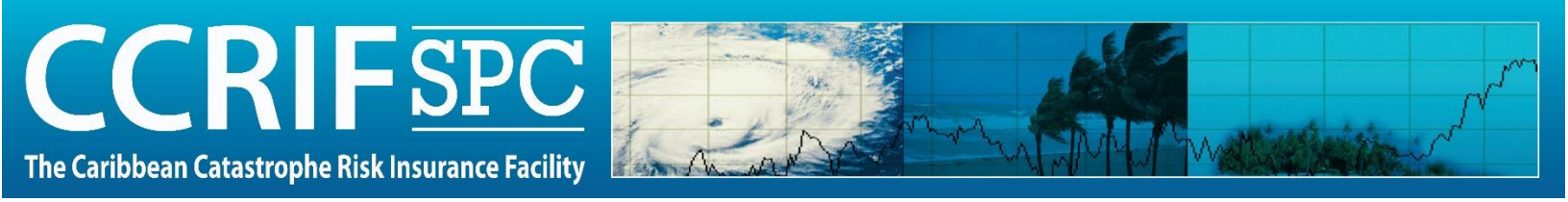


Covered Area Rainfall Event (31/10/2024 to 04/11/2024)

Excess Rainfall

Event Briefing

Panama
Panama-FAP

14 November 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 Panama, which was associated with a Covered Area Rainfall Event (CARE) starting on 31 October 2024 and ending on 04 November 2024. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was above the attachment point of Panama's Excess Rainfall (XSR) policy and Panama's FAP[1] Excess Rainfall policy (referred to as the Panama FAP Excess Rainfall policy), and therefore payouts of US$7,599,765.00 for Panama's XSR policy and US$19,100,504.00 for the Panama FAP XSR policy are due to the Government – for a total payout of US$26,700,269.00.

2 EVENT DESCRIPTION

Between 30 October and 4 November 2024, Panama experienced a significant rainfall event driven by the interaction between an approaching tropical wave and a low-pressure area embedded in the monsoon trough sited offshore Panama over the southwest Caribbean Sea. These factors supported the development of thunderstorms across Panama, mainly between 30 October and 1 November.

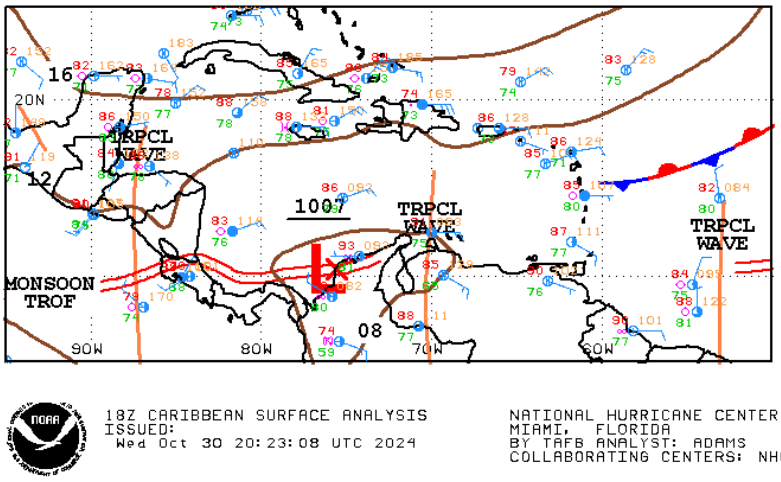
On 30 October, the East Pacific monsoon trough extended off the Pacific coast, near latitude 10°North, longitude 86°West, to a low-pressure system located in the SW Caribbean Sea, along the northern Colombia coast, near latitude 11°North, longitude 75°West (Figure 1a). Numerous areas of moderate to isolated strong convection were active throughout the day over the SW Caribbean in the vicinity of the monsoon trough, mostly over the waters to the north of Panama. Starting from 1800UTC, these features began to interact with an approaching tropical wave, positioned over the central Caribbean along longitude 70ºWest and south of latitude 16ºNorth, moving westward at around 6 mph (9 km/h), Figure 1a. This setup enhanced tropical moisture flow, creating conditions favourable for intense rainfall across the region. At 1800UTC, the satellite imagery indicated scattered showers and thunderstorms ahead of the tropical wave, from longitude 67°West to 74°West, which marked the beginning of the heaviest rainfall over Panama. During the next twelve hours, as the tropical wave approached Panama, the convective activity intensified over the SW Caribbean Sea and particularly over inland Panama, with strong thunderstorms developing over most of the country, as reported by satellite imagery (Figure 2a, 2b, 2c, 2d).

On 31 October at 1200UTC, the tropical wave was positioned just east of Panama, along approximately longitude 76ºWest and south of latitude 18ºNorth, moving westward at around 22 mph (36 km/h). Numerous areas of moderate and isolated strong convection occurred near the wave axis, over the SW Caribbean Sea and northern Colombia, extending sporadically to inland Panama. During the next 24 hours, the tropical wave crossed Panama, moving westward at 11 mph (18 km/h), while the monsoon trough drifted slightly northward and the low-pressure system evolved into a developing Central America Gyre (CAG), Figure 1b. This weather pattern was less favourable for strong convection over Panama but supported the formation of showers and

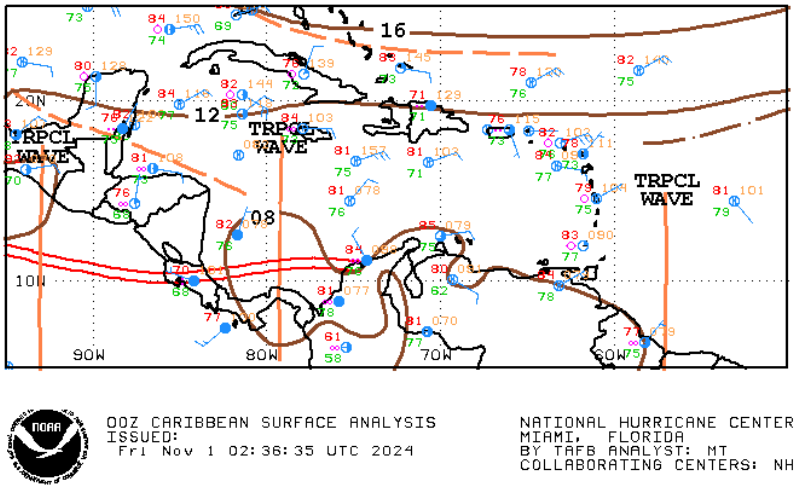
[1] Panama has 2 XSR policies, one of which is funded by the El Fondo de Ahorro de Panamá (FAP, the Panama Savings Fund).

thunderstorms with moderate to locally high intensity over the southwestern Caribbean Sea, extending intermittently onto the Panama shore (Figure 2e).

From the second half of 1 November to 4 November, as the tropical wave dissipated and the CAG moved northeastward and evolved into Tropical Depression Eighteen (later Tropical Storm Rafael), Panama saw a gradual reduction in rainfall intensity. However, intermittent showers and thunderstorms persisted due to the lingering effects of the broad area of low pressure and the monsoon trough (Figure 2f). On 4 November, conditions began to stabilize as Tropical Depression Eighteen shifted northward, marking the end of the rainfall event over Panama.



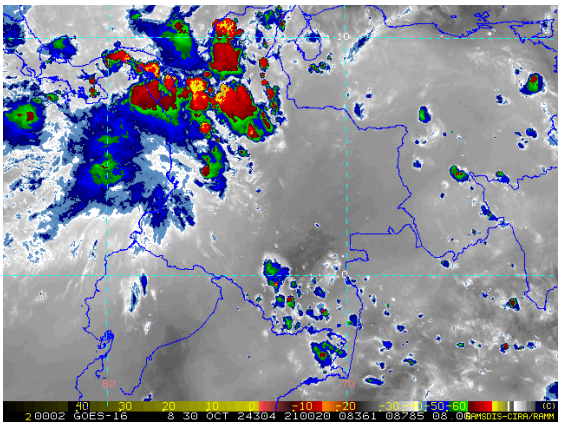
a) 30 October at 1800UTC



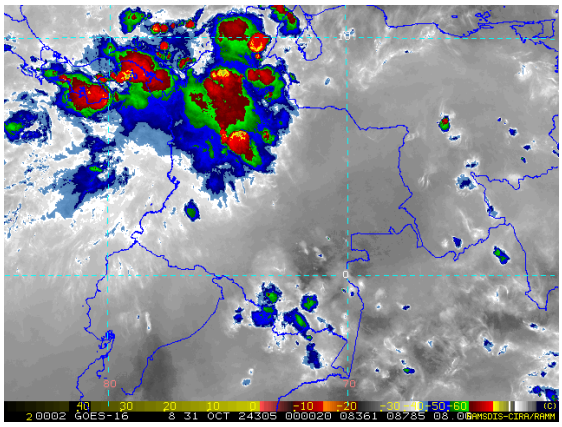
b) 1 November at 0000UTC

Figure 1. Surface analysis over the Caribbean Sea area on (a) 30 October and 1 November 2024 at different times as indicated by the labels. Source: US National Hurricane Center[2]

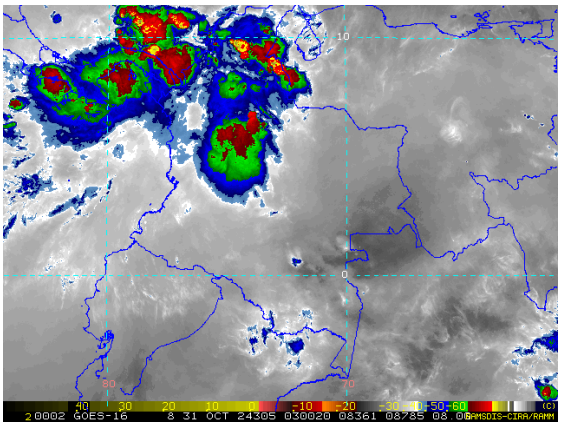
[2] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: 30 October and 1 November 2024, available at: https://www.nhc.noaa.gov/tafb/CAR_18Z.gif, https://www.nhc.noaa.gov/tafb/CAR_18Z.gif, https://www.nhc.noaa.gov/tafb/CAR_00Z.gif



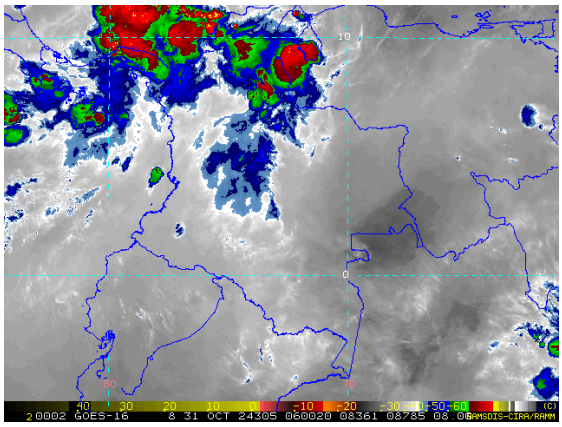
a)30 October at 2100UTC



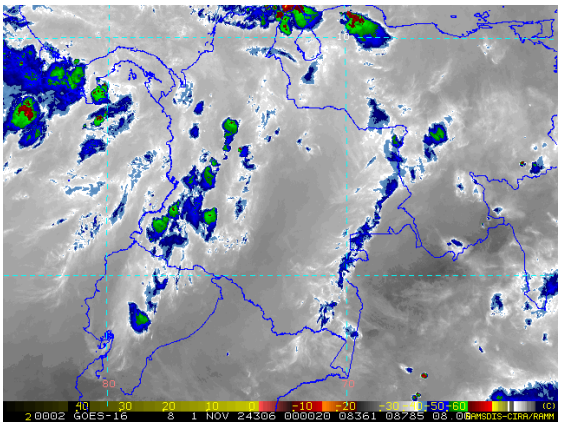
b)31 October at 0000UTC



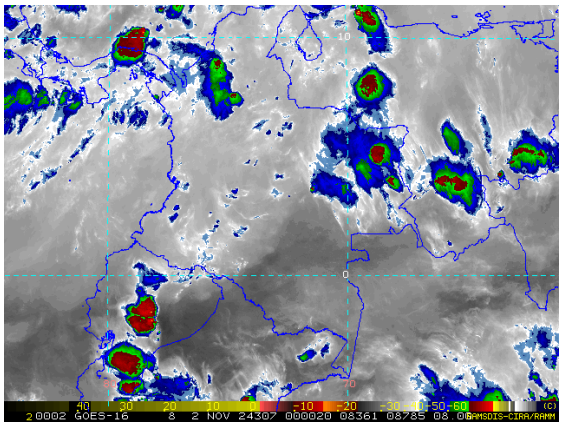
c)31 October at 0300UTC



d)31 October at 0600UTC



e)1November at 0000UTC



f) 2 November at 0000UTC

Figure 2. Satellite imagery from 30 and 31 October, 1 and 2 November 2024 at different times as indicated by the labels. 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].

[3] RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://cdn.star.nesdis.noaa.gov/GOES16/ABI/SECTOR/car/11/

3 REPORTED IMPACTS

At the time of writing this report, the information about damages in Panama due to this Covered Area Rainfall Event during the indicated period is shown below.

On November 4, Omar Smith, director of the National Civil Protection System, declared that due to the heavy rainfall that affected Panama, 5 persons lost their lives, and more than 1,500 had been affected. The time of this rainfall event resulted in a nationwide alert, with nine areas of red alert.

The heavy rainfall has caused rivers to swell, landslides, floods, falling trees and collapsed bridges in the country, specifically in the provinces of Chiriquí, Herrera, Los Santos, Veraguas, and Bocas del Toro. [4]

One of these landslides was registered on the Panamerican highway, in Viguí, Chiriquí province, which complicated traffic flow for drivers heading from Chiriquí to the central provinces and the capital city. [5]

Figure 3. Landslide caused by the heavy rainfall in Vigui, Chiriquí.

The following images show some of the areas where flooding was reported.

[4] Swissinfo: Cinco fallecidos y más de 1.500 personas afectadas por las fuertes lluvias en Panamá - SWI swissinfo.ch

[5] La Prensa: Tormenta Rafael causa deslizamientos de tierra en Chiriquí y Los Santos | La Prensa Panamá

Figure 4. Flooding reported in Las Garzas de Pacora, Panamá | Photo by Sinaproc[6].

Figure 5. Sinaproc personnel in evacuation efforts in Veraguas, Panamá. | Photo by Sinaproc [7]

[6] La Prensa: Alerta roja en Panamá: familias evacuadas y pérdidas significativas tras intensas lluvias | La Prensa Panamá

[7] La Prensa: Las lluvias seguirán azotando el país, asegura el Imhpa | La Prensa Panamá

Figure 6. Flooding reported in Boquete, Chiriquí Province, Panamá[8].

The agricultural sector also has been affected by the heavy rainfall. There might be a delay in the transition from the rainy to the dry season this year, influenced by the La Niña phenomenon, which is of concern to corn, bean, and curcubitaceae producers, who will be on alert until January of next year because of excess moisture. [9]

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15[10], detected the occurrence of precipitation over the Panama and the surrounding waters during the period 29 October to 04 November 2024. Each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 5. A CARE for Panama and Panama-FAP was activated on 31 October and lasted until 04 November. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for

[8] La Prensa: Unas 17 casas afectadas por inundaciones y deslizamientos en Boquete | La Prensa Panamá

[9] La Estrella: Lluvias hasta enero de 2025 afectarían cultivos en Azuero, no así en Chiriquí

[10] 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

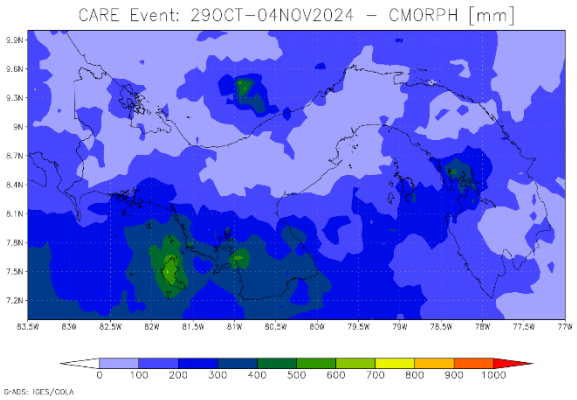
IMERG Model: The satellite-based rainfall estimation model developed by NASA, expressed in mm, derived by aggregating the IMERG 30-minute Rainfall Data at 10km spatial resolution and available at *https://jsimpsonhttps.pps.eosdis.nasa.gov/imerg/late*. Further details in the Definitions section of this 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 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.

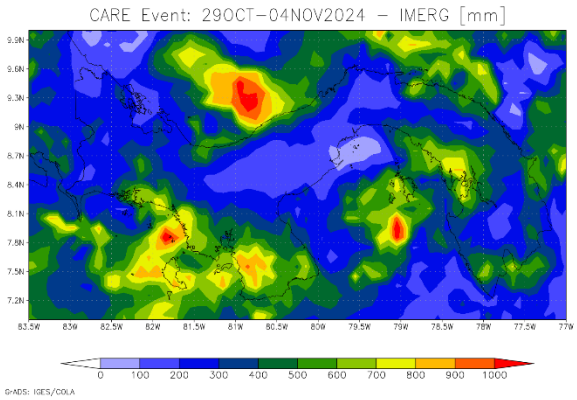
precipitation[11] and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in the Panama was 29 October to 04 November 2024.

CMORPH	CMORPH reported total accumulated values of precipitation higher than 200 mm over southern Panama, in the provinces of Veraguas, Herrera, Los Santos and Darien, with the maximum values, between 400 mm and 600 mm, in the district of Torio, in the province of Veraguas. Lower values were reported over the rest of Panama.
IMERG	IMERG reported total accumulated values of precipitation with a similar geographic distribution to that of CMORPH, but with higher values. Accumulated values of rainfall higher than 400 mm were reported over southern Panama (in the same provinces indicated by CMORPH), with the highest values reaching 800 mm to 900 mm in the district of Torio. Lower values were reported over the rest of Panama.
WRF5	WRF5 showed total accumulated values of precipitation higher than 600 mm along the western coasts of the provinces of Veraguas and Panama, with local maximum between 900 mm and 1000 mm. Values lower than 400 mm were reported over the rest of Panama.
WRF7	WRF7 reported total accumulated values of precipitation with a similar geographic distribution to that of WRF5, but with lower maxima, reaching 800 mm to 900 mm over limited areas. Additionally, values between 500 mm and 700 mm were reported in the province of Chiriquì. Values lower than 400 mm were reported over the rest of Panama.
WRF11	WRF11 reported accumulated values of precipitation with a similar geographic distribution and intensity to WRF7, but with lower values over the provinces of Chiriquì and Panama. The maximum values, between 800 mm and 1000 mm, were reported over isolated areas south of the district of Tolè (at the border between Veraguas and Chiriquì provinces). Values lower than 400 mm were reported over the rest of Panama.
WRF15	WRF15 reported accumulated values of precipitation with a similar geographic distribution and intensity to that of WRF11, but with lower values (mostly lower than 100 mm) in the provinces of Panama and Panama Oeste.

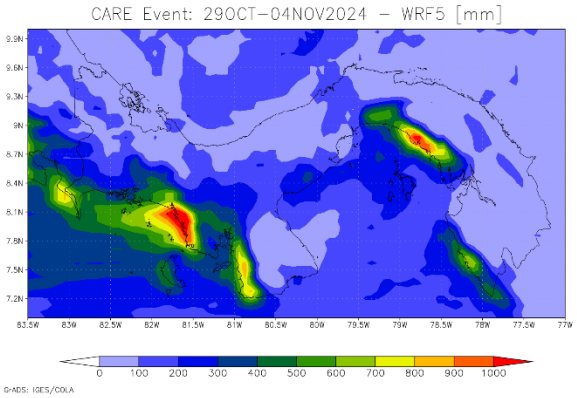
[11] The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.



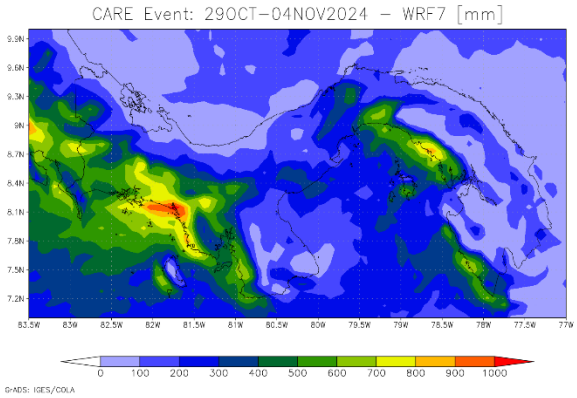
a) CMORPH



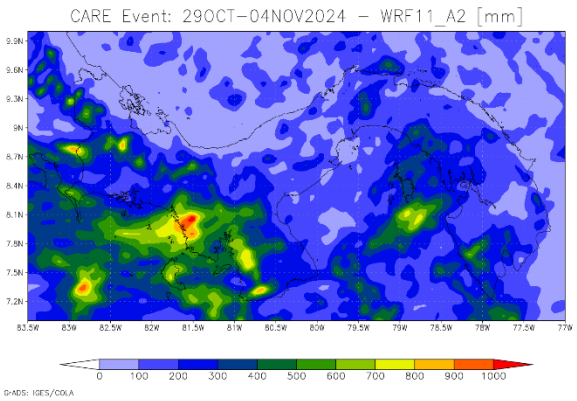
b) IMERG



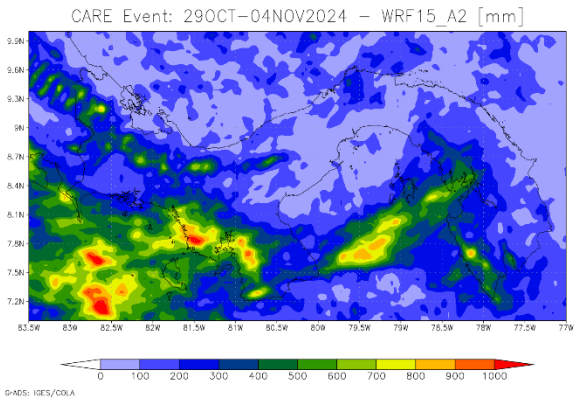
c) WRF5



d) WRF7



e) WRF11



f) WRF15

Figure 7 Total accumulated precipitation during the period 29 October and 04 November, 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/PAN/CARE_5_2024/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/PAN/CARE_5_2024/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Panama and Panama-FAP for five of the data sources used by XSR3.0: CMORPH, IMERG, WRF5, WRF7 and WRF11. The RIL was the highest for IMERG. No Disaster Alert declaration was issued by ReliefWeb for Panama related to the rain events during this period.

The final RIL (RIL_{FINAL}) was calculated as the average of the five RILs from CMORPH, IMERG, WRF5, WRF7, and WRF11. The RIL_{FINAL} was greater than the attachment point of the Excess Rainfall policy of Panama and Panama FAP, therefore this CARE qualified as a triggering event for both policies. The RIL_{FINAL} was greater than the exhaustion point of both Excess Rainfall policies. Therefore, a full payout is due to the Government of Panama under the Excess Rainfall policies of Panama and Panama FAP.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event (CARE) was above the attachment point of Panama's Excess Rainfall policy and the Panama-FAP Excess Rainfall policy. Also, the Rainfall Index Loss was above the exhaustion point of both policies and therefore payouts of US$7,599,765.00 for Panama's policy and US$19,100,504.00 for the Panama FAP policy are due to the Government – for a total payout of US$ 26,700,269.00.

CCRIF expresses sympathy with the Government and people of Panama for the loss of life and 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.