carolinas climate resilience conference

Presenter

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Intensifying storm dynamics: Implications for surface water quality management and the value of long term gage records

Global climate change creates a range of management challenges, including for the management of surface water quality pollution. However, uncertainty in future climate drivers and the resulting ranges of climate responses complicate adaptive pollution management and planning, and can also be cause for non-action. Since rainfall is the primary driver for surface water quality pollution and is likely to be affected by climate change, an exploratory analysis of changing rainfall dynamics has the potential to inform adaptation strategies in the present.

In this work, we use long term hourly precipitation gage records to explore the extent to which storm dynamics have changed in recent decades, concurrent with increasing atmospheric concentrations of GHGs. First, we apply an automated storm separation script to extract all identifiable storm events from selected NOAA and USGS gage records. For each identified storm we then extract event statistics (i.e., total depth; maximum hourly intensity), creating a large data set for analysis at each site. Finally, we bin the storm statistics in 10-year sliding windows and extract the 90th percentile value from each bin, creating time series' that span the periods of record.

Using this approach at NOAA gages in Charlotte, NC, Atlanta, GA, and Chattanooga, TN dating back to the 1940s, we extract over 4000 storm events per site and find that the highest 90th percentile maximum hourly intensities have occurred in the most recent two decades at all three sites, along with suggestively upward trends over time. Applying this analysis approach to a set of 71 USGS rain gages in and around Charlotte (dating from the 1990s), we find 26 sites with a significant upward trend in maximum hourly intensity (slope >0; r2 >0.75, p value <0.05), 1 site with a nominally significant downward trend (slope < 0; r2 >0.75, p value <0.05), and 44 sites that do not have a significant explanatory trend. Ongoing work is applying the same analysis framework to other long term NOAA sites around the US to explore the extent to which this dynamic is found outside of the southeast.

Lastly, to connect this work with the generation of surface water pollution we will discuss the dependency of peak flow rates, soil erosion, and impervious surface washoff on rainfall intensity via standard empirical approaches.