# TWO METHODS FOR DETERMINING THE EXTENT OF FLOODING DURING HURRICANE IRENE IN SCHENECTADY, NY

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In late August 2011, Hurricane Irene caused widespread flooding throughout the state of New York. This research compares the accuracy of two different methods for flood simulation: one which utilizes photographs of the flooding, and one which utilizes field data. Most existing papers utilized field methods to assess past flooding events, an approach which is not always practical. This research utilized a GIS software called GlobalMapper 17.0 (GM) and LiDAR data of the study area was used to model the ground surface. To begin, we obtained photographs showing water levels during the flood. The locations shown in each photograph were identified and tagged as placemarks in Google Earth. The collection of points was extracted as a .kmz file and imported into GM over the LiDAR digital elevation model. A 3D reconstruction model of the flood at the study area was then created using the GM 3D view capabilities. Within the 3D view window we increased the level of the flood water until it approached what was seen in the photographs. We then adjusted the flood level and found the minimum and maximum values that best match the pictures at each point.

A second set of data was obtained by visiting the study area and collecting GPS readings at each site with a Trimble GPS unit using the flood photographs to determine the water level. Once it had been identified, we placed the Trimble unit at that elevation and obtained a position with a horizontal accuracy of less than 0.2 m. To obtain more accurate points, a Trimble Tornado external antenna mounted on a 2.0 m pole was used to facilitate higher accuracy. Post-processing correction was done in ArcMap using a single base (Continuously Operating Reference Station (CORS.) A LiDAR digital elevation model was interpolated in GM to fill any gaps, and the maximum depression depth to be filled was fixed at 0.5 m. Using the water rise simulation capabilities in GM, we modeled flooding of the study area by increasing the water level of the Mohawk river from the level of 69.59 m, as derived from the GPS survey. The flood simulation of the photographic data had a consistent error of ± 0.2 m. The corrected GPS data contained an elevation error that ranges from 0.2 m to 0.82 m.

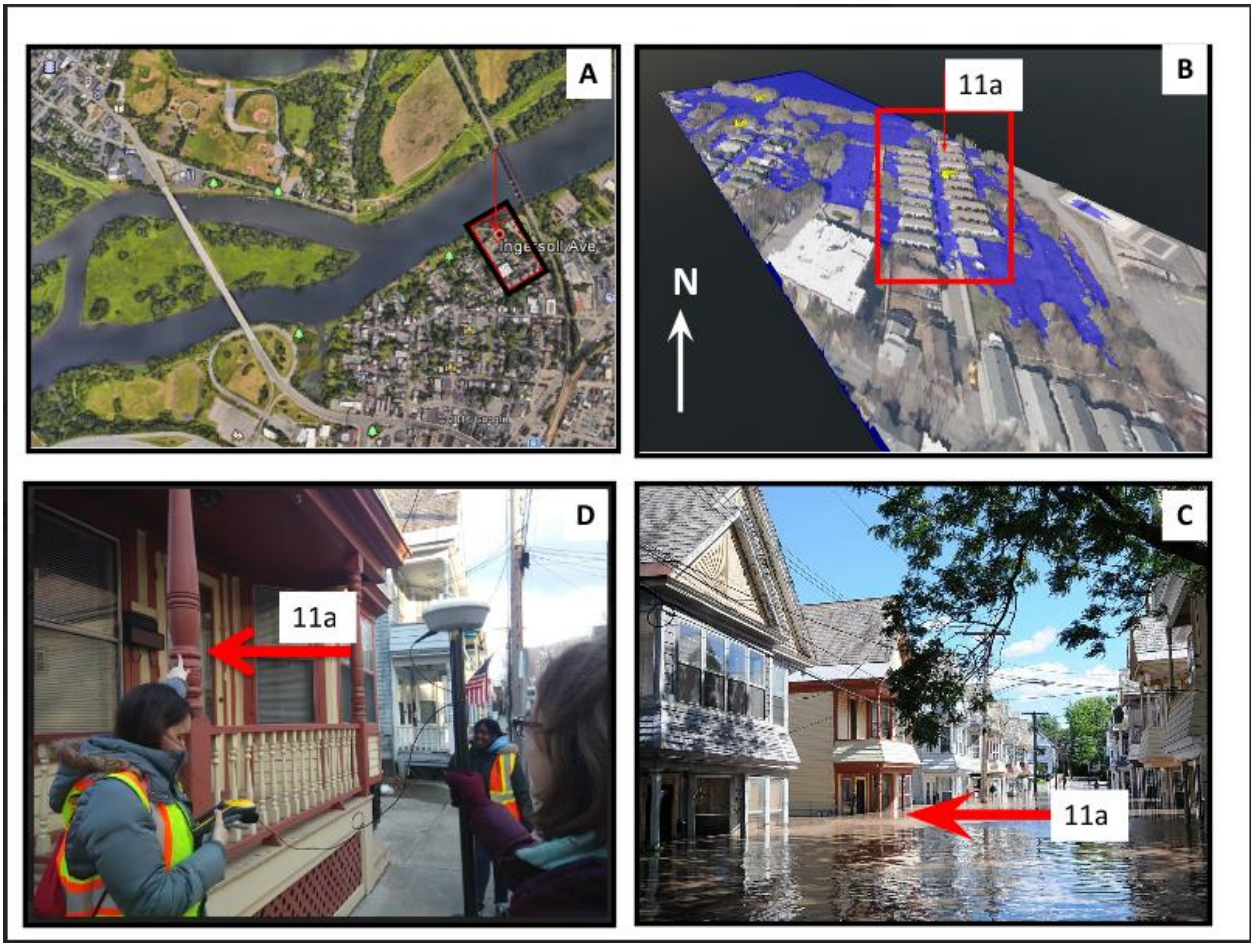


*Figure 1*: (A) Site 11a in Google Earth; (B) GlobalMapper simulation of the flood at site 11a using LiDAR data; (C) Flooding on Ingersoll Avenue in Schenectady, 2011; (D) Indicating high water mark at site.

The GPS data was less accurate than expected, which could be attributed to the large number of structures creating a multi-path effect from the multiple reflections of the GPS signal. At one site, an elevation far outside the expected range was recorded, probably as a result of these errors. However, the flood map created with GPS data matches quite closely with aerial images of the flooding, indicating the potential of this technique. It would likely be better researched in areas with fewer obstructions or with longer GPS observation times that will diminish the multi-path effect from the structures.

We would like to thank Hofstra University, as well as the Long Island Association of Professional Geologists, for the opportunity to present our research.