CCRIF SPC
The Caribbean Catastrophe Risk Insurance Facility

On behalf of
Caribbean XSR SP

Covered Area Rainfall Event (16/08/2019 to 18/08/2019)

Excess Rainfall

Event Briefing

Jamaica

25 August 2019

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1 INTRODUCTION

A tropical wave produced periods of rain/showers and thunderstorm activity over north-eastern Jamaica on 16 August 2019.

This event briefing describes the impact of the precipitation on the island of Jamaica over the period 16-18 August 2019. The Rainfall Index Loss (RIL) calculated for this Covered Area Rainfall Event (CARE), which occurred in Jamaica, starting on 16 August and ending on 18 August 2019 was below the attachment point of Jamaica's Excess Rainfall policy and therefore no payout is due.

2 EVENT DESCRIPTION

On 16 August 2019, a tropical wave passed over the western Caribbean Sea, originating from longitude 20N and along latitude 75W moving towards the west with a velocity of 15 to 20 knots (28 to 37 km/h), as shown in Figure 1. The combination of the instability associated with the tropical wave and the presence of an upper level trough extending from SE Cuba to Jamaica and to Honduras (not shown) led to moderately scattered to strong local rain showers over the waters from 10N to15N between 73W and 79W. Of significance was the development of a strong thunderstorm on the northern tip of the tropical wave axis over eastern Jamaica. The thunderstorm persisted for over six hours (from 1200 UTC to 1800 UTC) in the same portion of the island resulting in intense precipitation, as shown in Figure 2. On 17 August, a second thunderstorm developed over the western edge of Jamaica, causing moderate precipitation over this region. This second thunderstorm was not sustained by large-scale forcing and dissipated in approximately one hour.

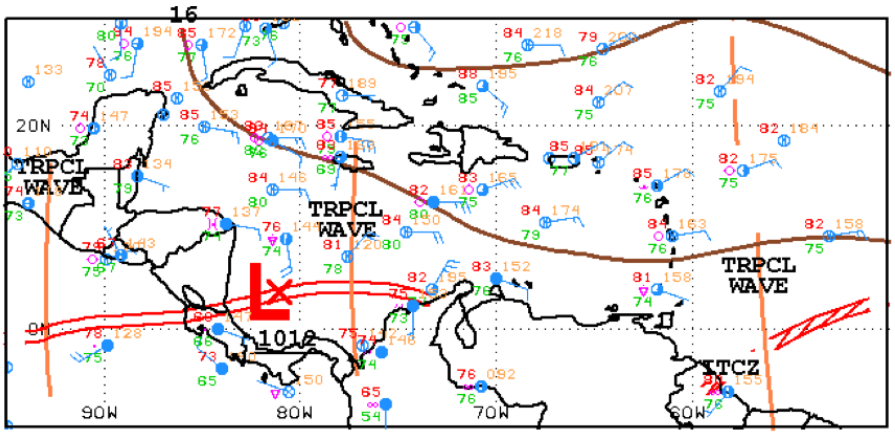
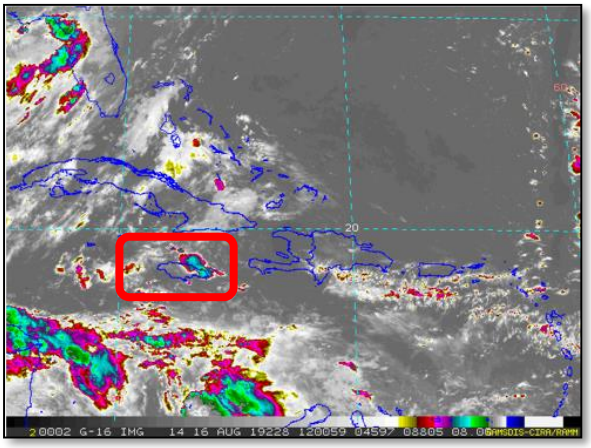
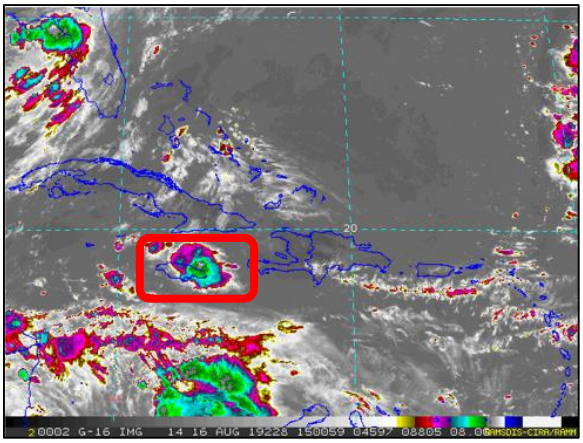


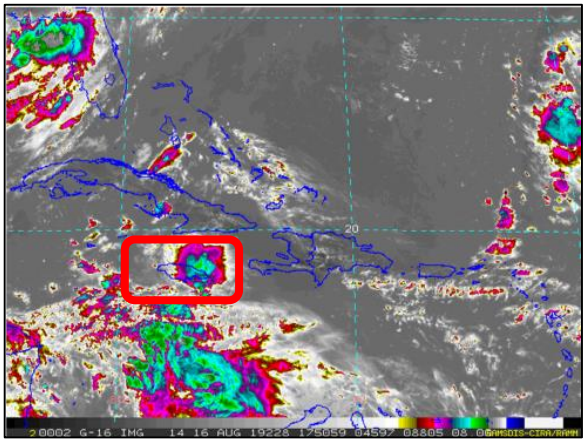
Figure 1 Surface analysis on 16 August at 1200 UTC over the Caribbean Sea showing the tropical wave in its westward movement passing over Jamaica Source: NOAA, *https://ocean.weather.gov*



a) 16 August at 1200UTC



b) 16 August at 1500UTC



c) 16 August at 1800UTC

Figure 2 Satellite imagery at different times (indicated in the labels) from thermal infrared channel enhanced with color (red/violet colours are for medium height clouds while blue/green colours are for high altitude clouds). High altitude clouds indicate strong convection associated with intense precipitation. The persistent thunderstorm over Jamaica is highlighted by a red box in the images.

Surface measurements from the GSOD dataset (Global Surface Summary of the Day - *https://www1.ncdc.noaa.gov*) report a moderate amount of precipitation on 16 August near Kingston, in the south-east of Jamaica at the Norman Manley International Airport. However, no precipitation is reported from 16 to 18 August at Sangster International Airport, in the north-west of Jamaica. These surface records indicate only a modest amount of precipitation during this period because those areas were only partially or not impacted/ affected by the two thunderstorms.

Table 1 Surface measurements from GSOD dataset (*https://www1.ncdc.noaa.gov*)

	16 August	**17 August**	**18 August**
NORMAN MANLEY INTL (17.94N 76.79W) Jamaica (southeast)	25 mm	0 mm	0 mm
SANGSTER INTL (18.50N 77.91W) Jamaica (north-west)	0 mm	0 mm	0 mm

The satellite-derived estimate of precipitation by IMERG (Integrated Multi-satellitE Retrievals for GPM) dataset for this event is reported in Figure 3. During the period 16-18 August, high amounts of accumulated precipitation were estimated over the eastern side of Jamaica, with a peak of 140-160 mm on the north-eastern edge of the island. This localization is consistent with the site of the persistent thunderstorm. IMERG data are also fairly consistent with the surface observations.

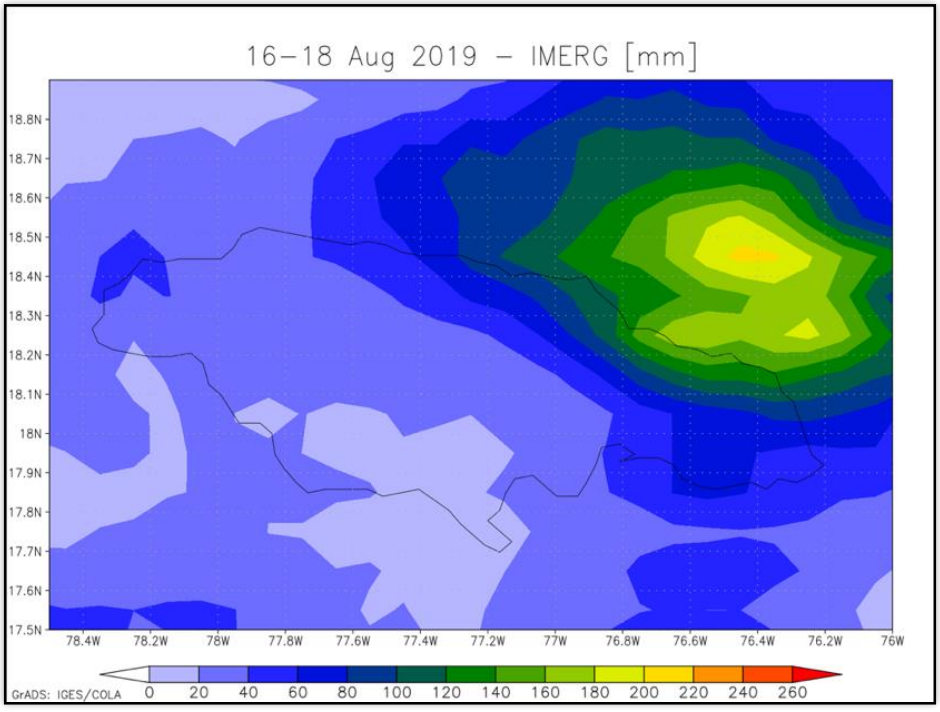
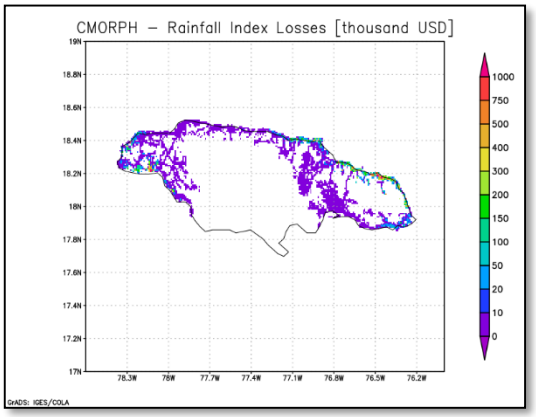


Figure 3 IMERG accumulated precipitation (rainfall) at 10 km resolution over Jamaica between 16 and 18 August 2019. Source: XSR Web

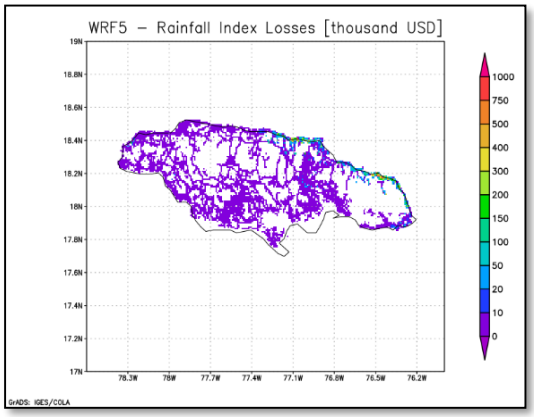
3 IMPACTS

At the time of this event brief, no information was available related to damage or loss in Jamaica due to this CARE. However, a subsequent version of this report may be updated with information contained in official reports or communications that may be issued by the Government of Jamaica.

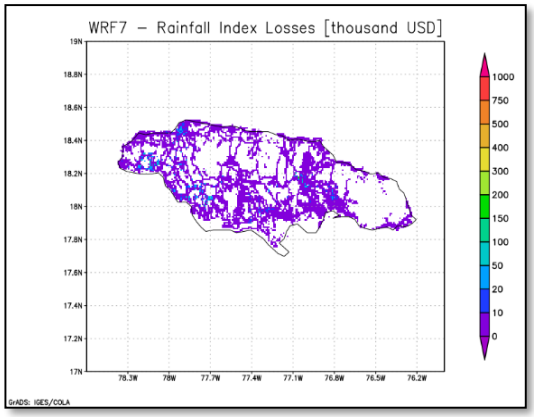
Illustrated in Figure 4 below are the estimated losses computed using rainfall information from the three models - CMORPH[1], WRF5 and WRF7[2] for this CARE, which shows the spatial distribution of Rainfall Index Loss values estimated for the tropical wave in Jamaica.



a) CMORPH



b) WRF5



c) WRF7

Figure 4 Rainfall Index Losses during the period 16-18 August 2019
estimated by CMORPH(a), WRF5(b) and WRF7(c)

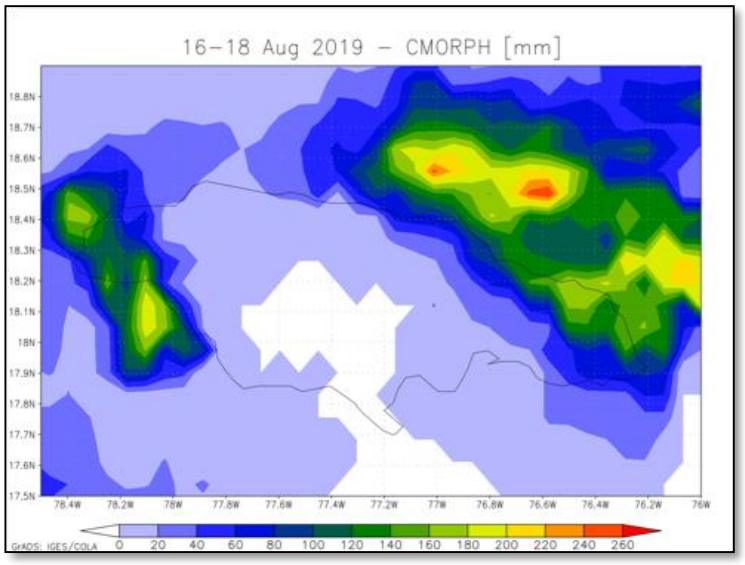
[1] CMORPH Model: the satellite-based rainfall precipitation estimates provided by the NOAA Climate Prediction Center (CPC) using the so-called Morphing Technique *http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph_description.html*. Further details in the Definitions section of this report.

[2] 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.

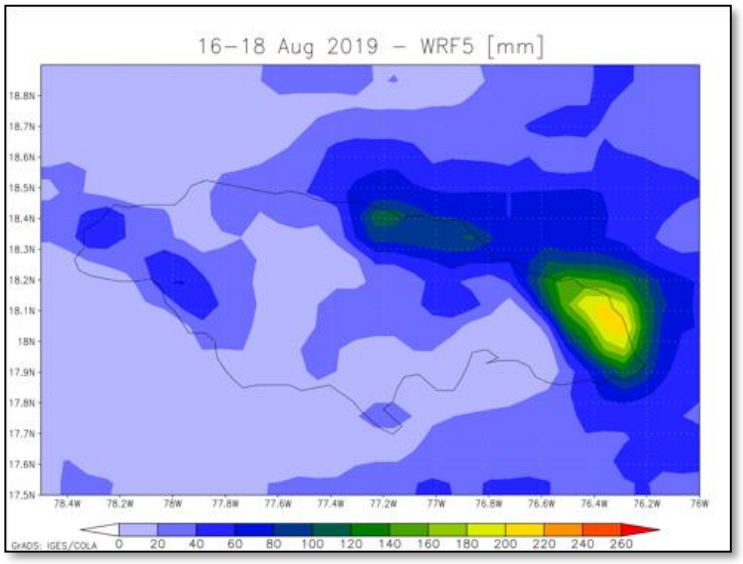
4 RAINFALL MODEL OUTPUTS

All three models, CMORPH, WRF5 and WRF7, simulated the occurrence of precipitation over Jamaica and the surrounding waters during the period 16-18 August 2019.

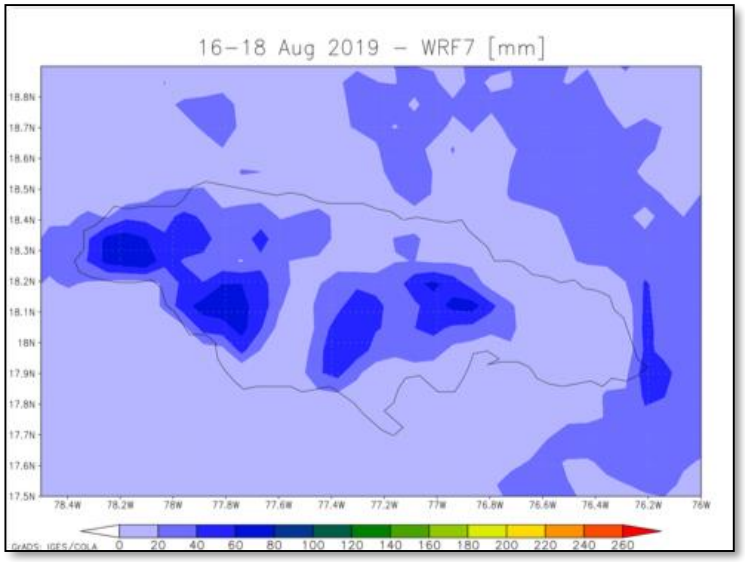
Both CMORPH and WRF5 reported a higher amount of total accumulated precipitation over the eastern side of Jamaica, consistent with IMERG (Figure 5). For CMORPH the maximum rainfall was between 160 mm and 180 mm while for WRF5 the maximum was between 200 mm and 220 mm. CMORPH also showed a second maximum over the western part of Jamaica. WRF7 showed lower values of precipitation over Jamaica since it did not simulate the persistent thunderstorm in the eastern part of Jamaica.



a) CMORPH



b) WRF5



c) WRF7

Figure 5 Total accumulated precipitation during the period 16-18 August 2019 estimated by CMORPH (a), WRF5(b) and WRF7(c)

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_2019/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/JAM/CARE_1_2019/daily_prec_long.mp4

The final RIL was calculated as US$16,813,945.75. RIL_{WRF7} (US$2,815,644.80) was below the loss threshold (US$10,000,000) and therefore the final RIL was the average of RIL_{CMORPH}= US$22,146,878.10 and RIL_{WRF5}= US$11,481,013.40. Despite the fact that CMORPH reported a lower maximum rainfall accumulated over the event compared to WRF5, it produced a larger RIL because it showed significant precipitation over a larger area of Jamaica, which was characterized by high exposure.

The final RIL was greater than zero and therefore this CARE qualifies as a loss event, but the RIL was below the attachment point for Jamaica and thus 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 Jamaica's Excess Rainfall policy and therefore no payout is due.

For further information, please contact ERN-RED, the CCRIF SPC Risk Management Specialist at the official email: monitor.xsr2@ccrif.org

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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.