

Introduction

- Dominica (Fig. 1) is vulnerable to strong winds, rain, and floods. (Benson and Clay 2001)
- Tropical cyclones (TCs) are frequent in occurrence and contribute significantly to the rainfall climatology in the Caribbean. (Hernández Ayala, and Matyas 2016)
- Over 22.8 inches (579 mm) of rainfall occurred during Hurricane Maria (2017) (Pasch et al., 2019)
- 80% of Dominica's population effected, & 90% of infrastructure destroyed by Maria (Barclay et al., 2019)
- Numerous studies on TCs and rainfall for Puerto Rico; few for Dominica

Study Region-Dominica

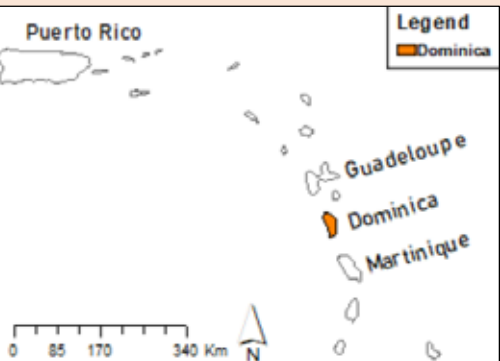


Figure 1: Map of the Lesser Antilles showing Dominica between Martinique and Guadeloupe, 637 km from Puerto Rico.

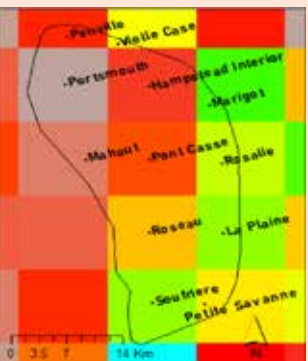


Figure 2: IMERG grid cells covering Dominica. Each cell covers 0.1 x 0.1°.

Data & Methods

Establishing rainfall amounts for Dominica:

1. Downloaded and pre-processed Integrated Multi- Satellite Retrievals (IMERG) data from Nasa.gov for monthly (2000-2019) and half hourly (September 18-20, 2017) rates of precipitation available globally
2. Maria data obtained from National Hurricane Center (Pasch, et al. 2019)
3. Using Geographic Information System (GIS) - Extracted values from 14 grid cell that intersected with Dominica (Fig. 2)
 - a) Calculated 20-year average for monthly data set
 - b) Visualized rainband locations to determine rainfall start and end times for Maria; summed 30- minute data for time before and after landfall

Results: 20 Year Average (Fig. 3)

1. Rainfall is highest in the Eastern part of the island.
2. Highest rainfall occurs during hurricane season, October (160-250mm).
3. Lowest rainfall occurs in February (20-40mm).

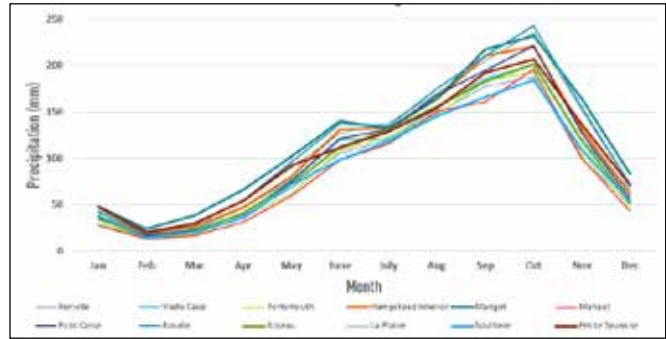


Figure 3: Average rainfall at each location marked in Fig. 2 over the 20-year period.

Results: Maria Analysis

1. Hurricane Maria produced rain for 45 hours starting at September 18, 2017, at 0600 UTC (Fig. 4a) and ending on September 20, 2017, at 0300 UTC (Fig. 4c).
2. Similar pattern in rain rates across the island, but peaks occurred at different times (Fig. 5).
3. Mahaut received the least (359mm), and Marigot received the most amount of rain (509mm). Overall rainfall is within 15mm to NHC report.
4. More rain after Maria's landfall (Fig. 6) due to rainbands behind storm center (Fig. 4b)

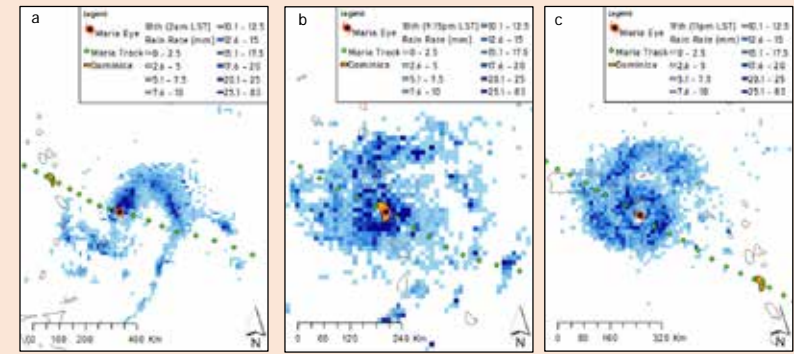


Figure 4: Raster layer of rainfall before landfall (a), at landfall (b), & after landfall (c). See fig.5 for individual locations peaks.

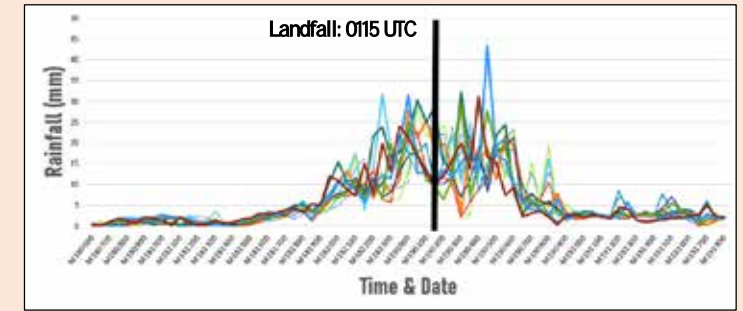


Figure 5: Maria rainfall time series. Peak rainfall from September 18th-19th 2017 over locations marked in Fig. 2. Use legend from Fig. 3.

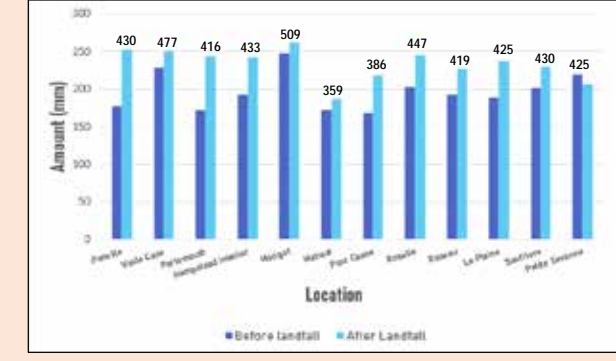


Figure 6: Total rainfall at each location marked above, measure in mm.

Research Questions

1. How much rainfall is received in each grid cell on average each month? (Fig 2)
2. How long did Hurricane Maria produce rain across the island?
3. How much rainfall was produced at each location and which location received the highest amount of rainfall?
4. Was there more rain before or after landfall?



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References

- Barclay, J., Wilkinson, E., White, C., Shelton, C., Forster, J., Few, R., Lorenzoni, I., Woolhouse, G., Jowitz, C., Stone, H. and Honychurch, L., 2019. Historical Trajectories of Disaster Risk in Dominica. *International Journal of Disaster Risk Science*, 10(2),149-165.
- Benson, C., Clay, E., Michael, F., & Robertson, A. (2001). The World Bank. Dominica: Natural Disasters and Economic Development in a Small Island State, 2, 1-5. <https://www.gfdr.org/sites/default/files/publication/Dominica%20Natural%20Disasters%20and%20Economic%20Development%20in%20a%20Small%20Island%20State.pdf>
- Hernández Ayala, J. J., & Matyas, C. J. (2016). Tropical cyclone rainfall over Puerto Rico and its relations to environmental and storm-specific factors. *International Journal of Climatology*, 36(5), 2223-2237.
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