Covered Area Rainfall Event (25/07/2021 to 25/07/2021)

Excess Rainfall

Event Briefing

Panama

3 August 2021

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1 INTRODUCTION

Panama was under the influence of a monsoon trough and several tropical waves resulting in adverse weather conditions that occurred primarily between July 23 and July 26, 2021. During this period, Panama was affected by moderate to strong periods of rainfall over a large area of the country.

This event briefing describes the impact of rainfall on Panama, which was associated with a Covered Area Rainfall Event (CARE), starting and ending on 25 July 2021. The Rainfall Index Loss (RIL) was below the attachment point of the excess rainfall policy for Panama and therefore no payout is due.

2 EVENT DESCRIPTION

On 25 July, several tropical waves were reported to move toward the west while a monsoon trough persisted over Panama (Figure 1). More organized convection activity was observed over Panama and the surrounding waters due to the combination of the instability caused by the monsoon trough and the westward transition of tropical waves, followed by the formation of a low-pressure system of 994 mb. This configuration led to the development of scattered showers over Panama, resulting in moderate to heavy precipitation which mainly affected the northern areas of the country (Figure 2).

The intense precipitation lasted throughout most of the day, slowly dissipating in the late afternoon hours from 1700 UTC with a slight increase in intensity around 2000 UTC. During the next several hours, with weakening and continuous movements to the north, the configuration became scattered and rainfall activity in Panama ended the following day.

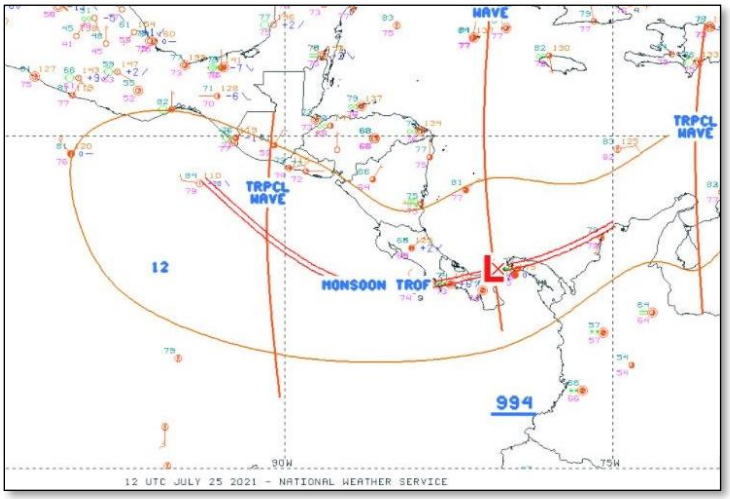
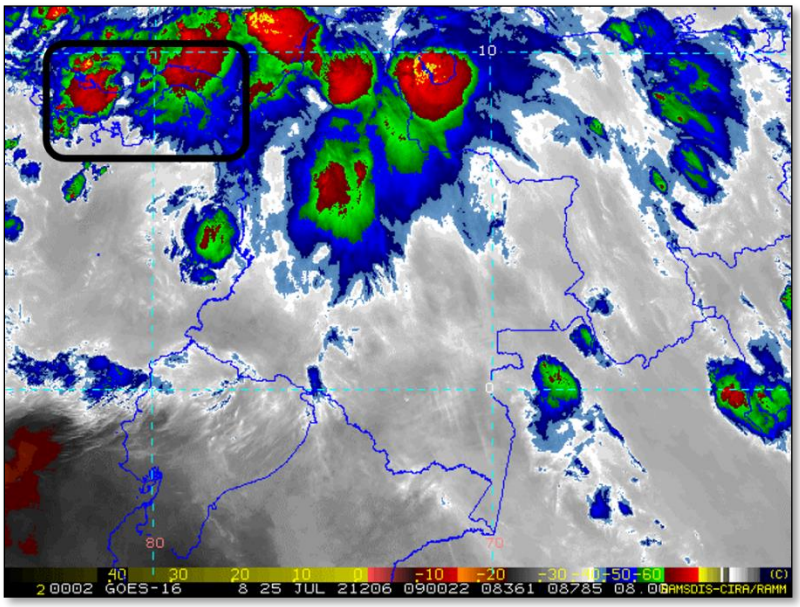
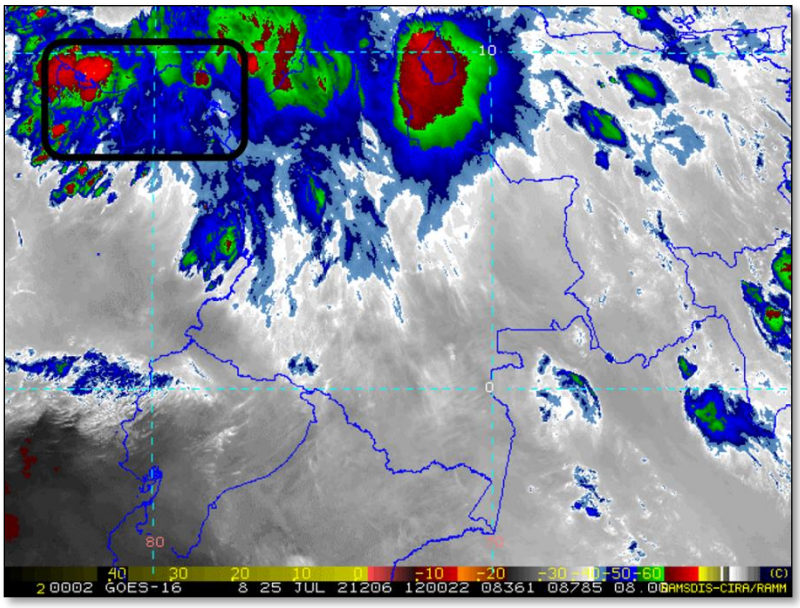


Figure 1 Surface analysis over the Central America area on 25 July at 1200 UTC.
Source: US National Hurricane Center[1]

[1] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, available at: *https://ocean.weather.gov/Loops/index.php?category=ua&product=UA_Mexico_hires&days=14&loop=0*



a) 25 July 2021 at 0900 UTC



b) 25 July 2021 at 1200 UTC

Figure 2 Satellite imagery at the time as indicated by the labels 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. The black square indicates the position of Panama. 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/rmtcsasec3ir304/rmtcsasec3ir304_20210725090022.gif
https://rammb.cira.colostate.edu/ramsdis/online/images/rmtc/rmtcsasec3ir304/rmtcsasec3ir304_20210725120022.gif

3 IMPACTS

According to an assessment from Panama's disaster management agency (in Spanish: Sistema Nacional de Protección Civil – SINAPROC), the districts most affected by this weather system were Changuinola, Almirante (Province of Bocas del Toro), Penonomé, Aguadulce (Province of Coclé), Panamá (Province of Panamá), Tierras Altas and Alanje (Province of Chiriquí). Due to heavy rains, the majority of the impacts were related to increased river levels, flooding, roads obstructed by falling trees and landslides.

At the time of this report the area severely affected by this weather system was the Province of Bocas del Toro. The impact in this province from the SINAPROC[3] and IFRC[4] was reported as described below:

- One person died
- Approximately 27,000 people and 5,500 homes were affected
- 858 citizens occupied shelters
- There were 11 landslides and 3 fallen trees
- The agriculture and livestock sectors were affected

Figure 3 shows some of the damage caused by this adverse weather in Panama.

Bocas del Toro

Coclé

Panamá

Chiriquí

Figure 3 Damage caused by this adverse weather period in Panama. July 2021.
Source: *Sistema Nacional de Protección Civil*

[3] SINAPROC, *Sistema Nacional de Protección Civil*, posted date: 25 July 2021, available at: '*PLATAFORMA TECNOLÓGICA AGILIZA ATENCIÓN DE EMERGENCIA EN BOCAS DEL TORO*'

[4] IFRC, - International Federation of Red Cross and Red Crescent Societies, DREF Plan of Action (As of 29 July 2021), available at: '*Panama: Floods*'

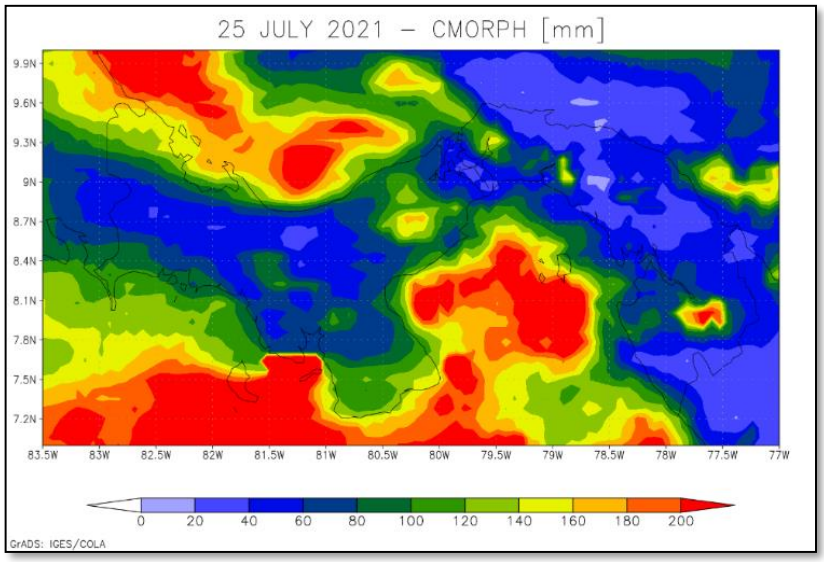
4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[5], WRF5 and WRF7[6], detected the occurrence of precipitation over Panama and the surrounding waters on 25 July 2021. However, each data source reported a specific distribution of rainfall, as discussed below and shown in Figure 4.

CMORPH reported total accumulated amounts of precipitation between 40 mm and 60 mm over the entire country. Higher amounts of precipitation were shown in some areas, ranging from 160 mm to above 200 mm in the southeast of the country.

WRF5 simulated total accumulated amounts of rainfall with different values over the whole country. For most parts of the country, it showed values of 60 mm with occasional precipitation greater than 200 mm, mostly in the southeast and southwest of the country.

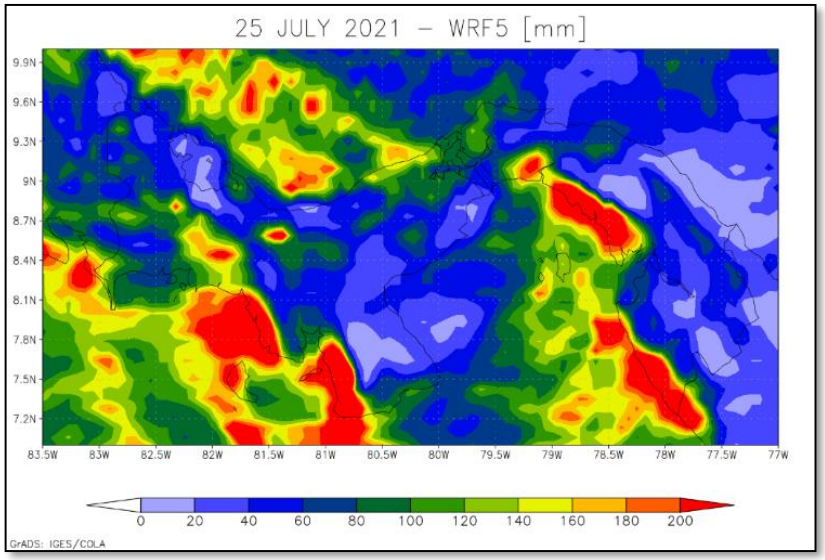
WRF7 showed the highest values of precipitation for the whole country. Generally, higher amounts of precipitation were shown in the western parts of Panama compared to the east. Values above 200 mm were shown in the western part of the country and smaller areas in the southeast of the country. The lowest values for precipitation were shown in the northeast with values between 20 mm and 80 mm, although some areas had up to 120 mm of rain.



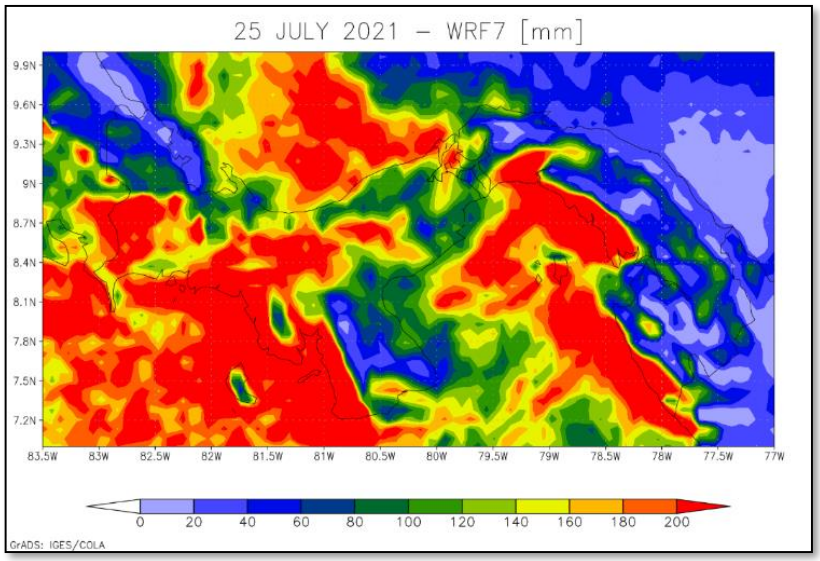
a) CMORPH

[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.



b) WRF5



c) WRF7

Figure 4 Total accumulated precipitation on 25 July, 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/PAN/CARE_2_2021/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/PAN/CARE_2_2021/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was slightly above the loss threshold for Panama for one of the data sources 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 Panama was issued. Therefore, this CARE qualified as a loss event. However, the RIL_{FINAL} was below the attachment point of the excess rainfall policy of Panama and thus did not trigger a policy payment.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event was below the attachment point of Panama's excess rainfall policy and therefore no payout is due.

CCRIF expresses empathy with the Government and people of Panama for the loss of life and impacts on communities and infrastructure caused by this weather system.

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.