Evaluation and Analysis of the Environmental Impact of the June 28, 2013 Flood in Herkimer, New York Using GIS and Other Reconstructive Data

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Abstract

Herkimer, New York is a village located in Herkimer County, north of the Mohawk River. Herkimer is a relatively flat floodplain spanning roughly 2.5 miles. This is an area that is accustomed to frequent flooding, having experienced around eighty-five flood events from 1960 to 2012 according to a New York State Storm Recovery report (Governor's Office of Storm Recovery, 2014). The June 28th to July 2nd flood event in Herkimer involved days of heavy rain that led to the river flooding. This flooding led to widespread economic and environmental damages in the Herkimer County area. Research relevant to our reconstruction looked at the history of flooding on the Mohawk River from 1634 to 2000. It was observed that since 1914, there has been a decline in frequency and magnitude of flooding on the Mohawk River (Johnston & Garver, 2001). Our review has indicated that flooding has been increasing on the Mohawk River since the early 2000's which is supported by research done by the NY State ClimAID Team in 2011.

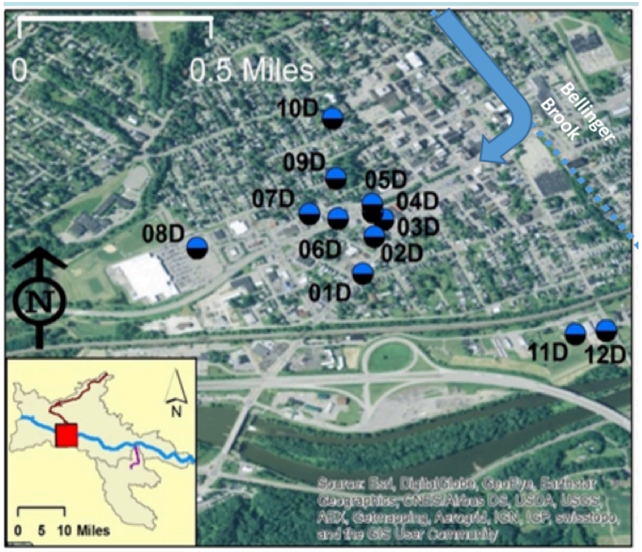
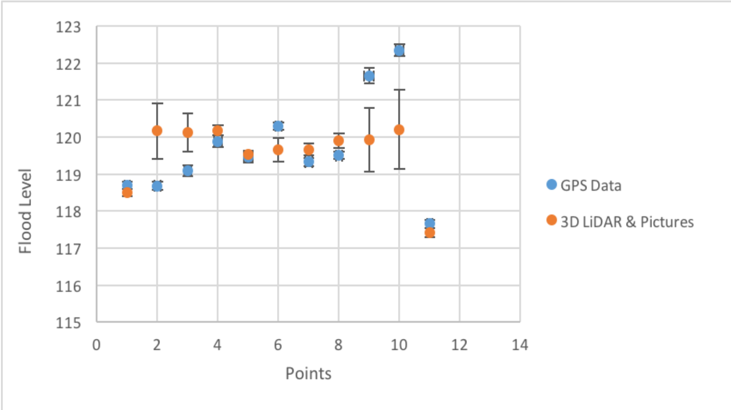


Figure 1. Aerial view of Herkimer, NY with points representing the location of the used pictures and the GPS measurements (blue and black dots). Blue arrow indicates flooding of Bellinger Brook.

Our reconstruction of the water levels during the 2013 flood in Herkimer village was created in the lab and by visiting the study area. Using ArcGIS and Global Mapper software, we were able to reconstruct the flood in 2D and 3D operations. The flood image locations were also visited to obtain a more precise reading of possible flood levels. Differential GPS survey at the flooded sites seen from the images has allowed us to provide higher accuracy of the high water marks at the partially flooded structures. To assess the environmental damage caused by the flood, we researched NY State storm recovery data. The length of the river was 6.325 km with a minimum elevation of 113.619 m and a maximum elevation of 121.475 m. The slope of the river was 0.08 degrees. Most of the points had flood levels of similar value, ranging between 117 to 122 meters in the GPS data and 117 to 120 in the simulation data. The highest error amount between our simulation and the GPS data came at point 10D, with an error of ±1.07. Point 05D had the smallest error of ±0.03. The GPS data we took in the field had high accuracy compared to the Picture-LiDAR simulation, so the flood simulation incorporating flow network and considering barriers that affect the flood extent was run twice in Global Mapper. The first simulation utilized the GPS survey data and the second the picture data. Figure 2 plotted the GPS data against the Picture-LiDAR data alongside the error as seen by the error bars. The environmental damages of the flood were mainly water pollution that followed the aftermath of the flood. Recreational and drinking water sources were reported for pollution and one hundred miles of the New York State Canal System were closed due to debris build up. Mudslides were also triggered on the outskirts of Herkimer Village (Governor's Office of Storm Recovery, 2014).

Figure 2. GPS data and Picture-LiDAR data plotted with error bars.



The post-processing of the GPS data and flood simulation has shown limitations of the 3D reconstruction but not for the flow network and resulted flood map of the area. The 3D reconstruction of the flood is capable of local flood levels determination that does not account for any kind of disruptions in the landscape like buildings or barriers. For example, when we simulated the flood at the baseball field, it continuously flooded the street by the field, even though that street was not flooded in the photo of the field during the flood. This can be explained as the flood simulation rises the water level and considers terrain features as barriers of the water flow such as the fence surrounding the field. Another significant flood factor that was not identified by the 3D reconstruction of the flood at the study area was the existence of a brook that runs through the town of Herkimer. We are assuming that during the summer of 2013 the brook aided to flooding in the town.

Reconstruction of past flood events is important specially to determine the impact it had on the surrounding environment. By addressing the actual and possible damage, this project could be used to help shape policy that prevents damages in future floods. With the prediction of a rise in floods due to global warming this research may be applicable to coastal flooding as well. The economy, environment, and health of the people of Herkimer would be benefit by enhanced research and implementation of changes to protect the community and enhance the resilience of the local infrastructure. We believe that this research can help to increase preparedness and possibly lead to the implementation of policy to protect residents from the harmful impacts of future floods.

References

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