NEW JERSEY'S RISING SEAS AND CHANGING COASTAL STORMS:

A Summary of the 2019 Science and Technical Advisory Panel

November 2019

Human-caused climate change is accelerating sea-level rise in New Jersey and, together with shifts in coastal storms, driving increases in coastal flood hazards. In 2016, Rutgers University researchers convened a panel of scientists to assess projections of future sea-level and storm changes affecting the Garden State. To ensure the usability of their assessment, the scientists also consulted with state and local practitioners to discuss how they would integrate the science into their decisions to enhance the coastal resilience of New Jersey's people, places, and assets.

Recently, the New Jersey Department of Environmental Protection engaged Rutgers to conduct new consultations with panels of scientists and practitioners to update its 2016 work to reflect the most recent climate science. Key updates in the new report include: the addition of historical sea-level rise information for New Jersey; consideration of the latest information related to ice-sheets changes and their effect on sea-level rise; and assessment of increasing tidal flooding under sea-level rise. This document briefly summarizes the 2019 report.

Two important sets of terms associated with the 2019 report:

1. Use of the term "likely" Consistent with convention in the climate science community, the science panel employs the term "likely" to indicate that there is at least a 66% chance a stated outcome will occur.

2. Pathways of future global emissions of greenhouse gases Projecting the magnitude and rate of sea-level rise after the year 2050 requires considering the pathways of future global emissions of greenhouse gases. In other words, if global emissions of greenhouse gases are not curtailed, the magnitude and rate of sea-level rise will be greater than if emissions are significantly reduced. The panel considered three greenhouse gas emissions scenarios to inform its sea-level rise projections:

- **High-emissions scenario** In this scenario, global greenhouse gas emissions increase as a result of unchecked growth of fossil fuel consumption, and the Earth's temperature reaches 5°C (9°F) above early Industrial (1850-1900) levels (4°C, or 7°F warmer than today) by the end of the century.
- **Moderate emissions scenario** In this scenario, roughly consistent with current policies around the globe, emissions growth is slowed and warming limited to about 3-4°C (5-7°F) above early Industrial levels.
- **Low emissions scenario** In this scenario, emissions are sharply curtailed and warming limited to 2°C above early industrial levels, consistent with the primary temperature target under the 2015 Paris Agreement.

Sea-level rise

Due to a variety of factors, sea level is rising faster in New Jersey and the Mid-Atlantic region than globally. The science panel's projections include both the magnitude (amount) and rate (speed) of sea-level rise in New Jersey.

Magnitude of Sea-level Rise in New Jersey

Historical sea-level rise in New Jersey Sea-level in New Jersey rose 17.6 inches (1.5 feet) along the New Jersey coast from 1911 to 2019, compared to a 7.6-inch (0.6 feet) total change in the global mean sea-level.

Near term future projections of sea-level rise New Jersey coastal areas are likely to experience sea-level rise of 0.5 to 1.1 feet between the years 2000 and 2030, and 0.9 to 2.1 feet between 2000 and 2050.

Longer term projections of sea-level rise

- *Under a high-emissions scenario,* coastal areas of New Jersey are likely to see sea-level rise between 1.5 to 3.5 feet between the years 2000 and 2070, and 2.3 to 6.3 feet between the years 2000 and 2100.
- *Under a moderate-emissions scenario,* coastal areas of New Jersey are likely to see sea-level rise 1.4 to 3.1 feet between the years 2000 and 2070, and 2.0 to 5.2 feet between 2000 and 2100.
- *Under a low-emissions scenario,* coastal areas of New Jersey are likely to see sea-level rise between 1.3 to 2.7 feet between the years 2000 and 2070, and 1.7 to 4.0 feet between the years 2000 and 2100.

Rate of Sea-level Rise in New Jersey

Historical rate of sea-level rise Over the last forty years, from 1979-2019, sea-level rose at an average rate of 0.2 inches per year along the New Jersey coast, compared to an average rate of 0.1 inches per year globally.

Near-term future rates of sea-level rise New Jersey coastal areas are likely to experience average sea-level rise rates of 0.2 to 0.5 inches per year over 2010–2050.

Longer term future rates of sea-level rise

- *Under a high-emissions scenario,* coastal areas of New Jersey are likely to see sea-level rise rates of 0.3 to 1.1 inches per year over 2060-2100.
- *Under a moderate-emissions scenario,* coastal areas of New Jersey are likely to see sea-level rise rates of 0.2 to 0.8 inches per year over 2060-2100.
- *Under a low-emissions scenario,* coastal areas of New Jersey are likely to see sea-level rise rates of 0.2 to 0.6 inches per year over 2060-2100.

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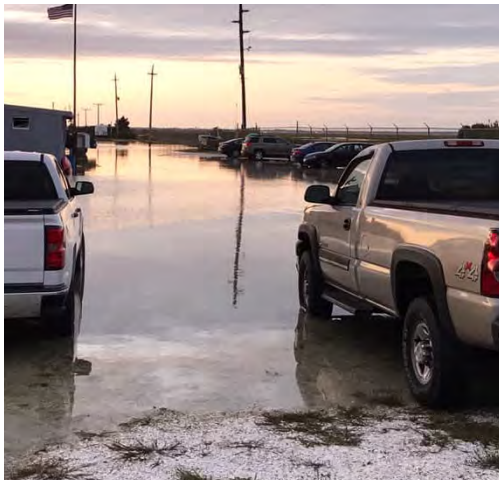

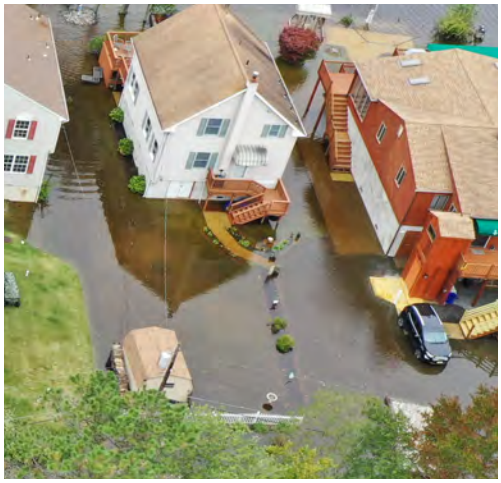

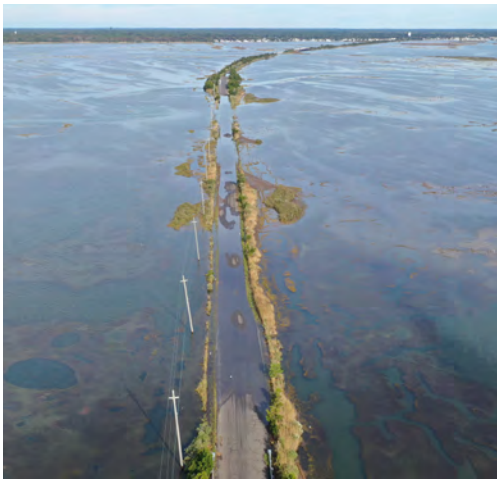

Coastal Storms

Higher sea-levels will increase the baseline for flooding and impacts from high tides and coastal storms which includes hurricanes and nor'easters:

Tropical Cyclones

The science panel focused on three issues with respect to tropical cyclones (i.e., hurricanes and tropical storms): frequency, intensity and precipitation. While most studies do not project an increase in the global frequency of tropical cyclones, both maximum wind speeds and the rate of rainfall during tropical cyclones are likely to increase. Changes in the frequency, wind speed and tracks of tropical cyclones remain an area of active research, and there is no definitive consensus at this time regarding such changes specific to New Jersey.

Extratropical Cyclones

The global frequency of extratropical cyclones (i.e., nor'easters) is not likely to change substantially. While there is some evidence for a decrease in frequency of extratropical cyclones over the North Atlantic as a whole, this is not apparent near the coast. While some research points to the possibility of changes to extratropical storm tracks in the North Atlantic, this research is not reliably established. Changes in the frequency, wind speed, precipitation rate, and tracks of extratropical cyclones remain an area of active research; at this time, there is no definitive consensus regarding such changes.

Tidal Flooding

The number of days that New Jersey residents have experienced high-tide floods in the absence of an associated storm has increased in recent years. High-tide flooding (i.e., "sunny day flooding") can have detrimental impacts on infrastructure and communities in the absence of a major storm. Between 2007-2016, there was an average of 8 high-tide flood events in Atlantic City, NJ, with annual event totals ranging between 4 events in 2007 and 18 events in 2009. This frequency has grown from an average of less than one high-tide flood event per year in the 1950s. The frequency of high tides exceeding the current high-tide flood threshold will continue to increase with sea-level rise. For example, based on the likely range of sea-level rise projections, Atlantic City will experience 17-75 days of expected high-tide flooding per year in 2030, and 45-255 days per year of expected high-tide flooding in 2050.

Future Updates and Application of the 2019 Report

The 2019 report also illustrates an example scenario-based planning application of the sea-level rise projections that practitioners could consider within their current professional framework, recognizing that tolerance for risk and flood levels differs depending upon the situation under consideration.

The science panel recommends that its estimates be reviewed and updated on a regular basis, not to exceed 5 years, as well as after the publication of relevant global (i.e., Intergovernmental Panel on Climate Change) or national (i.e., National Climate Assessment) assessments.

Full copies of the 2019 and 2016 reports are available at:
climatechange.rutgers.edu/resources/climate-change-and-new-jersey/nj-sea-level-rise-reports