Covered Area Rainfall Event (19-31 May 2019)

Excess Rainfall

Event Briefing

Nicaragua

7 June 2019

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1 INTRODUCTION

During the second half of May, a persistent area of low pressure located over the eastern Pacific Ocean created conditions favourable for the development of thunderstorms and showers over Central America and the surrounding waters[1] [2]. In particular, the Nicaraguan territory was affected by high thunderstorm activity and associated heavy precipitation.

This event briefing describes the impact on Nicaragua of the precipitation that occurred between 16 and 31 May 2019. The Rainfall Index Loss (RIL) was calculated for this Covered Area Rainfall Event (CARE), which started on 19 May and ended on 31 May 2019. The Rainfall Index Loss calculated for this CARE was below the attachment point of Nicaragua's Excess Rainfall policy and therefore no payout is due.

2 EVENT DESCRIPTION

From 16 May to 31 May, a broad area of low pressure associated with the monsoon trough persisted over the eastern central Pacific. During this period, its centre was mainly located over 200 hundred miles (about 400 km) to the east of the southern coast of Nicaragua, with an inland movement over Nicaragua on 22-23 May (Figure 1). At the end of that period, the centre of this low pressure system moved north over Guatemala, Belize and Yucatan Peninsula. This almost stationary configuration for more than two weeks led to the continuous development of disorganized showers and thunderstorms along the west coast of Nicaragua and inland over the Nicaraguan territory (Figure 2). The associated heavy rain in combination with the soil saturation due to the persistency of the system resulted in the occurrence of flash floods and mudslides.

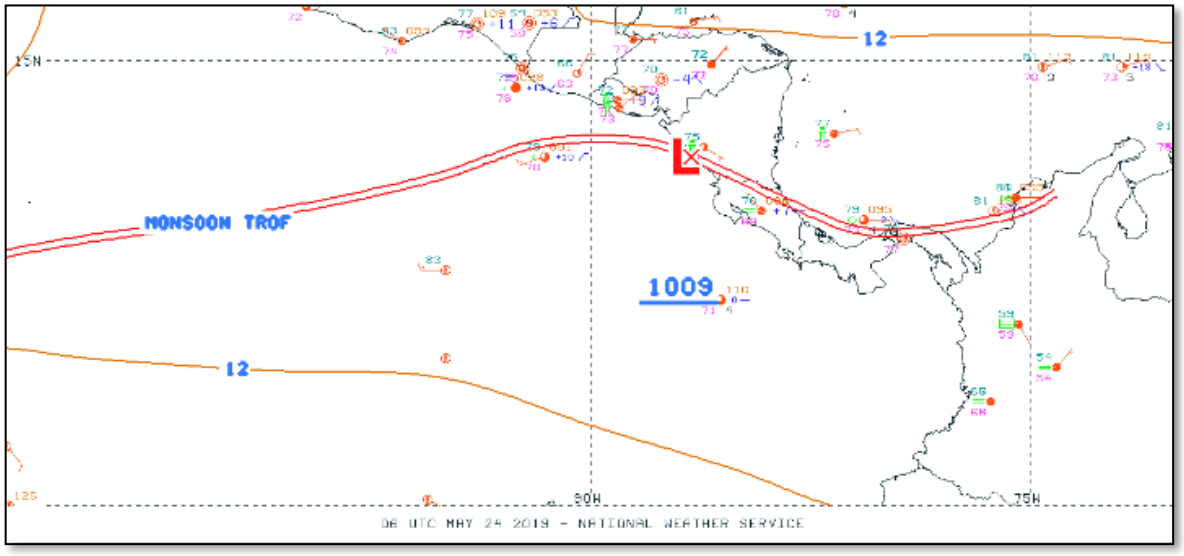
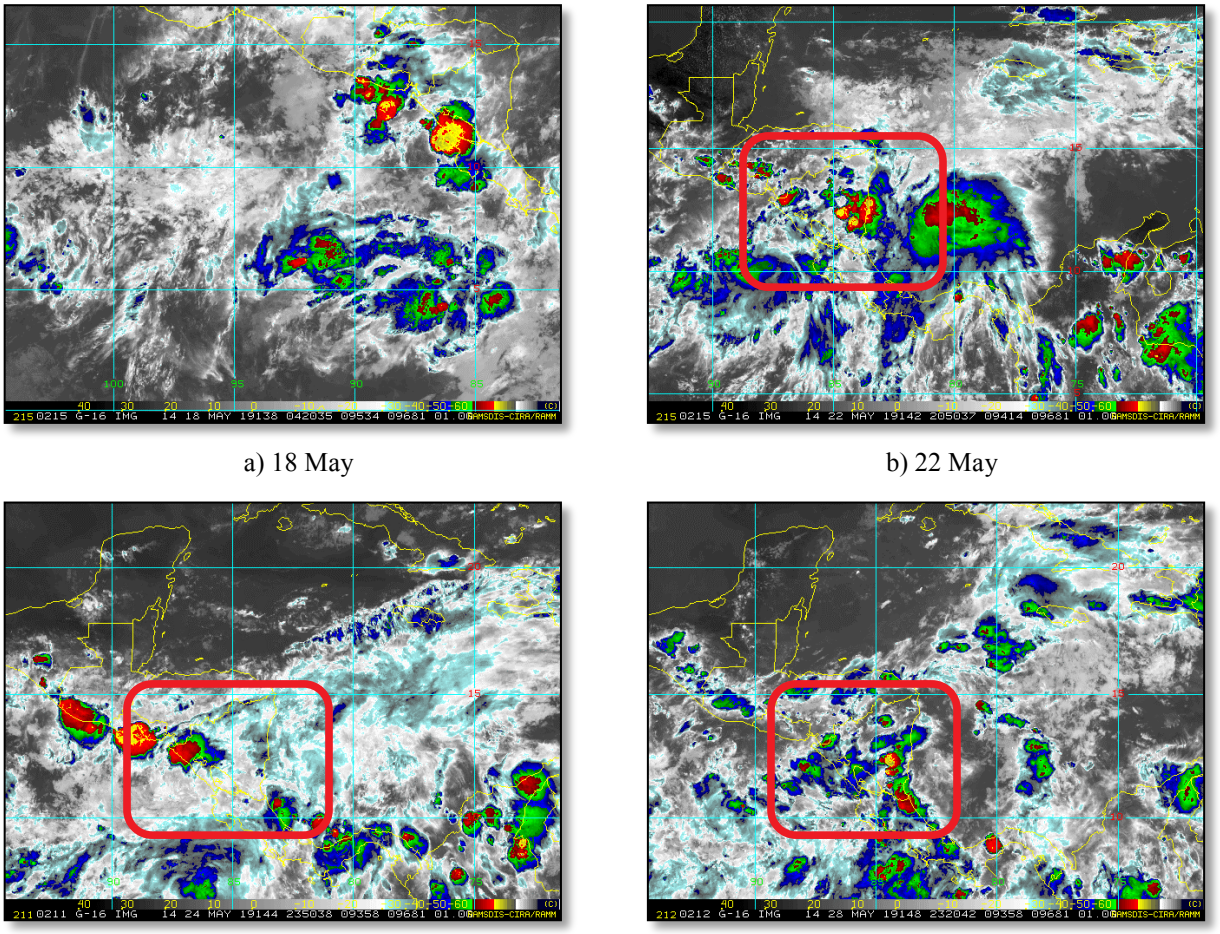


Figure 1 Surface analysis on 24 May at 12UTC over Central America showing the monsoon through and the associated low pressure area centred over the west coast of Nicaragua. This configuration persisted almost stationary between the 16 and the 30 of May. Source: NOAA, https://ocean.weather.gov

[1] National Oceanic and Atmospheric Administration, NOAA, *https://www.noaa.gov/*
[2] Instituto Nicaragüense de Estudios Territoriales, INETER, *https://www.ineter.gob.ni/index*

Surface measurements from the GSOD dataset (Global Surface Summary of the Day https://www1.ncdc.noaa.gov/) provide very little information about rainfall over Nicaragua during this period, as the rain gauges were not working or indicating 0 mm (especially at the end of the period, when rainfall was likely absent).

The satellite-derived estimate of precipitation by the IMERG (Integrated Multi-satellitE Retrievals for GPM) dataset reports that the areas of Nicaragua mostly affected by the event were the west and the east coasts and the nearby regions (e.g. Lake Nicaragua), as shown in Figure 3. In these areas, the rainfall amounts accumulated during the period varied between 280 and 700 mm. Lower values were reported in the inner mountain region of the country (Figure 3). Rainfall amounts greater than 1,000 mm were reported offshore, especially over the Pacific waters to the south of Nicaragua, approximately where the centre of minimum pressure was located for most of time.



a) 18 May

b) 22 May

c) 24 May

d) 28 May

Figure 2 Satellite images derived from GEOS infrared channel centred over Central America on different days as indicated by the labels. The colour indicates the cloud temperature, with cold and high clouds in red/yellow. Higher and spotted clouds are associated with local development of thunderstorms. Nicaragua is highlighted by a red box. Source: NOAA, National Environmental Satellite, Data and Information Service.

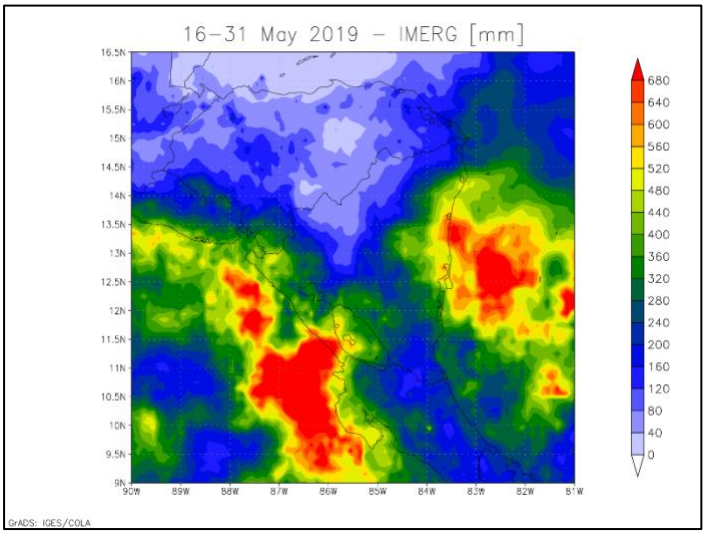


Figure 3 S IMERG accumulated precipitation (rainfall) at 10 km resolution over Nicaragua on 16-31 May 2019. Source: XSR Web

3 IMPACTS

According to the initial information and assessments provided by Nicaragua's Disaster Management Agency (in Spanish: Sistema Nacional para la Prevención, Mitigación y Atención de Desastres - SINAPRED) there were 2 confirmed deaths. Due to the impacts of this adverse weather, the Government of Nicaragua issued declarations of Yellow Alert along the Pacific coast and Green Alert for the Central region.

Also, thousands of people were affected by flooding of roads, houses and other buildings. The departments most severely impacted were Rivas, Boaco, Chontales and Carazo (Figure 4).

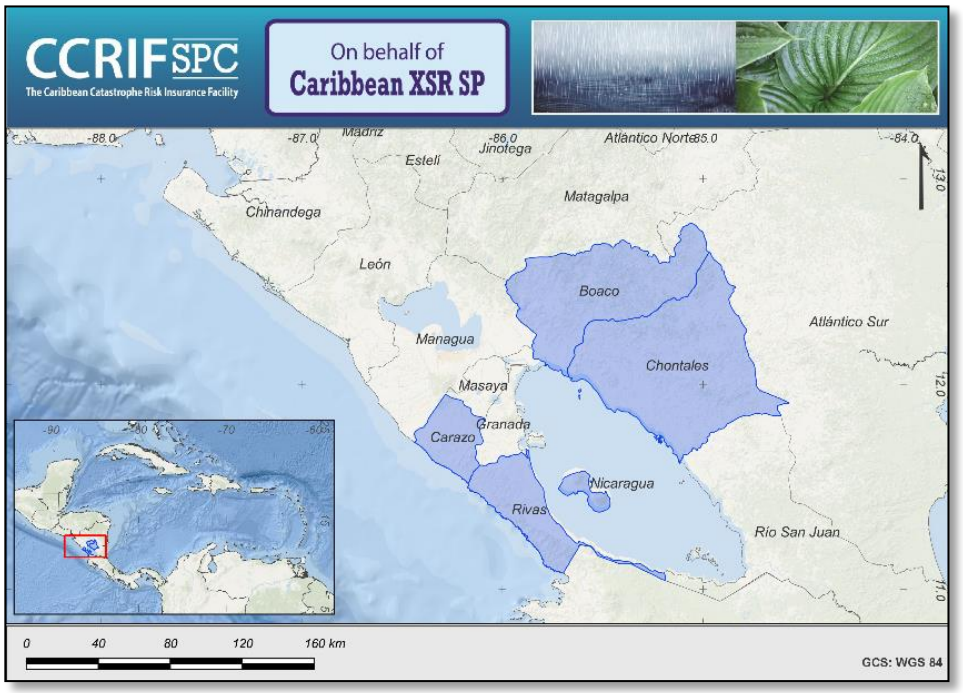


Figure 4 Departments most severely impacted by heavy rainfall in Nicaragua – May 2019

At the time of this report, the following impacts had been reported:

- 107 communities in 31 municipalities of 15 departments were affected
- 824 families and 760 homes were affected
- falling trees

Figure 5 shows some of the flood damage caused by heavy rainfall in Nicaragua.

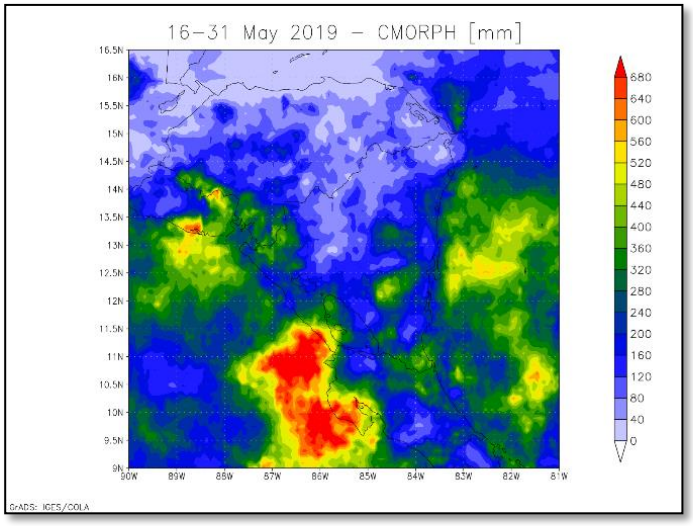
Figure 5 Damage caused by heavy rainfall in Nicaragua – May 2019
Sources: *El Nuevo Diario*

4 RAINFALL MODEL OUTPUTS

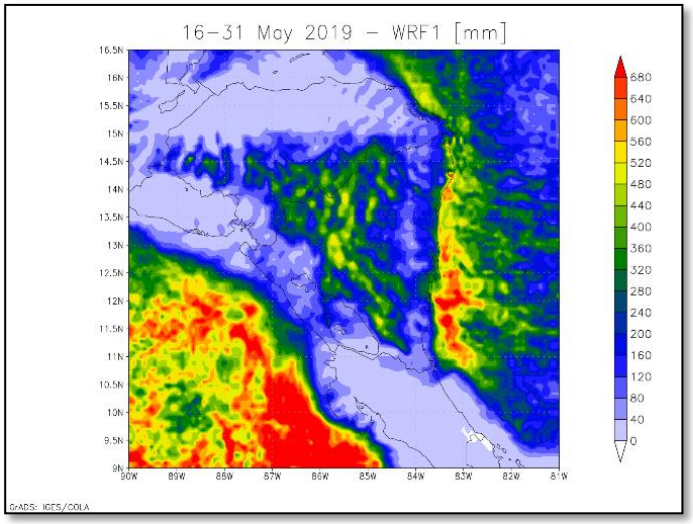
All three models, CMORPH[3], WRF1 and WRF2[4], simulated the occurrence of showers over Nicaragua and the surrounding waters during the period 16-31 May 2019. However, they differ in the spatial localization and intensity of the precipitation.

[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.

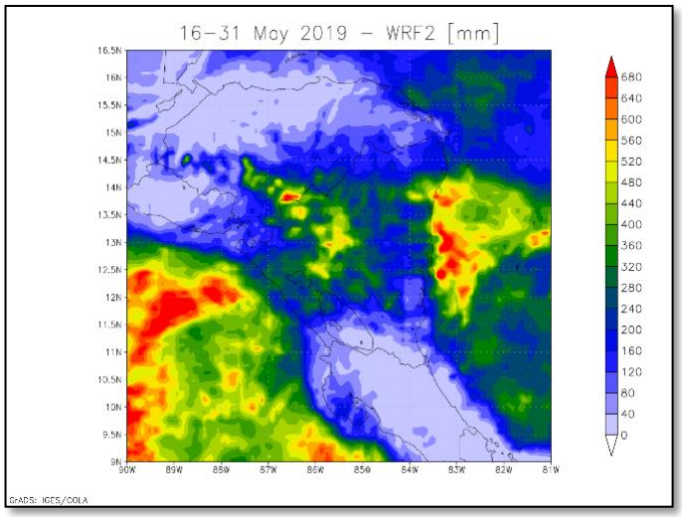
[4] WRF1 and WRF2 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data *https://www.mmm.ucar.edu/weather-research-and-forecasting-model*. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [*http://rda.ucar.edu/datasets/ds083.2/*]). Further details in the Definitions section of this report.



a) CMORPH



b) WRF1



c) WRF2

Figure 6 Total accumulated precipitation during the period 16-31 May 2019 estimated by CMORPH (a), WRF1 (b) and WRF2 (c)

CMORPH presents a rainfall pattern very similar to the one of IMERG, but with less extended areas receiving extreme amounts of accumulated precipitation (e.g. only the very south west coast is affected by values greater than 700 mm). On the other hand, both WRF configurations report the higher amounts of accumulated precipitation over the internal mountain area of Nicaragua, with larger values for WRF2 than WRF1 (accumulated amounts in this region range between 280 and 560 mm for WRF1 and between 280 and 680 mm for WRF2). According to both WRF simulations, some peaks of precipitation occurred also along the east and west coast, but without great inland extension.

Daily maps of precipitation by CMORPH, WRF1 and WRF2 over the exposure map of XSR2.1 are not herein reported as they can be downloaded at the following link:

https://xsr.redrisk.com/OUTPUT/CCRIF/XSR/Events/NIC/CARE_7_2018/daily_prec.mp4

The final RIL associated with this event is US$17,193,262.1, computed as the average of the RILs of CMORPH, WRF1 and WRF2, since all the model RILs exceed the loss threshold. They are respectively RIL_{CMORPH}=US$9,142,070, RIL_{WRF1}=US$12,732,089 and RIL_{WRF2}=US$29,705,627. Among the three models, WRF2 produces the largest RIL because it reports the largest peak of accumulated rainfall in combination with the exposure of the country.

5 TRIGGER POTENTIAL

The Rainfall Index Loss calculated for this Covered Area Rainfall Event (CARE) was below the attachment point of Nicaragua's Excess Rainfall policy and therefore no payout is due.

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

For further information, please contact ERN-RED, the CCRIF SPC Risk Management Specialist.

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DEFINITIONS

Active Exposure Cell Percentage Threshold	The percentage of the total number of XSR Exposure Grid Cells as defined in the Schedule, with in the covered Area of the Insured, which when exceeded triggers a Covered Area Rainfall Event.
Active Exposure Grid Cells	The XSR Exposure Grid Cells for which in the same single day the Average Aggregate Rainfall value computed using the CMORPH-based Rainfall Estimate equals or exceeds the Rainfall Event Threshold.
Average Aggregate Rainfall	The Average Aggregate Rainfall amount (where the number of days in the Rainfall Aggregation Period is defined in the Schedule) as measured in millimeters per day (mm/day) in any of the XSR Exposure Grid Cells in the Covered Area of the Insured. For a given number of days n, the n-day aggregation period is the average of rainfall on the day itself and on the previous n-1 days.
Calculation Agent	Entity charged with undertaking the primary calculation of the Rainfall Index Loss as described in the Calculation Agency Agreement.
CMORPH-based Maximum Average Aggregate Rainfall	The maximum value during the Covered Area Rainfall Event of the Average Aggregate Rainfall computed using the CMORPH-based Daily 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 Daily Rainfall Estimates using the XSR Rainfall Model. Parameters are drawn from XSR Exposure Grid Cells within the Covered Area of the Insured as identified in the Cell Identification and Rainfall Exposure Value Table in the Schedule, 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 Relief Web (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 will not be considered.
Maximum Average Aggregate Rainfall	The highest value during a Covered Area Rainfall Event of the Average Aggregate Rainfall amount in any of the XSR Exposure Grid Cells in the Covered Area of the Insured computed.
Rainfall Event Threshold	Average Aggregate Rainfall level as defined in the Schedule which should be exceeded to trigger an Active Exposure Cell.
Rainfall Aggregation Period	The number of days over which the Average Aggregate Rainfall 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.
WRF1 Model	The weather research and forecasting rainfall model by NOAA with Configuration #1 data initialized 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 the Policy.
WRF2 Model	The weather research and forecasting rainfall model by NOAA with Configuration #2 data initialized 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, as provided in the Schedule.
XSR Grid Cell Exposure Value	The value, as shown in the Cell Identification and Rainfall Exposure Value Table in the Schedule, used to calculate the CMORPH-based Exposure Grid Cell Loss, the WRF1-based Exposure Grid Cell Loss, and the WRF2-based Exposure Grid Cell Loss.