FLASH Guidance Validation: The Puerto Rico Study

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Abstract

Flash floods are a year-round hazard in Puerto Rico and the U.S. Virgin Islands. In Puerto Rico and nationwide, the National Weather Service (NWS) issues Flash Flood Warnings (FFWs) to alert the public, emergency management, and cooperating agencies when flash flooding is occurring, imminent, or highly likely.During the issuance of FFWs, the NWS Weather Forecast Office (WFO) evaluates factors such as Flash Flood Guidance (FFG) exceedance and the Average Recurrence Interval (ARI), which are part of the Flooded Locations and Simulated Hydrographs (FLASH) project. Although recommended FFG and ARI values are available in the literature for issuing FFWs, these values were validated primarily at sites within the continental U.S. (CONUS). This research aimed to validate the guidance for locations outside of CONUS (OCONUS), such as Puerto Rico. The study involved retrieving Local Storm Reports from the NOAA Storm Database from October 2020 to May 2024 and comparing them with corresponding FFG and ARI values obtained from FLASH using the Multi-Radar Multi-Sensor (MRMS) interface. The results showed that the recommended FFG values apply to Puerto Rico, as flash flood reports aligned with the expected range.However, the recommended ARI values for issuing FFWs were significantly lower across the island, with nearly 60% of flash flood reports occurring below the suggested 10-year ARI threshold.

Background

The purpose of this research is to validate threshold values from Flash Flood Guidance and Average Recurrence Interval. They are part of The Flooded Locations and Simulated Hydrographs Project (FLASH). Meteorologists rely on these tools to know when would be the perfect time to issue Flash Flood Warnings and Flood Advisories. To do this, they rely on guidance models like the one in **Figure 1** based on the use of FLASH and MRMS. Flash Flood Guidance is an estimate of how much rainfall is needed for flooding or flash flooding to analyze the likelihood of a Flash Flood occurring, while Average Recurrence Interval is a ratio based on the probability that an atmospheric event can be exceeded or equal during a certain year. While they have been validated throughout most of the United States, hey have yet to be validated in Puerto Rico.

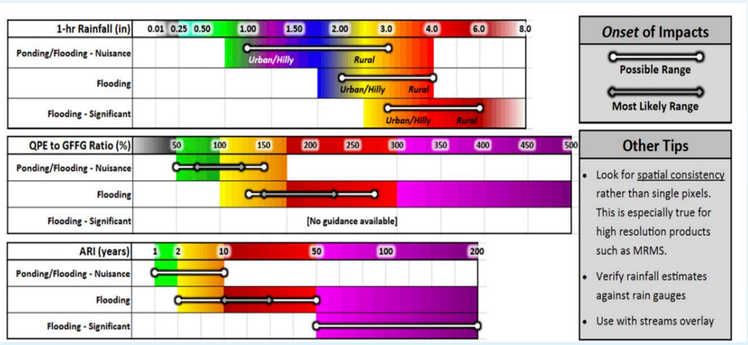


Figure 1:Guidance Model used for the research. This model was first used in an article by Jonathan Gourley and Humberto Vergara as a reference guide for emitting Flood Warnings

Results

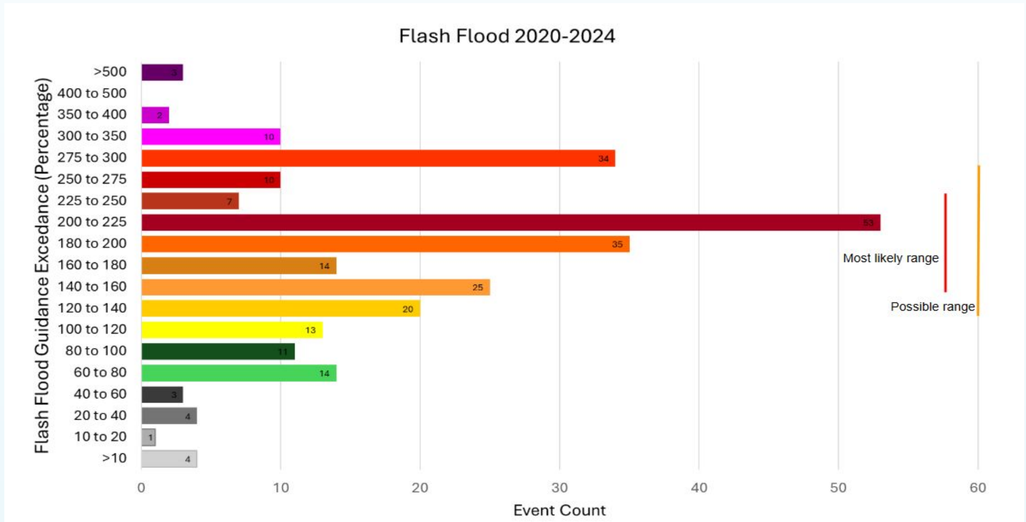


Figure 2: Flash Flood Guidance Values taken from Flash Flooding Events in Puerto Rico. The possible and most likely ranges are to signal when the meteorologist should emit a Flash Flood Warning. A total of 263 events were found.

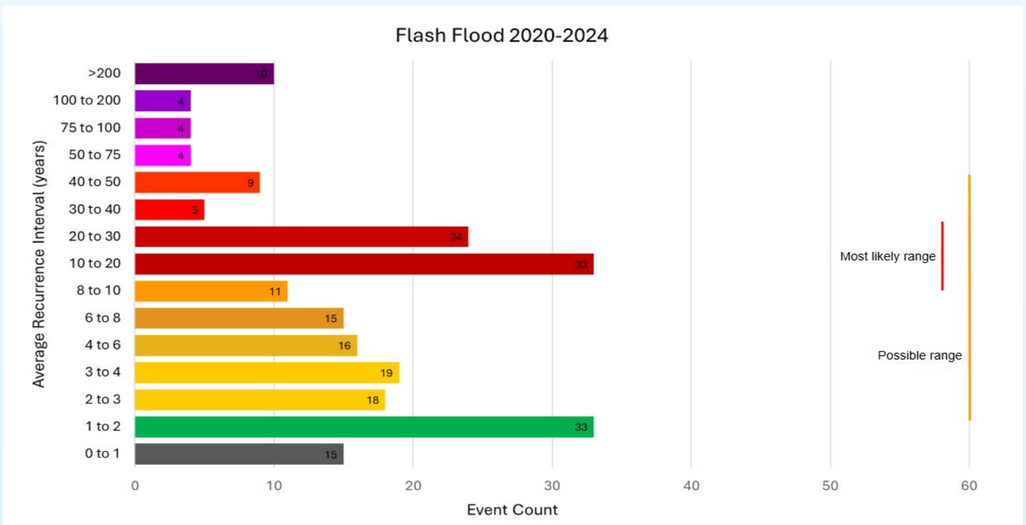


Figure 3: Average Recurrence Interval Values taken from Flash Flooding Events in Puerto Rico. The possible and most likely ranges are to signal when the meteorologist should emit a Flash Flood Warning. A total of 220 events were found.

Methodology

1. We Retrieved Local Storm Reports (flash floods) from the NOAA Storm Database. Period of Record: October 2020 to May 2024.
2. Retrieved Flash Flood Guidance (FFG) Exceedance and Average Recurrence Interval (ARI) values from FLASH using the Multi-radar multi-sensor (MRMS) interface.
3. Identify if the guidance provided in the literature applies to Puerto Rico.
4. It is recommended that Flood Advisories and Flash Flood Warnings are issued if the values coincide with the following guidance model:

Discussion

- Flash Flood Guidance Exceedance recommended values apply to Puerto Rico with most of the Flash Flood Reports observed within the expected range.
- Although the recommended values of the Average Recurrence Interval to issue Flash Flood Warnings are values greater than 10 yrs; NWS warning meteorologists need to pay close attention to lower values since impacts/reports are observed.
- It is recommended that the “most likely” range of ARI change for Puerto Rico.
- Two main factors forecasters consider:
- If the storm intensifies and starts affecting the behavior of the flood
- If the storm moves to another nearby area that may also be affected by flooding

Recommendations and Future Work

Evaluate if the flash flood cases analyzed in this study were warned, particularly those in the lower range of the Average Recurrence Interval. By doing this, there might be a higher probability for meteorologists to emit Flash Flood Warnings when the ARI values are lower.

It is also important that meteorologists should not only look at the ARI values but also how the storm is behaving. If the storm is showing signs of intensifying and maturation, then they should pay attention to it and whether it will impact the population.

Acknowledgements

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