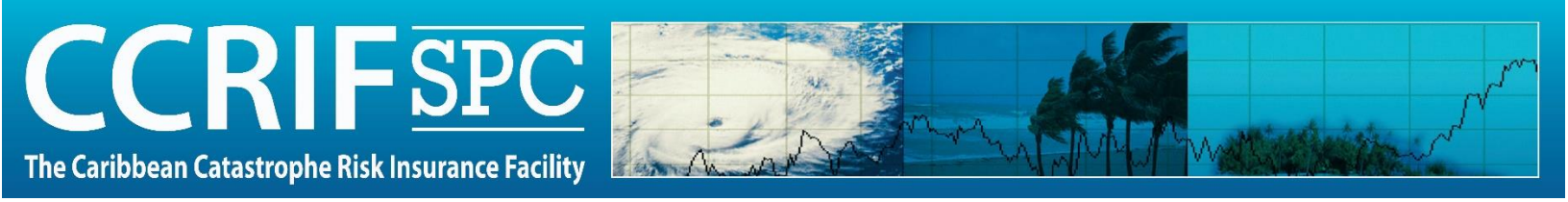

Covered Area Rainfall Event (30/05/2020 to 01/06/2020)

Excess Rainfall

Event Briefing

Belize

9 June 2020

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1 INTRODUCTION

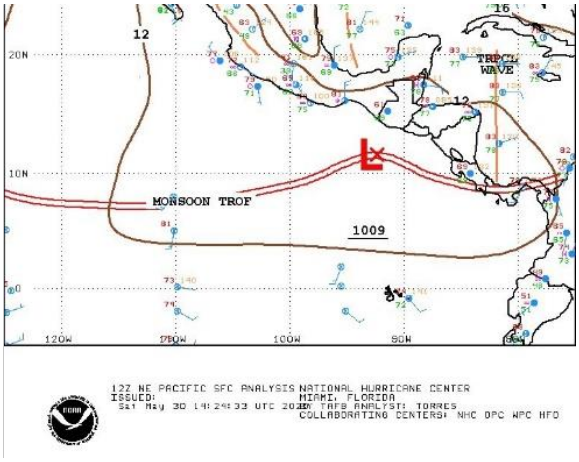
In the last days of May 2020, the first named storm of the 2020 Pacific Hurricane Season was generated. This storm – Tropical Storm Amanda – developed from a large area of low pressure associated with a tropical wave. On May 31 (0900UTC) Tropical Depression Two-E evolved into Tropical Storm Amanda over the waters south of Guatemala. Hours later Amanda weakened and dissipated. However, as it crossed Guatemala and Mexico, its remnants reorganized to form Tropical Storm Cristobal in the oceanic waters of the Gulf of Mexico.

This event briefing describes the impact of the precipitation on Belize, which is associated with a Covered Area Rainfall Event (CARE), starting on 30 May and ending on 1 June 2020. The Rainfall Index Loss (RIL) indicated government losses above the attachment point of the Excess Rainfall policy for Belize. Final calculations show that a payout of US$203,136 is due.

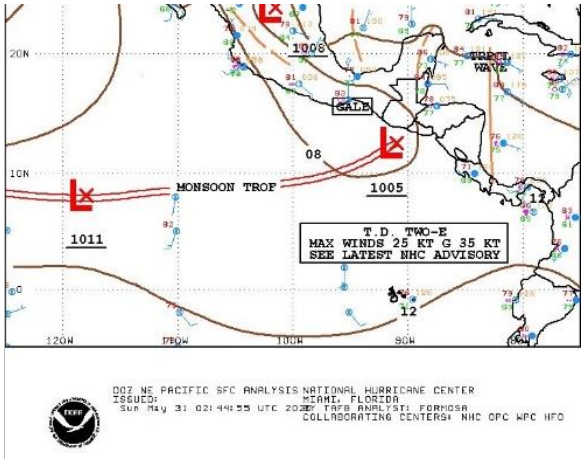
2 EVENT DESCRIPTION

On 30 May 2020, a broad area of low pressure was located over the eastern central Pacific Ocean and over Central America, with a minimum pressure of 1009 mb over the waters south of Guatemala (Figure 1a).

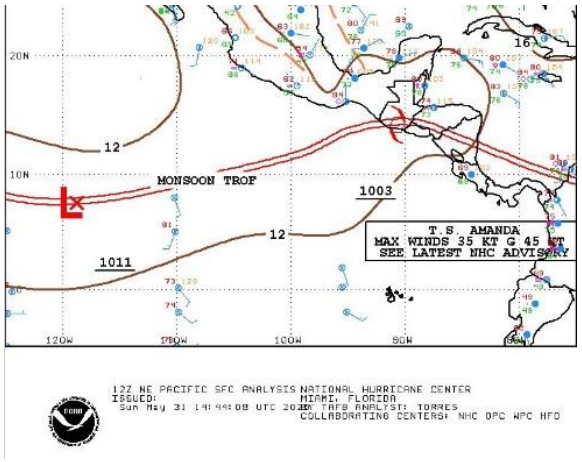
Over Central America, the combination of the instability associated with the low pressure area and the great amount of moisture, led to the development of scattered moderate to locally intense rain showers and thunderstorms. Particularly over Belize, numerous convective cells were triggered from 0600UTC to 1800UTC and the associated moderate to intense rainfall affected the entire territory, moving from the southern to the northern region (Figure 2a).



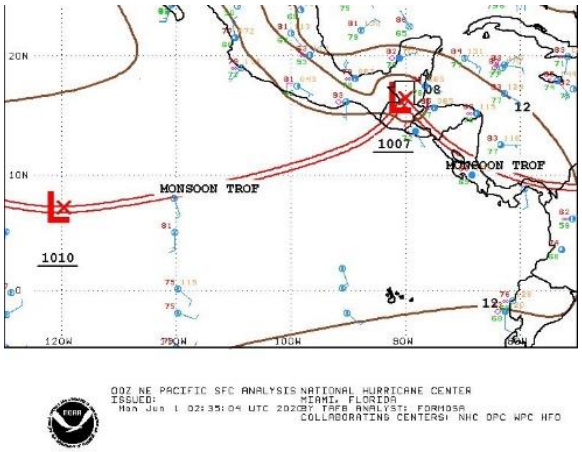
a) 30 May at 1200UTC



b) 31 May at 0000UTC



c) 31 May at 1200UTC



d) 01 June at 0000UTC

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

[1] National Oceanic and Atmospheric Administration - FTP, National Hurricane Center, review dates: from 30 May to 01 June 2020, available at: *https://www.nhc.noaa.gov/tafb/EPAC_00Z.gif*

The minimum pressure fell to 1005mb and on 31 May at 0000UTC, the US National Hurricane Center (NHC) declared it a tropical depression (Figure 1b). At this time, the system was approaching the southern coast of Guatemala, heading northward into the country.

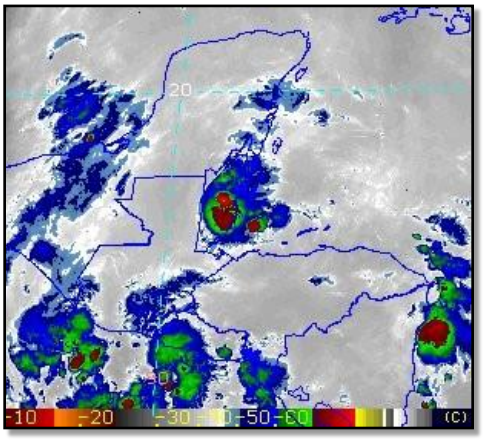
Over Belize very unstable weather conditions were produced by the approach of the tropical depression from the south, the approaching tropical wave from the east with an axis along 83W from 9N to 21N and finally the presence of a surface trough over the Yucatan Peninsula (Figure 1b). As a consequence, a large nucleus of deep convection was active over Belize from 0000UTC to 1400UTC (Figures 2b and 2c), with heavy precipitation affecting the entire territory. It developed over the southern portion of Belize at 0000UTC and during the day it intensified and slowly moved northward across Belize, dissipating at 1600UTC over the Yucatan Peninsula. During this time, at 1200UTC, while this nucleus of convection was leaving northern Belize, the outer rain band of the tropical depression, just upgraded by NHC to Tropical Storm Amanda (Figure 1c), started to affect the southern area of Belize (Figure 2c) with moderate precipitation. During the next four hours, from 1700UTC to 2100UTC, the rain band moved northward, bringing scattered moderate to locally intense rainfall over northern Belize (Figure 2e).

At 2100UTC, Tropical Storm Amanda dissipated due to interaction with the land surface and was downgraded by NHC to a minimum pressure system (Figure 1d). At this time, its remnants were located at 16N 90W, over northern Guatemala. Despite the system losing its tropical storm intensity at the lower levels, the upper level circulation was still active.

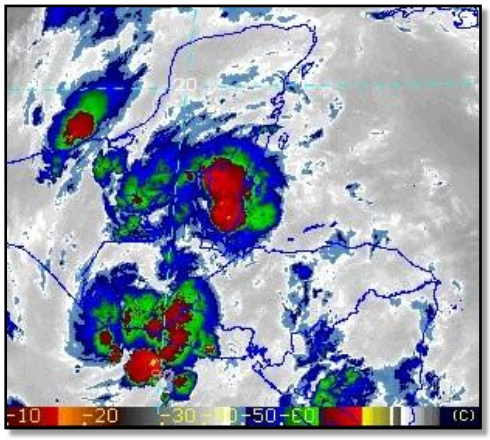
On 1 June at 0300UTC a large area of deep convection developed over the northern portion of Belize and it quickly extended to the majority of the Yucatan Peninsula. The associated heavy rainfall affected the northern part of Belize from 0300UTC to 1400UTC (Figure 2f), when the system and the area of minimum pressure moved over the Yucatan Peninsula. The same day at 2100UTC, its centre had moved over the eastern portion of the Bay of Campeche. Over the warm waters, the circulation associated to the system reorganized and the NHC declared it a tropical depression.

On 2 June at 2100UTC, the depression was further upgraded to tropical storm, and the NHC named it Tropical Storm Cristobal, the third tropical storm of the Atlantic Hurricane Season 2020. The Tropical Storm Cristobal then tracked southwest and made landfall on the Mexico coast. Heavy rain was spread over southern Mexico, north Guatemala and Belize.

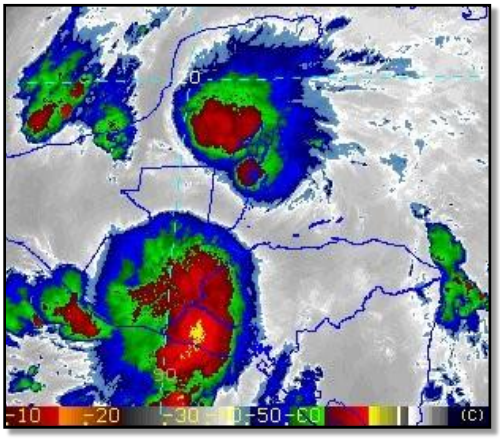
Another event briefing report will be issued due to the intense precipitation that affected Belize from 4 June to 6 June.



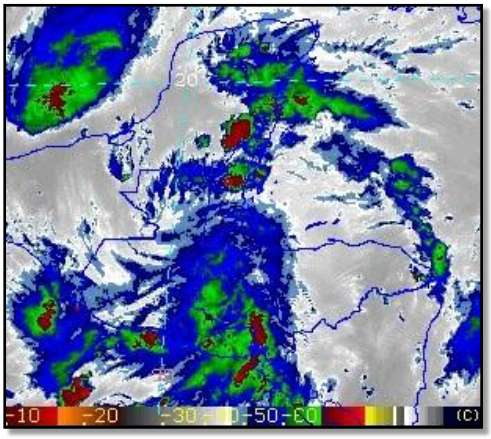
a) 30 May at 1300UTC



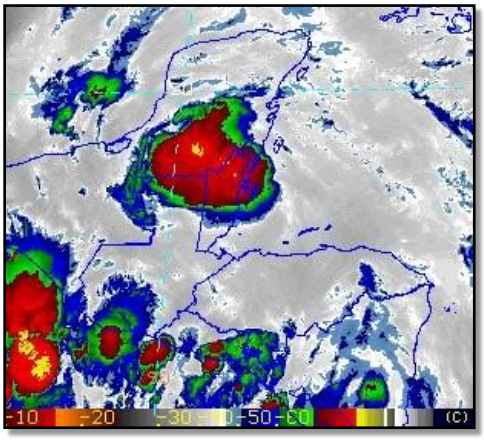
b) 31 May at 0600UTC



c) 31 May at 1200UTC



d) 31 May at 1800UTC



e) 01 June at 0600UTC

Figure 2 Satellite imagery at different times as indicated by the captions from a 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. Dry environment is shaded with orange to dark red colours. Source: NOAA Satellite and Information Service[2]

[2] RAMSDIS Online Archive, NOAA Satellite and Information Service, review dates: from 30 May to 01 June 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 an evaluation from the National Emergency Management Organization (NEMO), due to the impacts of both Tropical Storm Amanda and Tropical Storm Cristobal, there were several floods in western Belize and in some regions of the Belize District but no significant damages or casualties were reported.

The most affected communities were Cotton Tree and St. Matthews (in Cayo District) where eight people moved to a shelter. The communities of Mahogany Heights and La Democracia (in Belize District) experienced extreme flooding.

A subsequent version of this report may be produced with updated information obtained from official reports or communications that are issued by the Government of Belize.

4 RAINFALL MODEL OUTPUTS

All three data sources used by the XSR 2.5 model, CMORPH[3], WRF5 and WRF7[4], simulated the occurrence of precipitation over Belize during the period 30 May – 01 June 2020.

CMORPH reported total accumulated amounts of precipitation higher than 60 mm over the majority of Belize, with maximum amounts greater than 320 mm and reaching 380 mm over the central-northern portion of Belize.

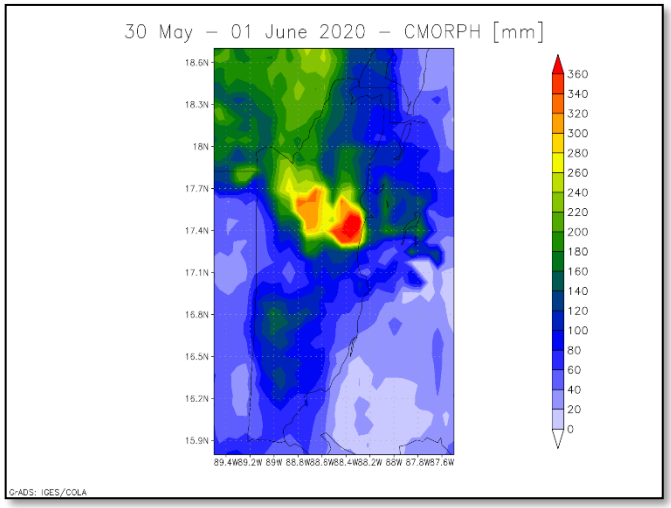
Both WRF simulations produced larger amounts of accumulated rainfall compared with CMORPH over the coastal area in central-north Belize.

WRF5 reported maximum values onshore between 280 mm and 300 mm and higher values over Hick's Cayes (320 mm - 340 mm).

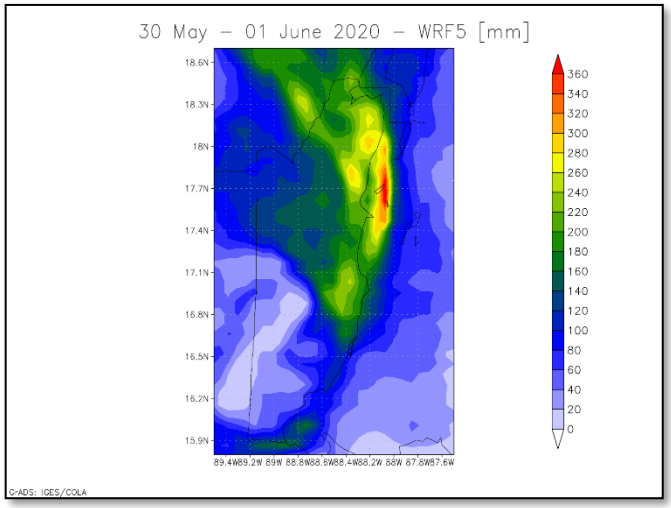
WRF7 showed maximum amounts along the coast between 260 mm and 280 mm, and the peak elongated inland over north Belize with values greater than 280 mm and locally reaching 340 mm.

[3] 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.

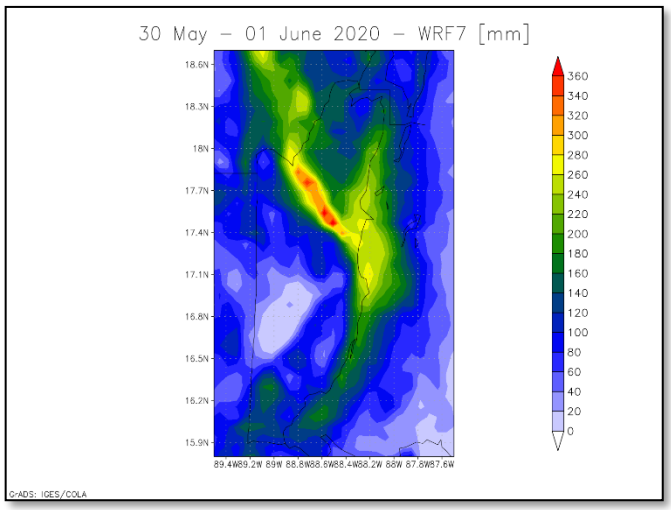
[4] WRF5 and WRF7 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data *https://www.mmm.ucar.edu/weather-research-and-forecasting-model*. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [*http://rda.ucar.edu/datasets/ds083.2/*]). Further details in the Definitions section of this report.



a) CMORPH



b) WRF5



c) WRF7

Figure 5 Total accumulated precipitation during the period 30 May – 01 June 2020 over Belize 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/BLZ/CARE_6_2019/daily_prec_short.mp4

https://wemap.ccrif.org/OUTPUT/CCRIF/XSR/Events/BLZ/CARE_6_2019/daily_prec_long.mp4

The Rainfall Index Loss (RIL) was above the loss threshold for Belize for all the data sources used by XSR2.5, CMORPH, WRF5 and WRF7. The RIL was similar for WRF5 and WRF7, while the RIL associated with CMORPH was lower. This was due to the high amounts of accumulated precipitation presented by the WRF simulations over the coastal central part of Belize (and particularly over Belize City), an area characterized by high exposure.

The final RIL (RIL_{FINAL}) was calculated as the average of the RILs from the three data sources. The RIL_{FINAL} was higher than the attachment point of the Excess Rainfall policy for Belize, and therefore this event was classified as a triggering event thus resulting in a payout.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event (CARE) that started on 30 May and ended on 1 June 2020, produced government losses which were above the attachment point of the Excess Rainfall policy for Belize. Final calculations show that a payout of US$203,136 is due.

CCRIF expresses empathy with the Government and people of Belize for the impacts on communities and infrastructure caused by this adverse weather.

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.