



Covered Area Rainfall Events (17/12/2023 to 19/12/2023))

Excess Rainfall

Event Briefing

The Bahamas - Central

28 December 2023

1 INTRODUCTION

This event briefing describes the impact of rainfall on the central region of The Bahamas (The Bahamas – Central), which was associated with a Covered Area Rainfall Event (CARE) from December 17, 2023 to December 19, 2023. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was below the attachment point of the country’s Excess Rainfall policy for the Central¹ region, and therefore no payout is due to the Government of The Bahamas.

2 EVENT DESCRIPTION

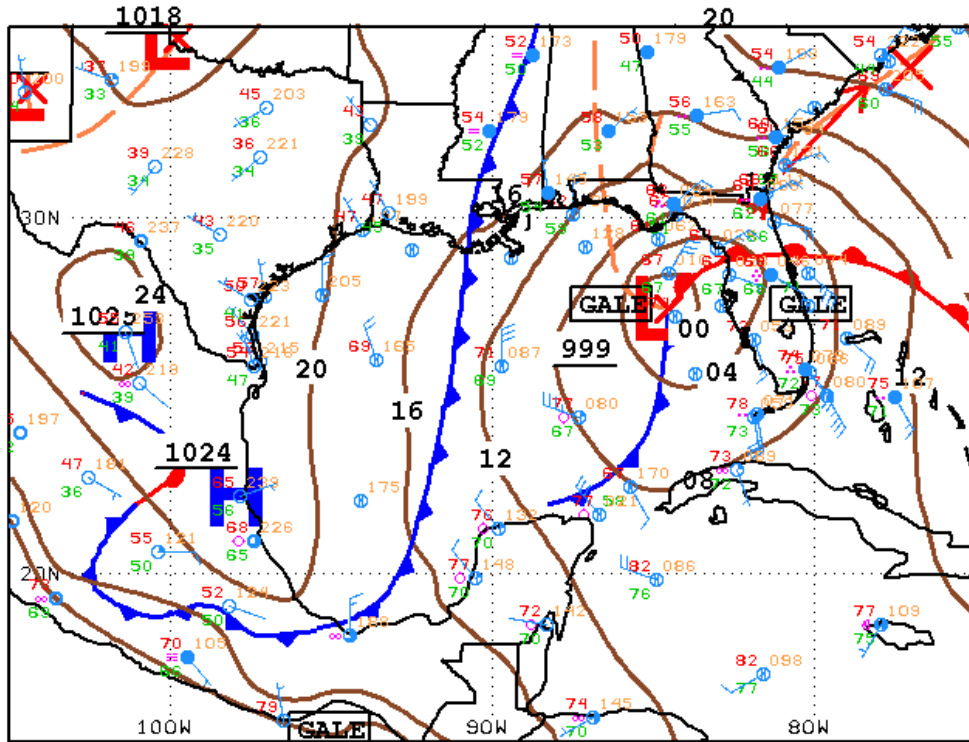
On 17 December at 0600UTC, a deep low pressure system was located near latitude 27.5°North, longitude 84.5°West, over the eastern Gulf of Mexico. An associated cold front extended south-southeastward from the low pressure system to the north of the Yucatan Peninsula. A warm front ran southeastward from this low pressure system across the western Atlantic to the north of the southeast Bahamas near latitude 25°North, longitude 72°West (Figure 1a). Scattered moderate to strong showers and thunderstorms spread in the vicinity of the warm front and over a large area northward from central Cuba and The Bahamas, to the west of longitude 72°West, and continued beyond latitude 31°North.

During the next 12 hours, the low pressure system strengthened and moved northeastward and at 1800UTC, it was sited along the North American coast near latitude 33°North, longitude 80°West. At this time, the cold front extended south-southwestward from the low pressure system to central Cuba and into the Caribbean, while the warm front trailed from the low pressure system to near latitude 22°North, longitude 67°West (Figure 1b). From 0600UTC to 1800UTC, strong thunderstorms spread ahead of the low pressure system and the cold front, over the Atlantic waters north of latitude 20°North and west of longitude 66°West. The satellite imagery showed a strong convective cell over central Bahamas, between 1200UTC and 1800UTC (Figure 2a).

During the next 24 hours, the deep low pressure system continued to move northeastward into the western Atlantic Ocean, while the cold front trailing southward from the system moved eastward, passing over central and eastern Bahamas. The satellite imagery showed an elongated band of deep convection ahead of the cold front, and embedded within it, a strong thunderstorm over central and eastern Bahamas, active between 17 December at 1800UTC and 18 December at 1200UTC (Figure 2b).

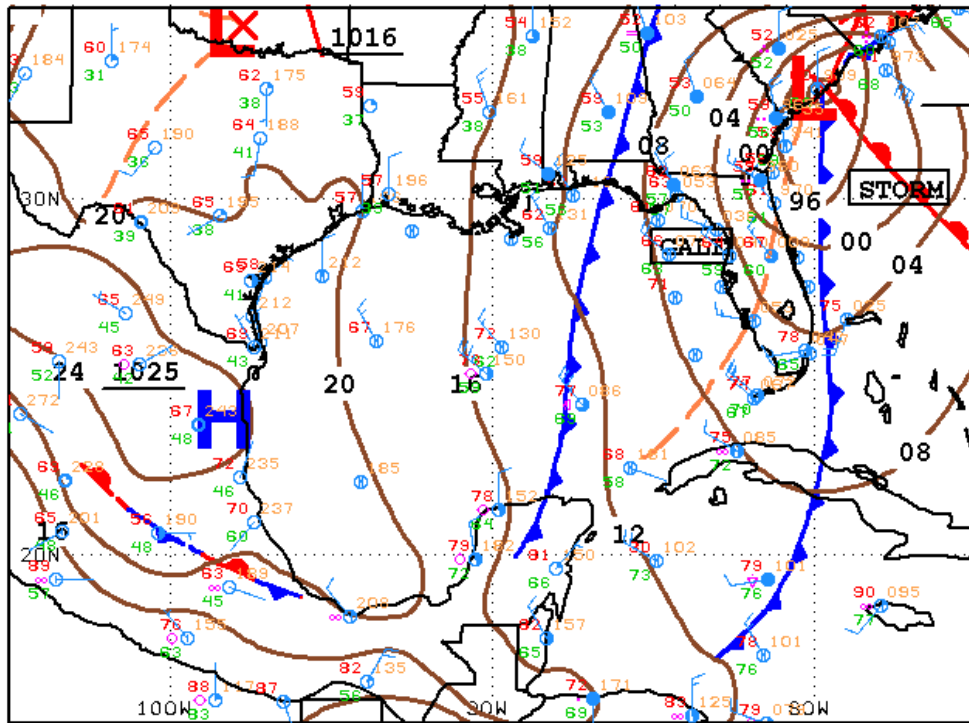
On 19 December, the cold front and the associated convection moved northeastward, leaving the Atlantic waters near The Bahamas.

¹ The Government of Bahamas has four excess rainfall policies: one for The Bahamas Central; one for The Bahamas Extreme North; one for The North and one for The Bahamas South East. This heavy rainfall did not affect the Extreme North, North or South – East areas and therefore the respective XSR policies for these regions were not triggered.



06Z GULF SURFACE ANALYSIS NATIONAL HURRICANE CENTER
ISSUED: MIAMI, FLORIDA
Sun Dec 17 08:36:24 UTC 2023 BY TAFB ANALYST: KRV
COLLABORATING CENTERS: NHC OPC WPC

a) 17 December at 0600UTC

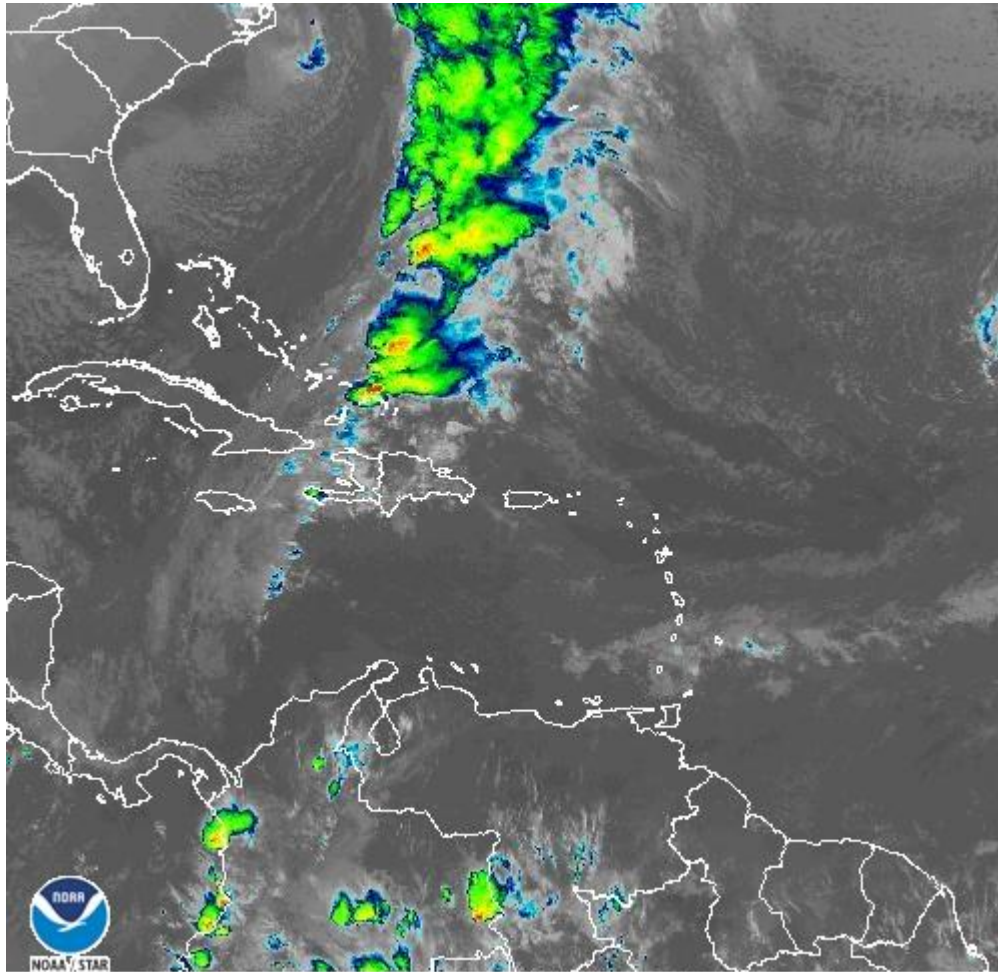


18Z GULF SURFACE ANALYSIS NATIONAL HURRICANE CENTER
ISSUED: 70 MIAMI, FLORIDA
Sun Dec 17 21:34:49 UTC 2023 BY TAFB ANALYST: PC
COLLABORATING CENTERS: NHC OPC WPC

b) 17 December at 1800UTC

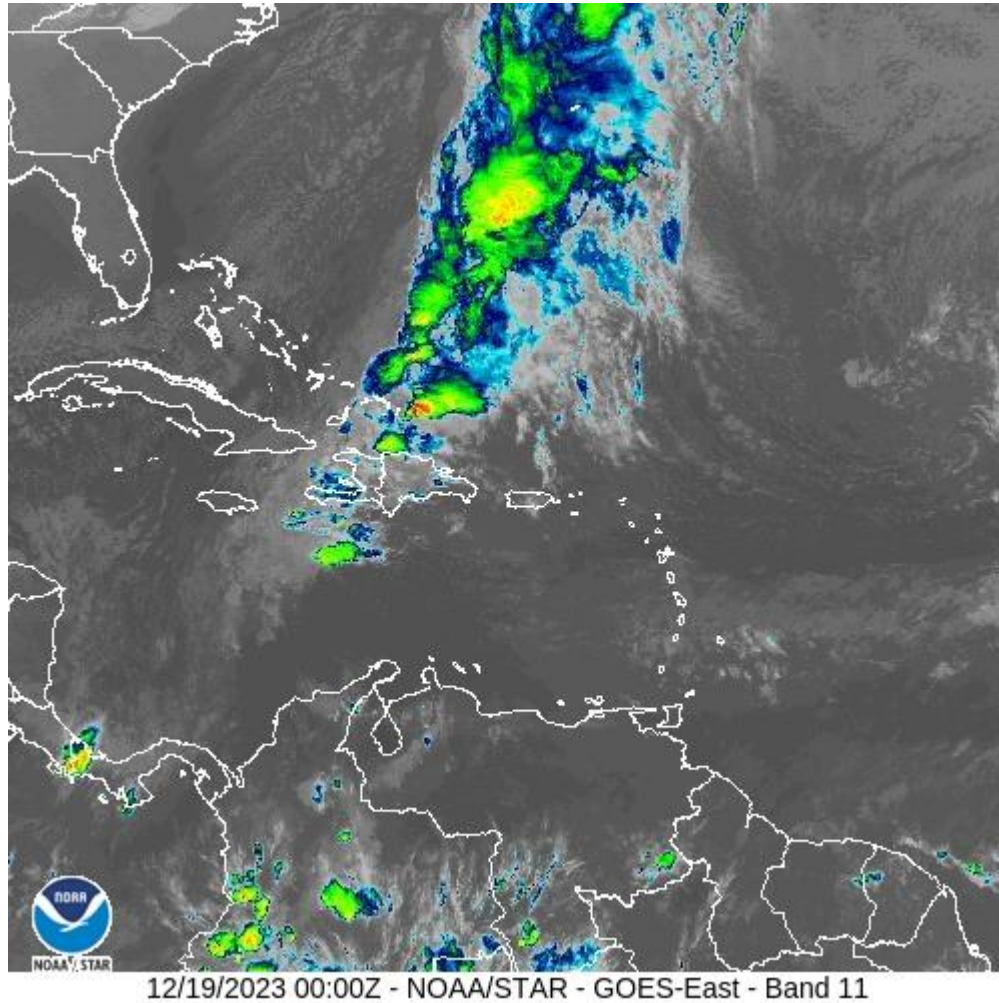
Figure 1 Surface analysis over the Gulf of Mexico on 17 December 2023 at different times as indicated in the labels. Source: US National Hurricane Center²

2 National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, available on 17 December 2023 at: https://www.nhc.noaa.gov/tafb/CAR_06Z.gif, https://www.nhc.noaa.gov/tafb/CAR_18Z.gif



12/18/2023 12:00Z - NOAA/STAR - GOES-East - Band 11

a) 17 December at 1200UTC



b) 18 December at 0000UTC

Figure 2 Satellite imagery on 17-18 December, 2023 at different times as indicated by the labels 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. Source: NOAA, National Environmental Satellite, GOES Image View³.

3 NESDIS Online Archive, NOAA National Environmental Satellite, GOES Image View, available at: <https://www.star.nesdis.noaa.gov/GOES/sector.php?sat=G16§or=cam>

3 IMPACTS

At the time of writing this report, no information was available related to damage or loss in Central Bahamas due to this Covered Area Rainfall Event during the indicated period. However, many cruise ships were affected due to severe weather in The Bahamas, causing them to change their itineraries on that weekend.⁴

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15⁵, detected the occurrence of precipitation over The Bahamas and the surrounding waters during the period 15 to 19 December 2023. However, each data source reported a specific distribution and accumulated rainfall, as discussed below and shown in Figure 4. A CARE for The Bahamas - Central⁶ was activated on 17 December and lasted until 19 December. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation⁷ and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in The Bahamas - Central was 15-19 December. Moreover, the same rainfall event activated a low modelled impact CARE for The Bahamas - South East (18 – 19 December), while no CAREs were activated for the other subregions of The Bahamas (i.e. The Bahamas - North and The Bahamas -Extreme North).

CMORPH reported total accumulated values of precipitation between 90 mm and 120 mm over the southern and extreme north portions of Cat Island. Lower values were shown over the remainder of The Bahamas - Central.

IMERG reported total accumulated values of precipitation higher than 90 mm over most of The Bahamas – Central. The maximum values, between 210 mm and 240 mm, were shown in a few

4 ABC News: ['Devastated': Passengers speak out after Bahamas-bound cruise diverted to New England, Canada over weather - ABC News \(go.com\)](#)

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 report

WRF5, 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.

6 The Government of Bahamas has four excess rainfall policies: one for The Bahamas Central; one for The Bahamas Extreme North; one for The North and one for The Bahamas South East. This heavy rainfall did not affect the Extreme North, North or South – East areas and therefore the respective XSR policies for these regions were not triggered.

7 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.

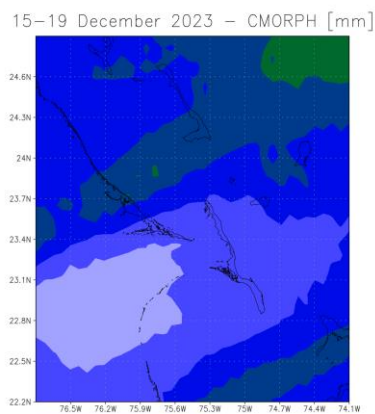
localized areas: along the southern coast of Cat Island and along the northern edges of the islands of Great Exuma and San Salvador.

WRF5 showed total accumulated values of precipitation lower than 60 mm over most of The Bahamas – Central, apart from few localized areas over Cat Island, where the precipitation values ranged between 60 mm and 90 mm.

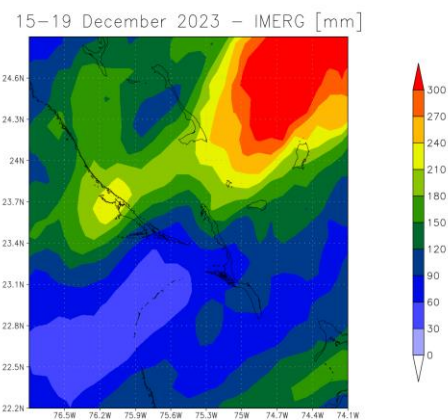
WRF7 showed total accumulated values of precipitation lower than 60 mm over most of The Bahamas – Central. Higher values, between 60 mm and 90 mm, were shown over the northern and extreme southern parts of Cat Island.

WRF11 showed total accumulated values of precipitation higher than 60 mm over San Salvador and the central parts of Long Island and Cat Island. The maximum values, between 120 mm and 150 mm, were reported over San Salvador. Lower values were shown over the remainder of The Bahamas - Central.

WRF11 showed total accumulated values of precipitation higher than 60 mm over Rum Cay, the central part of Cat Island and the southern portion of Long Island. The maximum values, between 150 mm and 180 mm, were reported over the southern edge of Long Island. Values lower than 60 mm were shown over the remainder of The Bahamas - Central.



a) CMORPH



a) IMERG

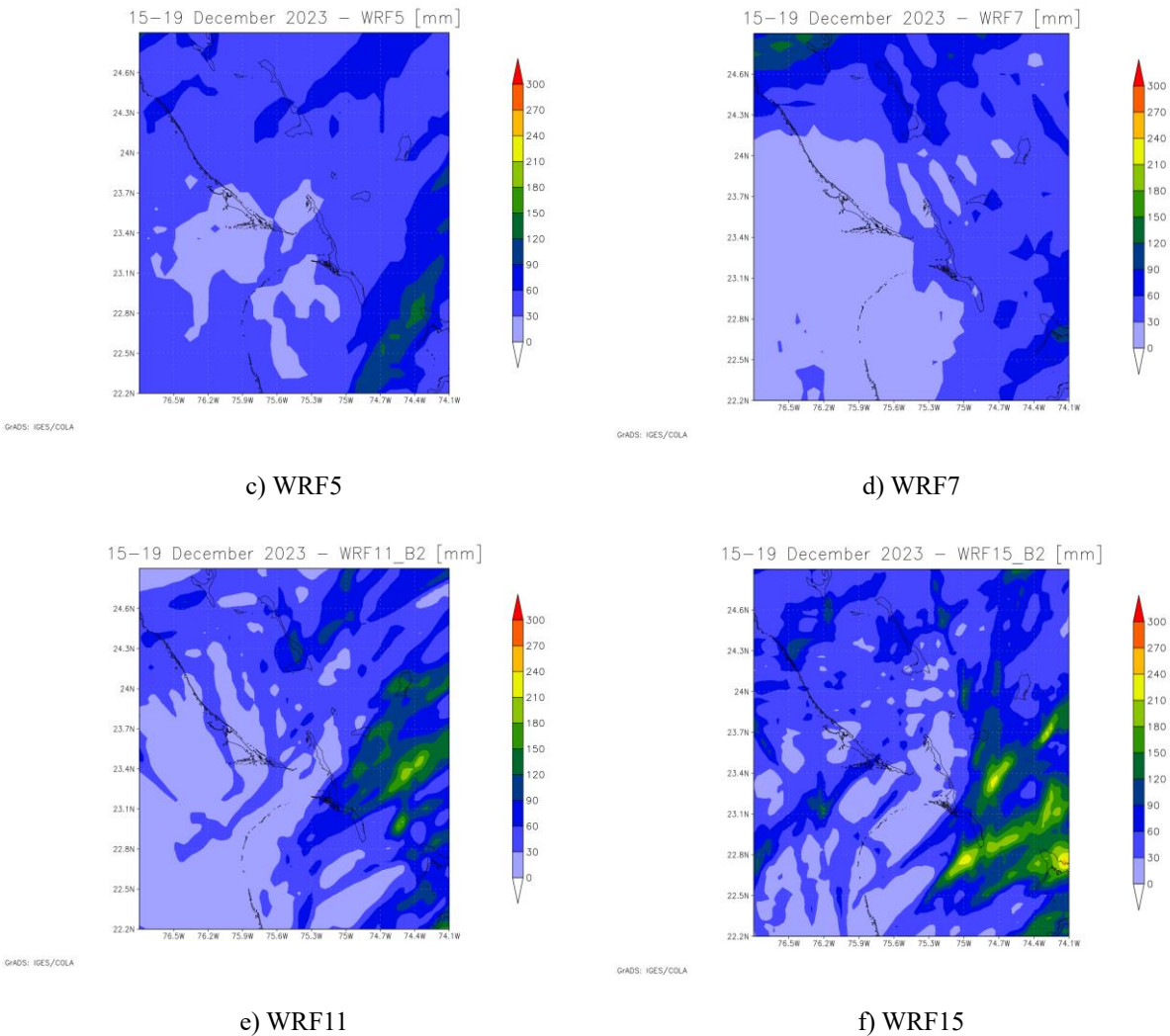


Figure 4 Total accumulated precipitation during the period 15-19 December, 2023 estimated by CMORPH (a), IMERG (b), WRF5 (c), WRF7 (d), WRF11 (e), WRF15 (f). Source: CCRIF SPC

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/BHS/BHS_C/CARE_7_2023/daily_prec_s hort.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BHS/BHS_C/CARE_7_2023/daily_prec_l ong.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for The Bahamas - Central for three data sources used by XSR3.0: CMORPH, IMERG and WRF15. The RIL was the highest for IMERG.

The final RIL (RIL_{FINAL}) was calculated as the average of the three RILs from CMORPH, IMERG and WRF15. 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 The Bahamas – Central and therefore the policy was not triggered. Therefore, no payout is due under this Excess Rainfall policy to the Government of The Bahamas.

The Wet Season Trigger (WST) component of the XSR3.0 model did not identify this CARE as a “Wet Season” event⁸. Therefore, no payout is due under the Wet Season Trigger endorsement of any of the Excess Rainfall policies of The Bahamas.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for the Covered Area Rainfall Event (CARE) for The Bahamas - Central was below the attachment point of The Bahamas’ Excess Rainfall policy for the central region, and therefore no payout is due. This CARE did not activate the Wet Season Trigger endorsement of any of The Bahamas’ Excess Rainfall policies and therefore no payout under this endorsement is due.

For additional information, please contact CCRIF SPC at: pr@ccrif.org

⁸ The WST endorsement provides a fixed payout for rainfall events that happen when the soil is already saturated and has limited absorption ability. The WST endorsement is activated based on two factors: the Wet Index (the average 1-month Standardized Precipitation Index for all grid cells in the country) and Wet Periods (the period of time where the Wet Index exceeds 1, which indicates that the soil is wetter than its long-term average and serves as an indicator of soil saturation). The WST policy endorsement provides a payment when one or more CAREs with a modelled loss greater than zero occur within a Wet Period and the corresponding value of the Wet Index during the Wet Period exceeds a predetermined threshold.

DEFINITIONS

<i>Active Exposure Cell Percentage Threshold</i>	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.
<i>Active Exposure Grid Cells</i>	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.
<i>Aggregate Rainfall #1</i>	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.
<i>Aggregate Rainfall #2</i>	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.
<i>Calculation Agent</i>	Entity charged with undertaking the primary calculation of the Rainfall Index Loss.
<i>CMORPH-based Maximum Aggregate Rainfall #1</i>	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.
<i>CMORPH-based Maximum Aggregate Rainfall #2</i>	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.
<i>CMORPH-based Covered Area Rainfall Parameters</i>	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.