Covered Area Rainfall Event (20/10/2024 to 23/10/2024)

Excess Rainfall

Event Briefing

The Bahamas - Southeast

31 October 2024

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1 INTRODUCTION

This event briefing describes the impact of rainfall on The Bahamas - Southeast, which was associated with a Covered Area Rainfall Event (CARE) starting on 20 October 2024 and ending on 23 October 2024. The Rainfall Index Loss (RIL) for the Covered Area Rainfall Event was below the attachment point of The Bahamas'Excess Rainfall policy for the Bahamas - Southeast, therefore no payout is due to the Government of The Bahamas.

2 EVENT DESCRIPTION

On 20 October 2024 at 0300UTC, the Category 1 Hurricane Oscar was located about 70 mi (115 km) W of Grand Turk, in the Turks and Caicos Islands, and about 55mi (87km) E of Great Inagua, in southeast region of The Bahamas, with its centre near latitude 21.3° North, longitude 72.2° West. It presented maximum sustained winds of 85 mph (140 km/h) and a minimum central pressure of 987 mb, while moving westward at about 10 mph (17 km/h), approaching the southeastern Bahamas. Satellite imagery indicated that Oscar presented a tight inner core with intermittent convective bursts. Starting at this time, the precipitation associated with Oscar affected Great Inagua, with increasing intensity (Figure 1a).

At 0900 UTC, the centre of Hurricane Oscar made landfall on the eastern side of Great Inagua. Its centre was positioned near latitude 21.1° North, longitude 73.1° West, with maximum sustained winds of 80 mph (130 km/h) and higher gusts. The rainfall intensity increased over Great Inagua, as the convective core of the hurricane crossed the island, being the heaviest between 0900UTC and 1200UTC (Figure 1b). Indeed, the hurricane's slow forward motion, at approximately 12 mph (19 km/h), prolonged the intense rainfall event over the island. At 1200 UTC, the hurricane centre moved about 10 mi (20 km) SW from Great Inagua, to near latitude 20.8° North, longitude 73.6° West (Figure 2).

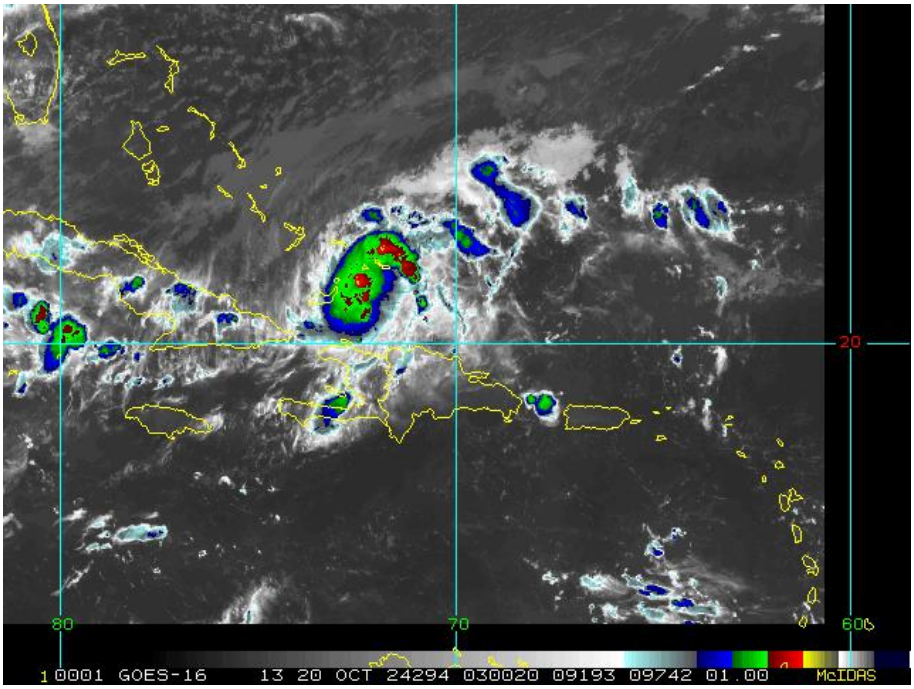
The slow forward velocity of the hurricane persisted throughout the second part of the day, while the system moved west-southwestward towards eastern Cuba, under the influence of a strong mid-level ridge over the Gulf of Mexico. Although the distance from the southeastern Bahamas increased, numerous showers and thunderstorms extended to as far as 104 mi, 167 km from the hurricane centre, yielding to moderate to locally intense precipitation over this portion of The Bahamas.

Oscar made landfall at 2150UTC on the northeastern coast of Cuba and it began to weaken, due to the interaction with land and a slight increase in wind shear. Oscar remained over eastern Cuba for nearly 24 hours. During this time, the maximum sustained winds decreased from 80 mph (130 km/h) to 40 mph (65km/h), and the hurricane was downgraded to a tropical storm. Despite the distance from the centre of the tropical cyclone, the southeastern part of The Bahamas and the surrounding waters were affected by moderate to locally heavy rainfall produced by the northeastern rainband of the system, as visible from the satellite imagery (Figure 1c).

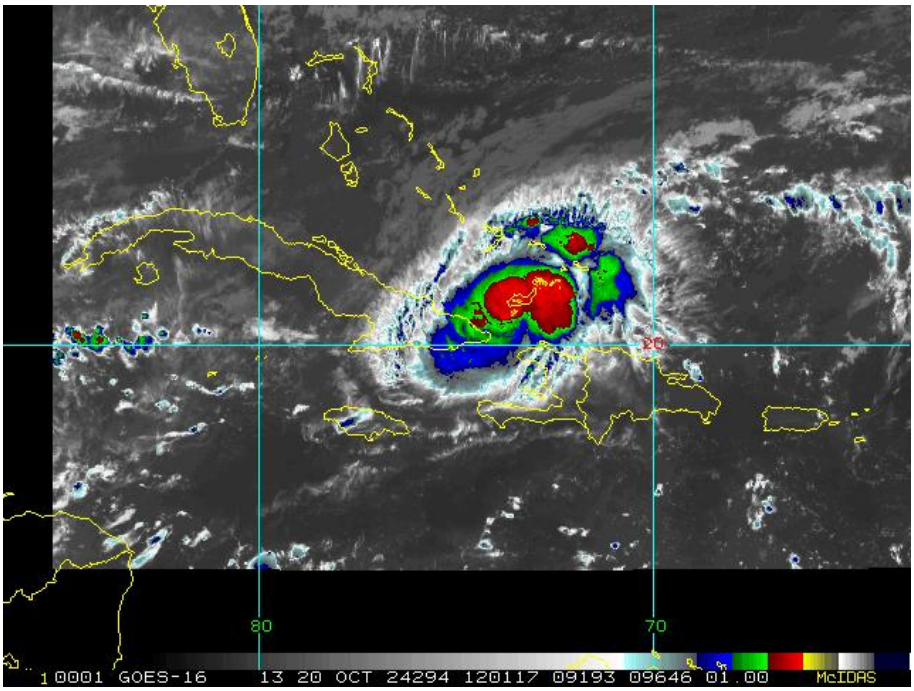
On 21 October, Oscar shifted north-northeast, moving away from Cuba and heading for the central part of The Bahamas. This change in direction was driven by a trough that created a weakness in the ridge that initially had steered the tropical cyclone. In the next hours, although the passage over

open water could fuel some re-strengthening, the tropical storm structure remained disorganized due to the moderate wind shear and the intrusion of dry air in the system circulation. Therefore, Oscar was still a tropical storm when it approached the central part of The Bahamas -. During the first part of the day, moderate to locally intense precipitation continued to affect intermittently the southeastern area of The Bahamas due to the external rainband of the tropical cyclone (Figure 1d), while moderate precipitation spread over the central region.in the afternoon.

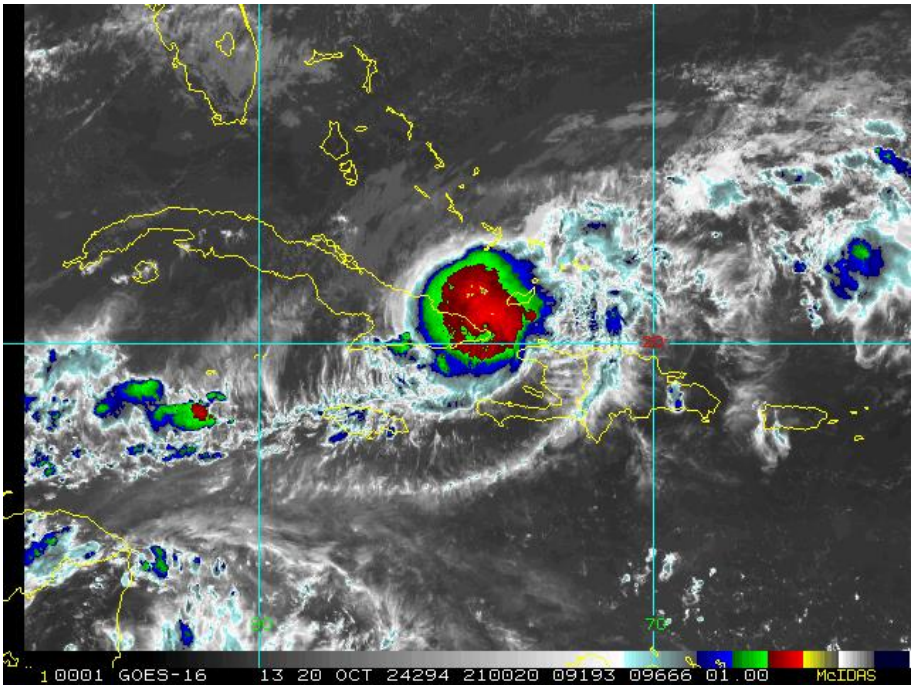
On 22 October at 0300 UTC, the tropical storm centre was located near latitude 21.8° North, longitude 75.4° West, about 105 mi (170 km) S of Long Island, in central Bahamas. At this time, the convection activity was very disorganized and displaced far east from the system centre due to the increasing wind shear. As a result, scattered showers linked to Oscar developed over the southeastern Bahamas and the waters to the east throughtout the day, while no significant rainfall affected the central area. Oscar fully dissipated by 1720 UTC, degenerating into a broad low-pressure area near the southeastern area of The Bahamas. After dissipation, the remnants of Oscar continued to produce moderate and scattered showers in the area, extending rainfall impacts over the southeastern Bahamas on 23 October.



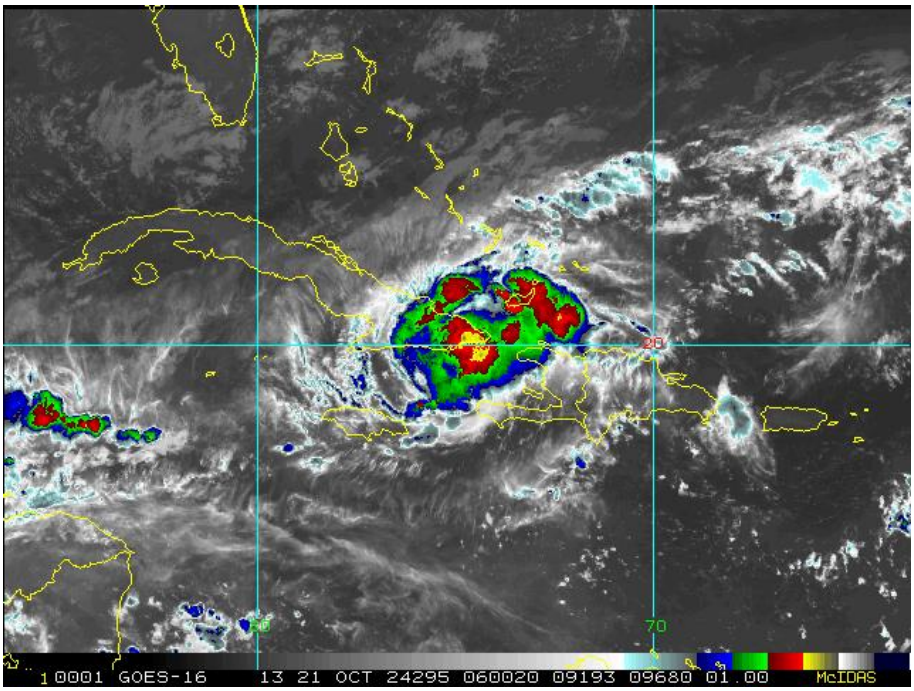
a) 20 October at 0900UTC



b) 20 October at 1200UTC



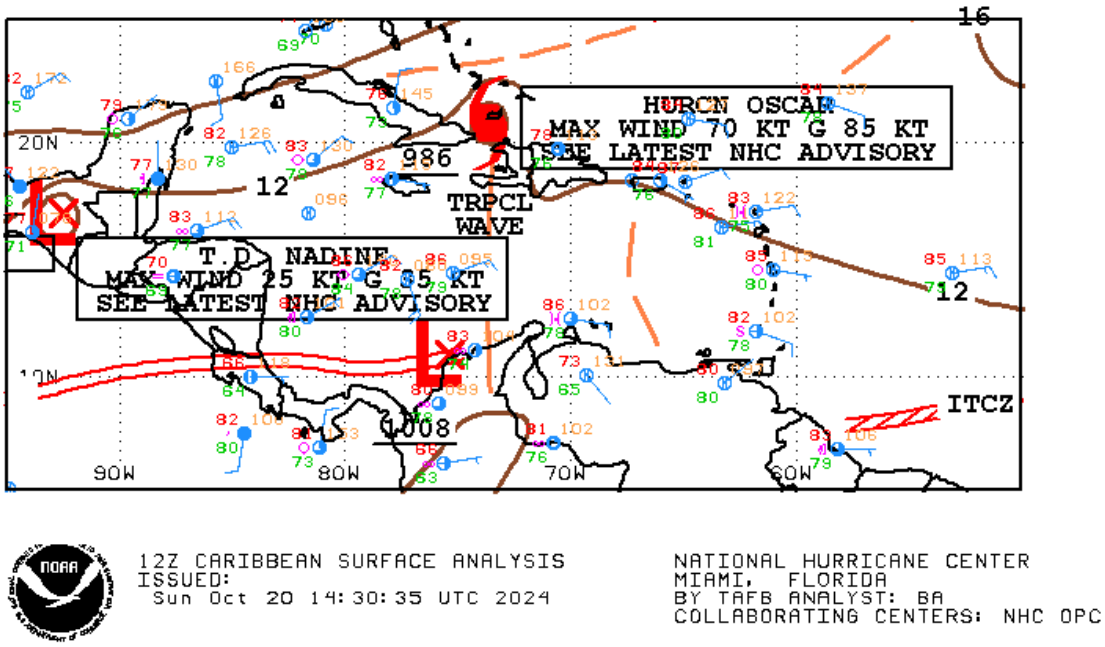
c) 20 October at 2100UTC



d) 21 October at 0600UTC

Figure 1. Satellite imagery on 20 and 21 October at different times as indicated in 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, Data and Information Service[1].

[1] RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: https://rammb-data.cira.colostate.edu/tc_realtime/storm.asp?storm_identifier=al162024



20 October at 1200 UTC

Figure 2. Surface analysis over the Caribbean Sea area on 20 October 2024 at 1200 UTC. Source: US National Hurricane Center[2]

3 REPORTED IMPACTS

At the time of writing this report, there is no information about damages in the southeastern area of The Bahamas due to this Covered Area Rainfall Event during the indicated period.

4 RAINFALL MODEL OUTPUTS

All data sources used by the XSR 3.0 model, CMORPH, IMERG, WRF5, WRF7, WRF11 and WRF15[3], detected the occurrence of precipitation over Southeast region of The Bahamas (The

[2] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: 20 October 2024, available at: https://www.nhc.noaa.gov/tafb/CAR_12Z.gif

[3] 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

Bahamas - Southeast)[4] and the surrounding waters during the period 18 to 23 October 2024. Each data source reported a specific distribution and accumulation of rainfall, as discussed below and shown in Figure 5. A CARE for The Bahamas - Southeast was activated on 20 October and lasted until 23 October. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[5] and thus the period considered by the XSR 3.0 model for the loss estimate based on the accumulated precipitation in The Bahamas - Southeast was 18 to 23 October 2024.

CMORPH CMORPH reported total accumulated values of precipitation higher than 100 mm over the islands of Great Inagua, Little Inagua and Mayaguana. The maximum values, between 200 mm and 250 mm, were reported over Mayaguana.

IMERG IMERG reported total accumulated values of precipitation higher than 150 mm over Great Inagua, Little Inagua and Mayaguana. The maximum values, between 300 mm and 400 mm, were reported over Great Inagua.

WRF5 WRF5 showed total accumulated precipitation values between 50 mm and 200 mm over the The Bahamas - Southeast. The highest values, between 150 mm and 200 mm, were reported over the island of Acklins and a small portion of Crooked Island.

WRF7 WRF7 reported total accumulated values of precipitation between 50 mm and 150 mm over The Bahamas - Southeast, with the maximum values, between 100 mm and 150 mm, over the northern area of Great Inagua.

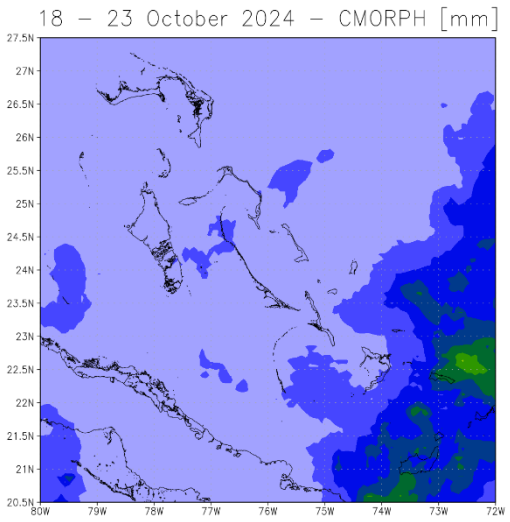
WRF11 WRF11 showed total accumulated precipitation values higher than 50 mm over The Bahamas - Southeast, with the maximum values, between 200 mm and 300 mm, over Acklins.

WRF15 WRF15 reported total accumulated values of precipitation higher than 100 mm over most of The Bahamas - Southeast, with the maximum values, between 350 mm and 450 mm, over a small area of Great Inagua.

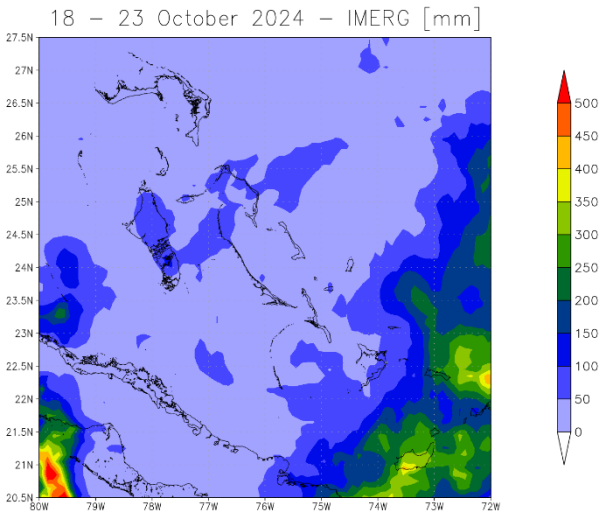
initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [*http://rda.ucar.edu/datasets/ds083.2/*]). Further details are provided in the Definitions section of this report.

[4] The Bahamas has 4 XSR policies: The Bahamas - Southeast, The Bahamas – Central, The Bahamas North and The Bahamas Extreme North. Only the policy for The Bahamas – Southeast was activated.

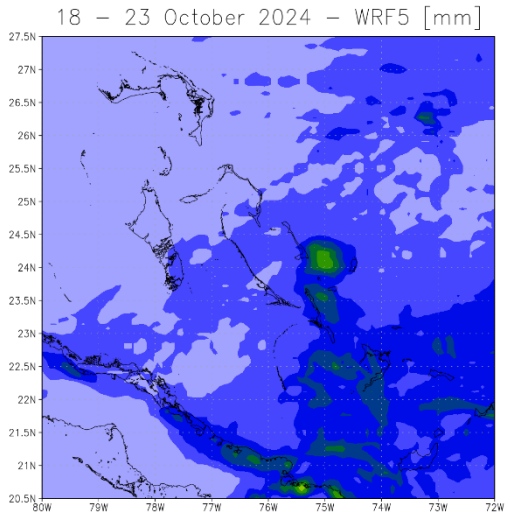
[5] The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.



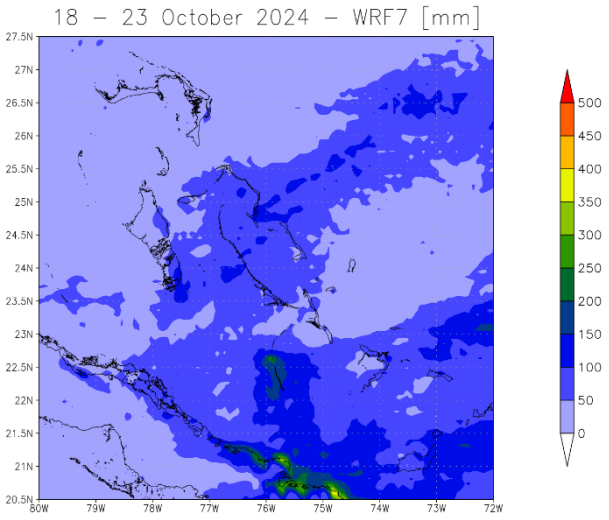
a) CMORPH



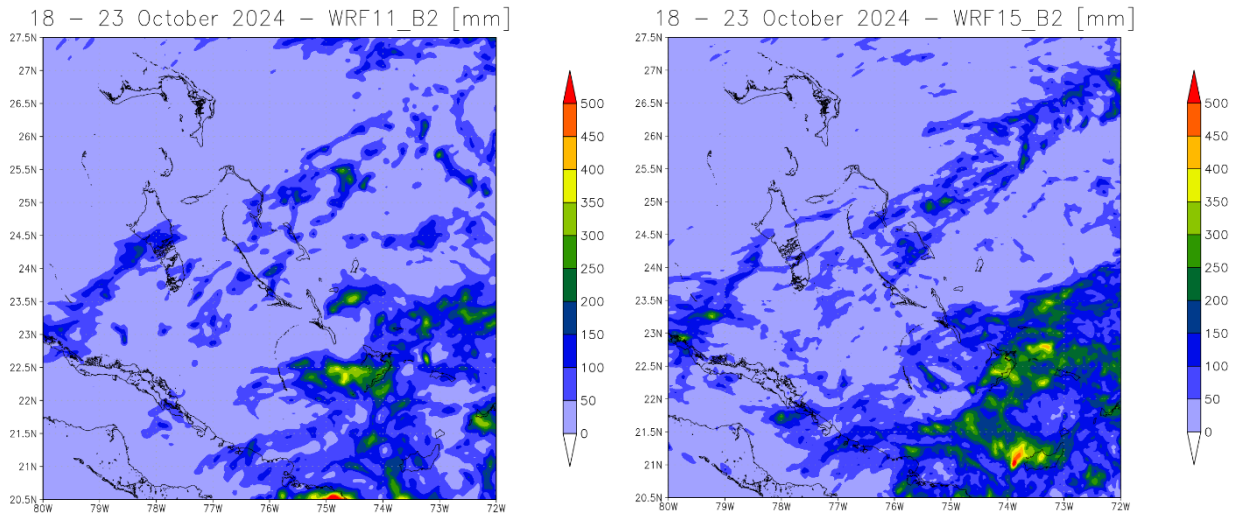
b) IMERG



c) WRF5



d) WRF7



e) WRF11 f) WRF15

Figure 5. Total accumulated precipitation during the period 18 - 23 October, 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/BHS/BHS_SE/CARE_3_2024/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BHS/BHS_SE/CARE_3_2024/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for The Bahamas - Southeast for four of the data sources used by XSR3.0: CMORPH, IMERG, WRF11 and WRF15. The RIL was the highest for IMERG. A Disaster Alert declaration was issued by ReliefWeb for the Bahamas related to TC Oscar[6].

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs above the loss threshold: CMORPH, IMERG, WRF11 and WRF15. The RIL_{FINAL} was below the Attachment Point of The Bahamas - Southeast Excess Rainfall policy and therefore the policy was not triggered. Therefore, a payout is not due to the Government of the Bahamas under its Excess Rainfall – Southeast policy.

The Wet Season Trigger (WST) endorsement of the XSR3.0 model did not identify this CARE as

[6] The Disaster Alert declaration in this case did not have any impacton the policy activation or on the RIL computation.The CARE was activated because the RIL_{CMORPH} and RIL_{IMERG} were greater than the Country Loss Threshold and at least one among RIL_{WRF5}, RIL_{WRF7}, RIL_{WRF11} and RIL_{WRF15} was greater than the Country Loss Threshold. In this case the $Final_{RIL}$ is equal to the average of the RIL_{CMORPH}, the RIL_{IMERG} and all values greater than the Country Loss Threshold among RIL_{WRF5}, RIL_{WRF7}, RIL_{WRF11} and RIL_{WRF15}

a "Wet Event"[7]. Therefore, no payment is due under the Wet Season Trigger endorsement of The Bahamas' Excess Rainfall – Southeast policy.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event (CARE) was below the attachment point of The Bahamas - Southeast Excess Rainfall policy and therefore no payout is due.

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

[7] The WST endorsement is designed to provide a predetermined payout for rainfall events occurring amidst already saturated soil conditions, effectively capturing the heightened risk of flooding and landslides. It 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.
A Wet Event (WE) is any period of consecutive days, during which the Wet Index (WI) is equal or greater than 1.

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.