

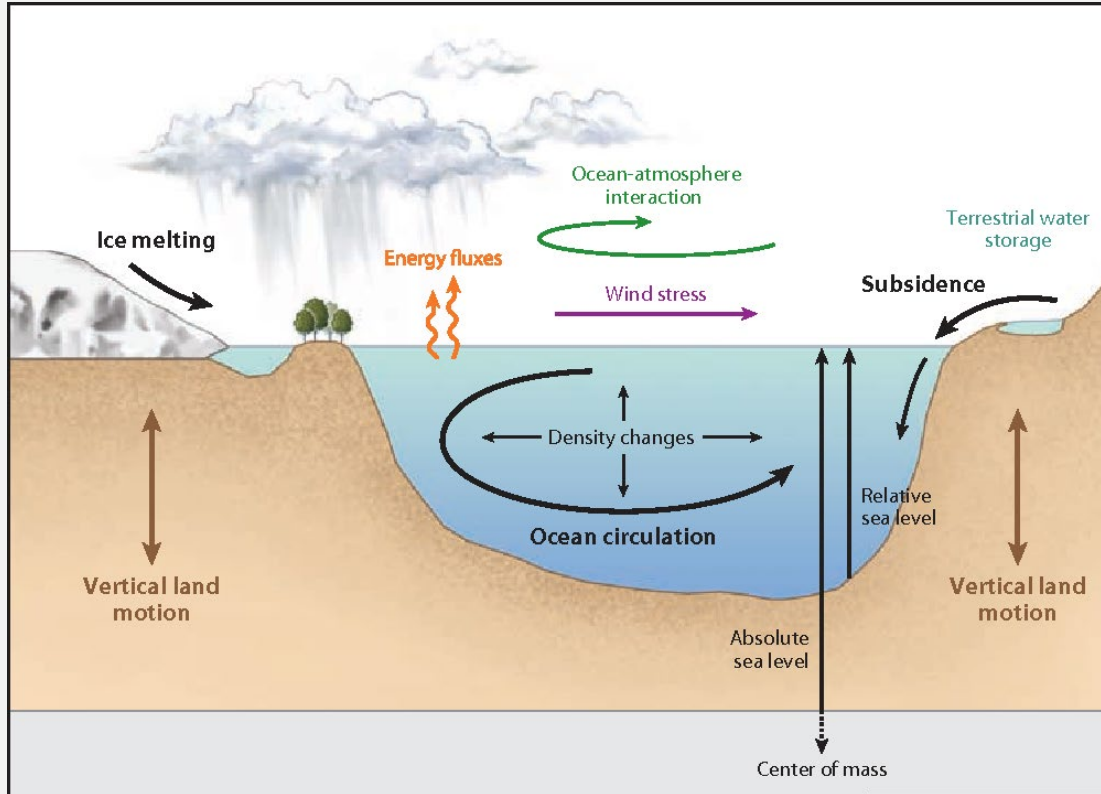


Consequences of Sea Level Rise and Climate Change

Carl B. Harbitz, Sylfest Glimsdal, and Elisabeth H. Reutz

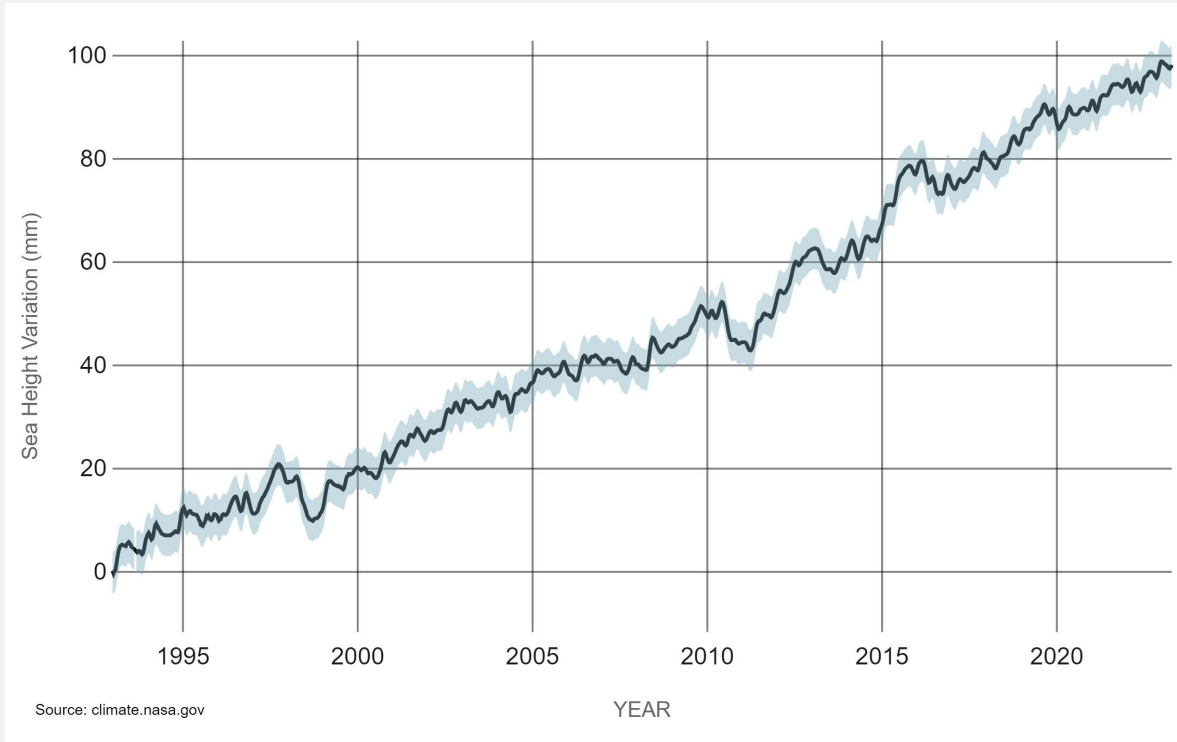
**Bilateral Workshop on Disaster Risk Mitigation for the state of Kerala;
October 17-21, 2023**

Sea Level Rise and Climate Change



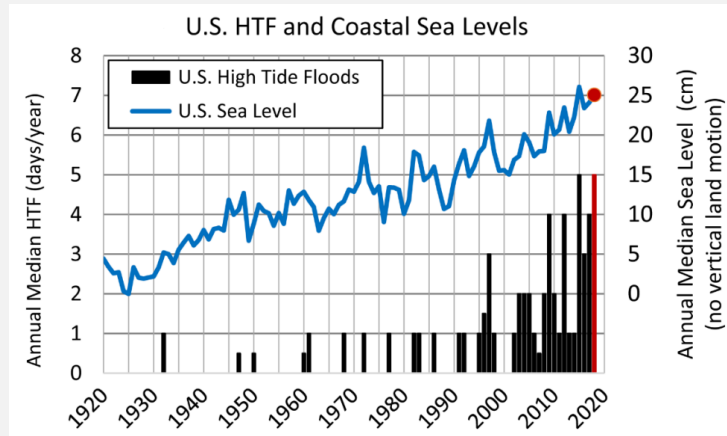
From: Stammer, Detlef et al. "Causes for contemporary regional sea level changes." Annual review of marine science 5 (2013): 21-46 .

Sea Level Rise since 1993



Coastal Flooding and Erosion

- Increased coastal flooding
- Accelerating coastal erosion



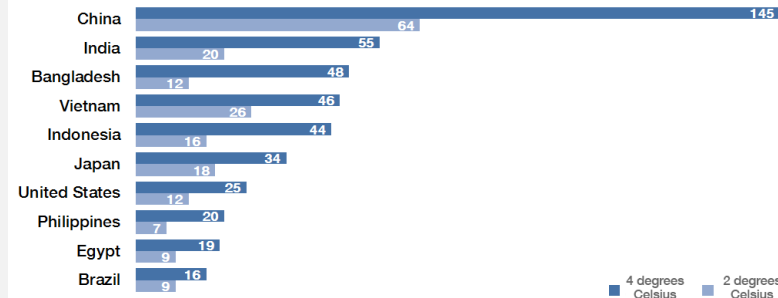
From: Sweet, William, et al. "2018 state of US high tide flooding with a 2019 outlook." (2019)

Impact on Coastal Communities

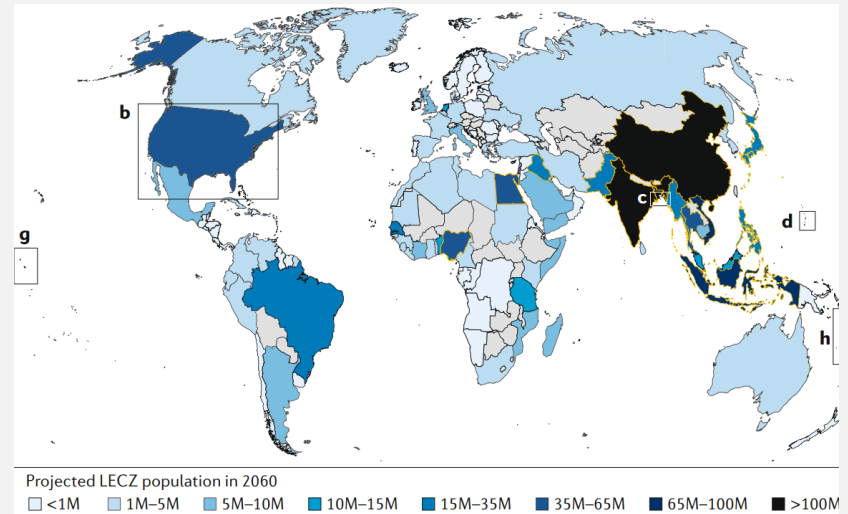
- Increased coastal flooding and erosion
- People forced to relocate → climate-induced migration
- Global problem
 - India is one of the countries with dense populations in LECZ
- Social and political challenges
 - → refugee crisis

Which countries are most in danger from rising sea levels?

Total 2010 population (millions) below median locked-in sea level rise, based on different warming levels



Source: Climate Central



From: Hauer, M.E., Fussell, E., Mueller, V. *et al.* Sea-level rise and human migration. *Nat Rev Earth Environ* 1, 28–39 (2020).

Threats to Biodiversity due to SLR

- Habitat loss for coastal species
 - Many islands are biodiversity hotspots for endemic species
- Disruption of coastal ecosystems
 - Wetlands, mangroves, estuaries are crucial nurseries for many marine species
- Disrupted migration patterns
 - Change in distribution and abundance of marine life
- Disruption of marine ecosystems
 - SLR can alter the salinity levels in coastal waters



From: NC Wetlands from Raleigh, NC - scene ghost forest Nags Head Woods ncwetlands

Infrastructure Damage

- ↗ Coastal infrastructure is vulnerable to SLR and extreme weather events
- ↗ Urban areas at particular risk
- ↗ Economic impact
 - Damage, repairs, public resources, delays...



From: N.C. DOT and U.S. DOT.



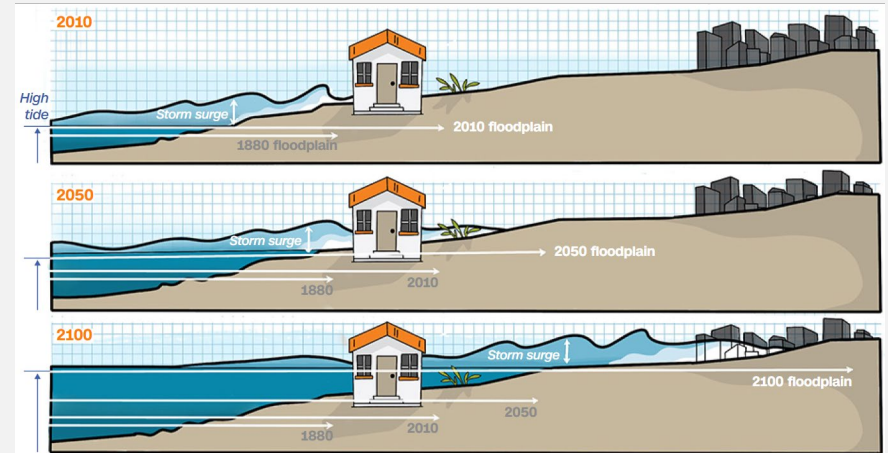
From: NOAA Aviation Weather Center

Increased Storm Intensity

- ↗ Impact of rising sea surface temperatures
 - More intense and more frequent hurricanes
- ↗ Exposure of new areas
- ↗ Exacerbated storm surges
 - Intensity, duration, frequency (IDF)
 - Wind waves
 - → erosion, coastal devastation



From: Japan Meteorological Agency.



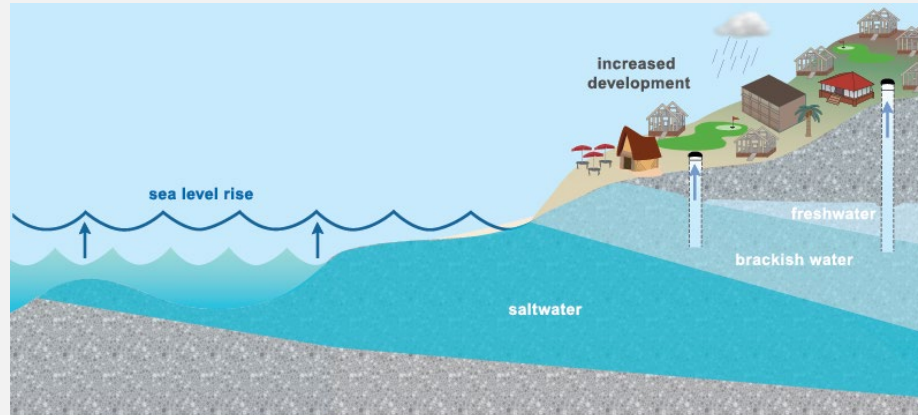
From: Union of Concerned Scientists.

Saltwater Intrusion by SLR

- ↗ Ecological consequences
- ↗ Contaminated freshwater sources
- ↗ Agriculture impact
 - Reduced soil fertility
 - → food and water crisis



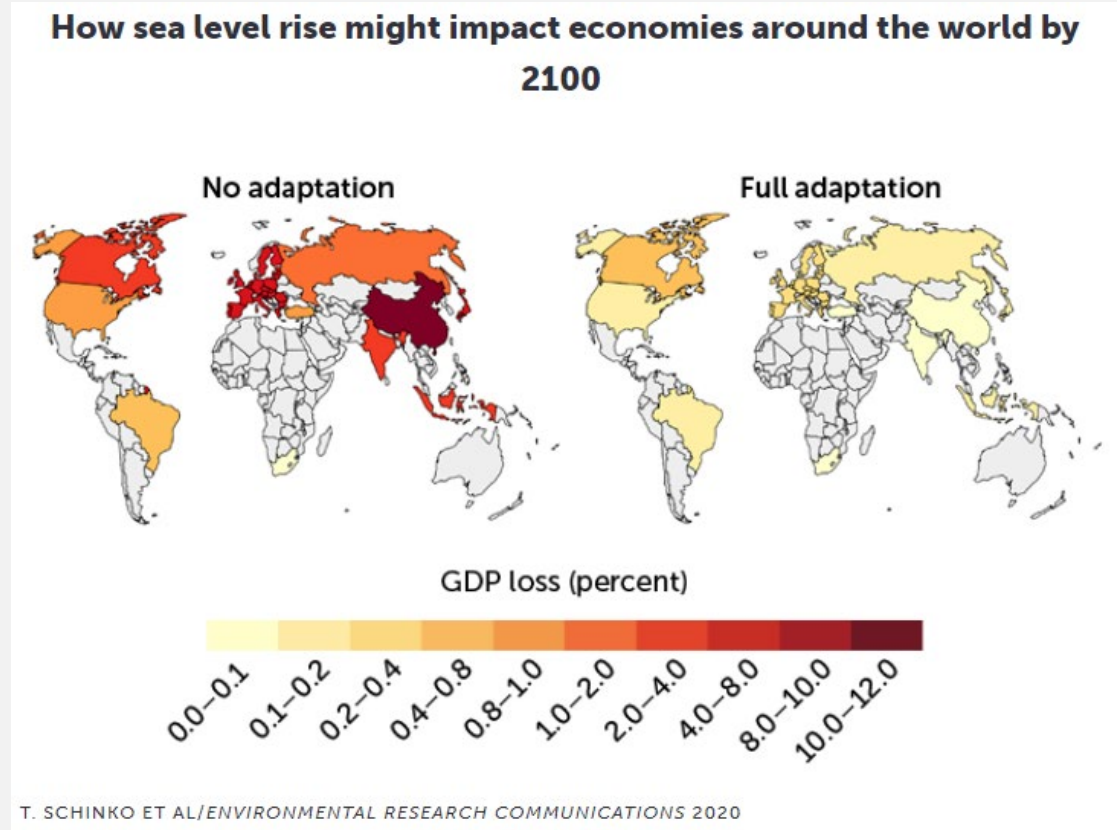
From: Pasquotank County Center.
[Salt Water Is Fine for the Ocean, But....](#)
[| Extension Marketing and Communications \(ncsu.edu\)](#)



From: [Coral reefs and climate change --](#)
[Integration and Application Network \(teachoceanscience.org\)](#)

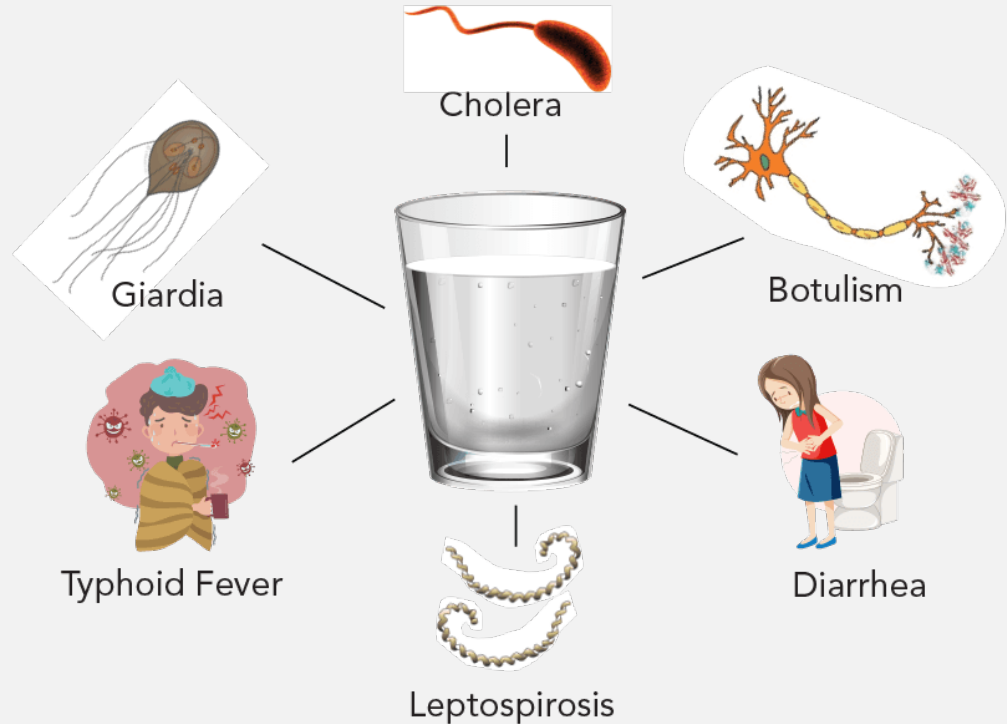
Economic Impacts by SLR

- Damage to infrastructure and properties
- Loss of property value
 - Increased insurance costs
- Loss of income source
 - Fishery, tourism may suffer
- Increased cost for coastal protection



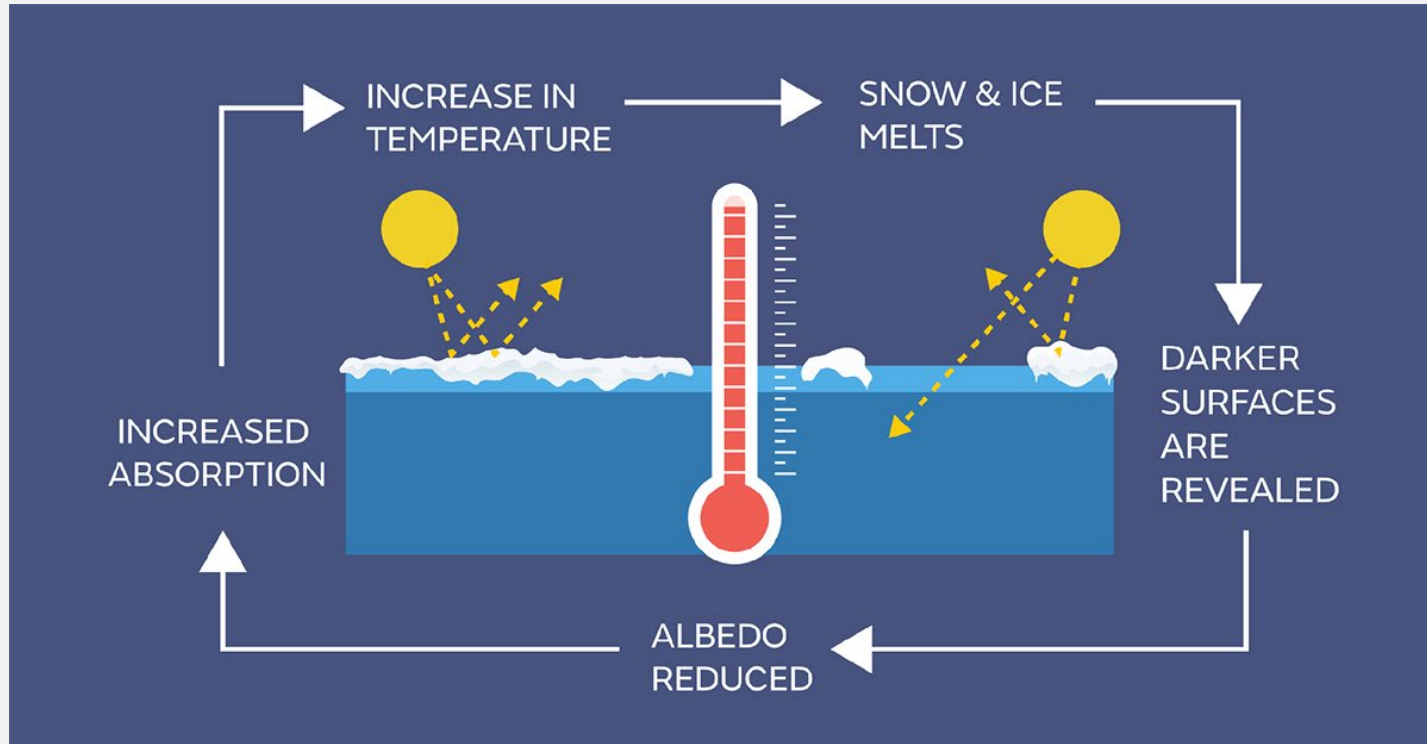
Health Risk due to flooding events

- ↗ Waterborne diseases
 - Contaminated floodwater
 - Flooded sewage systems
- ↗ Expanded habitats for disease-carrying vectors
- ↗ Direct injuries
- ↗ Access to healthcare
- ↗ Food safety concerns
 - Contamination of supplies
 - Failing crops



From: mfine. [8 Common Water Borne Diseases in India: Treatment & Prevention \(mfine.co\)](https://mfine.co/8-Common-Water-Borne-Diseases-in-India-Treatment-Prevention/)

Global Climate Feedback Loop



Adapting to Sea Level Rise

- ↗ Coastal defence
- ↗ Sustainable urban planning
- ↗ International cooperation and policy initiatives



From: engineeringcivil. [Coastal Protection Structures | Water front Structures | Wave Protection](#)



#onsafeground