CCRIF SPC
The Caribbean Catastrophe Risk Insurance Facility

Covered Area Rainfall Event (17/08/2021 to 18/08/2021)

Excess Rainfall

Event Briefing

Haiti

25 August 2021

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1 INTRODUCTION

Haiti was affected by Tropical Cyclone Grace, which caused adverse weather conditions that occurred between 16 August and 17 August, 2021. During this period, Haiti was affected by intense rainfall.

This event briefing describes the impact of rainfall on Haiti, which was associated with a Covered Area Rainfall Event (CARE), starting on 17 August and ending on 18 August 2021. The Rainfall Index Loss (RIL) was below the attachment point of the excess rainfall policy for Haiti and therefore no payout is due.

As reported in a separate tropical cyclone event briefing, "TC Grace: Haiti" dated 19 August 2021, Haiti experienced heavy rains and strong winds from the system. The preliminary runs of the CCRIF loss model for tropical cyclones produced losses for Haiti. However, Haiti's tropical cyclone policy, which provides coverage for wind and storm surge, was not triggered because the modelled losses were below the policy's attachment point.

Other Tropical Cyclone event briefing reports on TC Grace's impacts have been issued for CCRIF member countries: Montserrat, St. Kitts and Nevis, Jamaica and the Cayman Islands.

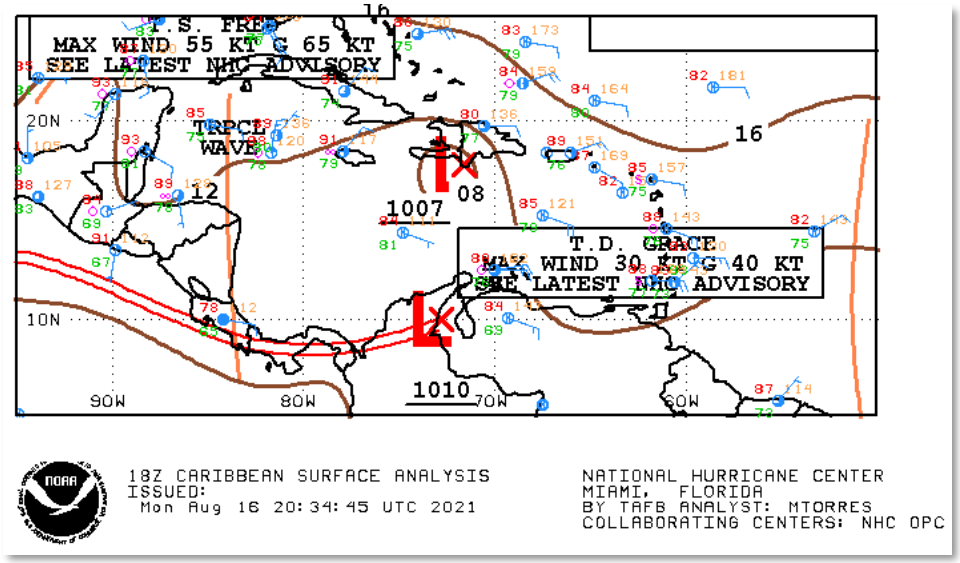
2 EVENT DESCRIPTION

On 14 August the US National Hurricane Center (NHC) reported that a tropical storm developed over the western tropical Atlantic and it was named Grace, and characterized as a small tropical storm. Over the following several hours Tropical Storm Grace became stronger as it moved westward toward the Leeward Islands and it produced stormy weather with heavy rainfall which spread across the Lesser Antilles.

On 15 August the NHC reported that the Tropical Storm Grace weakened to become a tropical depression. Its centre was located near latitude 17.0 North, longitude 67.3 West. Grace moved toward the west with the velocity near 15 mph (24 km/h) and estimated minimum central pressure 1011 mb. During the next 12 hours these parameters were almost unchanged.

On 16 and 17 August, the centre of Tropical Depression Grace passed over Haiti, which resulted in heavy rainfall over the country, particularly in the southern areas. Minimum central pressure decreased to 1007 mb and the velocity decreased (to approximately 12 mph, 19 km/h). On 16 August at 2100 UTC, the centre of Tropical Depression Grace was located near latitude 17.9 North, longitude 72.4 West, about 80 km south of Port-au-Prince Haiti (Figure 1a). Heavy rains persisted over portions of Haiti, especially on the Tiburon Peninsula (Figure 2a). During the following several hours, Tropical Depression Grace continued to move toward the west. Its velocity was in the range between 13 mph (20 km/h) and 16 mph (20 km/h), with ever increasing maximum sustained winds reaching 50 mph (85 km/h) and with constantly decreasing minimum central pressure to 1005 mb and below. On 17 August at 0600 UTC, the NHC reported that Tropical Depression Grace was upgraded to a tropical storm again (Figure 1b). Heavy rains were present over the southern parts of Haiti throughout the day (Figure 2b). Tropical Storm Grace continued to intensify becoming a hurricane on 18 August while it moved to the west toward the Cayman Islands.

a)



b)

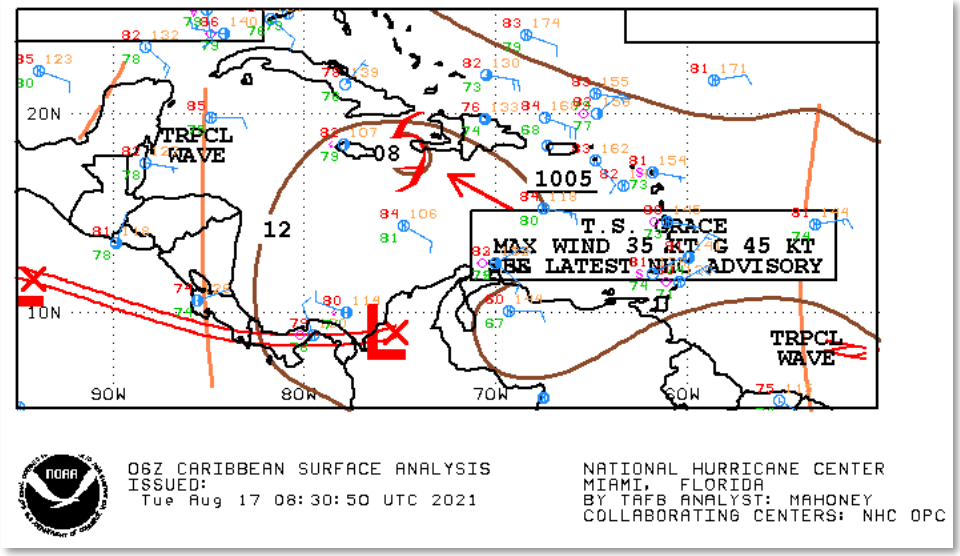
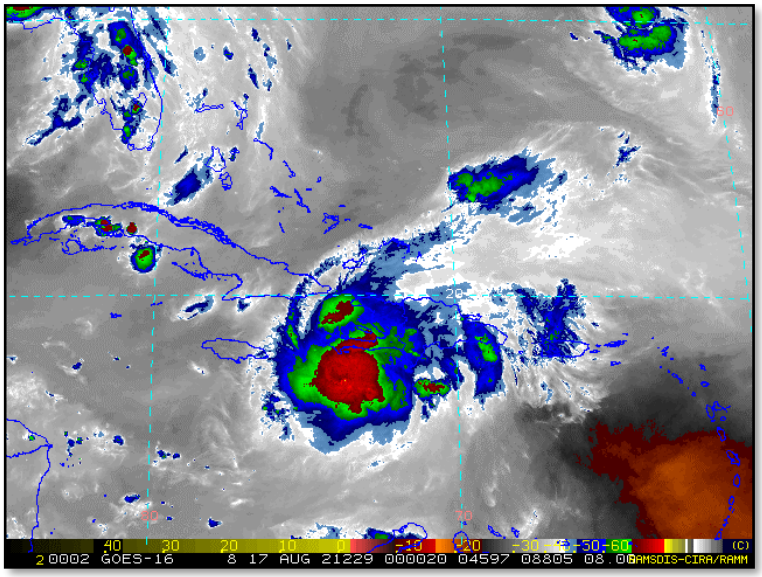


Figure 1 Surface analysis over the Caribbean area on 16 (a) and 17 August (b) at the different times as indicated by the labels. Source: US National Hurricane Center[1]

[1] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: 16-17 August 2021, available at: https://www.nhc.noaa.gov/tafb/CAR_18Z.gif and https://www.nhc.noaa.gov/tafb/CAR_06Z.gif

a)



b)

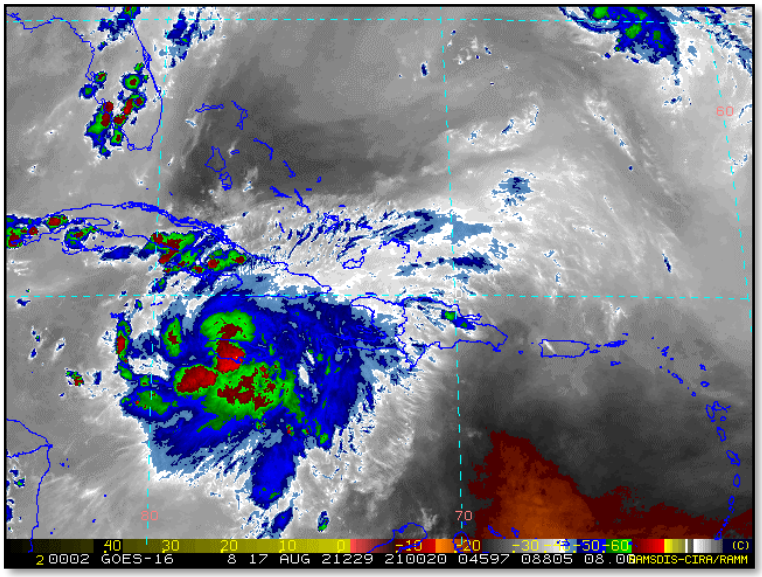


Figure 2 Satellite imagery on 17 August at 0000 UTC (a) and at 2100 UTC (b) as indicated in the label from thermal infrared channel enhanced with colour. Blue/green colours represent high altitude clouds (top cloud temperature between -50°C and -70°C), while the red/yellow colours represent very high 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]

[2] RAMSDIS Online Archive, NOAA Satellite and Information Service, available at: *https://rammb.cira.colostate.edu/ramsdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304_20210817000020.gif* *https://rammb.cira.colostate.edu/ramsdis/online/images/rmtc/rmtcsasec4ir304/rmtcsasec4ir304_20210817210020.gif*

3 IMPACTS

The Caribbean Disaster Emergency Management Agency[3] (CDEMA) reported that the most affected area was the Sud-Est Department where four persons died due to Tropical Storm Grace. The communes most affected were Cayes-Jacmel and Marigot. A total of 615 houses in the Department were flooded, 500 of which were in Marigot. The majority of the impacts were related to flooding and landslides across the southern regions of Haiti.

Prior to the arrival of Tropical Storm Grace, the Hydro-meteorological Unit and the Permanent Secretariat for Risk and Disaster Management activated the yellow alert for Tropical Storm Grace[4]. Additionally, a Tropical Storm Watch was put into effect for entire coast of Haiti.

4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[5], WRF5 and WRF7[6], detected the occurrence of precipitation over Haiti and the surrounding waters during the period 15 – 18 August 2021. However, each data source reported a specific distribution and accumulation of rainfall, as discussed below. The CARE for Haiti was activated on 17 August and lasted for the period 17 – 18 August. The CARE was activated due to the use of the 12-hour and the 48-hour aggregation intervals for precipitation[7], thus the period considered by the XSR 2.5 model for the loss estimate based on the accumulated precipitation in Haiti was 15 – 18 August.

CMORPH reported total accumulated amounts with different values over the whole country. The precipitation increased gradually from north to the south. In the north, precipitation was about 20 mm, increasing to between 40 mm and 100 mm in the central areas of the country. The highest precipitation values were shown in the south, on the Tiburon Peninsula. The precipitation values were in the range between 60 mm in the northern part of peninsula, and 140 mm to 160 mm in the southern parts. On most of the peninsula precipitation values were between 80 mm and 140 mm.

WRF5 also simulated total accumulated amounts of rainfall with different values across the country. For most of Haiti, precipitation value was about 20 mm, except on the Tiburon Peninsula. Higher precipitation values were presented in the south, reaching 160 mm and above

[3] CDEMA - Caribbean Disaster Emergency Management Agency, Situation Report No. 2 (As of 4:00 PM on August 19, 2021), review date: 19 August 2021, available at: '*Tropical Storm Grace*'

[4] Haiti Libre, review date: 19 August 2021, available at: '*Haiti - FLASH : The tropical depression «Grace» will affect the South of Haiti*'

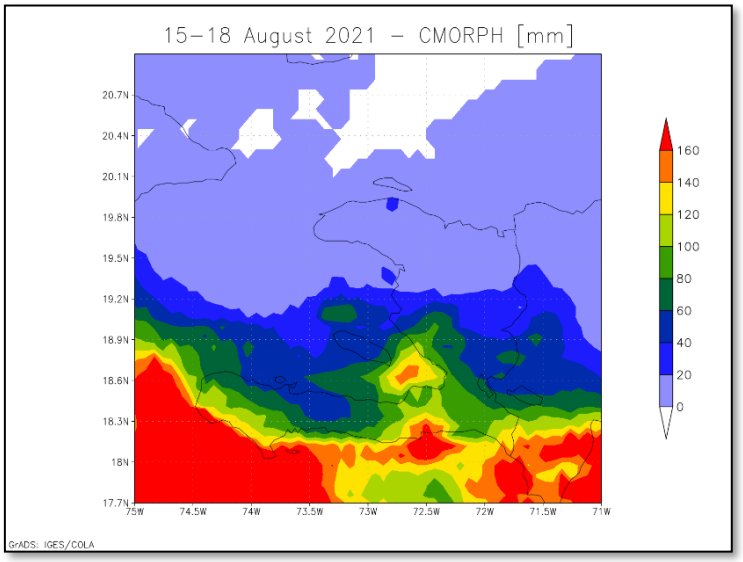
[5] CMORPH Model: the satellite-based rainfall precipitation estimates provided by the NOAA Climate Prediction Center (CPC) using the so-called Morphing Technique *http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph_description.html*. Further details in the Definitions section of this report.

[6] 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.

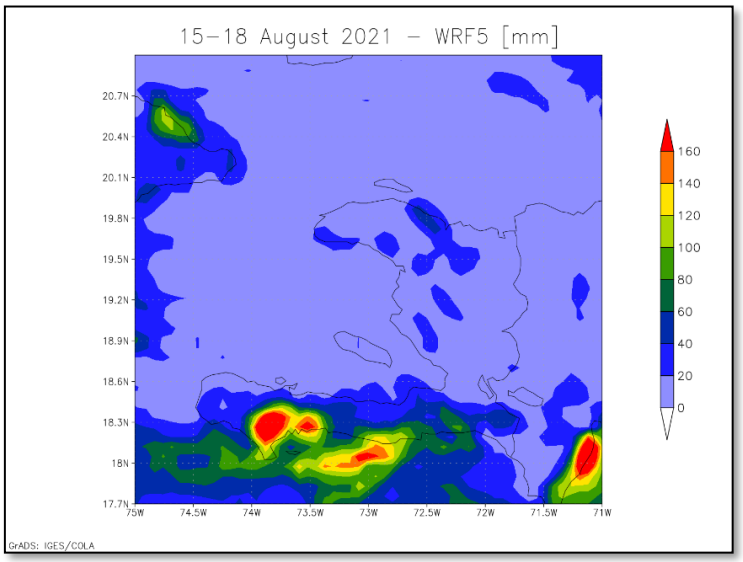
7 The two aggregation periods correspond to the Rainfall Aggregation Period #1 and Rainfall Aggregation Period #2, as indicated in the Schedule. Further details in the Definitions section of this report.

in some areas. Lower values were shown in the north of the peninsula, ranging between 40 mm and 120 mm.

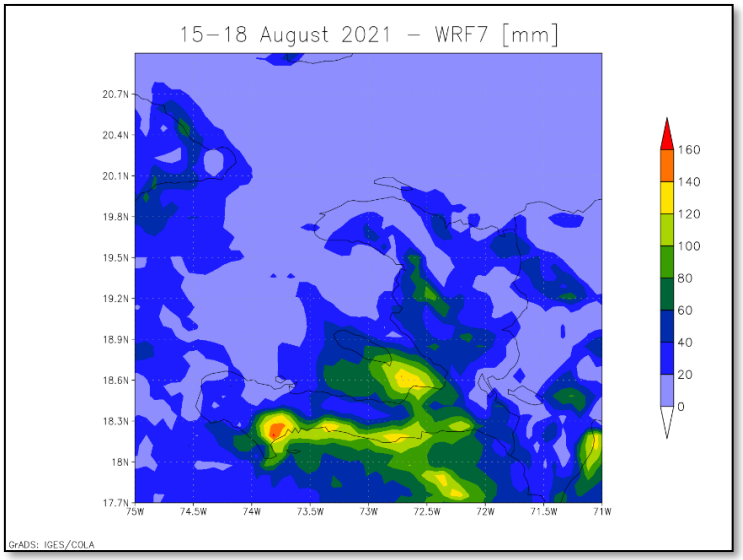
Total accumulated amounts of precipitation presented by WRF7 showed lower values than the previous two models. The precipitation values were again different for the whole country, varying between 20 mm and 60 mm for most of the country. On the Tiburon Peninsula, the simulated precipitation values were between 20 mm and 60 mm in the northern part, while precipitation values in the southern part were in the range between 80 mm and 140 mm.



a) CMORPH



b) WRF5



c) WRF7

Figure 3 Total accumulated precipitation during the period 15 August – 18 August, 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/HTI/CARE_1_2021/daily_prec_short.mp4

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

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

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 Haiti'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 Haiti's excess rainfall policy and therefore no payout is due.

CCRIF expresses sympathy with the Government and people of Haiti for the loss of life and impacts on communities and infrastructure caused by this event.

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.