CCRIF SPC
The Caribbean Catastrophe Risk Insurance Facility

On behalf of
Caribbean XSR SP

Covered Area Rainfall Event (20-21 June 2017)

Tropical Storm Bret Excess Rainfall

Event Briefing
Trinidad and Tobago

27 June 2017

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1 SUMMARY

Tropical Cyclone Bret is the second named storm of the 2017 Atlantic Hurricane Season and was formed as a Tropical Storm on 19 June 2017 at 21UTC southwest of Trinidad and Tobago. Heavy rain was experienced over this country between 19 June at 21UTC and 20 June at 09UTC.

Bret affected one CCRIF member country, Trinidad and Tobago, which has two excess rainfall policies: one for Trinidad and one for Tobago. This briefing describes the impact of Bret on the island of Trinidad. The Rainfall Index Loss calculated for this covered area rainfall event (CARE) was below the attachment point of Trinidad's Excess Rainfall policy and therefore no payout is due. For Tobago the XSR model did not trigger a CARE and therefore did not register a Rainfall Index Loss.

2 INTRODUCTION

On 18 June 2017 at 21UTC, the US National Hurricane Center (NHC) reported that a potential tropical storm had developed off the coast of French Guyana. Its centre was approximately located at 7.5° N and 50.4° W, with estimated minimum central pressure of 1008 mb and maximum sustained winds of 34 mph (54.7 km/h).

During the next 24 hours, the system strengthened, with a drop of the minimum central pressure to 1005 mb and an increase in the maximum sustained winds reaching 40 mph (64.4 km/h). During this period the disturbance moved toward the west at approximately 23-25 mph (37-40 km/h).

On 19 June 2017 at 21UTC, the disturbance was upgraded to a tropical storm and was named Bret, the second storm of the 2017 Atlantic Hurricane Season. At this time, its centre was located at approximately 9.4° N and 59.8° W, to the east-southeast of Trinidad and Tobago (Figure 2a). The maximum sustained winds were 40 mph (64.4 km/h) with gusts up to 52 mph (83.4 km/h). The tropical storm was moving west-northwest at 30 mph (48.3 km/h).

At approximately 03UTC on 20 June, the centre of the tropical storm was near Trinidad and Tobago (Figure 1). Its strength was unchanged with respect to 00UTC and Bret produced heavy rains locally (Figure 2c) and strong gusty winds over Trinidad and Tobago and the southern Windward Islands. This activity continued up to 09UTC (Figure 2d, Figure 2e).

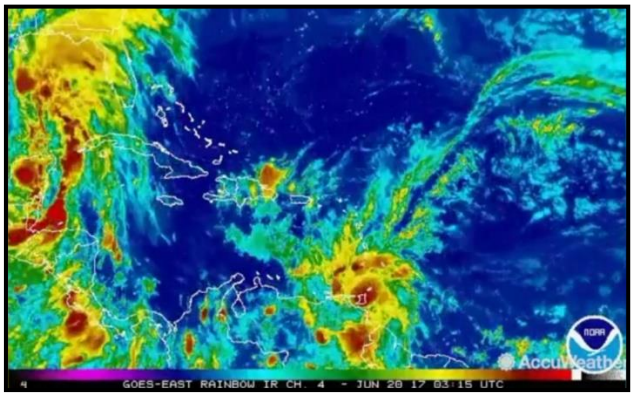
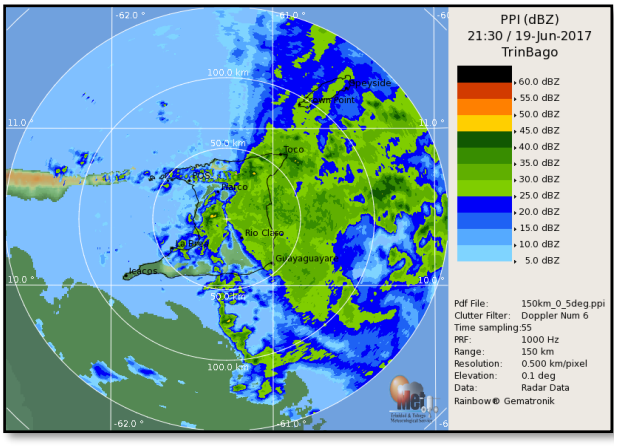
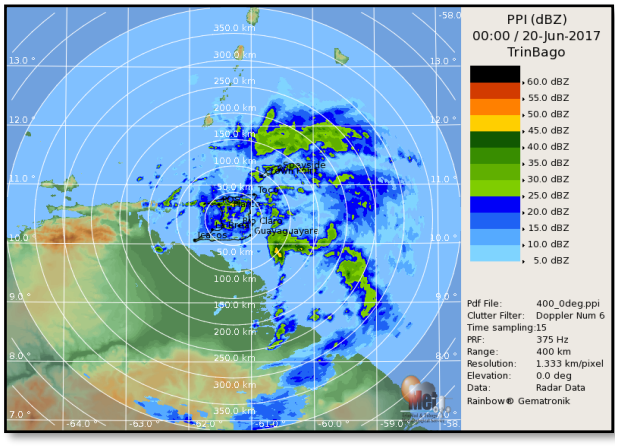


Figure 1 Satellite image of Tropical Storm Bret 20 June 2017 03:15 UTC. Source: *http://www.nhc.noaa.gov/*

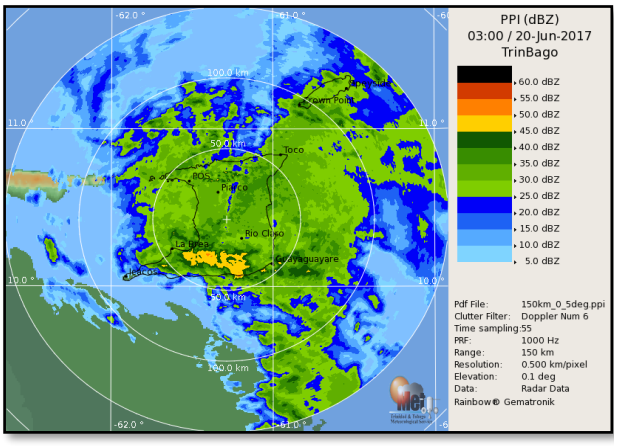
Heavy rain associated with the storm rain bands started to affect Trinidad and Tobago, as shown by the radar map in Figure 2a.



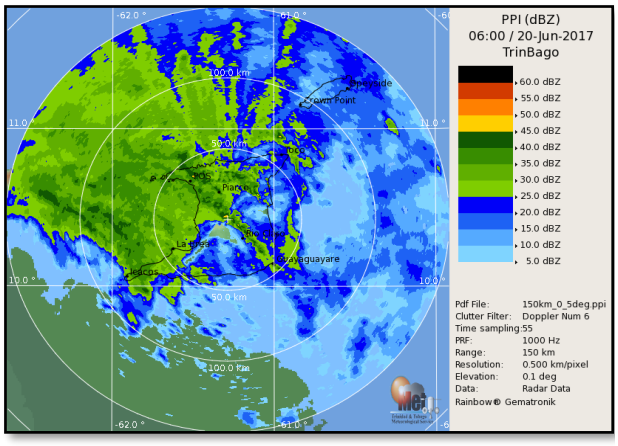
a) 19 June at 21:30 UTC



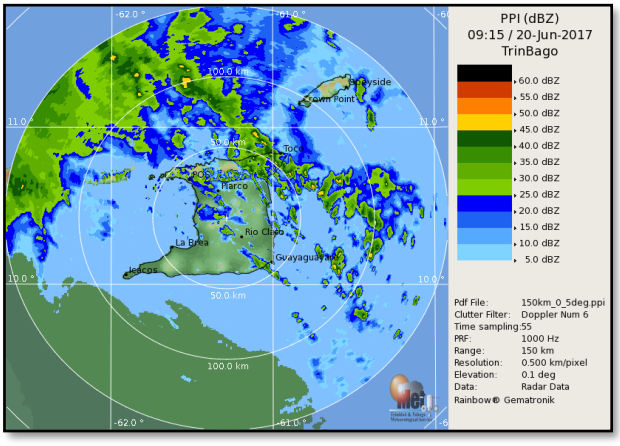
b) 20 June at 00:00 UTC



c) 20 June at 03:00 UTC



d) 20 June at 06:00 UTC



e) 20 June at 09:00 UTC

Figure 2 Reflectivity maps of the radar centred over Trinidad and Tobago
(source: http://www.metoffice.gov.tt/Radar)

On 20 June at 00UTC, Trinidad and Tobago continued to be affected by heavy rain bands (Figure 2b), associated with tropical-storm-force winds (maximum sustained winds were 40 mph, 64.4 km/h). The latter extended outward up to 80 miles (128.7 km) from the centre, located at 9.5° N and 60.5° W. The tropical storm was still moving west-northwest but its forward velocity decreased to 25 mph (40.2 km/h) at that time.

At 09UTC, Bret had left Trinidad and Tobago, moving toward the west-northwest at almost 21 mph (33.8 km/h) along the northeastern coast of South America into the southeastern Caribbean Sea. The tropical storm activity continued up to 20 June at 21UTC, when Bret degenerated into a tropical wave. At that time, the remnants of Bret were located near latitude 12.0° N and longitude 67.3° W.

3 IMPACTS

Seven days after tropical storm Bret and according to General Direction of the Office of Disaster Preparedness and Management (ODPM), damages had not been quantified at the time of this report.

As of the date of this report, the following information had been published in the local and regional news[1] [2] [3]:

- Trinidad closed all public schools, while Tobago shuttered all schools and government offices. The storm prompted the cancellation of many flights.
- Schools, banks and some commercial businesses remained closed.
- Winds downed trees and blocked several roads.
- Flash floods were reported in low lying areas, and there were power outages across many parts of Trinidad and Tobago.

The worst hit areas were in the Penal/Debe, Siparia and Mayaro/Rio Claro regions of southern Trinidad.

Figure 3 Flood damage caused by Tropical Storm Bret in Trinidad – June 2017.
Source: *http://www.trinidadexpress.com/*

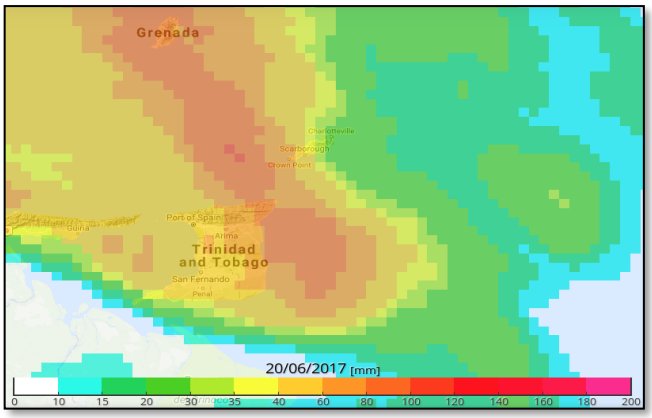
[1] The Habari Network, review date: 21 June 2017, available in: *http://www.thehabarinetwork.com/*

[2] Trinidad Express Newspapers; review date: 21 June 2017, available in: *http://www.trinidadexpress.com/*

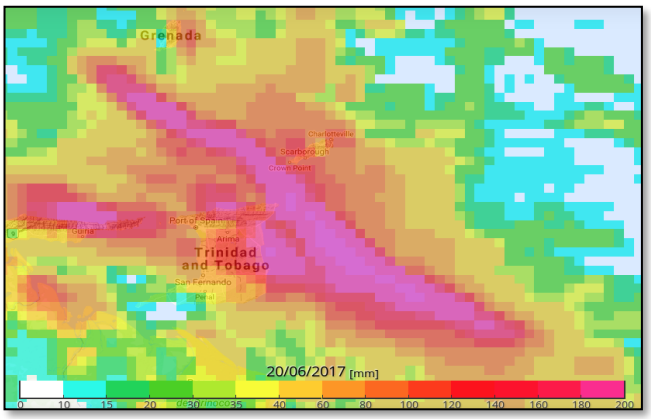
[3] Trinidad and Tobago, NEWSDAY; review date: 27 June 2017, available in: *http://www.newsday.co.tt/*

4 RAINFALL MODEL OUTPUTS

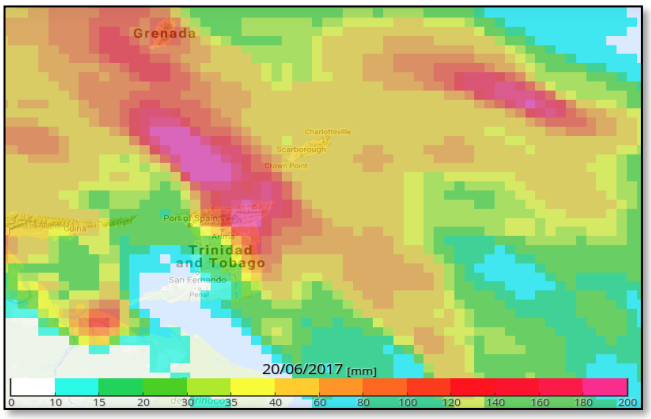
The trajectories of cumulated precipitation reported by CMORPH, WRF1 and WRF2 during Bret's passage broadly agrees with the one inferred by the event description and the radar maps (see previous section). Indeed the core of the system (more intense precipitation) left a footprint along the south-east to north-west direction (see Figure 4).



a) CMORPH



b) WRF1



c) WRF2

Figure 4 Accumulated precipitation estimated on 20 June 2017.

The largest differences among CMORPH, WRF1 and WRF2 are in the intensity of precipitation and the inland rainfall. WRF1 presented the heaviest rainfall, with a daily cumulated maximum of 160-180 mm over the north and eastern coasts of the island of Trinidad. Moreover, WRF1 presented the largest tendency to inland rainfall entrance.

The only ground precipitation measurement available for 20 June was at Piarco Airport in Trinidad airport[4] reporting a daily accumulated precipitation of 26 mm. The best agreement with this rainfall amount was with WRF2 (20-30 mm) and with CMORPH (40-60 mm), which slightly overestimated the amount. On the other hand, WRF1 showed a large overestimation (80-100 mm) of the observed rainfall. The scarcity of ground measurements prevents the formation of general conclusions on the performances of the different models. Nevertheless, this example shows evidence of the advantage of a system based on several triggers, rather one trigger only,

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this CARE was below the attachment point of Trinidad's Excess Rainfall policy and therefore no payout is due.

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

For further information, please contact ERN-RED, the CCRIF SPC Risk Management Specialist.

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[4] Weather Underground, review date: 27 June 2017, available in: *https://www.wunderground.com*

DEFINITIONS

Active Exposure Cell Percentage Threshold	The percentage of the total number of XSR Exposure Grid Cells as defined in the Schedule, with in the covered Area of the Insured, which when exceeded triggers a Covered Area Rainfall Event.
Active Exposure Grid Cells	The XSR Exposure Grid Cells for which in the same single day the Average Aggregate Rainfall value computed using the CMORPH-based Rainfall Estimate equals or exceeds the Rainfall Event Threshold.
Average Aggregate Rainfall	The Average Aggregate Rainfall amount (where the number of days in the Rainfall Aggregation Period is defined in the Schedule) as measured in millimeters per day (mm/day) in any of the XSR Exposure Grid Cells in the Covered Area of the Insured. For a given number of days n, the n-day aggregation period is the average of rainfall on the day itself and on the previous n-1 days.
Calculation Agent	Entity charged with undertaking the primary calculation of the Rainfall Index Loss as described in the Calculation Agency Agreement.
CMORPH-based Maximum Average Aggregate Rainfall	The maximum value during the Covered Area Rainfall Event of the Average Aggregate Rainfall computed using the CMORPH-based Daily 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 Daily Rainfall Estimates using the XSR Rainfall Model. Parameters are drawn from XSR Exposure Grid Cells within the Covered Area of the Insured as identified in the Cell Identification and Rainfall Exposure Value Table in the Schedule, 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 event will not be considered.
Maximum Average Aggregate Rainfall	The highest value during a Covered Area Rainfall Event of the Average Aggregate Rainfall amount in any of the XSR Exposure Grid Cells in the Covered Area of the Insured computed.
Rainfall Event Threshold	Average Aggregate Rainfall level as defined in the Schedule which should be exceeded to trigger an Active Exposure Cell.
Rainfall Aggregation Period	The number of days over which the Average Aggregate Rainfall 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.
WRF1 Model	The weather research and forecasting rainfall model by NOAA with Configuration #1 data initialized 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 the Policy.
WRF2 Model	The weather research and forecasting rainfall model by NOAA with Configuration #2 data initialized 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, as provided in the Schedule.
XSR Grid Cell Exposure Value	The value, as shown in the Cell Identification and Rainfall Exposure Value Table in the Schedule, used to calculate the CMORPH-based Exposure Grid Cell Loss, the WRF1-based Exposure Grid Cell Loss, and the WRF2-based Exposure Grid Cell Loss.