filling the gaps

Climate and Weather Information for Small- and Medium-size Water Utilities

Building Resilience to Climate Change: Information Needs of Small to Medium Size Water System Managers in the Gulf Coast Region

Science and Trends

Over the last century, the Gulf Coast region has experienced a shift towards more intense rainfall events[1,2]. Rising temperatures are encouraging longer heat waves, fewer days below freezing, fewer record low temperatures, and warmer average night time temperatures[3]. There will likely be fewer tropical cyclones in the Gulf of Mexico, but more will become category 3, 4, and 5 storms (major hurricanes) with higher precipitation levels[4]. Coastal impacts will be exacerbated by rising sea-levels, with projections showing 1.2-12.4 ft. of sea-level rise for the northern Gulf Coast by 2100[5]. The combination of these changes poses significant risks to the region, including but not limited to, increased flooding and runoff, declining water quality, saltwater intrusion, and increased pressure on aging water infrastructure.

1 Russell, B. T., et al., 2020. Environmetrics 31: 2.
2 Easterling, D.R., et. al., 2017. U.S. Global Change Research Program, Washington, DC, USA, pp. 207-230, doi: 10.7930/J0H993CC
3 Vose, R.S., et. al., U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: http://doi.org/10.7930/J0N29V45.
4 Bruyère, C. L., et. al. NCAR Tech. Note NCAR/TN-535+STR, 165 pp.
5 Sweet, W.W.V., et. al. 2018. NOAA Technical Report NOS CO-OPS 086

Purpose of the Workshop Series

This workshop series was designed by the National Oceanic and Atmospheric Administration (NOAA) and the Water Research Foundation (WRF) to improve the delivery of information resources to small- and medium- size water systems, with the goal of building their resilience to climate change. Each workshop was organized by NOAA's regional partners and was tailored to address issues identified by and for each region. The workshops sought to exchange ideas to:

- Identify gaps and improve NOAA climate and weather-related tools and information resources;
- Increase regional-scale awareness of NOAA water tools and resources;
- Build regional connections that support small-scale utility decision making;
- Develop improved communication materials to make NOAA's information and tools more accessible.

The Gulf Coast Workshop

The Southern Climate Impacts Planning Program (SCIPP) hosted a virtual workshop in July 2020 to provide information to water, wastewater, and stormwater managers along the Gulf Coast, especially those in rural communities. The workshop included information on weather and climate; tools available on the NOAA Water Resource Dashboard; and a discussion of equity and justice in water resource management.

Summary

Workshop participants described their challenges with sea level rise and heavy precipitation adding stress to already aged drainage systems, as well as freshwater intakes being overwhelmed, urban flooding, and saltwater intrusion into drinking water supplies. Additionally, some areas are losing population and commerce because of frequent flooding, thereby leading to underutilized water systems. Even winter freezes pose a challenge especially in rural areas where frozen pipes burst in vacant homes/camps, leading to a lack of water pressure that derails water systems. Further, high poverty rates, aging infrastructure, and lack of affordability challenge water managers in the region which has been historically underserved and underfunded. Planners use a variety of tools to evaluate future vulnerability and are attempting to determine how to ensure infrastructure investments are 'future proof.'

Participants who attended the workshop stated they had little familiarity with the Dashboard and many of its tools but left the workshop with positive impressions and an expectation of using them in the future. Results also indicated that more outreach is needed to expand communication with smaller utilities who have smaller staffs and budgets.

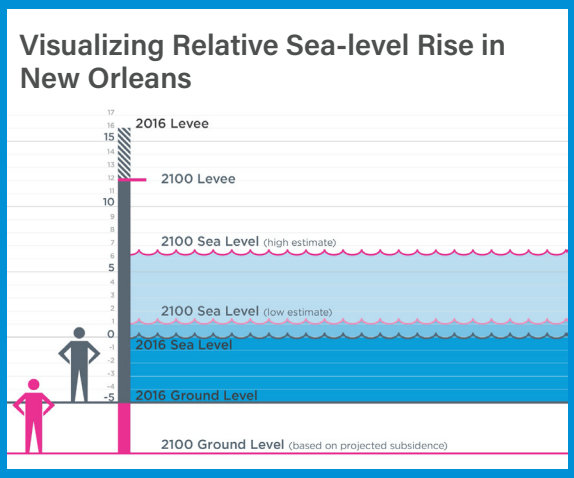
Workshop Date :: July 2020

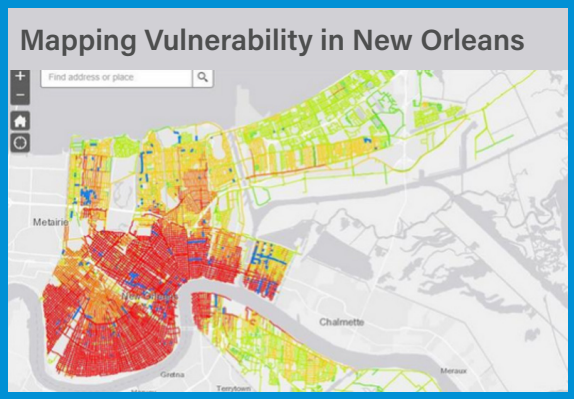
Case Studies

Terrebonne Parish Consolidated Waterworks (Michael Sorbert, General Manager). Accelerating sea-level rise and frequent tropical cyclones in this small coastal parish caused an exodus of population and commerce, requiring regular flushing of distribution systems of stale water, and responding to water loss from frozen pipes that burst in vacant, seasonally used homes.

New Orleans Sewerage and Water Board (Tyler Antrup, Director of Planning and Strategy). The New Orleans Sewerage and Water Board is grappling with how to maintain drainage and freshwater supply for a city that is already 50% below sea level, and potentially will need to increase protections against a combination of sea level rise and land subsidence of 10 feet in the next 80 years. Planners use a variety of tools to evaluate vulnerability, engage the community on redesigning neighborhoods, and identify critical areas for relocating water supply intakes and other infrastructure.

Water Equity in New Orleans (Jessica Dandridge, The Water Collaborative of Greater New Orleans). High poverty rates, old infrastructure, and threats from climate change equate to inequitable services with recurrent flooding, as well as water service disconnections for those who can least afford it. To improve services where most needed, a citizen-led collaborative, NOLA Green, is working to educate the public on the causes of flooding and to involve them in Water Board representation and decision making.





Lessons Learned

› *Design*

- Stormwater and drainage infrastructure design standards are typically codified based on TP40 (1961) or Atlas 14 (2013) and are often locked-in based on consent decrees and long term, multi-billion-dollar investments, as is the case with an EPA consent decree for Baton Rouge's sanitary sewer systems.
- Cloudbursts (short duration heavy rainfall events) are a problem. Stormwater systems are designed for quantities based on 12-hour or 24-hour rain values (occurring about every 1-2 years) and street drainage is typically based on 24-hour rains (occurring every 10-years). However, rain is frequently occurring in intense, short duration (minutes to hours) bursts that cause stormwater, storm sewers, sanitary sewers, and streets to flood. These events often shut down parts of the city for hours, disrupting commerce and day-to-day lives.
- Coastal water managers are faced with prospects of a 'perfect storm' – the confluence of sea-level rise, high tide storm surge, heavy precipitation, and, as in the case of New Orleans, high water levels in the Mississippi River that disrupts the ability to pump floodwaters out of the city. Planners need to understand the probabilities of low-frequency, high impact events. There is an ever-growing risk that multiple hazards will eventually align - such as high Mississippi River levels induced by above average spring/early summer precipitation in the central U.S. during an approaching tropical cyclone. Such confluence of events forces storm surge up the river, overtopping levees, while also dumping large amounts of precipitation that drown the city. The likelihood of these events overlapping events is, unfortunately, becoming more likely.
- City planners are puzzled over how to integrate capital planning with climate models to ensure that projects are built to be future proof and able to cope with multiple complex overlapping hazards.
- Water supply loss is a significant issue for small water utilities along the Gulf Coast due to residents' practices of leaving faucets running in winter to avoid freezing, as well as burst pipes in vacant homes. Another cause of significant water supply loss is the need to flush out old pipes to keep water fresh where legacy users are no longer there, i.e., in areas undergoing population exodus and decline as well as abandoned commercial sectors.

› *Equity*

- Older infrastructure is often more prevalent in low-income areas, where achieving equitable levels of service are more challenging due to lack of affordability as well as lack of funds to replace aging infrastructure.
- Mapping is not always overlaid with demographics of social vulnerability. There is a need to overlay physical science with social data to understand vulnerability to focus work where it is most needed. Mapping infrastructure with demographics of vulnerability would allow for a prioritization of areas within the city.

› *Operations*

- Operationally, communication is a challenge in several ways: communication with low-income residents who do not have access to the internet or other modes; educating residents on the constraints and challenges of maintaining and operating infrastructure; and interdepartmental communication during emergencies.

SCAN ME

› NOAA Workshop Series Website

› SCIPP Workshop Website

Tools Demonstrated:

› Water Resources Dashboard

› Esri Story Map

› NOAA Atlas 14

› Climate Explorer

› Tropical Cyclone Outlooks

› Quantitative Precipitation Forecasts (QPF)

› Experimental Extreme Precipitation Monitor

Information Needs

CLIMATOLOGY

- Research on cloudbursts/short duration heavy precipitation as a phenomenon.
- Research on why there are differences in precipitation intensity over the New Orleans service area.
- Historic hourly rainfall data for hydrology and hydraulic use at a useful spatial scale for planners/engineers; and the products that do exist at a better spatial resolution are not very long (2002-present)
- Better prediction and advanced warnings of heavy rainfall events that cause flooding.
- Improvements in models to resolve small scale deep convection events.
- A clearinghouse for all sources of precipitation data from multiple federal sources, e.g., USGS, USACE, NOAA.
- Probabilities of a confluence of low probability, high impact events, including high tide storm surge, sea-level rise, intense precipitation, and river levels at high tide.

HYDROLOGY

- River and stream models for evaluating flooding from a confluence of events.

CAPACITY BUILDING

- Social Risk: Tools to overlay physical science with social data to understand vulnerability.
- Scientific information that is more accessible and digestible for elected officials and the public, including trends and projections (especially rainfall) and its implications.
- Tools to help the public understand flooding, infrastructure, and extreme events.
- Guidance on how to integrate capital planning with climate models to ensure new projects are future proof.
- Methods to facilitate sharing data and resources between utilities to create better operational and planning.

Next Steps

The challenges confronting infrastructure planners in the Gulf Coast region are complicated by a shifting climate, leading them to seek improved information about risk and probability. SCIPP and its partners will explore opportunities to answer some of the most pressing questions.

Workshop Participant Poll

What impacts do you think climate change will have on your utility/organization?

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