surrounding waters during the period 16 – 20 August 2021. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below. The CARE for Trinidad was activated on 18 August and lasted for the period 18 – 20 August. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[7], thus the period considered by the XSR 2.5 model for the loss estimate based on the accumulated precipitation in Trinidad was 16 – 20 August.

CMORPH reported total accumulated amounts of precipitation higher than 60 mm over most of Trinidad. The highest values, between 100 mm and 140 mm, were shown over the central and northern sections (Figure 4a).

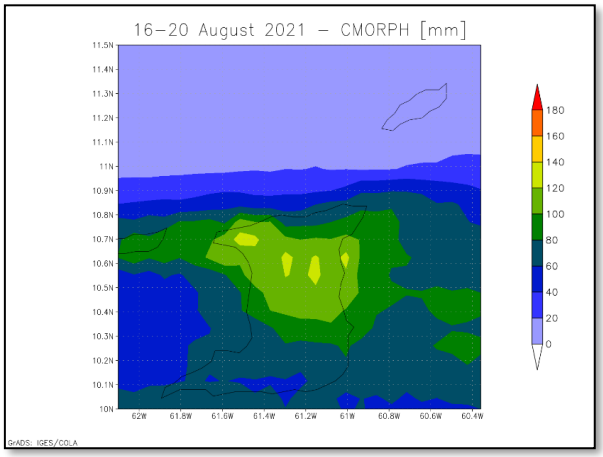
WRF5 presented total accumulated amounts of rainfall with values higher than 60 mm over the central and southern regions of Trinidad and in localized areas over the northern portion. Values between 100 mm and 160 mm were reported over the central part of Trinidad (Figure 4b).

[5] 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.

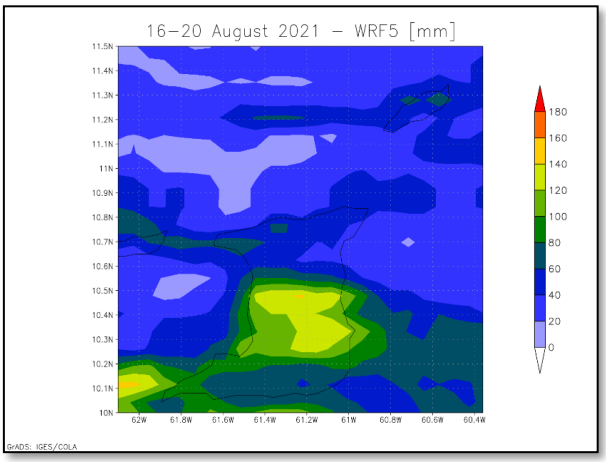
[6] WRF5 and WRF7 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data *https://www.mmm.ucar.edu/weather-research-and-forecasting-model*. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [*http://rda.ucar.edu/datasets/ds083.2/*]).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

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.

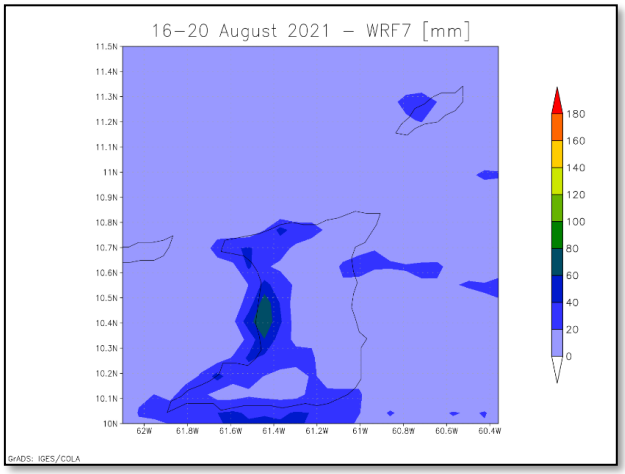
WRF7 showed total accumulated amounts of precipitation with values greater than 20 mm over the western portion of Trinidad and along the southern coastal area. The highest values, between 40 mm and 80 mm, were reported along the central west coast (Figure 4c).



a) CMORPH



b) WRF5



c) WRF7

Figure 4 Total accumulated precipitation during the period 16 August – 20 August, 2021 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:

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/TTO/TTO_TRI/CARE_4_2021/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/TTO/TTO_TRI/CARE_4_2021/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Trinidad for two of the data sources used by XSR2.5: CMORPH and WRF5. The RIL was higher for CMORPH due to the larger amount of accumulated precipitation presented over the north region in the vicinity of several urban areas (Port of Spain, Arima, Tunapuna, Piarco, and Sangre Grande), which are characterized by high exposure for Trinidad.

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs for the CMORPH and WRF5 data sources. The RIL_{FINAL} was greater than the attachment point of the Excess Rainfall policy for Trinidad and a payment of US$2,381,463.63 is due under this policy.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event (CARE) that started on 18 August and ended on 20 August 2021, produced government losses which were above the attachment point of Trinidad's excess rainfall policy. Final calculations show that a payout of US$2,381,463.63 is due to the Government of Trinidad and Tobago.

CCRIF expresses sympathy with the Government and people of Trinidad for the impacts on communities and infrastructure caused by this event.

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.