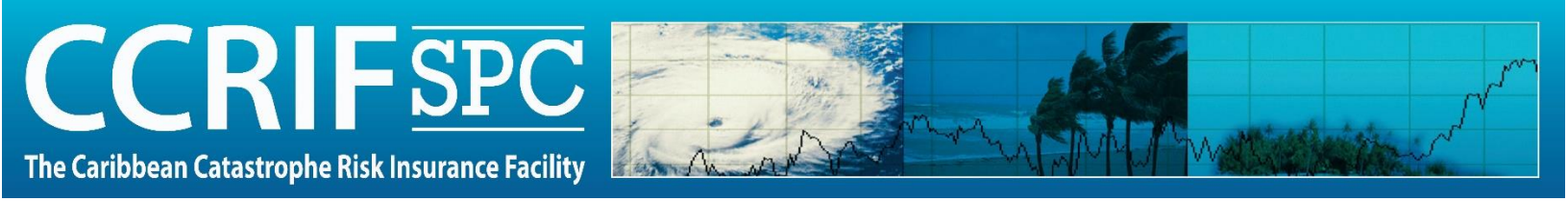


Covered Area Rainfall Event (27/05/2020 to 29/05/2020)

Excess Rainfall

Event Briefing

Panama

6 June 2020

Registered Office: CCRIF SPC c/o Sagicor Insurance Managers Ltd., 198 North Church Street
2nd Floor Sagicor House, P.O. Box 1087, Grand Cayman KY1-1102, Cayman Islands
Email: ccrif@ccrif.org | Website: ccrif.org | Twitter: @ccrif_pr | Facebook: CCRIF SPC

1 INTRODUCTION

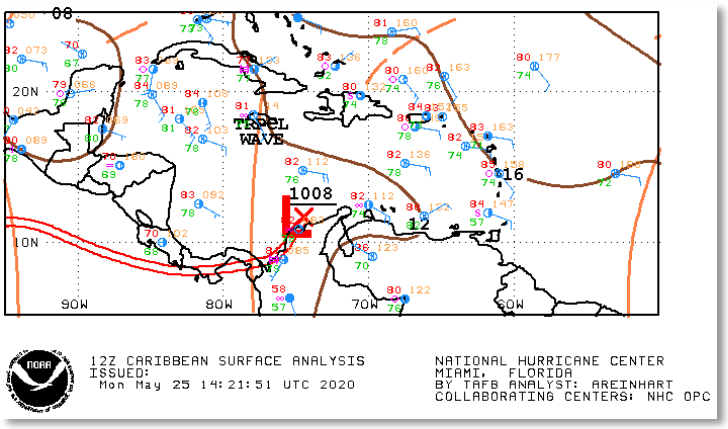
In the period between 23 May and 29 May, 2020, the interaction of different meteorological events generated disorganized rains over Panama. This interaction was influenced by conditions from both the Atlantic Basin and the Pacific Ocean.

This event briefing describes the impact of the precipitation on Panama, which is associated with a Covered Area Rainfall Event (CARE), starting on 27 May and ending on 29 May 2020. The Rainfall Index Loss (RIL) was below the attachment point of Panama's Excess Rainfall policy and therefore no payout is due to the Government of the Republic of Panama.

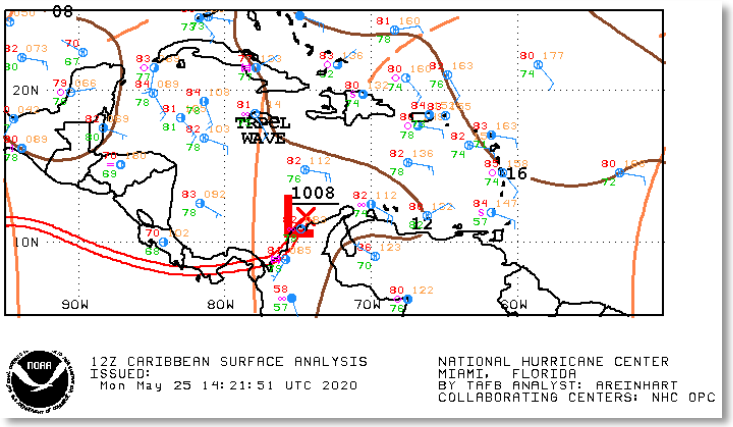
2 EVENT DESCRIPTION

From 23 to 29 May, a monsoon trough persisted over the southern countries of Central America and particularly over Panama (Figure 1). During this period, this almost stationary configuration led to the development of disorganized showers over Panama, mainly between 2000 UTC and 0300UTC (1500 and 2200 local time). Additionally, stronger and more organized convection activity was observed over Panama due to the combination of the instability associated with the monsoon trough and the passage of a tropical wave (25 May, Figure 1a) followed by the westward transition of a low pressure system of 500 mb from northern Colombia, over the Gulf of Panama, to the waters south of Costa Rica (27 May, Figures 2 and 1b).

On 25 May at 0900UTC, an area of deep convection developed SE of the Gulf of Panama from 5N to 8N and between 77W and 79W. During the following hours, the system moved towards the NW following the westward movement of the tropical wave (Figure 1a) and it was over the Gulf of Panama at 1500UTC. From 1700UTC to 26 May at 0000UTC, moderate scattered and locally intense precipitation affected the central portion of Panama, and then the system dissipated.



a) 25 May at 1200UTC



b) 27 May at 0000UTC

Figure 1 Surface analysis over Central America at different times as indicated in the caption. Source: US National Hurricane Center[1]

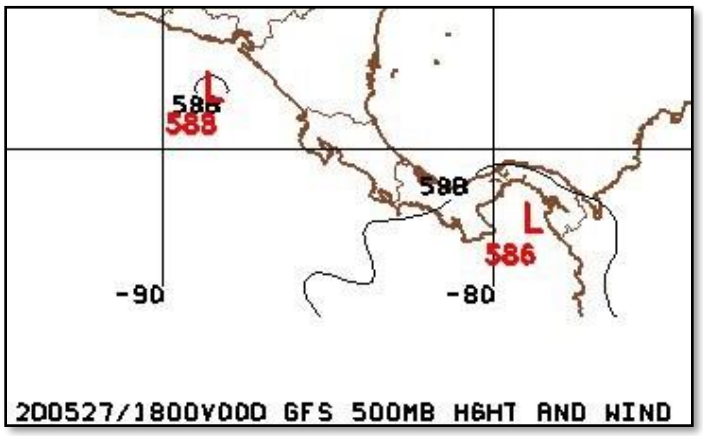
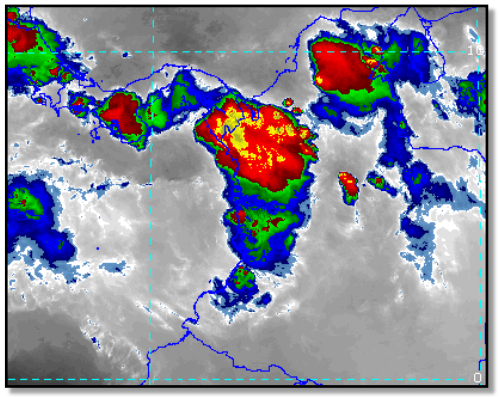


Figure 2 Upper level analysis (500 mb) over Central America on 27 May at 1800UTC produced by the Global Forecast System model. Source: US National Weather Service[2]

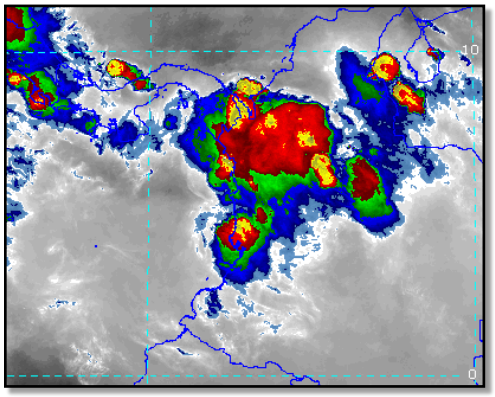
On 27 May at 0000UTC, a broad nucleus of strong convection was active at the border between Colombia and Panama, from 5N to 8N and between 76W and 78W, due to the presence of a low pressure system at 8N, 75W. Intense precipitation affected the eastern portion of Panama from 0000UTC to 0400UTC (Figures 3a and 3b). In the following hours, the system moved westward and at 1200UTC it was located over the Gulf of Panama and to the south of the country. From this time until 1800UTC, the associated intense precipitation affected southern Panama and in particular the Azuero Peninsula (Figures 3c, 3d and 3e). Subsequently the convection activity weakened, but a small cell of deep convection (and associated intense precipitation) was still active at 2100UTC over the western portion of Panama (Figure 3f).

[1] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: 25 May and 27 May 2020, available at: *https://www.nhc.noaa.gov/tafb/CAR_00Z.gif*

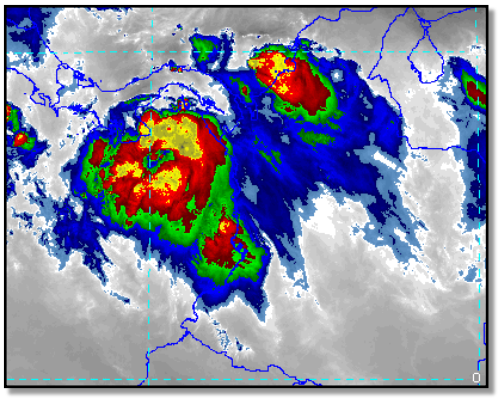
[2] National Oceanic and Atmospheric Administration, review data: 27 May, available at: *https://mag.ncep.noaa.gov/data/gfs/00/west-atl/500_wnd_ht/gfs_west-atl_000_500_wnd_ht.gif*



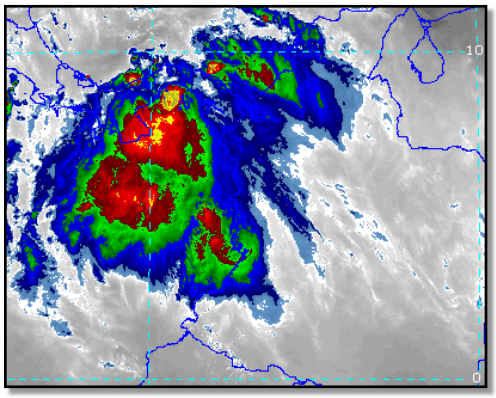
a) 27 May at 0000UTC



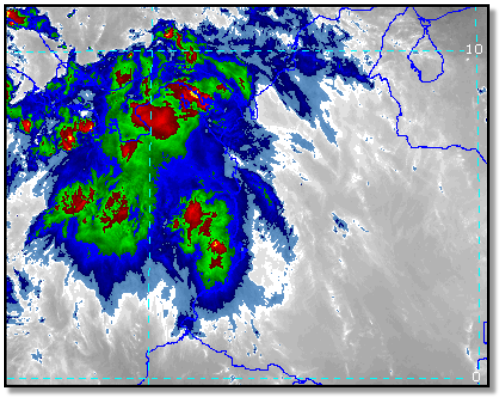
b) 27 May at 0300UTC



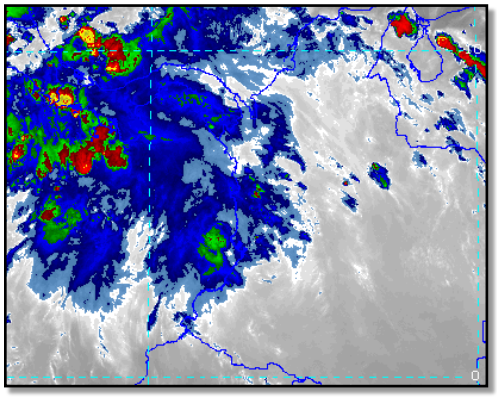
c) 27 May at 1200UTC



d) 27 May at 1500UTC



e) 27 May at 1800UTC



f) 27 May at 2100UTC

Figure 2 Satellite imagery at different times as indicated by the captions 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[3]

[3] RAMSDIS Online Archive, NOAA Satellite and Information Service, review date: 27 May 2020, available at: *http://rammb.cira.colostate.edu/ramsdis/online/archive.asp?data_folder=tropical/tropical_ge_14km_wv&width=640&height=480*

3 IMPACTS

According to the authorities in Panama, due to the impacts of this adverse weather, 350 people were affected by flooding of roads, houses and other buildings in Panama City. The majority of the reports provided by Panama's Disaster Management Agency (in Spanish: Sistema Nacional de Protección Civil - SINAPROC) pertained to flooding, landslides and fallen trees. The affected provinces include: Panamá, Panamá Oeste, Herrera, and Coclé. Reports indicated damage to infrastructure but no casualties were reported.

Figure 4 shows some of the damage caused by this adverse weather in Panama.

Figure 4 Damage caused by this adverse weather period in Panama – May 2020
Sources: *Sistema Nacional de Protección Civil* and *Radio Panamá*

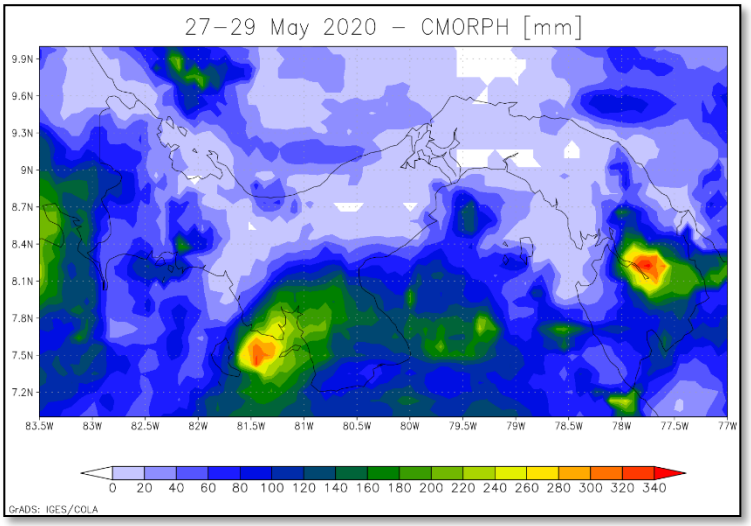
4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[4], WRF5 and WRF7[5], simulated the occurrence of precipitation over Panama during the period 27-29 May 2020.

CMORPH reported total accumulated amounts of precipitation higher than 60 mm in several sectors of Panama: over the eastern portion with a maximum between 320 mm and 340 mm, over the southern portion and particularly over the Azuero Peninsula with maximum amounts between 220 mm and 260 mm and over the western portion of Panama with a peak of 160 mm.

WRF5 simulated lower total accumulated amounts of rainfall compared with CMORPH, with values larger than 60 mm along the coast of the Gulf of Panama and the western side of the Azuero Peninsula, reaching 300 mm. Moreover, simulated by WRF5, amounts between 60 mm and 180 mm were reported over the mountains in the western portion of Panama.

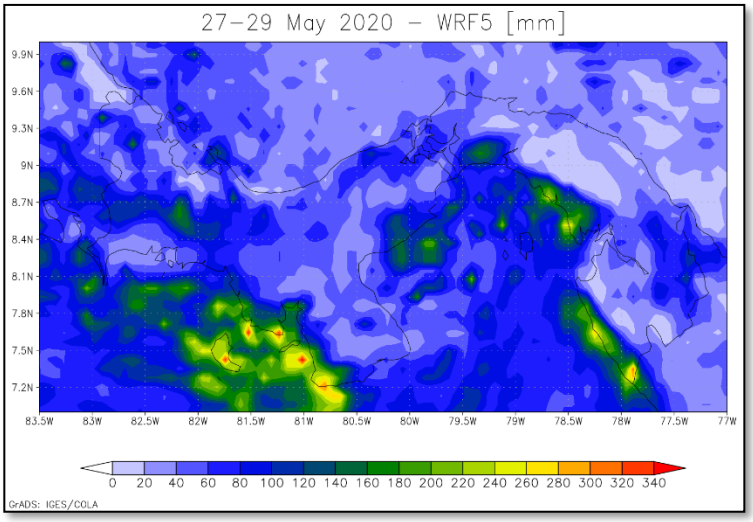
WRF7 showed a similar pattern of total accumulated precipitation to WRF5, but with higher amounts over the mountains in the western portion of Panama (reaching 300 mm) and lower amounts along the Pacific coast.



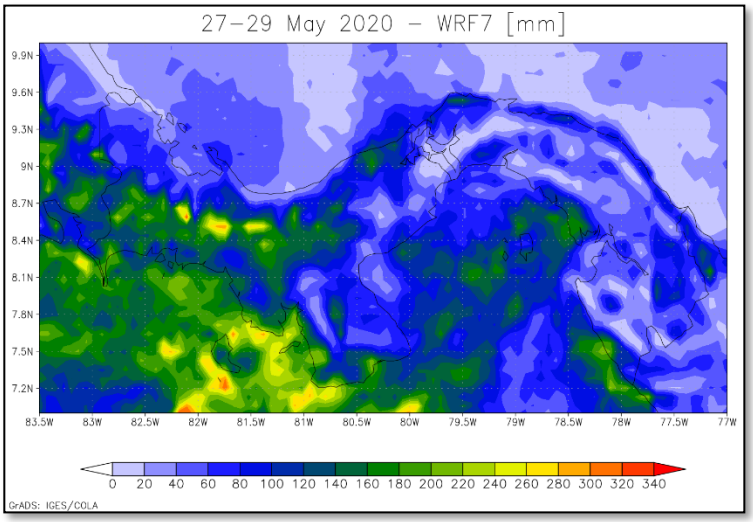
a) CMORPH

[4] 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.

[5] 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.



b) WRF5



c) WRF7

Figure 5 Total accumulated precipitation during the period 9-20 May 2020 over Guatemala 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; 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/PAN/CARE_11_2019/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/PAN/CARE_11_2019/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Panama for two of the data sources used by XSR2.5: CMORPH and WRF7. The associated RIL was higher for WRF7 due to the large amounts of accumulated precipitation in the internal western territory presented by WRF7, area characterized by high exposure.

The final RIL (RIL_{FINAL}) was calculated as the average RIL from the CMORPH and WRF7 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 Panama's Excess Rainfall policy 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 Panama'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.