Covered Area Rainfall Event (21/08/2020)

Excess Rainfall

Event Briefing

Antigua and Barbuda

29 August 2020

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1 INTRODUCTION

Antigua and Barbuda was under the influence of Tropical Storm Laura resulting in adverse weather conditions that occurred between 21 August (1700UTC) and 22 August (1500UTC), 2020. During this period, Antigua and Barbuda was affected by heavy rainfall.

This event briefing describes the impact of rainfall on Antigua and Barbuda, which was associated with a Covered Area Rainfall Event (CARE), starting and ending on 21 August 2020. The Rainfall Index Loss (RIL) was below the attachment point of Antigua and Barbuda's Excess Rainfall policy and therefore no payout is due to the Government of Antigua and Barbuda.

As reported in a separate tropical cyclone Event Briefing, "TC Laura: Leeward Islands" dated 25 August 2020, Antigua and Barbuda experienced heavy rains and strong winds from the system. The preliminary runs of the CCRIF loss model produced losses below the attachment point of Antigua and Barbuda's Tropical Cyclone policy and no payout under the main policy is due. However, the Aggregate Deductible Cover (ADC) was activated since a disaster alert related to Tropical Cyclone Laura was declared by ReliefWeb[1] for Antigua and Barbuda. An ADC payment of US$70,256.70 is due under that endorsement to the Tropical Cyclone policy.

2 EVENT DESCRIPTION

On 16 August, the NHC started to monitor a tropical wave located over the eastern Atlantic, as a potential genesis of a tropical cyclone. On 18 August, an area of low pressure developed within the tropical wave and on 20 August, a well-defined closed circulation was evidenced at the surface around the centre of the disturbance. Consequently, on 20 August at 0300UTC the US National Hurricane Center (NHC) reported that the system developed as a tropical depression, and it was named Tropical Depression Thirteen. Its centre was located at 14.6N 47.9W over the central tropical Atlantic. The environmental conditions were moderately favourable for the depression to strengthen as it presented a low to moderate wind shear and a moist air mass surrounding the depression. These conditions promoted the gradual strengthening of the tropical cyclone and on 21 August at 1305UTC, the NHC reported that it was upgraded to a tropical storm, and named Tropical Storm Laura. The estimated centre of circulation was located at 17.0N 59.8W, to the east-southeast of the northern Leeward Islands (Figure 1). At this stage, the system presented a poorly organized structure with a poorly defined convective band and a general ragged appearance of the cloud pattern (Figure 2). The minimum central pressure was 1008 mb and the maximum sustained winds were estimated at 45 mph (75 km/h). The system moved towards the west along the south periphery of the Bermuda-Azores high pressure system located over the Atlantic Ocean. Its forward velocity was estimated at 18 mph (30 km/h) and it was directed towards the northern Leeward Islands. A Tropical Storm Warning was in effect for Antigua and Barbuda, St. Kitts and Nevis, Anguilla, Montserrat, and the British Virgin Islands on 21 August.

On the same day at 2100UTC, Laura approached the northern Leeward Islands (Figure 1). The

[1] ReliefWeb - informing humanitarians worldwide – Disaster Alert by Tropical Cyclone Laura available at: *https://reliefweb.int/taxonomy/term/50413*

centre of the tropical storm was located at 17.1N 61.2W and it was at a distance of approximately 40 mi (65 km) to the east of Antigua. Three hours later, on 22 August at 0000UTC, the centre of Laura was over the waters to the south of Saint Kitts and Nevis and to the west of Montserrat, and it was at a distance of approximately 23 mi (38 km) from Charleston, Saint Kitts and Nevis, and approximately 25 mi (40 km) from Plymouth, Montserrat.

The precipitation associated with the Tropical Storm Laura affected Antigua and Barbuda from 21 August at 1700UTC to 22 August at 1500UTC. In this interval, the radar reflectivity maps evidenced moderate to isolated heavy rainfall over this country due to the storm rainbands (Figure 3).

The tropical storm then left the Leeward Islands heading for the north-eastern Caribbean Sea. The system moved with slightly increased forward velocity (21 mph, 33 km/h) towards the west-northwest. During the following days, the tropical storm intensified, becoming a category 1 hurricane while it moved over the south-east waters of the Gulf of Mexico.

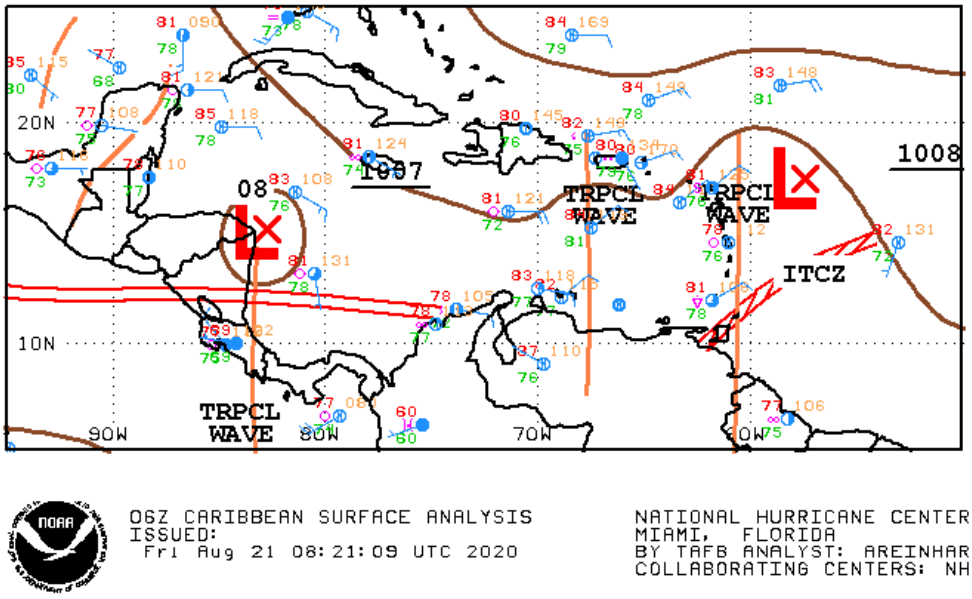


Figure 1 Surface analysis over the Central America and Caribbean area on 21 August at 0600UTC
Source: US National Hurricane Center[2]

2 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 21 August 2020, available at: *https://www.nhc.noaa.gov/tafb/CAR_18Z.gif* and *https://www.nhc.noaa.gov/tafb/CAR_12Z.gif*

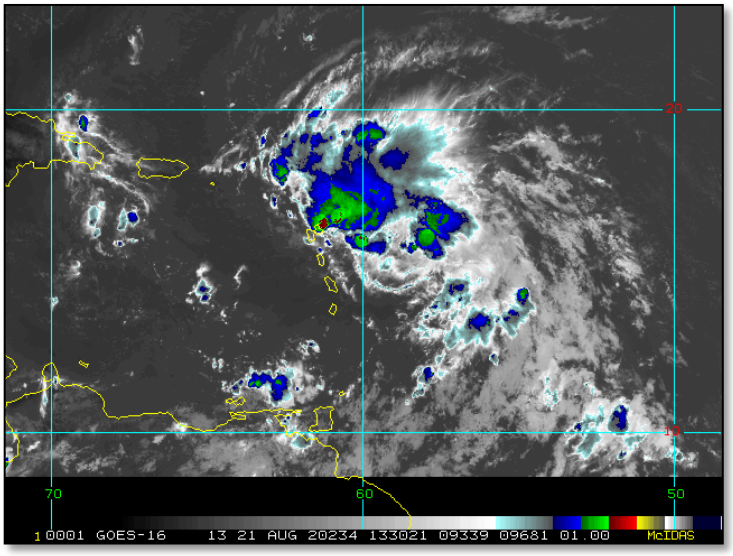
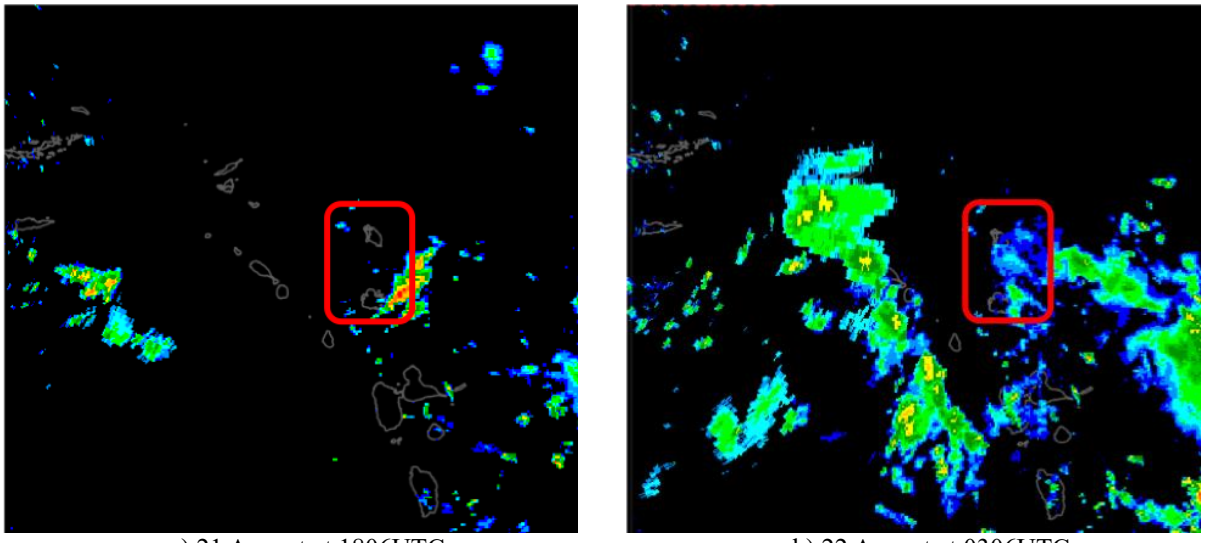


Figure 2 Satellite imagery at different times as indicated by the captions from thermal infrared channel enhanced with colour. Blue/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the red/yellow colours represent very high altitude clouds (top cloud lower than -70°C). High altitude clouds indicate strong convection associated with intense precipitation.
Source: Source: NOAA Satellite and Information Service[3]



a) 21 August at 1806UTC b) 22 August at 0306UTC

Figure 3. Reflectivity maps from the radar composite over the Caribbean Sea at different times as indicated in the labels. Colors indicate the reflectivity, function of the intensity of precipitation (green colors are for moderate, while yellow/red are for intense precipitation). A red square indicates the position of Antigua and Barbuda. Source: Barbados Weather[4]

3 RAMSDIS Online Archive, NOAA Satellite and Information Service, review date: 26 August 2020, available at: *http://rammb.cira.colostate.edu/ramsdis/online/archive.asp?data_folder=tropical/tropical_ge_14km_wv&width=640&height=480*

4 Barbados Weather. Review date: 22 August , available at: *https://www.barbadosweather.org/BMS_Radar_Composite_Resp.php#*

3 IMPACTS

At the time of this report, no information was available related to damage or loss in Antigua and Barbuda due to Tropical Cyclone Laura.

According to the weather reports from the Antigua and Barbuda Meteorological Service, Tropical Storm Laura was closely monitored and a Tropical Storm Warning was put into effect. Also as a precautionary measure, the government offices and schools in Antigua were closed.

4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[5], WRF5 and WRF7[6], simulated the occurrence of precipitation over Antigua and Barbuda and the surrounding waters associated with Tropical Storm Laura on 21 August 2020. However, each data source reported differing distributions of rainfall, as discussed below.

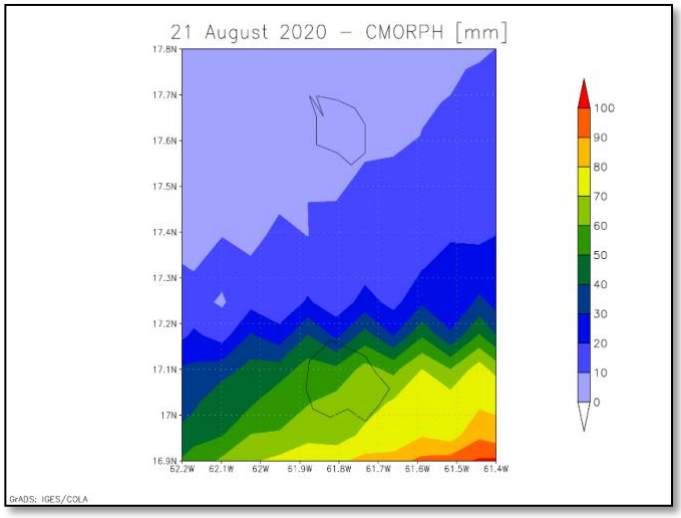
CMORPH reported total accumulated amounts of precipitation between 30 mm and 70 mm over Antigua and Barbuda. The largest values were estimated over the southern area of Antigua.

WRF5 simulated total accumulated rainfall values between 10 mm and 70 mm over Antigua and Barbuda, with higher amounts reported over Barbuda.

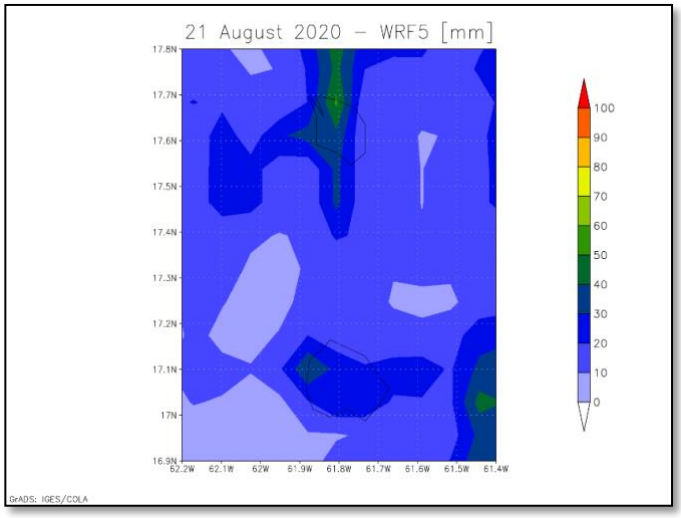
WRF7 showed accumulated rainfall values over Antigua and Barbuda, between 10 mm and 60 mm. The highest amounts were reported over the southern and central area of Antigua.

[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.

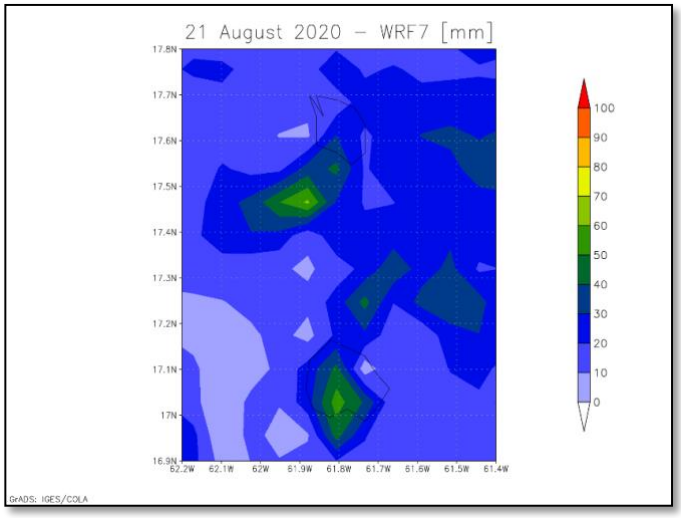
[6] WRF5 and WRF7 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data *https://www.mmm.ucar.edu/weather-research-and-forecasting-model*. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [*http://rda.ucar.edu/datasets/ds083.2/*]).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



a) CMORPH



b) WRF5



c) WRF7

Figure 4 Total accumulated precipitation during on 21 August 2020 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/ATG/CARE_1_2020/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/ATG/CARE_1_2020/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Antigua and Barbuda for one data source used by XSR2.5: WRF7, while the RIL was below the loss threshold for this country for both CMORPH and WRF5.

Consequently, the final RIL (RIL_{FINAL}) was equal to the RIL from WRF7 (since it was the only data source with an RIL above the loss threshold). The RIL_{FINAL} was greater than zero and a Disaster Alert for Tropical Cyclone Laura was issued for Antigua and Barbuda. Therefore this CARE qualified as a loss event. However, the RIL_{FINAL} was below the attachment point of Antigua and Barbuda's Excess Rainfall policy and thus did not trigger a policy payout.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event was below the attachment point of Antigua and Barbuda's Excess Rainfall policy 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.