Nuisance Flooding in Coastal Communities: Real-time Modeling and Decision Support to Improve Transportation Infrastructure Resilience

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Nuisance flooding, which is repetitive flooding caused by both tidal and rainfall-driven events, is increasing in frequency and severity for many coastal communities. As climate change causes sea level rise and more frequent and intense storm events, these nuisance flooding events are producing significant disruptions and impacts to coastal communities. The objective of this study is to improve modeling and decision support activities around nuisance flooding and, in particular, its impact on transportation infrastructure. Our study region and partner in the research is the City of Norfolk, Virginia, USA. Norfolk is home to the largest Navy base in the world, the second busiest port on the United States East Coast, and is the second most populous city in Virginia. It is also one of 100 Rockefeller Resilient Cities in the world, committed to taking progressive aims at combating nuisance flooding. Using real-time observational networks, crowdsourced data, physics-based and machine learning modeling approaches, model predictive control, and economic and social science methods, we are exploring ways to better understand and mitigate the impacts of street-scale flooding. Our research is showing how real-time control of stormwater infrastructure systems can help to improve the resilience of these systems during nuisance flooding events by strategically holding back rainfall runoff and preventing tidally driven stormwater backups. We are also showing physics-based and machine-learning methods can be combined for real-time decision support and how reputation system approaches can be used to measure trust in crowdsourced rainfall datasets. This presentation will provide an overview of these and related activities, each aimed at the common goal of leveraging real-time data from a variety of sources, innovative modeling techniques, and community-driven decision making to improve community resilience to nuisance flooding.