

HYDROGRAPHIC SERVICES REVIEW PANEL

A federal advisory committee, advising the NOAA administrator

Addressing the Threat of Increased Flooding: Informing Responses to Sea Level Rise and Subsidence with NOAA's Navigational Services

NOAA should play a proactive and leading role in aiding coastal states to address the threat of increased flooding and loss of habitable land area.

BACKGROUND

NOAA has tracked global sea level rising over the past century, and the rate has increased in recent decades. In 2014, global sea level was 2.6 inches above the 1993 average—the highest annual average in the satellite record (1993-present). Sea level continues to rise at a rate of about one-eighth of an inch per year and can be much greater in specific locations due to land subsidence.

The NOAA State of High Tide Flooding for 2018 and 2019 Outlook indicates that there are **over 40 locations with tide stations in the U.S. with accelerating high tide flooding trends**, and **25 location with trends that are linearly increasing**. These data suggest coastal impacts from flooding are or soon will be chronic rather than sporadic in many coastal communities and urban centers.

https://tidesandcurrents.noaa.gov/HighTideFlooding_AnnualOutlook.html

The combined effects of sea level rise, subsidence, and accelerated storm erosion all pose a threat to life, property, and the economic resilience of the United States coastal regions. Through foundational data and analysis, supported by its mandate to gather and analyze spatial information, NOAA is a key resource for understanding and managing the trends and impacts of these occurrences.

CASE STUDY – THE CANARY IN THE FLOODWATERS

Flooding in Leeville, LA, Hurricane Rita, Sept 2005; photo credit Windell Curole



When Hurricane Katrina made landfall in August 2005, wind, water, and waves from the storm destroyed coastal protection levees and seawalls, and devastated the city of New Orleans. The American Society of Civil Engineers' root cause analysis of seawall and levee failure in New Orleans during Hurricane Katrina describes how using an incorrect vertical reference plane combined with not accounting for subsidence led to levees along the Industrial Canal and its outfall canals being **up to 3 feet below design elevation** when the storm struck. Also, project modifications made due to budget constraints impacted their effectiveness. As a direct result of these structures failing, over 1,800 people died in New Orleans due to the storm. It is estimated hundreds of thousands became homeless when their houses were destroyed and over 125,000 jobs were lost.

NATIONAL IMPACT

What happened in New Orleans can happen elsewhere in the United States. Several remote Alaska communities are being forced to consider relocation due to erosion and flooding caused by the loss of protection ice provided from spring storms and exacerbated by sea level rise. In many of the coastal states, "phased adaptation" can help communities make small, manageable and affordable changes in the near-term that will cumulatively result in long-term improvements. Many communities around the coastal US are planning for "managed retreat" as part of the solution. These communities must make a decision as to what to protect, what to preserve and what to abandon along a stored coastline that continues to shrink. In California, driven by energetic storms and sea level rise, life and property are endangered. Townships in Alaska and Louisiana

have already voted to abandon their property and move inland or to higher ground. The Hampton Roads region is already being impacted by sea level rise and this is projected to continue over the next century. Without effective preparedness and mitigation measures in place, serious national security, economic and social consequences for the region are likely. With an estimated 20 years of service life remaining before sea level rise renders it inoperable, the U.S. Navy has begun planning when and how to relocate Norfolk Naval Station. At varying levels, the threat of sea level rise is pervasive throughout our coastal areas.

Because sea level rise, subsidence, increased rainfall, and increased storm erosion will continue, it is critically important along the coastal US to place the ground, buildings, and coastal protection walls into a single common vertical reference frame, assess the local sea level conditions including tides against that reference, and use that information to direct policy and planning. In order for decision-making for our future to be effective, this analysis of contemporary conditions should also be accompanied by an assessment of how these factors, such as vertical land motion and long-term sea level trends, are projected to change.

RECOMMENDATIONS FOR NOAA ACTION

Working with its federal, state and industry partners, NOAA should prioritize the following:

- **Geodetic Surveys:** Continue to modernize the National Spatial Reference System. (NSRS). The NSRS is the foundational framework for elevation mapping programs. The new reference frames and geopotential datum are scheduled to be released in 2022.
- **Expand funding and research programs for long-term observations** such as Continuously Operating Reference Stations (CORS), National Water Level Observation Network (NWLON) and leverage the data integration and local partnership connections offered by the Integrated Ocean Observing System Regional Associations to support interoperability of water level data from the national to local level.
- **InSAR (Interferometric Synthetic Aperture Radar):** Establish funding and research plan for mapping ground deformation and subsidence, measuring millimeter-scale changes in land deformation over the span of days to years at a 5-year recurring basis collected through the nation's coastal zone.
- **Data Analysis and Models:** Coupled by atmospheric and hydrodynamic physical modeling, support NOAA's sea level modeling and prediction efforts to establish a common framework for model interoperability and to more efficiently integrate systems across disciplinary boundaries.
- **Decision Support Tools:** Communicate the risk from changing water and land motion by enhancing existing or developing new tools and visualizations that bring existing coastal infrastructure into a common modern reference frame for coastal decision makers.

In October 2003, Secretary of Commerce Don Evans established the Hydrographic Services Review Panel as directed by the Hydrographic Services Improvement Act of 2002, Public Law 107-372. Panel members, appointed by the NOAA Administrator, include a diverse field of experts.

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