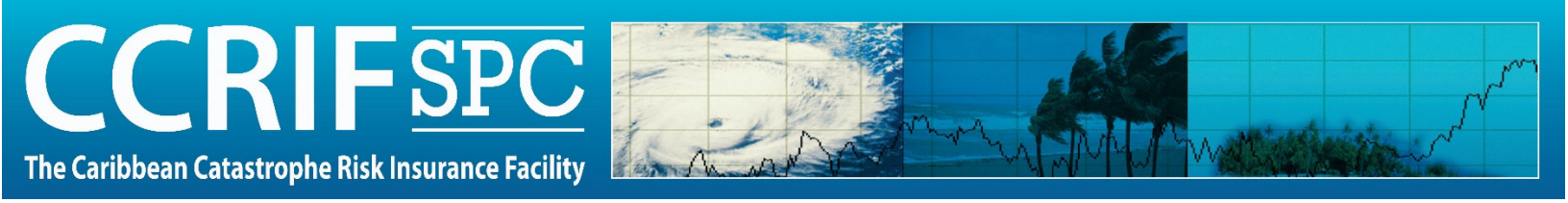

Covered Area Rainfall Event (04/07/2021 to 06/07/2021)

Excess Rainfall

Event Briefing

Jamaica

14 July 2021

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1 INTRODUCTION

Jamaica was affected by Tropical Cyclone Elsa, which caused adverse weather conditions that occurred between 4 July and 5 July, 2021. During this period, Jamaica was affected by intense rainfall.

This event briefing describes the impact of rainfall on Jamaica, which was associated with a Covered Area Rainfall Event (CARE), starting on 4 July and ending on 6 July 2021. The Rainfall Index Loss (RIL) was below the attachment point of the excess rainfall policy for Jamaica and therefore no payout is due.

As reported in a separate tropical cyclone Event Briefing, "TC Elsa: Haiti and Jamaica" dated 7 July 2021, Jamaica experienced intense rains and tropical-storm-force winds from the system. The final runs of the CCRIF SPHERA loss model for tropical cyclones produced losses due to wind impacts, which were below the attachment point of Jamaica's tropical cyclone policy and no payout under that policy was due.

2 EVENT DESCRIPTION

On 30 June, 2021, a tropical disturbance in the Atlantic called Potential Tropical Cyclone Five was reported by the US National Hurricane Center (NHC). A broad area of low pressure, associated with a tropical wave was reported to be moving to the west over the Atlantic. This phenomenon was poorly organized and it produced a large area of showers and thunderstorms. As reported by the NHC, over the next several hours it strengthened and was upgraded to Tropical Storm Elsa on 1 July at 0900 UTC. Tropical Storm Elsa continued its motion to the west, progressively intensifying. It was expected to produce locally heavy rainfall.

On 2 July at 1145 UTC, NHC reported that Tropical Storm Elsa was upgraded to Hurricane Elsa. At 1800 UTC, it was noted that Hurricane Elsa was strengthening as it moved toward the eastern Caribbean Sea. Consequently, the Government of Jamaica issued a Hurricane warning for the country. The following day, on 3 July, at 1200 UTC it was reported that Hurricane Elsa was moving very quickly toward the west-northwest at a velocity of almost 31 mph (50 km/h) and its centre was approaching Jamaica (Figure 1). As the NHC reported, at 1500 UTC Hurricane Elsa transitioned to Tropical Storm Elsa and the Government of Jamaica replaced a Hurricane warning with a Tropical Storm Warning.

The next day, on 4 July, Tropical Storm Elsa continued moving to the west-northwest at a velocity of almost 14 mph (22 km/h), with maximum sustained winds near 65 mph (100 km/h) and minimum central pressure of 1007 mb. At 1200 UTC its centre was located about 45 miles (70 km) ENE of Kingston, Jamaica. Tropical-storm-force winds were extended outward up to 125 miles (205 km) from the centre. As seen in Figure 2, these conditions brought intense rainfall to the entire country with most affected areas in the south and east of Jamaica.

The movement to the west-northwest continued over the next several hours at a velocity of approximately 13 mph (20 km/h), passing away from Jamaica and resulting in the end of the intense precipitation in the country.

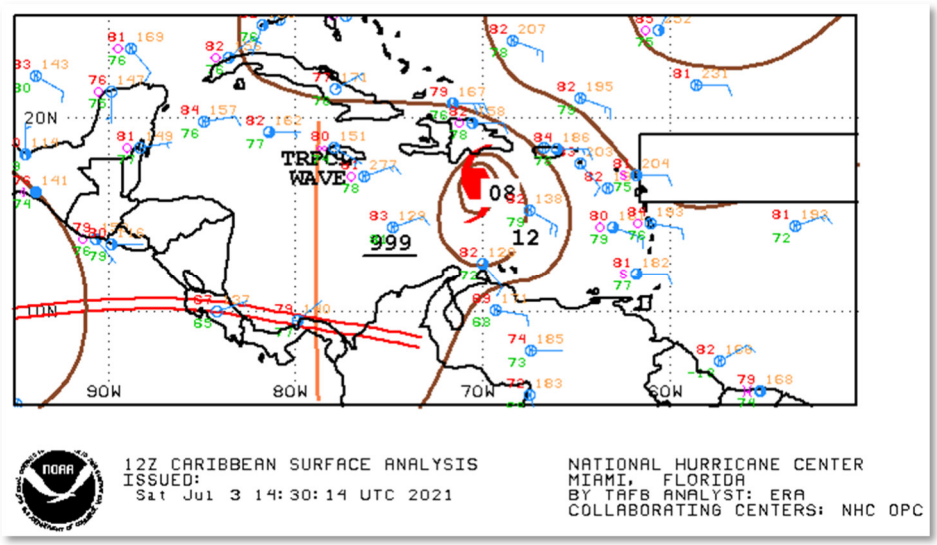
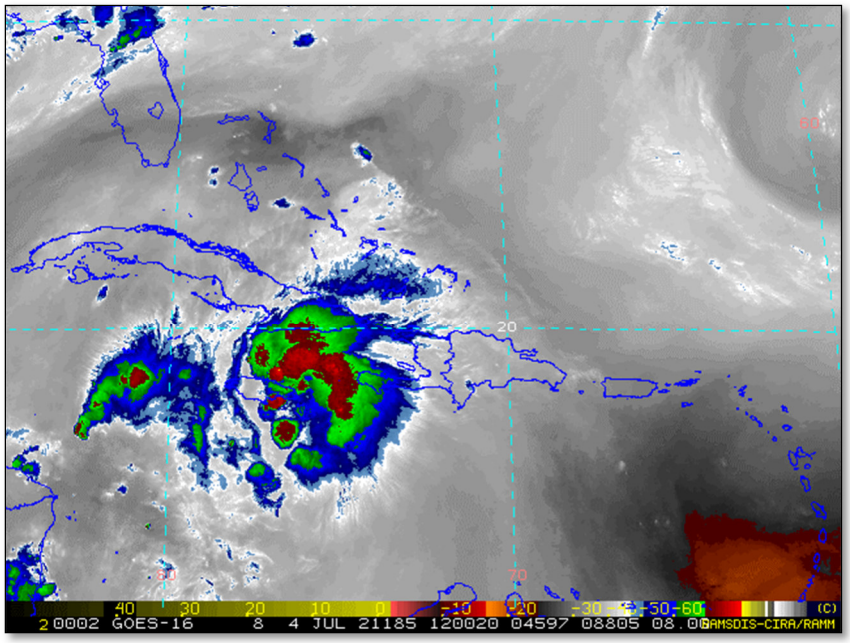
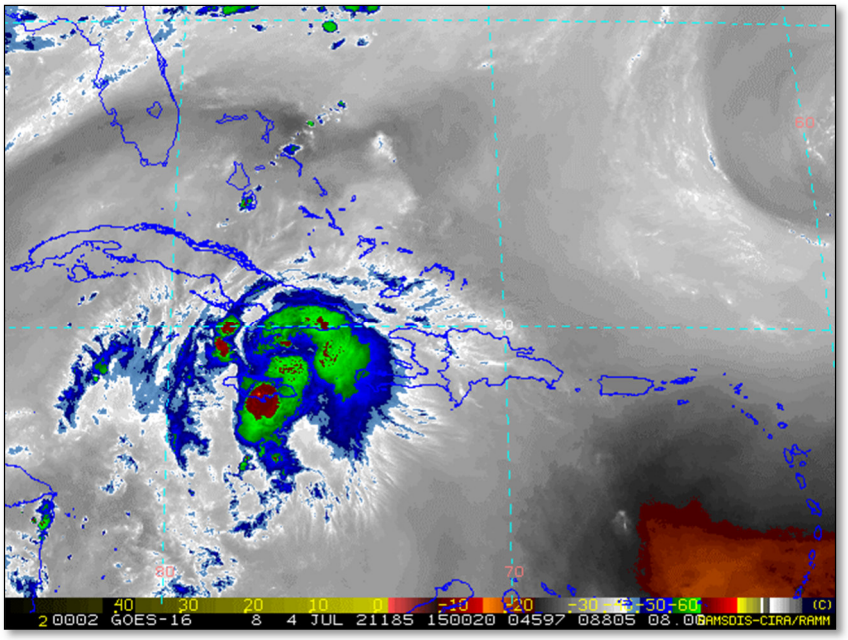


Figure 1 Surface analysis over the Caribbean area on 3 July at 14:30:14 UTC.
Source: US National Hurricane Center[1]



a) 4 July 2021 at 1200UTC

[1] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review date: 4 July 2021, available at: https://www.nhc.noaa.gov/tafb/CAR_12Z.gif



b) 4 July 2021 at 1500UTC

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. Source: NOAA Satellite and Information Service[2]

3 IMPACTS

According to the assessments provided by the Caribbean Disaster Emergency Management Agency (CDEMA), the damage in Jamaica was not significant following the passage of Tropical Storm Elsa[3]. The majority of the impacts pertained to flooded and blocked roads. In St. Catherine due to heavy rains several roads were affected[4]. Power service was also affected in some areas. Due to the passage of Elsa some communities in Kingston, Saint Andrew, Saint Thomas, Saint Catherine and Clarendon recorded flooding[5].

[2] RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: *https://rammb.cira.colostate.edu/ramsdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304_20210704120020.gif* *https://rammb.cira.colostate.edu/ramsdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304_20210704150020.gif*

[3] Caribbean Disaster Emergency Management Agency (CDEMA), Situation Report No. 3 (As of 4:00 PM on July 6, 2021), review date: 6 July 2021, available at: '*Tropical Storm Elsa*'

[4] The Gleaner, review date: 14 July 2021, available at: *TrackingElsa - Some roads in Portmore now flooded*

[5] IRIE FM, review date: 14 July 2021, available at: *Assessment and cleanup efforts to start today following passage of Tropical Storm Elsa*

According to the reports from the Meteorological Service Jamaica and the Office of Disaster Preparedness and Emergency Management (ODPEM), Tropical Storm Elsa was closely monitored. Prior to the arrival of Tropical Storm Elsa, Jamaica's authorities took precautionary measures such as activating the National Emergency Operation Centre (EOC). As additional prevention measures the authorities opened some emergency shelters and temporarily suspended air traffic[6].

Figure 3 shows some of the damage caused by Tropical Storm Elsa in Jamaica.

Figure 3 Damage caused by Tropical Storm Elsa in Jamaica. July 2021.
Source: *Jamaica Observer*

4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[7], WRF5 and WRF7[8], detected the occurrence of precipitation over Jamaica and the surrounding waters during the period 4

[6] Jamaica Observer, review date: 14 July 2021, available at: *Elsa stalls flights*

[7] 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.

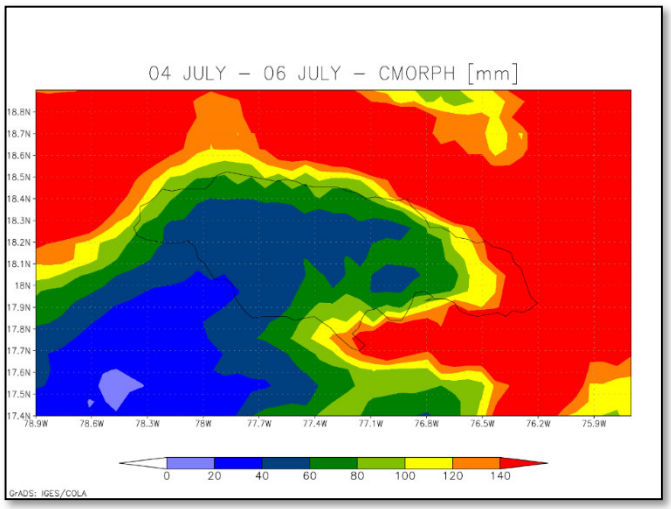
[8] WRF5 and WRF7 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data *https://www.mmm.ucar.edu/weather-research-and-forecasting-model*. These data are initialised by the

July – 6 July 2021. However, each data source reported a specific distribution of rainfall, as discussed below and shown in Figure 4.

CMORPH simulated total accumulated amounts of precipitation of around 40 mm over most areas of the country. The highest precipitation values were shown in the eastern part of Jamaica, where the values were in the range from 60 mm to over 140 mm in the easternmost part of the country. In the north of the country, precipitation reached 60 mm to 80 mm in small areas.

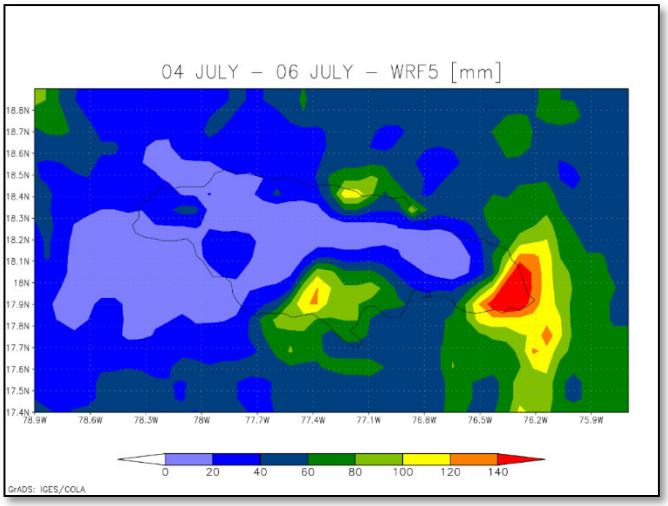
WRF5 presented total accumulated amounts of rainfall of 20 mm for most of the country. Locally intense precipitation was presented in the south with values ranging from 60 mm to 100 mm. As with CMORPH, the highest values of precipitation were shown in the easternmost part of the country, reaching the value of 140 mm.

WRF7 showed different precipitation values over the whole country. Most of the values were between 20 mm and 40 mm. Locally intense precipitation was shown in the westernmost part and in the south (west of Kingston) with values ranging between 60 mm and 120 mm. Unlike the other two models, WRF7 did not indicate the highest precipitation values in the easternmost part of the country. The highest precipitation values were shown in a small area in the south-eastern part of the country, reaching 100 mm to 120 mm.

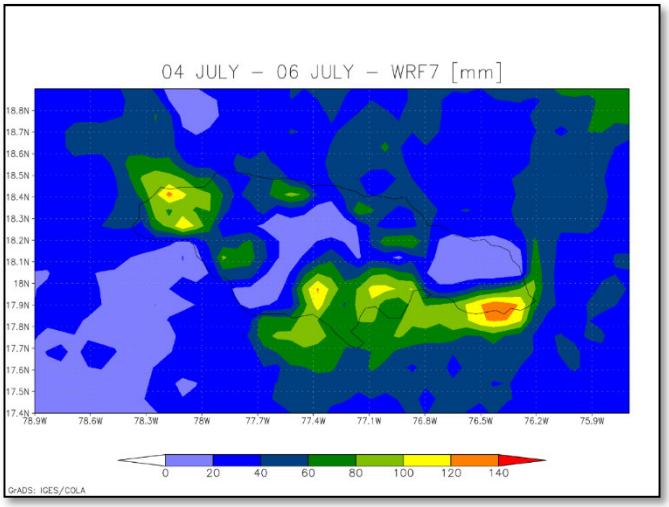


a) CMORPH

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 during the period 4 July – 6 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/JAM/CARE_1_2021/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/JAM/CARE_1_2021/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Jamaica for all three data sources used by XSR2.5: CMORPH, WRF5 and WRF7. The RIL was the highest for CMORPH.

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs from the three data sources. 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 Jamaica's excess rainfall policy and therefore it 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 Jamaica's excess rainfall policy 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.