The primary objective of this project is creating a time lapse visualization of runoff extent during a rainfall event in upstate New York, and performing a local Moran's i analysis of rain gauges in NY state. In order to perform this analysis, data will primarily be collected from USGS, specifically precipitation, baseflow, discharge values, and elevation data. The site selected is Oatka Creek, Warsaw, NY. This site was selected because it has a small drainage basin of approximately 40 square miles, has precipitation and discharge measurements, and has undergone a recent rain event.

In order to calculate the runoff extent, I will first need to calculate total runoff volume in cubic feet, or how much runoff is produced in the storm event. This is calculated first by subtracting the baseflow, or the amount of discharge before the storm, from the current discharge values, the difference will be then multiplied by the time interval (15 minutes) in seconds, to obtain the volume of runoff in each time interval. Next, runoff velocity will be calculated by using the rational method (Chin, 2021). There are several assumptions of using the rational method, including assuming uniform rainfall across the drainage basin, and the frequency of runoff and rainfall are equal (Chin, 2021). It is additionally recommended that this method is used in drainage basins of 30 square miles or less, which is why the specific site was chosen, as it was the smallest drainage basin with the needed data. By calculating the total volume of runoff, and the rate of runoff in cubic feet per second, the distance traveled by the runoff will be able to be determined. This math will be done in python by manipulating a csv file that has discharge and precipitation values per fifteen minute interval, where each column is a variable and each row is the following time interval. USGS provides drainage basin area, so a buffer will need to be created around the rain gauge to equal the area of the drainage basin.

Once the distance traveled by runoff is calculated per fifteen minute interval, I will visualize these results in a time series graphic, displaying the runoff per fifteen minute time interval during the event. One challenge of this will be determining how the elevation influences the flow of water. I will have calculated the distance moved by the water per time interval, but that does not tell us where it is moving to, and will be heavily influenced by the slope of the landscape. This part of the methodology still has to be developed. To create the visualization, geopandas and matplotlib will be used. A rain event occurred at the selected location on October 3rd, 2021 and lasted for about 24 hours. This means that 96 different scenes will need to be visualized, because there are 96 15 minute intervals within one day. The data obtained to be used in calculations will also be in this format in a csv.

Lastly, a local Moran's i will be performed to assess for spatial correlation of the rain gauges in NY state. A shapefile with the locations of rain gauges can also be downloaded from USGS and the point locations will be used in the Moran's i.

Literature:

Chin, David A. “Estimating Peak Runoff Rates Using the Rational Method.” Journal of Irrigation and Drainage Engineering, vol. 145, no. 6, 2019. doi:10.1061/(ASCE)IR.1943-4774.0001387. Accessed 15 Oct. 2021.

Lapides, Dana Ariel, et al. “Implications of Distinct Methodological Interpretations and Runoff Coefficient Usage for Rational Method Predictions.” Jawra Journal of the American Water Resources Association, (202108), 2021, doi:10.1111/1752-1688.12949.

Mushtaha, Ashraf & Van Camp, Marc & Walraevens, Kristine. (2019). Quantification of Recharge and Runoff from Rainfall Using New GIS Tool: Example of the Gaza Strip Aquifer. Water. 11. 84. 10.3390/w11010084.

Data source:

<https://waterdata.usgs.gov/monitoring-location/04230380/#parameterCode=00045&startDT=2021-10-03&endDT=2021-10-09>