Covered Area Rainfall Event (02/10/2023 – 05/10/2023)

Excess Rainfall

Event Briefing

Dominica

13 October 2023

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1 INTRODUCTION

This event briefing describes the impact of rainfall on Dominica, which was associated with a Covered Area Rainfall Event (CARE) on October 2 to 5, 2023. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was below the attachment point of the Excess Rainfall policy of Dominica, and therefore no payout is due to the Government of Dominica.

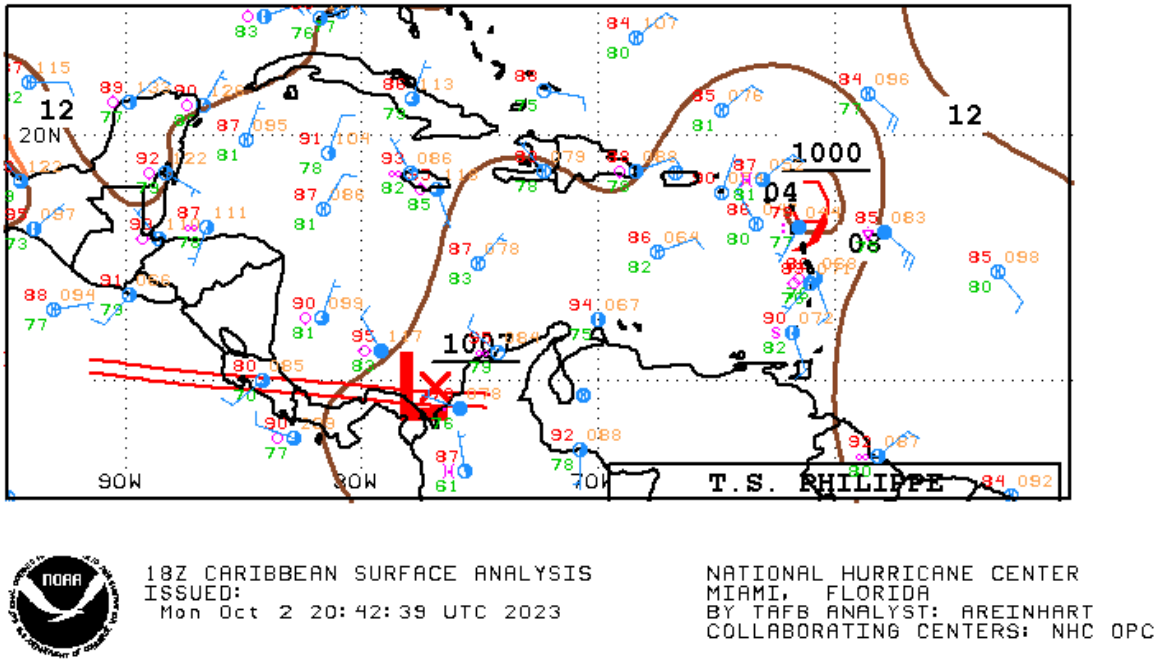
2 EVENT DESCRIPTION

On 23 September at 2100UTC, the US National Hurricane Center (NHC) reported that a tropical storm (TS) formed in the central tropical Atlantic Ocean, and it was named Philippe. Its centre was sited near latitude 15.6° North, longitude 39.7° West, about 1400 mi (2300 km) E of the Leeward Islands. The system proceeded with estimated forward velocity of 14 mph (22 km/h) towards the west. The minimum central pressure was 1005 mb and the maximum sustained winds were estimated at 40 mph (65 km/h).

During the next three days, the tropical storm proceeded with the same forward velocity and direction over the tropical Atlantic Ocean. The strong environmental wind shear and the entrainment of dry air hindered the intensification of the system, and the maximum sustained winds remained constant at about 50 mph (85 km/h). Moreover, the shear caused a marked asymmetry of the storm, with the convective bursts shifted well to the east of the system centre. From 27 September to 2 October, the intensity of the storm remained unvaried, but its forward velocity decreased and the storm started to meander towards the east of the northern Leeward Islands.

On 2 October at 1800UTC, the centre of Philippe was located near latitude 17.3° North, longitude 61.0° West, about 55 mi (90 km) ESE of the island of Barbuda (Antigua and Barbuda) and about 123 mi (200 km) NNE of Dominica, with maximum sustained winds estimated at 50 mph (85 km/h) and minimum central pressure of 1000 mb (Figure 1). TS Philippe presented a high asymmetry and a poorly defined circulation centre, sited near the northwestern edge of the large convective mass (Figure 2). Therefore, the moderate to locally intense rainfall associated with Philippe started to affect Dominica at this time, despite the large distance from the system centre (Figure 3a).

At 2200UTC, the centre of Philippe made landfall on the island of Barbuda (Antigua and Barbuda), with unvaried intensity. Precipitation became heavy over Dominica (Figure 3b).

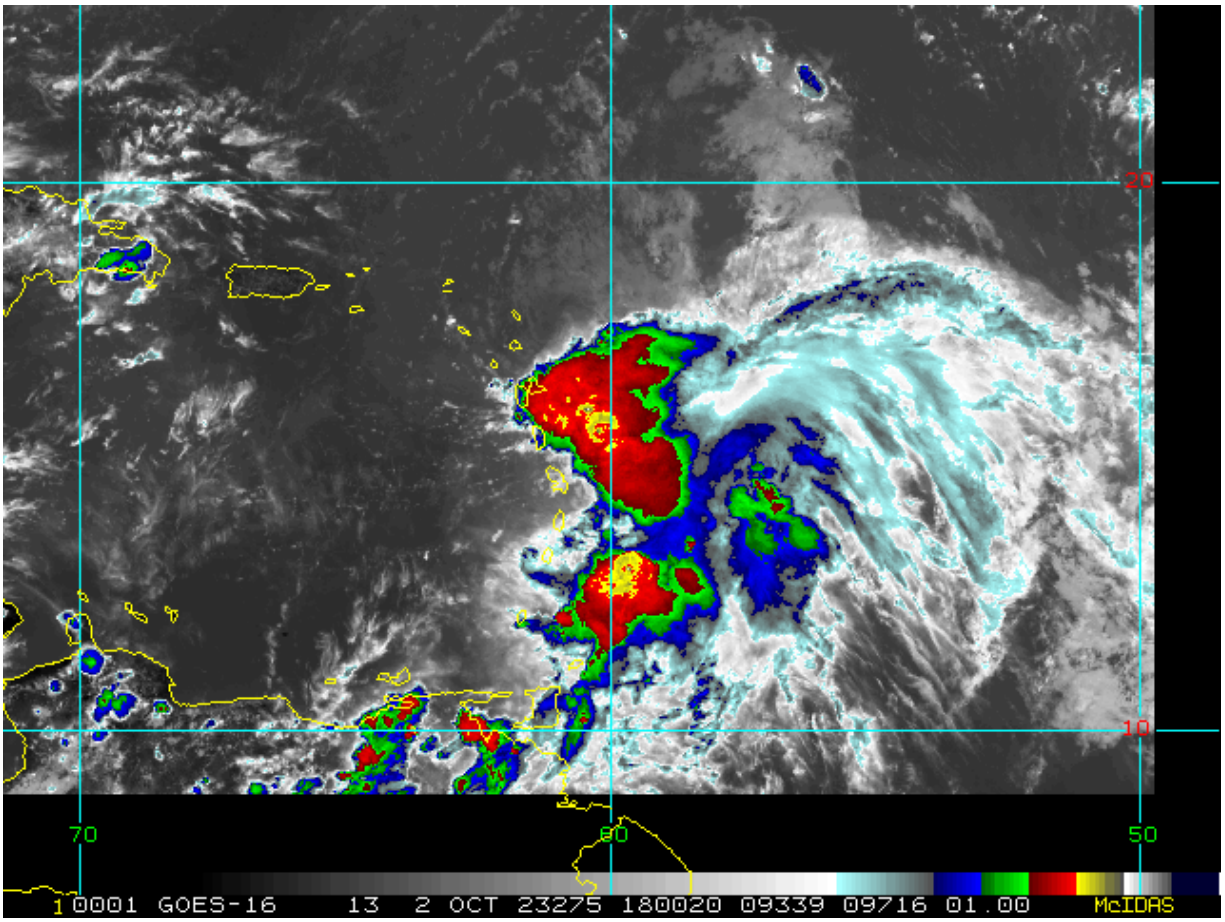


02 October at 1800UTC

Figure 1 Surface analysis over the Caribbean area on 2 October, 2023 at 1800UTC. Source: US National Hurricane Center[1]

On 3 October at 0300UTC, the centre of Philippe was located near latitude 17.8° North, longitude 62.1° West, about 24 mi (40 km) NW of Barbuda and about 70 mi (110 km) ESE of Sint Maarten. The intensity and sheared shape of the tropical storm was unchanged, while it gained forward velocity, moving west-northwest at 7 mph (11 km/h) along the western periphery of a mid-level high pressure area over the central Atlantic Ocean. The precipitation associated with the large convective mass of the tropical storm was still intense over Dominica, as shown by the radar imagery (Figure 3b-3c).

1 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 2 October 2023, available at: *https://www.nhc.noaa.gov/tafb/CAR_18Z.gif*

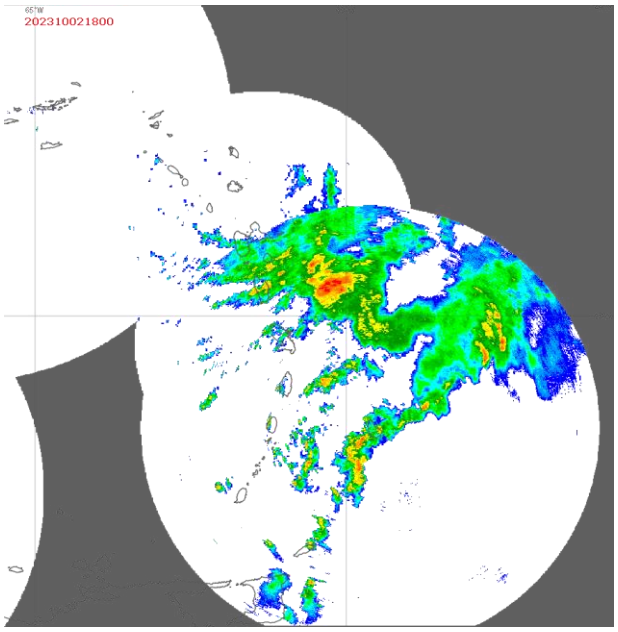


02 October at 1800UTC

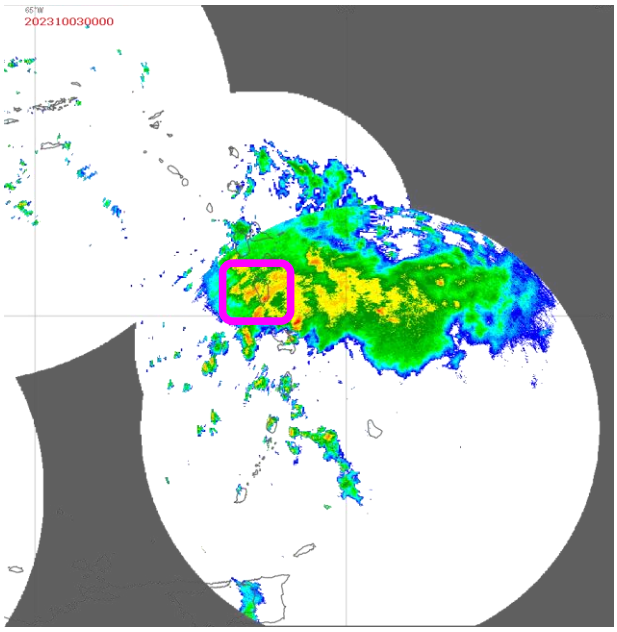
Figure 2 Satellite imagery on 2 October, 2023 at 1800UTC from the thermal infrared channel enhanced with colour. Blue/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the red/yellow colours represent very high altitude clouds (top cloud lower than -70°C). High altitude clouds indicate strong convection associated with intense precipitation. The position of the circulation centre of TS Philippe is indicated by a purple dot. Source: NOAA, National Environmental Satellite, Data and Information Service[2].

At 1200UTC, the centre of Philippe was sited near latitude 18.6° North, longitude 63.5° West, about 40 mi (60 km) NW of Anguilla. As in the previous hours, most of the stronger convection was over the southern and eastern portions of the storm. Consequently, the Leeward Islands and Dominica continued to experience strong winds and heavy rains even when the centre of the storm moved north of those islands. At this time, Dominica was still affected by moderate to locally intense rainfall (Figure 3d).

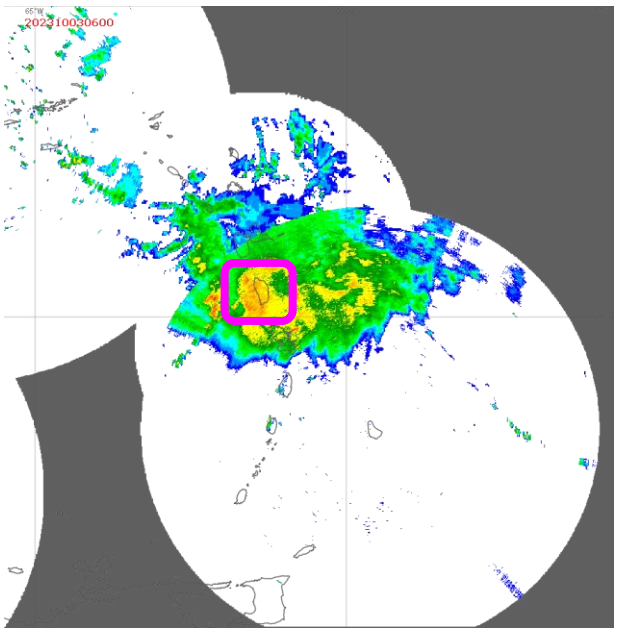
2 RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://rammb-data.cira.colostate.edu/tc_realtime/storm.asp?storm_identifier=al172023



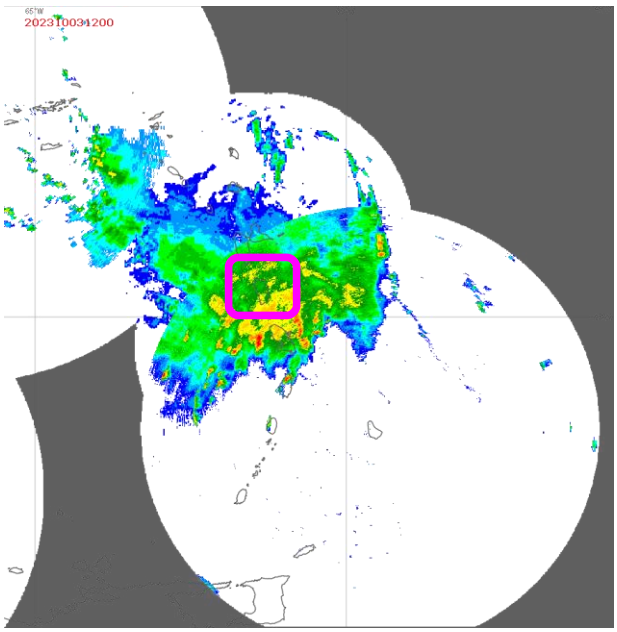
a) 2 October at 1800UTC



b) 3 October at 0000UTC



c) 3 October at 0600UTC



d) 3 October at 1200UTC

Figure 3 Radar imagery on 2 and 3 October at different times as indicated by 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. Dominica is surrounded by a purple square. Source: Barbados Radar Composite[3].

3 Barbados Radar Composite, available on 2 and 3 October 2023 at: *https://www.barbadosweather.org/BMS_Radar_Composite_Resp.php#*

The tropical storm proceeded towards the northwest at 10 mph (17 km/h) and at 1800UTC its centre was located near latitude 19.0° North, longitude 64.4° West, about 17 mi (27 km) N of Anegada Island, British Virgin Islands. At this time, the precipitation associated with TS Philippe ceased over Dominica and the other Leeward Islands.

In the following six hours, TS Philippe lost organization and moved away from the British Virgin Islands, proceeding north-northwest towards the north Atlantic Ocean.

3 IMPACTS

At the time of writing this report, information available on the effects of excess rainfall in Dominica, due to the passage of Tropical Storm Philippe, indicated that heavy rains and strong winds caused extensive flooding in some places. The Government of Dominica ordered the closure of schools due to heavy rainfall. The Minister of National Security said it was important that students remained at home to facilitate the clean-up operations as various landslides had been reported across the island. [4]

Figure 4 Weather update of Dominica on October 4, 2023

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15[5], detected the occurrence of precipitation over Dominica and the surrounding waters

[4] Writeups 24: Weather radar and current conditions in Dominica - Writeups 24

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 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 30 September to 5 October 2023. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 4. The CARE for Dominica was activated on 2 October and lasted until 5 October. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[6] and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in Dominica was 30 September – 5 October, 2023.

CMORPH reported total accumulated values of precipitation higher than 240 mm over most of Dominica, with the maximum values between 320 mm and 360 mm over the central-northern portion of the island.

IMERG showed total accumulated values of precipitation higher than 320 mm over most of Dominica, with the maximum values between 360 mm and 400 mm over the central-western portion of the island, in particular over the Saint Peter, Saint Andrew, Saint Joseph and Saint Paul parishes.

WRF5 showed total accumulated values of precipitation higher than 80 mm over the entire country, with maximum values between 160 and 200 mm over central-eastern Dominica.

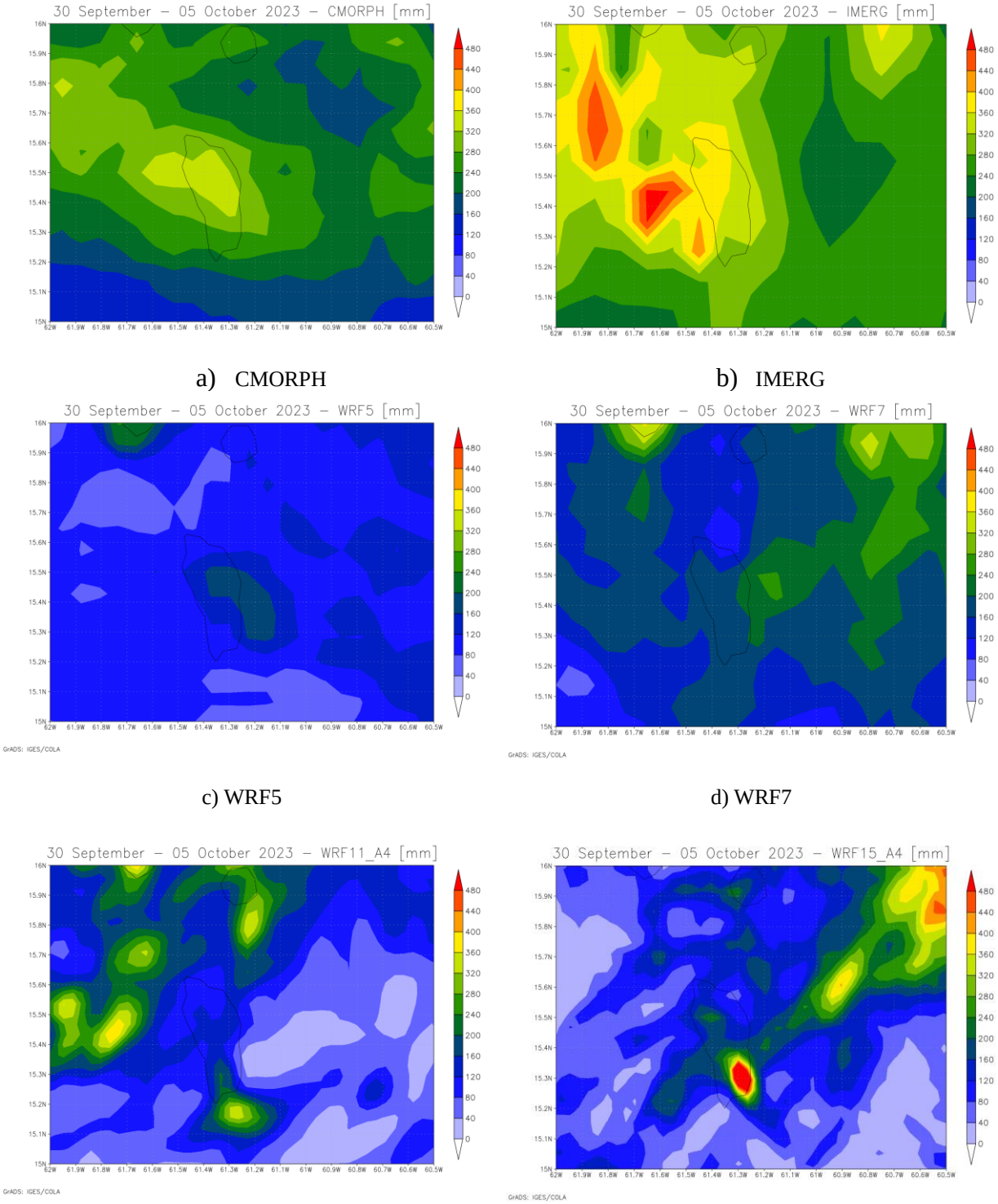
WRF7 showed total accumulated values of precipitation greater than 160 mm over most of the country. The highest values, between 200 mm and 240 mm, were reported along the eastern coast.

WRF11 showed total accumulated values of precipitation higher than 80 mm over most of Dominica, with the maximum values between 200 mm and 240 mm over the southern edge of the island.

WRF15 showed total accumulated values of rainfall greater than 120 mm over most of Dominica. The maximum values, above 480 mm, were shown over the south-eastern edge of Dominica, with a local peak of 722 mm.

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.

6 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 5 Total accumulated precipitation during the period 30 September - 05 October, 2023 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/DMA/CARE_2_2023/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/DMA/CARE_2_2023/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Dominica for four of the data sources used by the XSR3.0 model: CMORPH, IMERG, WRF15 and WRF5. The RIL was the highest for CMORPH.

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs from CMORPH, IMERG, WRF15 and WRF5. 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 Dominica and therefore the policy was not triggered.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for the Covered Area Rainfall Event (CARE) for Dominica was below the attachment point of the Excess Rainfall policy for this country, 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.