



# Covered Area Rainfall Event (31/05/2022 to 02/06/2022)

## Excess Rainfall

### Event Briefing

### Belize

**10 June 2022**

## **1 INTRODUCTION**

In the period between May 31<sup>st</sup> and June 2<sup>nd</sup>, 2022, the remnants of Tropical Cyclone Agatha generated adverse atmospheric conditions that caused moderate to heavy rainfall over several regions of Belize.

This event briefing describes the impact of rainfall on Belize, which was associated with a Covered Area Rainfall Event (CARE), starting on May 31<sup>st</sup> and ending on June 2<sup>nd</sup> 2022. The Rainfall Index Loss (RIL) was below the attachment point of the Excess Rainfall policy for Belize and therefore no payout is due to the Government of Belize.

Neither Belize nor any of the other CCRIF members experienced tropical-storm-force winds from Tropical Cyclone Agatha, and therefore, a tropical cyclone event briefing was not issued for this event.

## **2 EVENT DESCRIPTION**

Between May 31<sup>st</sup> and June 2<sup>nd</sup>, a large and complex area of low pressure developed and gradually intensified near the Yucatan Peninsula and the northwestern Caribbean Sea (Figure 1). The system was partially related to the remnants of Tropical Cyclone Agatha, the first tropical cyclone of the Pacific Hurricane Season, and to its interaction with an upper level trough located over the Gulf of Mexico (Figure 2). The high moisture content in the middle and upper troposphere (as visible in Figure 2) led to the production of numerous moderate to strong thunderstorms over the far western Caribbean from 16°N to 19°N west of 85° W, including the Gulf of Honduras.

The storm activity in Belize started in the first hours of May 31<sup>st</sup> (Figure 3a) and quickly moved eastward across the country. The radar image in Figure 3 reported that moderate to locally intense precipitation was ongoing from 0000 UTC to 0500 UTC mainly over central and northern Belize (Figure 3a). From approximately 0500 UTC until 1100 UTC, the storm activity organized in a squall line, extending from northwestern Belize up to the waters of the Gulf of Honduras (Figure 3b and 3b). A similar weather condition occurred on June 1<sup>st</sup>, with moderate to locally intense precipitation over Belize from 0000 UTC to 0500 UTC, followed by the development of a squall line over the waters off the Belize coast. In contrast to the previous day, the rainfall occurred mainly over the waters of Belize rather than inland, over the country

In the following days, the system moved northeastward across the Yucatan Peninsula, the northwestern Caribbean Sea, the Gulf of Mexico, and the Florida Peninsula as a tropical disturbance. On June 5<sup>th</sup>, it evolved into Tropical Storm Alex, the first tropical cyclone of the 2022 Atlantic Hurricane Season.

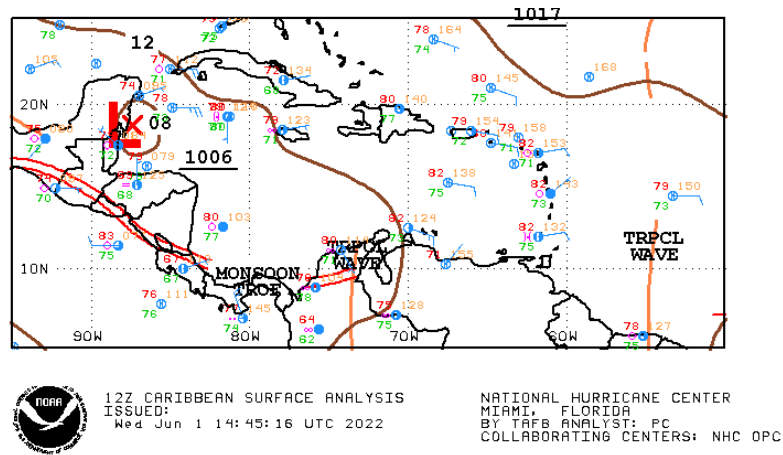


Figure 1 Surface analysis over the Caribbean area on June 1<sup>st</sup> at 1200 UTC. Source: US National Hurricane Center<sup>1</sup>

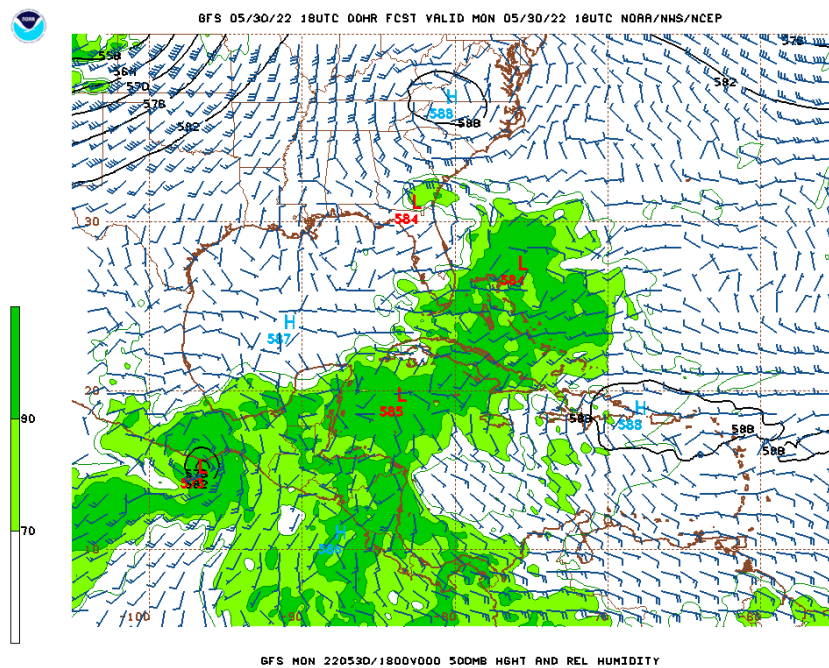


Figure 2 Upper analysis at 500 mb over the Caribbean area on May 31<sup>st</sup> at 1800 UTC, as produced by GFS model. Relative Humidity is indicated by the green contouring. Source: US National Hurricane Center<sup>2</sup>

<sup>1</sup> National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, available on 1 June 2022 at: [https://www.nhc.noaa.gov/tafb/CAR\\_12Z.gif](https://www.nhc.noaa.gov/tafb/CAR_12Z.gif)

<sup>2</sup> National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, available on 31 May 2022 at: [https://maq.ncep.noaa.gov/data/gfs/18/west-atl/500\\_rh\\_ht/gfs\\_west-atl\\_000\\_500\\_rh\\_ht.gif](https://maq.ncep.noaa.gov/data/gfs/18/west-atl/500_rh_ht/gfs_west-atl_000_500_rh_ht.gif)

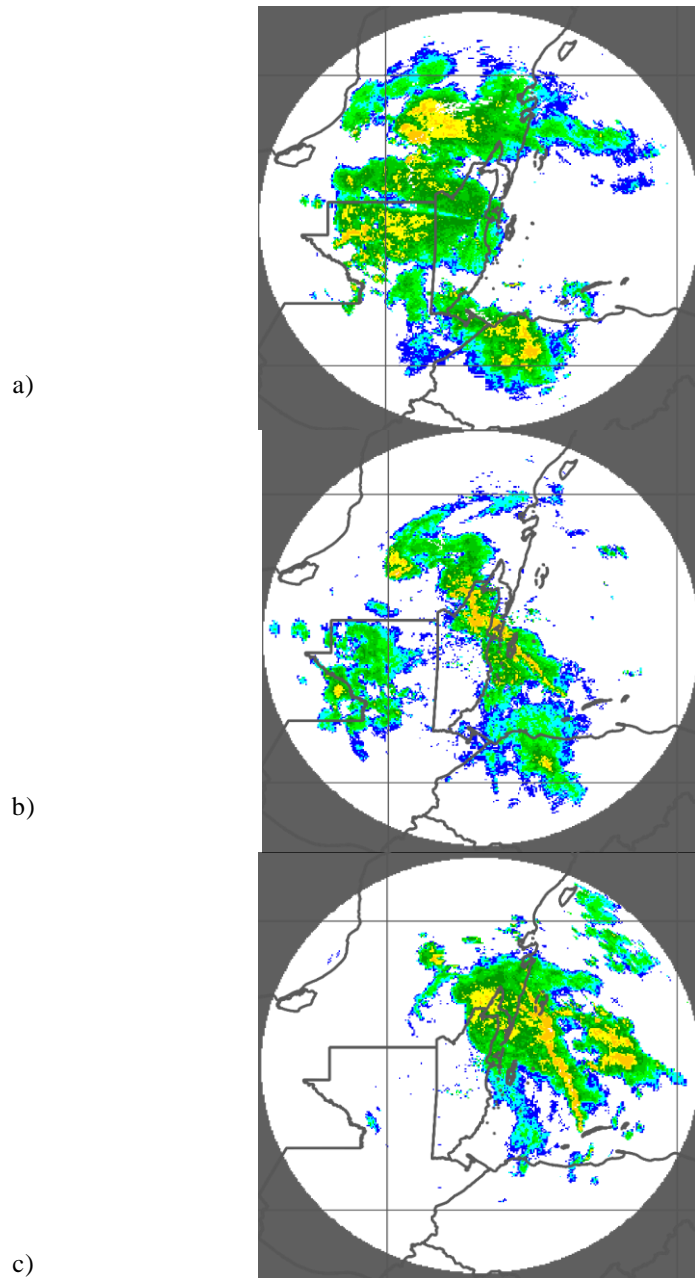


Figure 3 Radar imagery on May 31<sup>st</sup> at 0306 UTC (a) at 0706 UTC (b) and at 1106 UTC (c) as indicated in the label from the radar composite over the Caribbean and Central America region. Blue/green colours represent low to moderate rainfall, while the yellow/red colours represent intense and very intense precipitation. Source: Barbados Radar Composite<sup>3</sup>.

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<sup>3</sup> Barbados Radar Composite, available on 31 May at:  
[https://www.barbadosweather.org/BMS\\_Radar\\_Composite\\_Resp.php#](https://www.barbadosweather.org/BMS_Radar_Composite_Resp.php#)  
[https://rammb.cira.colostate.edu/ramdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304\\_20210817210020.gif](https://rammb.cira.colostate.edu/ramdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304_20210817210020.gif)

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### 3 IMPACTS

The National Meteorological Services of Belize and the National Emergency Management Organization (NEMO) informed the general public that Hurricane Agatha made landfall as a strong Category 2 hurricane approximately 5 miles west of Puerto Angel, on the southern Pacific coast of Mexico. The National Meteorological Services informed that over four inches of rainfall affected the northern parts of Belize, and heavy rainfall and thunderstorms were expected in most areas of the country especially at night. A flood watch was in effect for areas prone to flooding.

NEMO advised the general public to be alert and to pay attention to the weather situation; people in the cayes, along rivers, creeks, and low-lying areas, farmers and fisherfolk, were cautioned to be alert and take the necessary actions to be safe. Drivers were asked to drive slowly and put on their hazard lights when driving in the rain.<sup>4</sup> According to the information available at the time of writing this report, no specific damages to population or infrastructure were reported in Belize as a result of this rainfall event.

### 4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH<sup>5</sup>, WRF5 and WRF7<sup>6</sup>, detected the occurrence of precipitation over Belize and the surrounding waters during the period May 29<sup>th</sup> – June 2<sup>nd</sup> 2022. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below. The CARE for Belize was activated on May 31<sup>st</sup> and lasted for the period May 31<sup>st</sup> - June 2<sup>nd</sup>. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation<sup>7</sup>, thus the period considered by the XSR 2.5 model for the loss estimate based on the accumulated precipitation in Belize was May 29<sup>th</sup> - June 2<sup>nd</sup>.

CMORPH reported total accumulated amounts of precipitation higher than 100 mm over the northern area of Belize, with a maximum between 220 mm and 240 mm along the coast approximately 30 km – 70 km to the north of the capital, Belize City. In the south of the country, precipitation values were lower, ranging between 60 mm and 140 mm, while over the central region the total amount did not exceed 80 mm.

WRF5 showed total accumulated values of precipitation higher than 120 mm over the eastern area of Belize, in the vicinity of the Atlantic coast. The maximum was reported over the extreme north of the country, in the Corozal District, with a peak amount of 530 mm. Another

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<sup>4</sup> <http://site.nemo.org.bz/advisory-1-remnants-of-hurricane-agatha/>

<sup>5</sup> 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](http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph_description.html). Further details in the Definitions section of this report.

<sup>6</sup> 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.

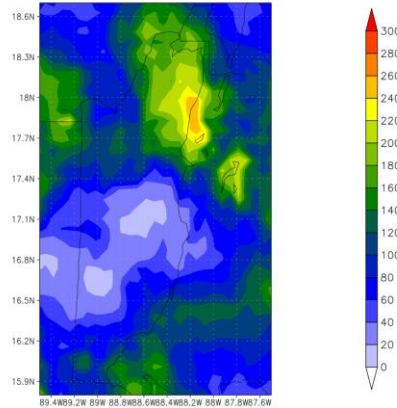
<sup>7</sup> The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.

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peak, between 240 mm and 280 mm, was shown in the Stann Creek District, approximately 100 km to the south of Belize City. For the rest of the country, the simulated precipitation values were lower than 120 mm.

WRF7 simulated total accumulated values of rainfall with a similar pattern to that of WRF5, but with lower peak amounts. The highest values of precipitation, between 220 mm and 240 mm, were present approximately in the same areas as that of WRF5 (i.e. in the Corozal District, in the extreme north of Belize, and Stann Creek District, in the coastal central region). The total rainfall amount over Belize City was simulated to vary between 200 mm and 220 mm, which was higher than that of both CMORPH and WRF5. Values higher than 120 mm were reported also in the northern area of the country, in the Orange Walk District. For the other regions of the country, the simulated rainfall amounts were lower than 120 mm.

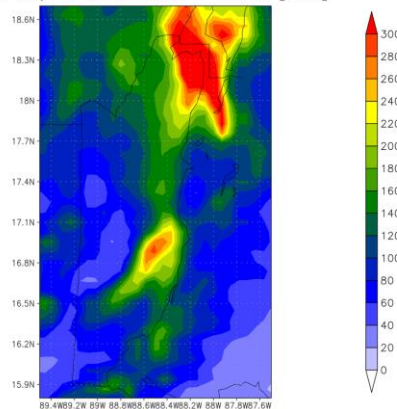
29 May–2 June 2022 – CMORPH [mm]



GRADS: IGES/COLA

a) CMORPH

29 May–2 June 2022 – WRF5 [mm]



GRADS: IGES/COLA

b) WRF5

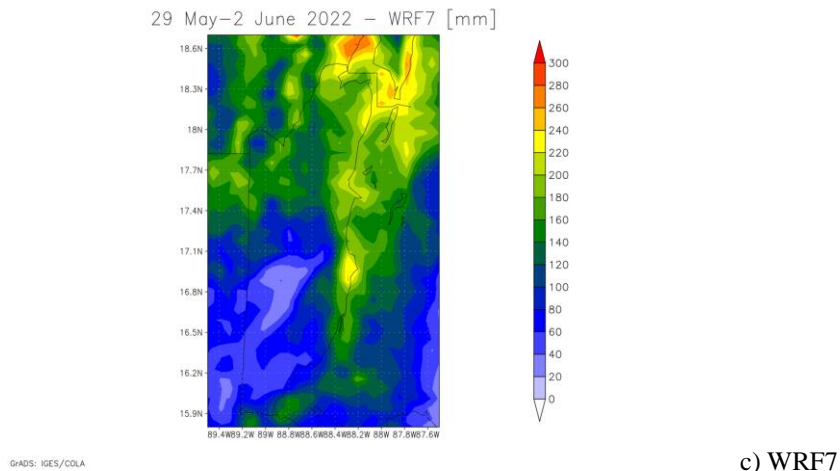


Figure 5 Total accumulated precipitation during the period May 29<sup>th</sup>–June 2<sup>nd</sup>, 2022 estimated by CMORPH (a), WRF5 (b) and WRF7 (c). Source: CCRIF SPC

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/BLZ/CARE\\_4\\_2021/daily\\_prec\\_short.mp4](https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_4_2021/daily_prec_short.mp4)  
[https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE\\_4\\_2021/daily\\_prec\\_long.mp4](https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_4_2021/daily_prec_long.mp4)

The Rainfall Index Loss (RIL) was above the loss threshold for Belize for two of data sources used by XSR2.5: CMORPH and WRF7. The RIL was the highest for WRF7, due to the larger amount of accumulated precipitation presented in the vicinity of the capital, Belize City, the area characterized by the highest exposure for Belize.

The final RIL (RIL<sub>FINAL</sub>) was calculated as the average of the RILs from CMORPH and WRF7. The RIL<sub>FINAL</sub> was greater than zero and therefore this CARE qualified as a loss event. However, the RIL<sub>FINAL</sub> was below the attachment point of Belize’s excess rainfall policy and therefore it did not trigger a policy payout.

## 5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event was below the attachment point of the Excess Rainfall policy for Belize and therefore no payout is due.

For additional information, please contact CCRIF SPC at: [pr@ccrif.org](mailto:pr@ccrif.org)

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## DEFINITIONS

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

<b><i>Rainfall Event Threshold #2</i></b>	Aggregate Rainfall #2 level as defined in the Schedule which should be exceeded to trigger an Active Exposure Cell.
<b><i>Rainfall Aggregation Period #1</i></b>	The number of hours over which the Aggregate Rainfall #1 is computed for all XSR Exposure Grid Cells during a Covered Area Rainfall Event.
<b><i>Rainfall Aggregation Period #2</i></b>	The number of hours over which the Aggregate Rainfall #2 is computed for all XSR Exposure Grid Cells during a Covered Area Rainfall Event.
<b><i>Rainfall Index Loss</i></b>	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.
<b><i>WRF5 Model</i></b>	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.
<b><i>WRF7 Model</i></b>	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.
<b><i>XSR Rainfall Model</i></b>	The computer model used to calculate the Rainfall Index Loss, as described in the Attachment entitled ‘Calculation of Rainfall Index Loss and Policy Payment’.
<b><i>XSR Exposure Grid Cells</i></b>	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.
<b><i>XSR Grid Cell Exposure Value</i></b>	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.