FLOOD IMPACTS ON CRITICAL INFRASTRUCTURE IN A COASTAL FLOODPLAIN IN WESTERN PUERTO RICO DURING HURRICANE MARÍA

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Flooding during extreme weather events damages critical infrastructure, property, and threatens lives. This paper describes the development of a hydrologic model using the Gridded Surface Subsurface Hydrologic Analysis (GSSHA), capable of simulating flood depth and extent for the Añasco coastal flood plain in Western PR. The purpose of the study was to develop a numerical model to simulate flooding from extreme weather events and to evaluate the impacts on critical infrastructure and communities; Hurricane María is used as a case study. GSSHA was calibrated for Irma, a Category 3 hurricane, which struck the northeastern corner of the island on 7 September 2017, two weeks before Hurricane María. The upper Añasco watershed was calibrated using United States Geological Survey (USGS) stream discharge data. The model was validated using a storm of similar magnitude on 11–13 December 2007. Owing to the damage sustained by PR's WSR-88D weather radar during Hurricane María, rainfall was estimated in this study using the Weather Research Forecast (WRF) model. Flooding results were compared with forty-two values of flood depth obtained during face-to-face interviews with residents of the affected communities. Impacts on critical infrastructure (water, electric, and public schools) were evaluated, assuming any structure exposed to 20 cm or more of flooding would sustain damage. Calibration equations were also used to improve flood depth estimates. Our model included the influence of storm surge, which we found to have a minimal effect on flood depths within the study area. Water infrastructure was more severely impacted by flooding than electrical infrastructure. From these findings, we conclude that the model developed in this study can be used with sufficient accuracy to identify infrastructure affected by future flooding events.