Arctic Answers
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How will coastal communities be affected by climate change?

THE ISSUE. Rising sea level and the expected increases in the frequency and severity of strong storms make coastal areas and their residents among the most vulnerable to natural hazards from a changing climate.

WHY IT MATTERS. Extreme weather events cause billions of dollars in damage, scores of deaths and injuries, and thousands of disrupted lives each year. Coastal areas are among the most developed regions in the world. In the United States, 23 of the 25 most densely populated counties are on the coast; globally, 19 of the 20 emerging mega cities are coastal. Damages from flooding exceed those from any other natural disaster.

STATE OF KNOWLEDGE. Steadily rising sea level threatens coastal communities around the world. While local rates of sea level rise vary, the sea today is nearly one-foot higher (globally) than 100 years ago. It is estimated that had Superstorm Sandy occurred without this increase, the damage would have been $2 billion less and flooding would have been less severe[1]. As sea levels rise, flooding events of all magnitudes are more likely to occur than in the past. Many areas have already experienced a sharp increase in "sunny day" flooding from predictable tidal patterns like spring tides and king tides[2]. Due to the expansion of warming ocean water and melting land ice in places like the Arctic, sea level is very likely to continue to rise through to the end of the century, with predictions only varying in the details regarding how much and how fast it will occur[3]

Exposure to natural hazards, particularly during sea-level extremes driven by events like hurricanes and intense rainfall, increases property damage and threatens lives. The lower atmospheric pressures of storms act to raise water levels—a drastic decrease in air pressure, which typically accompanies hurricanes and other severe weather systems, can cause an additional one-foot increase in sea level. These episodic weather events are expected to increase in frequency, intensity, and duration as global temperatures continue to increase. The intense wind and low pressure that accompany these events can exacerbate storm surges and produce larger, more damaging waves, thus increasing the risks and impacts from coastal flooding and erosion.

Storms coinciding with high tides amplify the damage. Even for coastal areas where tides normally vary a foot or less, this can be a significant factor. For areas where tides vary more than 10 feet, like the Pacific Northwest, the timing of landfall relative to high tide plays a critical role in determining the potential damage of a storm.

The expected frequency of future flooding events (and their magnitudes) is vital information that scientists should provide to coastal managers. This would allow communities to factor these threats into local development, infrastructure, and planning decisions. Traditionally, historical data have been used

to estimate the severity of flooding events that occur once-per-decade or once-per-century. However, with sea level rise, past data cannot adequately predict the future frequency of these events. For example, in New York City, a 3.6-foot flood has occurred roughly once per decade. Without any sea level change, three such events would be expected in the three decades between 2001 and 2030. Sea level rise is expected to increase this to 4.8 events[4]. What would have been a "ten-year flood" will come roughly every other year. Correspondingly, between four and nine of the much larger hundred-year floods are expected this century.

NOAA's "Digital Coast" provides numerous tools and diverse data to assist coastal managers with decision support for their specific regions[5]. These same data, along with the scientific projections of future sea level rise and storm behavior, will figure critically in insurance and re-insurance industries' assessments of future risk, as well as FEMA's determination of areas mandated to be covered by flood insurance. An increase in risk can be economically damaging even before the expected storms occur, by reducing property values, eroding the local tax base, and potentially dragging economies into a downward spiral.

Where the Science is Headed. Current scientific projections of increased frequency of flooding are likely underestimates, because they generally only account for the increase in sea level (the "launching pad") but do not include the likely increases in either storm frequency or intensity. Improved projections of future storm frequency and intensity can help coastal decision makers plan for stronger and more frequent storms.

Key References

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5. Coastal County Snapshots (accessed 2017), NOAA Office of Coastal Management, DIGITALCOAST, https://coast.noaa.gov/digitalcoast/tools/snapshots.html.

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Contacts for further information:

Casey Dennehy, Surfrider Foundation
cdennehy@surfrider.org

Jill Gambill, University of Georgia
jgambill@uga.edu