CCRIF SPC
The Caribbean Catastrophe Risk Insurance Facility

On behalf of
Caribbean XSR SP

Covered Area Rainfall Event (4-9 October 2018)

Excess Rainfall

Event Briefing

Nicaragua

16 October 2018

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: www.ccrif.org | Twitter: @ccrif_pr | Facebook: CCRIF SPC

1 INTRODUCTION

In the first days of October the Nicaraguan Institute of Territorial Studies (in Spanish: Instituto Nicaragüense de Estudios Territoriales), indicated that the country remained under the simultaneous influence of two low pressure systems: one located in the Caribbean Sea near the northern border between Nicaragua and Honduras and the other in the Pacific Ocean west of San Juan de Sur. Both systems presented a slow movement that provided the opportunity for the entry of moisture and generation of rain. Therefore, authorities began monitoring flood and landslide susceptible sites (ineter.gob.ni).

This event briefing describes the impact on Nicaragua which was affected by heavy precipitation between 4 and 9 October. The Rainfall Index Loss was calculated for this Covered Area Rainfall Event (CARE),which started on 4 October and ended on 9 October 2018. 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

On 4 October, a large area of low pressure covered a portion of Central America and the western Caribbean Sea. Within this area several incidences of middle-level minimum pressure were identified from 8N87W to 15N83W (Figure 1), embedded in a moist middle-level environment (Figure 2). At the surface, the region was surrounded by a monsoon on the west, extending along the 11N90W to 9N85W axis, and a tropical wave with axis from 13N83W to 19N81W on the east (Figure 3). The flow convergence and the humidity created a favorable condition for the development of deep convection and associated heavy rain showers over the region. On 4 October at 1200UTC, the United States National National Oceanic and Atmospheric Administration (NOAA) reported that scattered moderate convection affected the western Caribbean mainly west of 75W. In the subsequent days, the low pressure system and the associated perturbed weather slowly drifted toward the northwest (Figure 3). On 5 October at 1800UTC, the NOAA reported scattered moderate to numerous strong convection (and associated thunderstorms) affecting the area from 13N to 18N between 79W and 87W. On 6 October at 1200UTC, the same intensity of precipitation activity was reported over most of the northwest Caribbean, north of 14N and west of 80W. On 7 October, this pressure configuration was still causing numerous moderate to isolated strong convection (and associated thunderstorms) from 16N to 20N between 84W and 87W. Moreover, it led to the development of Tropical Depression 14 (later becoming Tropical Cyclone Michael) at 18.6N 86.9W, as announced by NOAA at 1800UTC. On the subsequent days, the deepest convection area was associated with Tropical Storm Michael, which moved further towards the north, affecting the Yucatan Peninsula and Cuba.

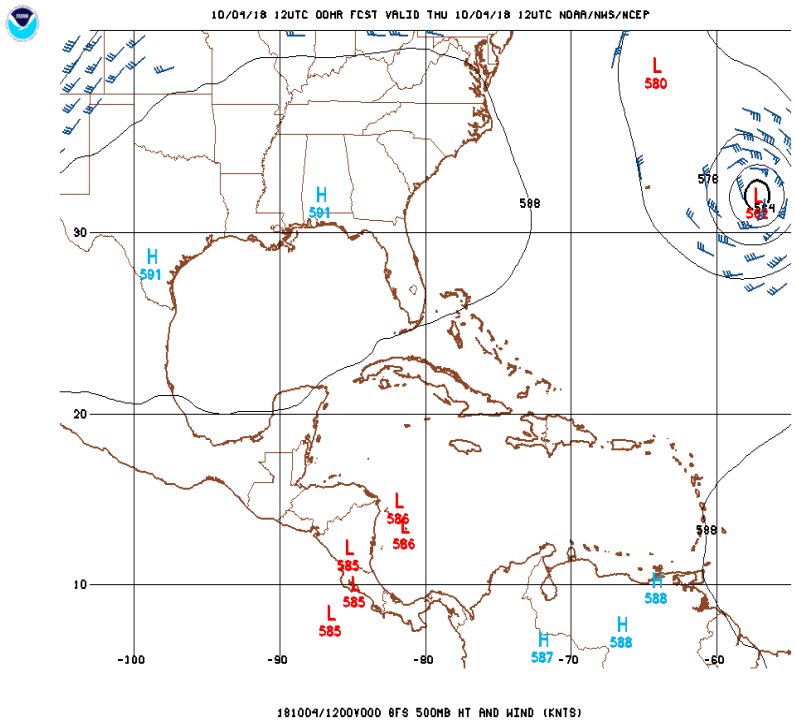


Figure 1 Geopotential height and wind speed at 500 mb on 4 October at 1200UTC. Minimum pressures are evidenced in red. Source: US National Hurricane Center (NHC).

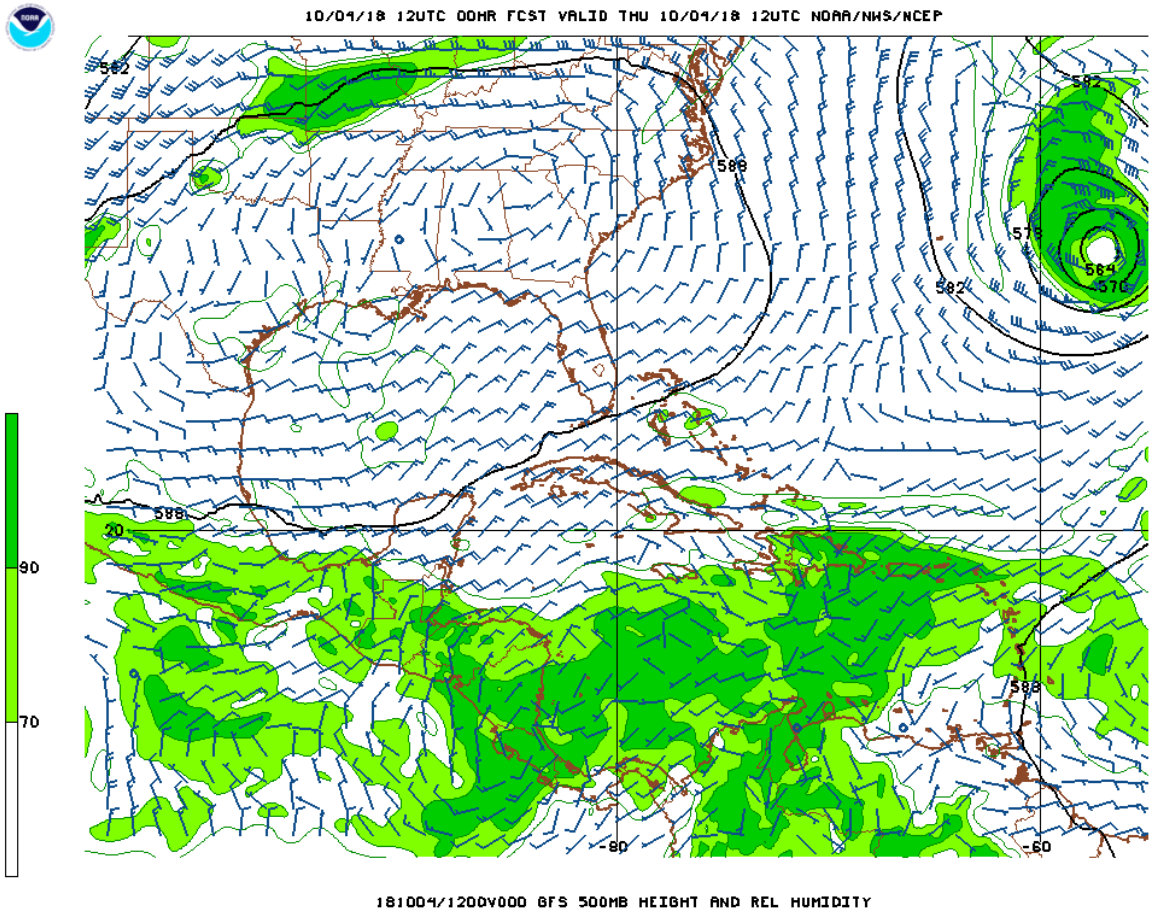
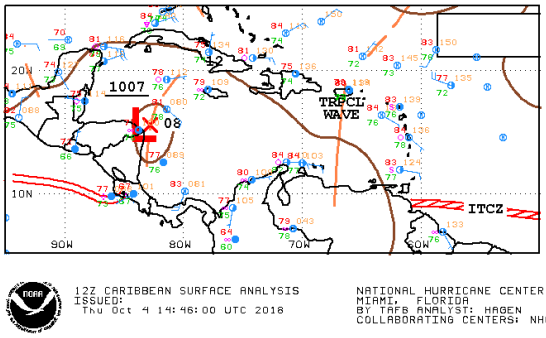


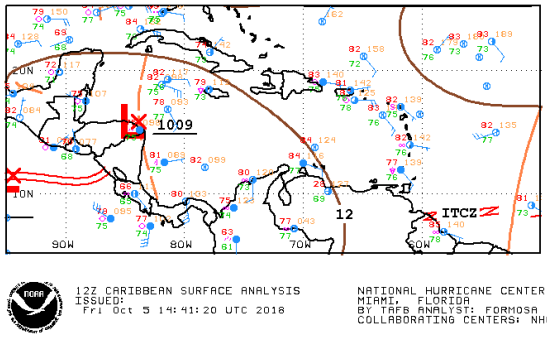
Figure 2 Geopotential height and relative humidity at 500mb on 4 October at 1200UTC.
Source: US National Hurricane Center (NHC).



12Z CARIBBEAN SURFACE ANALYSIS
ISSUED:
Thu Oct 4 14:46:00 UTC 2018

NATIONAL HURRICANE CENTER
MIAMI, FLORIDA
BY TAFB ANALYST: HAGEN
COLLABORATING CENTERS: NHC OPC

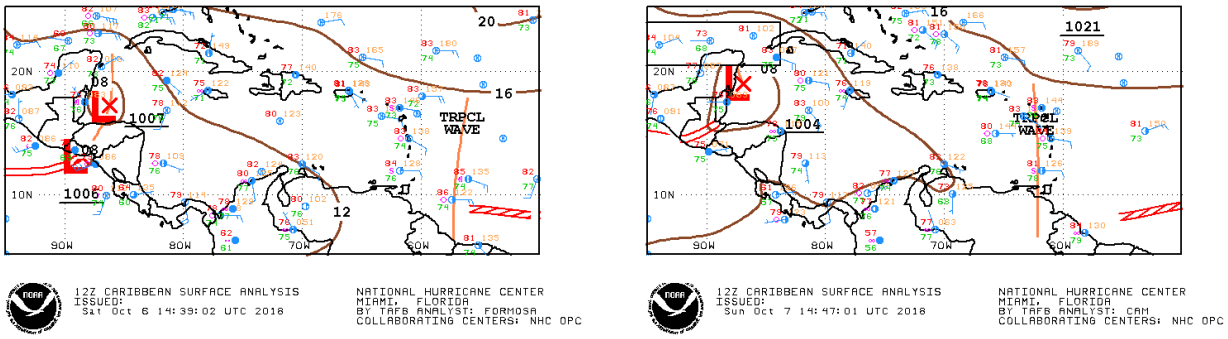
a) 4 October at 1200UTC



12Z CARIBBEAN SURFACE ANALYSIS
ISSUED:
Fri Oct 5 14:41:20 UTC 2018

NATIONAL HURRICANE CENTER
MIAMI, FLORIDA
BY TAFB ANALYST: FORMOSA
COLLABORATING CENTERS: NHC OPC

b) 5 October at 1200UTC



c) 6 October at 1200UTC

d) 7 October at 1200UTC

Figure 3 Surface analysis maps at different times. Source: US National Hurricane Center (NHC).

Over Nicaragua, the pressure configuration led to scattered moderate to numerous strong rain showers from 4 October to 9 October, as reported by the satellite precipitation estimates of the IMERG (Integrated Multi-satellitE Retrievals for GPM) dataset (Figure 4). During the event the maximum estimated accumulated precipitation over the country was on its north-western edge.

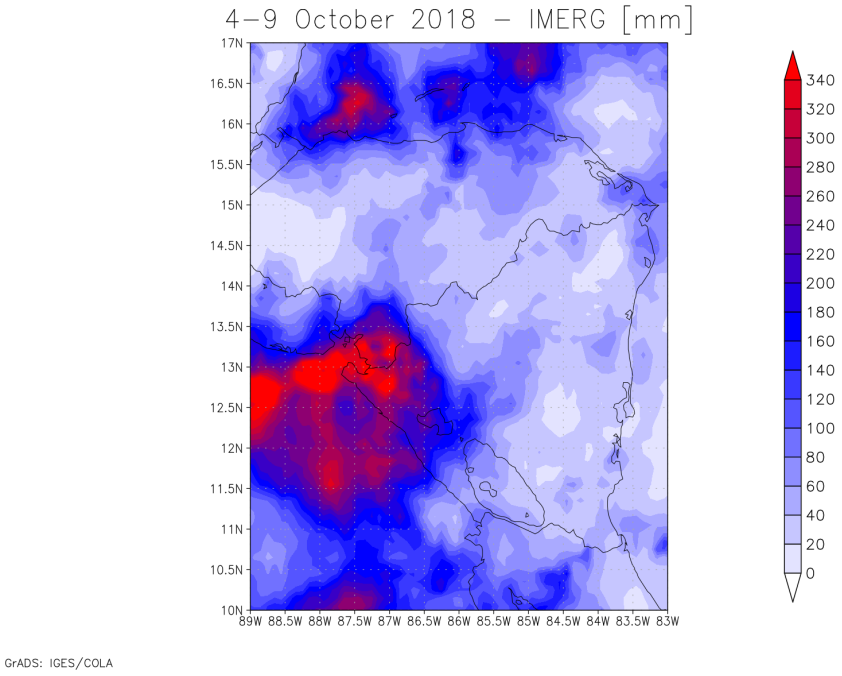


Figure 4 IMERG accumulated precipitation (rainfall) at 10 km resolution over Nicaragua on 04-09 October 2018. Source: XSR Web.

The surface rain gauges data published by NOAA (NNDC Climate data online, source: https://data.noaa.gov/dataset/dataset/global-surface-summary-of-the-day-gsod) presented several missing data in the period 4-9 October. Consequently, it was not possible to determine the accumulated precipitation value in the period for any of the measuring stations. Since CCRIF does not use the data from these gauges for the XSR modelling, the lack of these data does not affect the performance of the model.

3 IMPACTS

According to Vice President Rosario Murillo there were 4 confirmed deaths. Also, 24,461 people were affected by flooding of roads, houses and other buildings. The departments most severely impacted were Granada, Carazo, Boaco, Estelí, Matagalpa, Caribe Norte, Rivas and Managua.

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

- 374 communities in 73 municipalities of 13 departments were affected
- 6,665 people were evacuated
- 6,018 families and 5,000 homes were affected
- 8,000 people were left without water supply
- Some rivers overflowed their banks

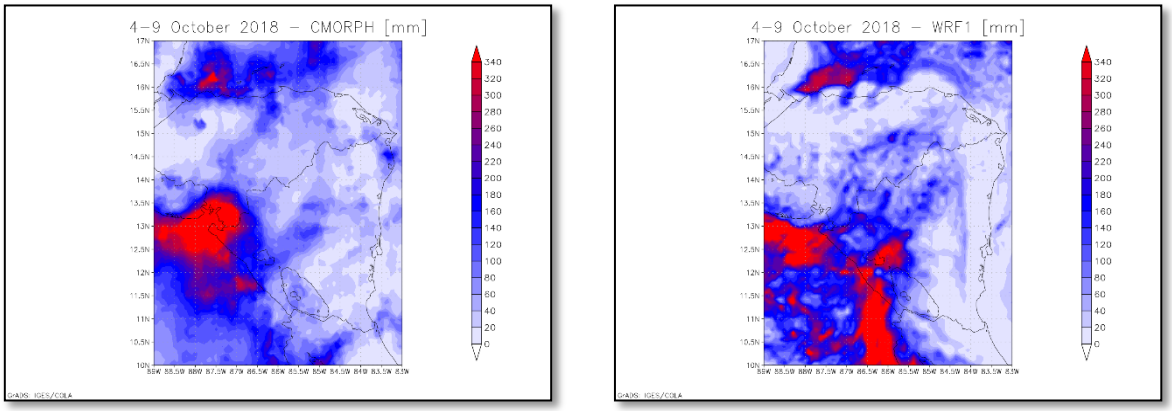
Figure 5 shows some of the flood damage caused by heavy rainfall in Nicaragua.

Figure 5 Damage caused by heavy rainfall in Nicaragua – October 2018.
Sources: *El Nuevo Diario*

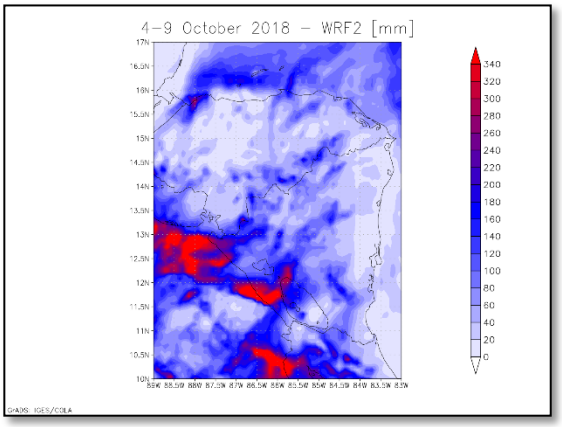
4 RAINFALL MODEL OUTPUTS

All three models used by the XSR 2.1 model, CMORPH[1], WRF1 and WRF2[2], simulated the heavy precipitation associated with the low pressure systems in the region during the period 4-9 October 2018.

CMORPH simulated the highest precipitation occurring at the western edge of the border between Nicaragua and Honduras and the surrounding waters (Figure 6), while WRF1 and WRF2 simulated the highest precipitation over the Pacific coast of Nicaragua, just inland and over the surrounding waters (Figure 6).



a) CMORPH b) WRF1



c) WRF2

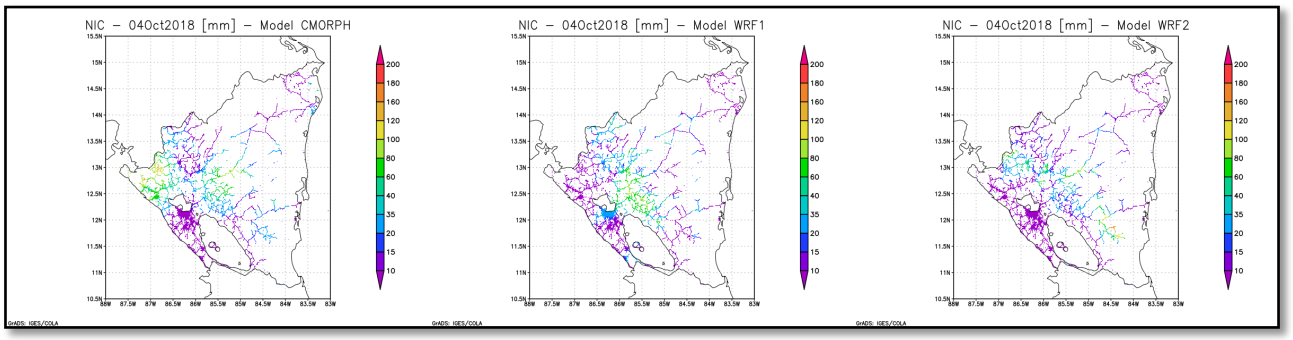
Figure 6 Accumulated precipitation at 8km resolution during 4-9 October 2018 simulated by the models CMORPH, WRF1 and WRF2. Source: XSR Web

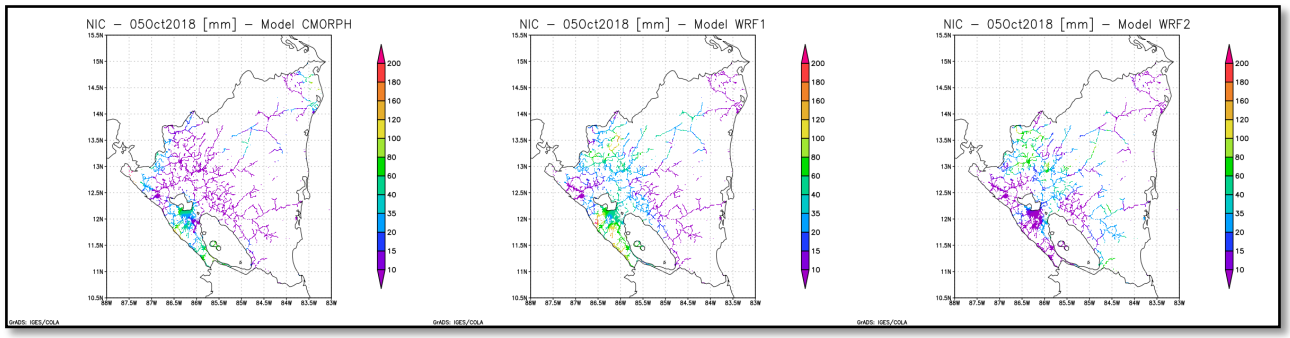
[1] CMORPH Model: the satellite-based rainfall precipitation estimates provided by the NOAA Climate Prediction Center (CPC) using the so-called Morphing Technique http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph_description.html. Further details in the Definitions section of this report.

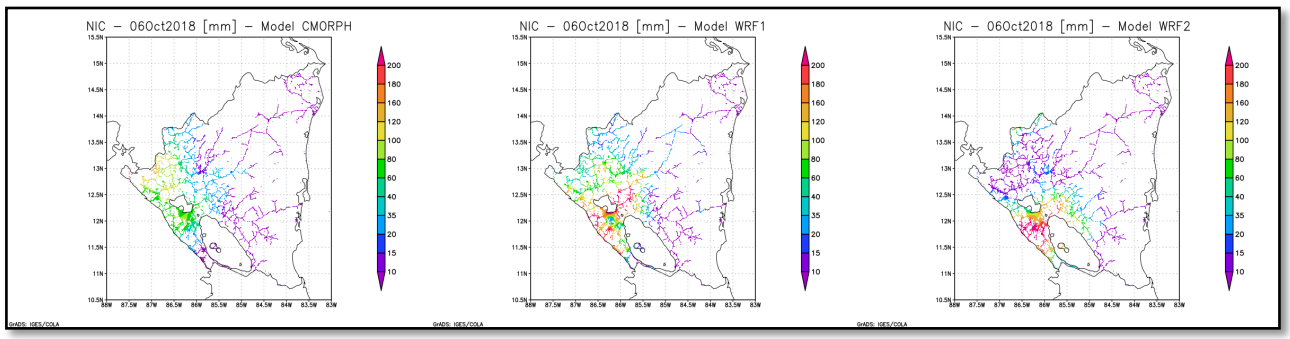
[2] WRF1 and WRF2 Models: the Weather Research and Forecasting Model weather model-based Configuration #1 and #2 data https://www.mmm.ucar.edu/weather-research-and-forecasting-model. These data are initialised by the NCEP FNL dataset. (NCEP FNL Operational Model Global Tropospheric Analyses [http://rda.ucar.edu/datasets/ds083.2/]).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

Over Nicaragua (Figure 7):

- CMORPH simulated the greater part of the rainfall falling between 4 and 7 October. On 4, 5 and 6 October, the daily accumulated precipitation was estimated higher than 40 mm (with a maximum above 120 mm) over the northwest, west and central portions of the country.
- WRF1 similarly showed the greater part of the rainfall affecting Nicaragua between 4 and 7 October. Precipitation of more than 40 mm was simulated on the west side of the country, with a maximum above 200 mm on 6 October in the area surrounding Managua.
- WRF2 simulated a pattern of precipitation similar to that produced by WRF1, with values higher than 40 mm over the west portion of the country on 4, 5, 6, and 7 October. Maximum values of above 200 mm were simulated on 6 and 7 October in the region around Managua and over the northwest of the country.







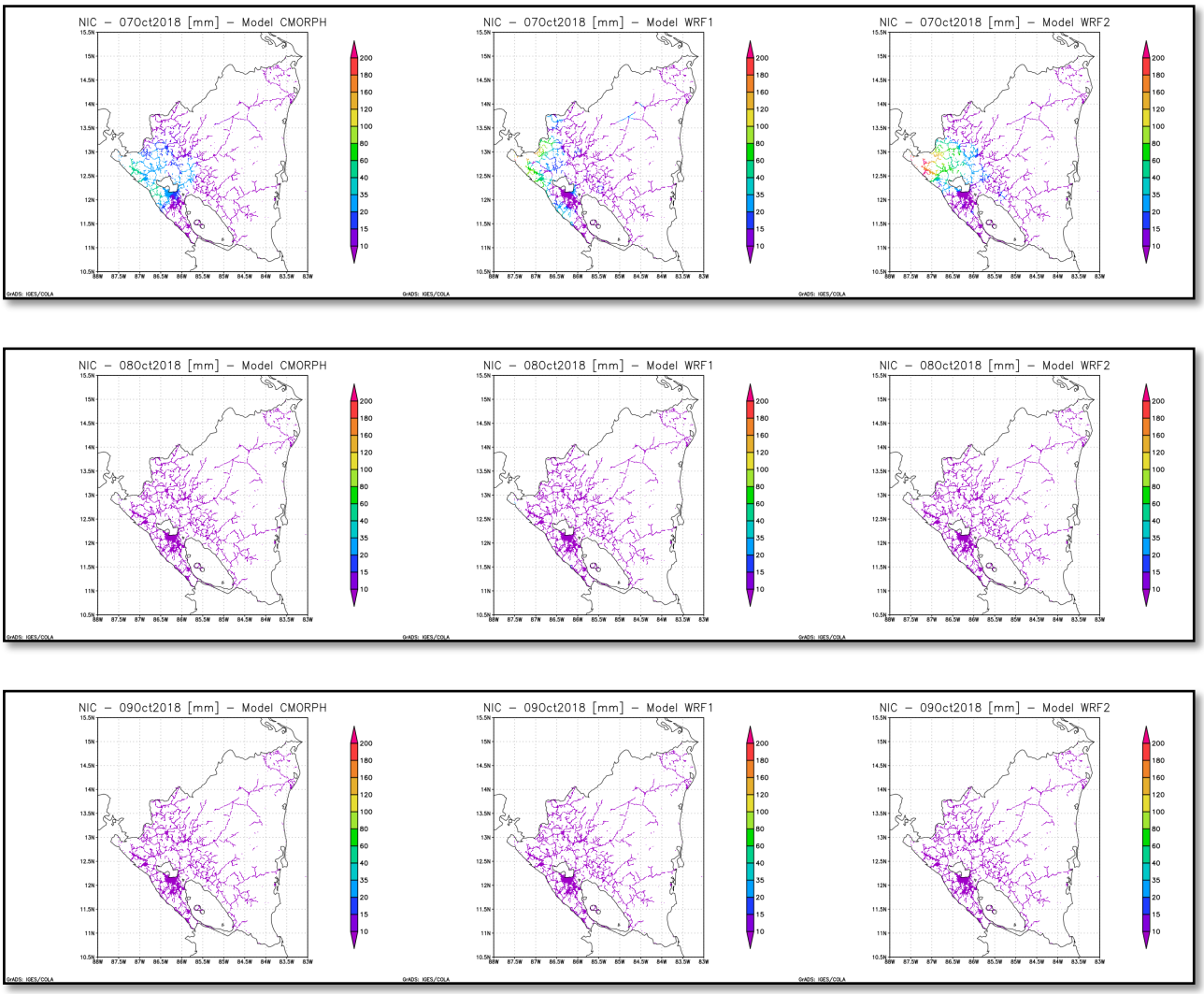


Figure 7 Accumulated precipitation (rainfall) at 1km resolution over Nicaragua exposure on 4, 5, 6, 7, 8 and 9 October 2018 (from top to bottom) by CMORPH (left), WRF1 (centre) and WRF2 (right). Source: XSR Web.

The highest Rainfall Index Loss (RIL) was produced by WRF1 (RIL_{WRF1} = US$49,165,072.41), because it simulated higher and more extended accumulated values of precipitation compared to the other models, especially in western Nicaragua (characterized by high exposure). WRF2 produced a lower RIL value (RIL_{WRF2} = US$27,364,458.27), because the rainfall was estimated less spatially extended over the western area. CMORPH produced the lowest RIL value (RIL_{CMORPH} = US$19,493,451.78), because the highest accumulated rainfall values were simulated on the north-western edge of the country, where the exposure is lower.

All three models produced a Rainfall Index Loss larger than the Country Loss Threshold (US$5,430,000). Therefore, the final RIL for this event is equal to the average of the RILs of CMORPH, WRF1 and WRF2. The final RIL is US$32,007,660.83. Given that the final RIL is lower than the attachment point for Nicaragua's Excess Rainfall policy, this event is classified as a loss event and does not trigger a payout.

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.

Evaluación de Riesgos Naturales
Vito Alessio Robles No.179
Col. Hda. Gpe. Chimalistac.
Del. Álvaro Obregón. CP 01050, México D.F.
+52 (55) 5616-8161, 62, 64
cavelar@ccrif.org

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.