



Sea Level Rise and Storm Surge

What It Means to Alaskans and How We Can Adapt

What is sea level rise and storm surge?

A warmer global climate is causing glaciers and continental ice sheets to melt, sending increased volumes of freshwater into the sea. At the same time higher temperatures cause thermal expansion of the ocean itself. The result is that sea level is slowly rising.

Why does it matter?

Along the southern shores of Alaska the effect so far is hardly noticeable, because most of the coastline also is slowly rising due to tectonic forces and isostatic rebound (springing back of land after the last ice age). On the Bering Sea coast and in the Arctic, however, communities are experiencing increased damage from storm surges (extreme high water events caused by high winds and low atmospheric pressure), shoreline loss to fierce winter storms, and saltwater intrusion into freshwater sources, sanitation lagoons, and fish and wildlife habitats. Indications are that all of this is being made worse by a gradual rise in sea level.

Furthermore, changing climate may cause a change in storm pathways, bringing more frequent or intense storms to some parts of Alaska.

A big factor is the loss of protective sea ice, which makes the effects of storm waves on the shoreline more severe. Decline of sea ice increases ocean fetch (the distance waves travel uninterrupted) which increases wave height. Decline of shore-fast ice leaves the coast unprotected from waves and more vulnerable to wave action, and as ice coverage decreases so does the damping effect it has on wave action. The effects of sea level rise and storm surges are therefore becoming more destructive than they otherwise would be.



ALASKA DEPT. OF ENVIRONMENTAL CONSERVATION

Storm waves batter Kivalina, a remote village on a barrier island along Alaska's northwest Arctic coast.

What are Alaskans observing?

- Coastal towns and villages report rapidly eroding coastlines, resulting in loss of homes, streets, businesses, and even graveyards.
- Storm surges cause short-term flooding that damages homes and community facilities, and can push small boats some distance inland from the sea.
- Increased seasonal flooding accelerates shoreline erosion, and in a few cases entire villages are being forced to begin moving to higher ground.
- Rapid erosion has threatened homes and forced emergency evacuations.
- Six Alaska communities are planning partial or total relocation, and 160 have been identified as threatened by climate-related erosion by the U.S. Army Corps of Engineers. The Corps estimates relocation costs at \$30 to \$50 million per village.

What are the facts?

- During the last 100 years, the annual average temperature in the Arctic has climbed slightly more than 3 degrees F.
- The world's oceans have risen overall about 8 inches in the past century.
- Although sea level rise on the Alaska coast is not yet documented due to a lack of historical data, scientists say that eventually it will affect at least some parts of the state.
- Thawing permafrost (also climate-related) increases the coast's susceptibility to erosion. When melted water in the soil drains off, it leaves the remaining soil soft and porous, so when it is attacked by waves or moving water, it easily erodes or sloughs off.
- In some places, the shoreline has receded by as much as 100 feet in a single storm.

- Seawater intrusion from storm surges has contaminated water sources and changed the salinity of coastal ponds that are essential to wildlife.
- The National Oceanic and Atmospheric Administration predicts storm surges of 10 feet or more for many western Alaska coastal communities during the next 50 years, and some parts of the western Alaska coast could experience surges as high as 13 feet.

Why are sea level rise and storm surge happening?

Atmospheric scientists say burning of fossil fuels (coal, oil, natural gas) releases “greenhouse gases” into the air, which trap heat that would otherwise escape into space. Some scientists say that the earth’s natural climate cycle also is at work.

What can we do to halt and reverse sea level rise?

Most authorities say that the only solution is using less fossil fuel–based energy wherever possible, driving less, walking more, and using public transport. This is called climate change mitigation. To make significant improvements will require worldwide changes in society and economies, however, and decades or centuries will pass before current trends are completely reversed.

How can we adapt to these inevitable changes?

- Encourage communities to work with state and federal agencies to plan for gradual but permanent migration to a safer and more stable location.

For more information or assistance

Climate Change Adaptation, Alaska Sea Grant Marine Advisory Program
<http://www.marineadvisory.org/climate>

Alaska Center for Climate Assessment and Policy (ACCAP)
http://ine.uaf.edu/accap/alaska_arctic.html

CRISIS Sea Level Rise Maps
<https://www.cresis.ku.edu/data/sea-level-rise-maps>

Alaska Department of Commerce, Community & Economic Development
<http://www.commerce.state.ak.us/dcra/ACCIMP.htm>

US Army Corps of Engineers Alaska District Alaska Baseline Erosion Assessments
<http://www.poa.usace.army.mil/AKE/Home.html>

Scenarios Network for Alaska Planning—community temperature profile charts
<http://www.snap.uaf.edu/community-charts>

NOAA Climate Prediction Center Alaska Storm Tracks Monitoring, Outlook and Assessment
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/stormtracks/strack_alaska.shtml

NOAA sea level trends in Alaska Station location maps, data, and tide predictions
<http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml>

- Look into flood and inundation resistant constructions, such as houses that are elevated on pilings or that float.
- Organize other response efforts. For example, make plans to relocate homes and businesses away from the shore.
- Structures and facilities can be fortified, and beaches armored with riprap, concrete, or sheet piling walls, although these expensive options are not always effective .
- Establish protective buffers of vegetation to prevent or moderate the effects of wind wave and storm surge.
- Encourage land use zoning to prevent future building in vulnerable areas.
- Help your community develop emergency evacuation plans. Identify a safe area or building away from the shoreline or riverbank where community members can quickly seek safety. In some cases an evacuation shelter should be built in or near the community.
- Families can develop their own evacuation strategies. Identify a safe meeting place for family members, and store emergency equipment and supplies in an area that will be safe from inundation.

This Alaska Sea Grant Marine Advisory Program (MAP) project is supported by the Alaska Center for Climate Assessment and Policy (ACCAP). MAP is a statewide outreach and technical assistance program that helps Alaskans sustain economic development, traditional cultural uses, and conservation

of marine and coastal resources. ACCAP’s mission is to assess the socioeconomic and biophysical impacts of climate variability in Alaska, make this information available to local and regional decision-makers, and improve the ability of Alaskans to adapt to a changing climate.

