Overview of coastal hazards in Africa

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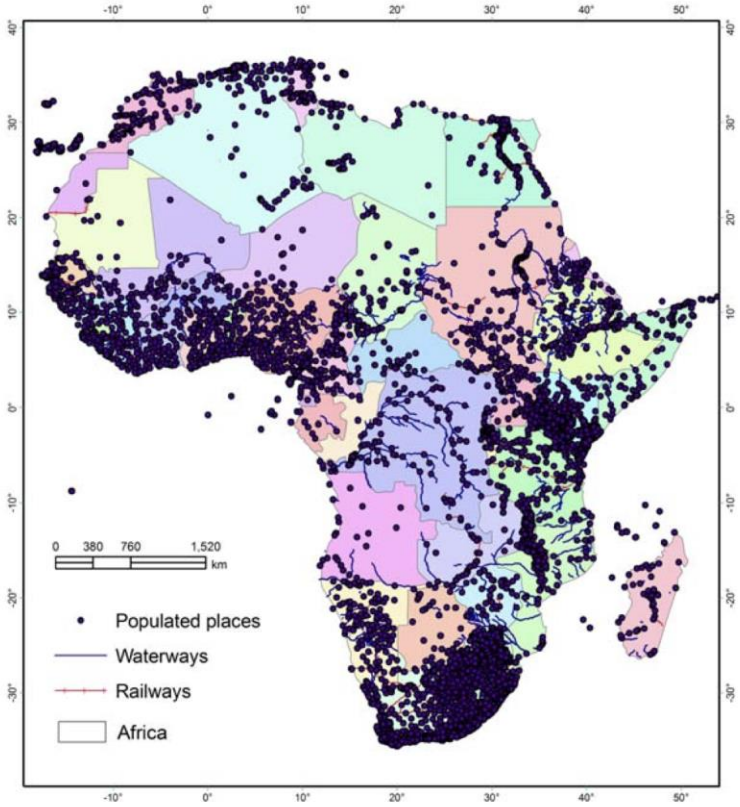
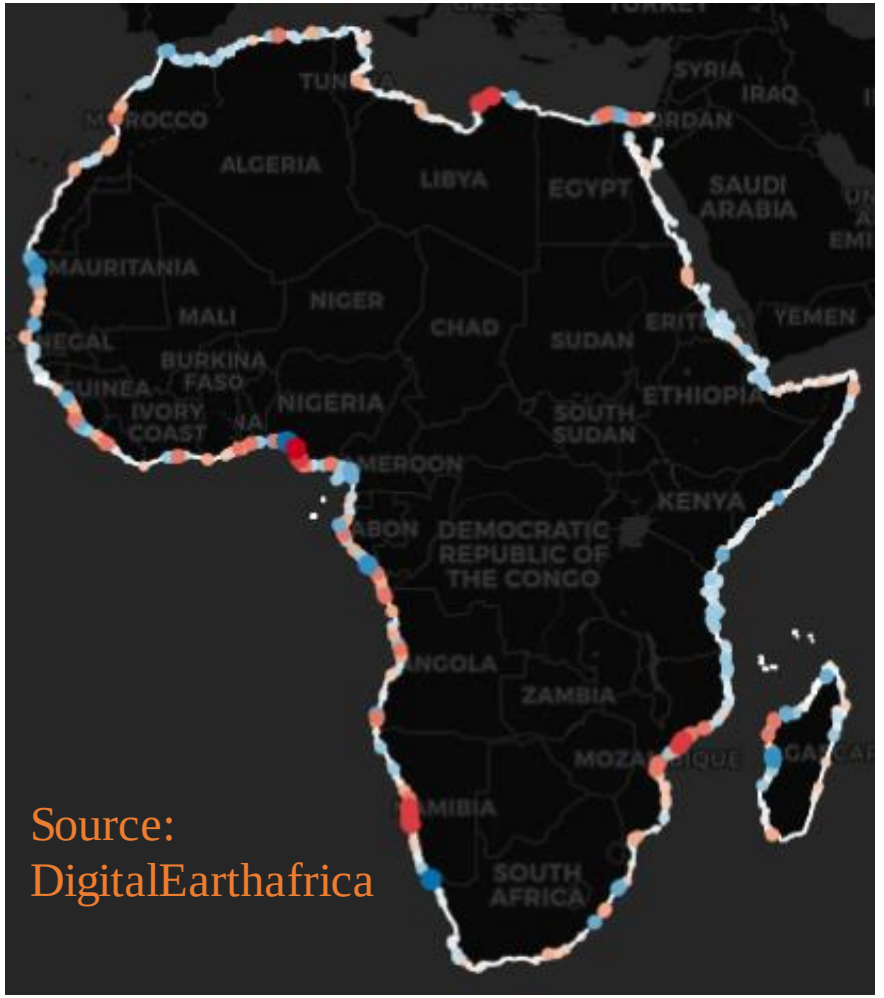
Significant Coastal stretch of Africa

- Total coastline is about 18, 950 miles
- Coastlines of 38 different countries range from 25 miles short to 3000 miles long
- 40% of population live near coastal zone and in the low-elevation areas

- This number could increase depending on the shared socioeconomic pathway scenario used, with consequences
- With many resources



Relative population density on the Africa continent (http://geoengine.nga.mil)



Source: DigitalEarthafrica

Definition of coastal hazards:

the occurrence of a phenomenon (e.g. a flood), which has the potential for causing damage to, or loss of, natural ecosystem, buildings, and infrastructure.

The most serious coastal hazards are the following:

Rapid-Onset Hazards

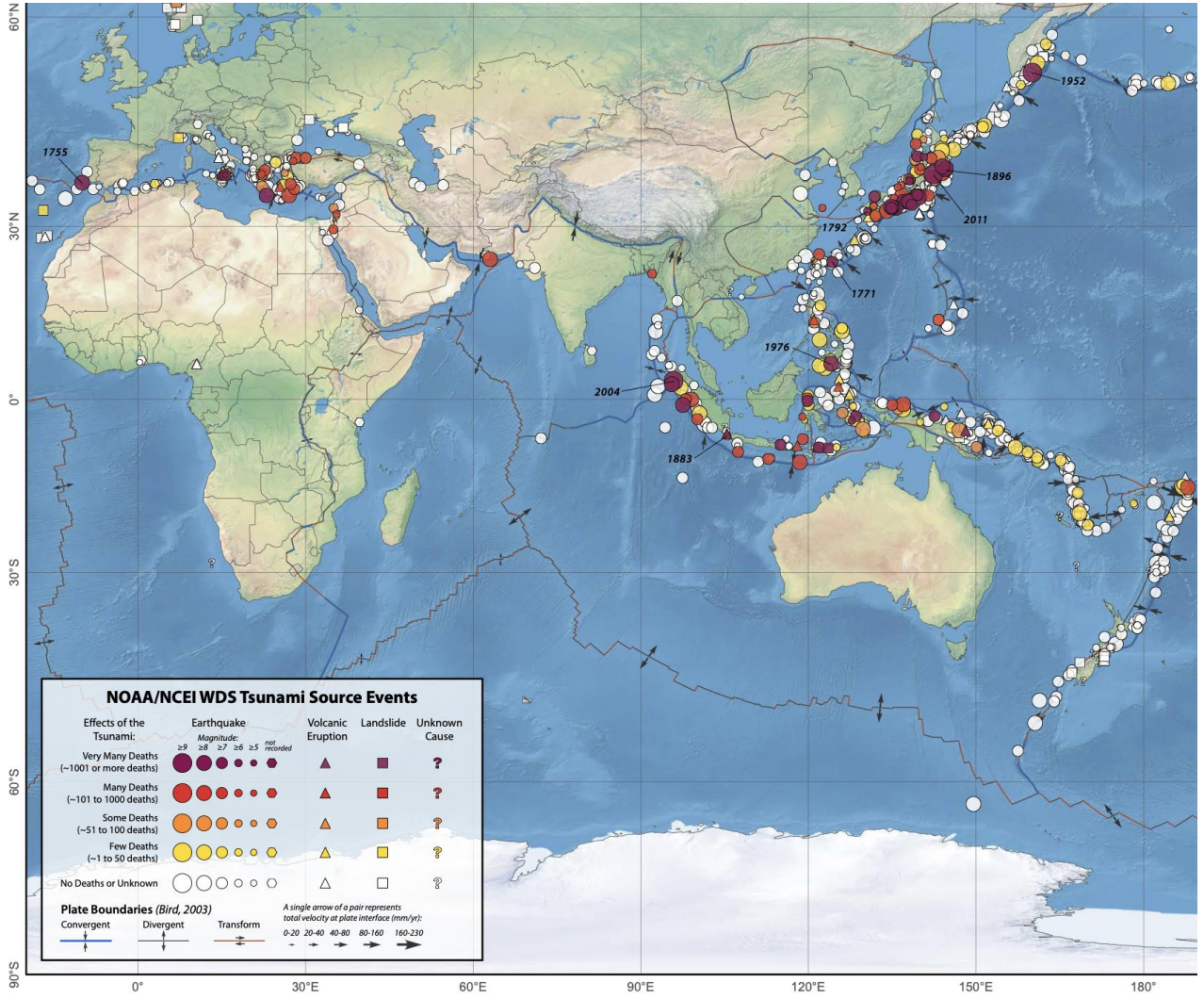
- ✓ Coastal Flooding
- ✓ Storm surge
- ✓ Storm tide
- ✓ Tsunamis

Slow-Onset Hazards

- ✓ Coastal erosion
- ✓ Land subsidence
- ✓ Sea level rise
- ✓ Saltwater intrusion
- ✓ Pollution
- ✓ Rip currents

Tsunamis

-Sudden disruption of the ocean floor and entire water column by uplift of the ocean floor caused by an earthquake
-At the shoreline, wave length decreases and the wave height is increased rapidly up to 40 meters high



In many areas, Tsunami is a severe hazard.

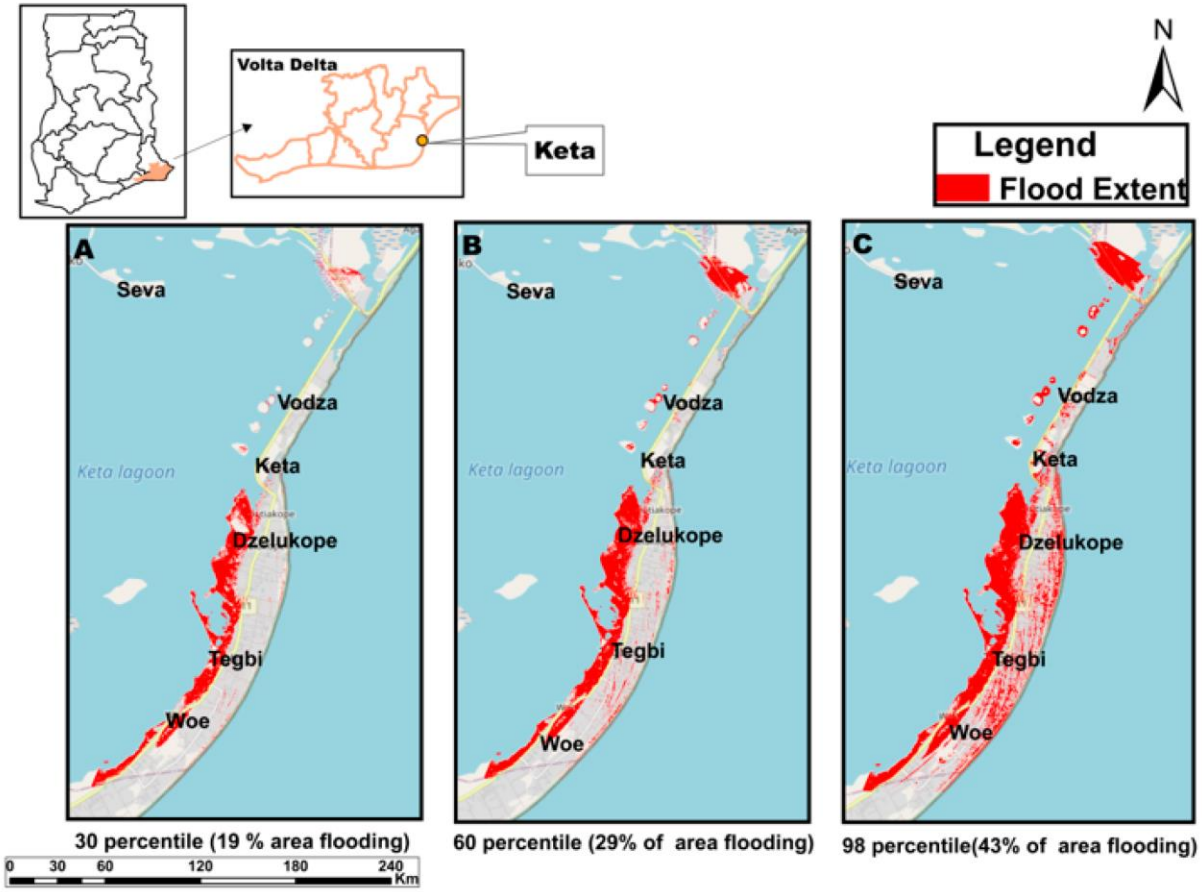
- Africa has experienced the effects of it
- It is not a significant hazard to Africa

E.g., in 2004, the Indian Ocean tsunami affected 11 countries, killing about 283,000 and affecting *Kenya and Tanzania though no deaths.*

Storm surges and flood

Storms are a year-round concern for many coastal residents. Storms are abnormal rise in water due to high winds, increasing ocean water height, and wave action along the coast.

- ✓ West Africa is mostly regarded as storm surge-free zone
- ✓ But storm tide defined as the water level due to the combination of storm surge and the astronomical tide is common along this coastline
- ✓ Because this coastal area is low-lying these storm tides still have significant effects



Floods at 30th, 60th, and 98th percentiles, corresponding to 0.54 m, 0.97 m, and 1.62 m at Volta Delta

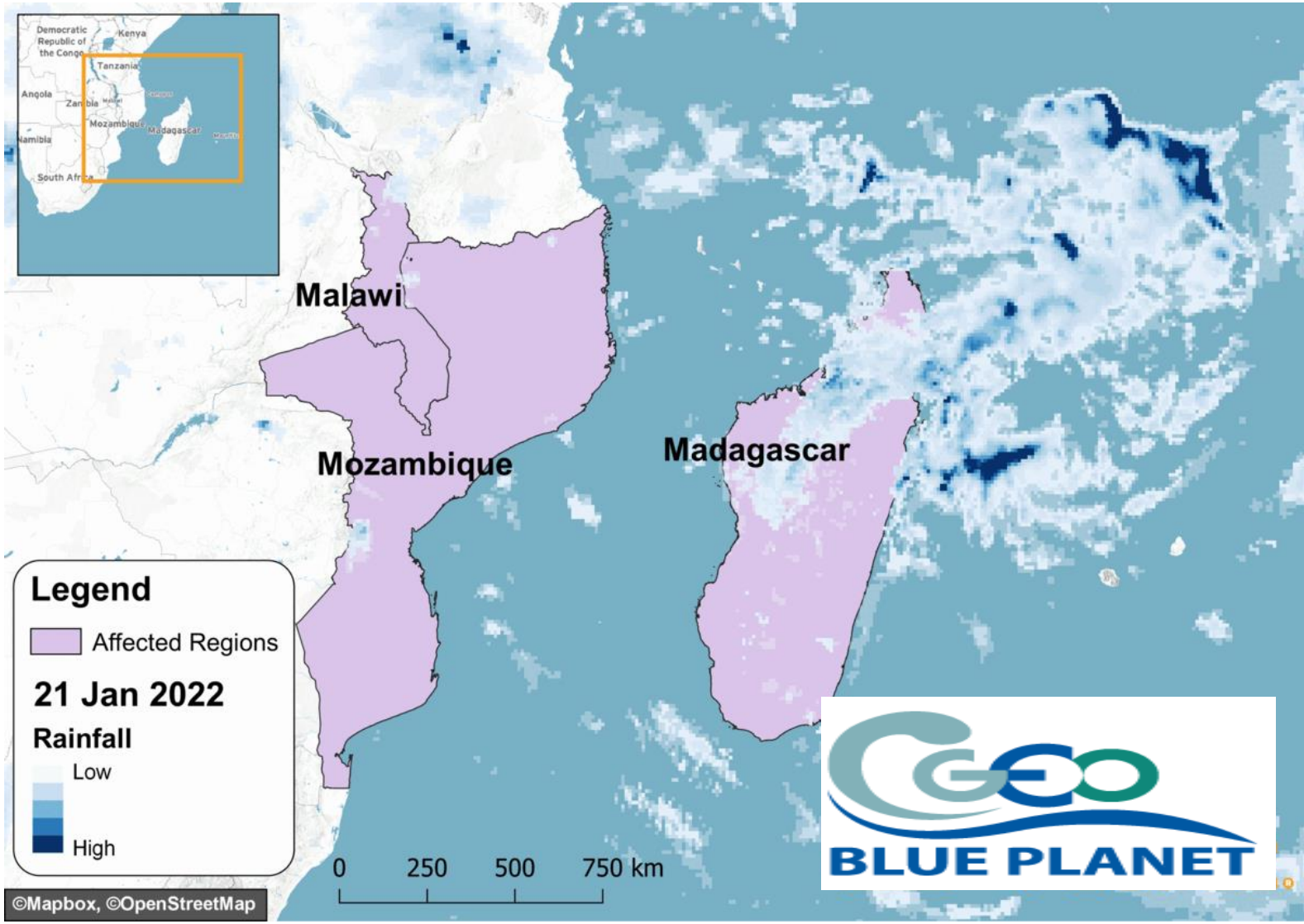
Storm and flood hazards

- ✓ Nonetheless, in East Africa, storms/storm surges are common

- ✓ In 2022, tropical Storm Ana and cyclone Batsirai caused devastation and flooding in 4 countries as reported in several media

- ✓ Many houses got displaced and several people died

- ✓ In April 2022 also, KwaZulu-Natal in SA, witnessed devastating floods killing more than 440 people



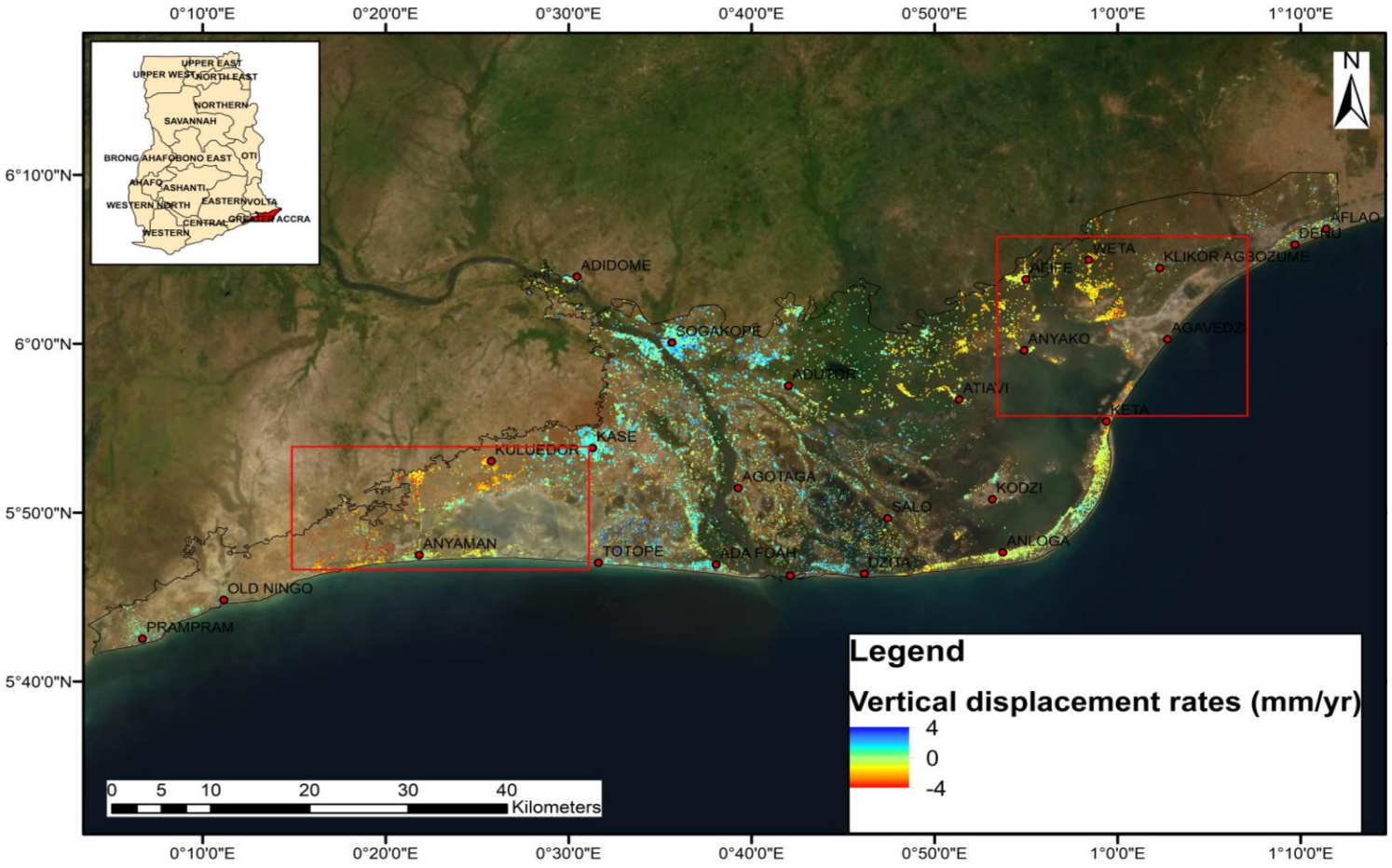
100-year coastal floods in Africa now happen every 40 Years (Africa Center for Strategic Studies)

Subsidence hazard

The motion of a coastal surface as it shifts downward relative to a datum such as sea-level.

Processes Responsible:

- ✓ Regional faulting associated with gravity spreading and/or salt evacuation;
- ✓ Sediment load-induced down-warping;
- ✓ Groundwater extraction-compaction of shallow aquifers (sands)
- ✓ Oil/gas extraction related-compaction of sediment layers (sands)

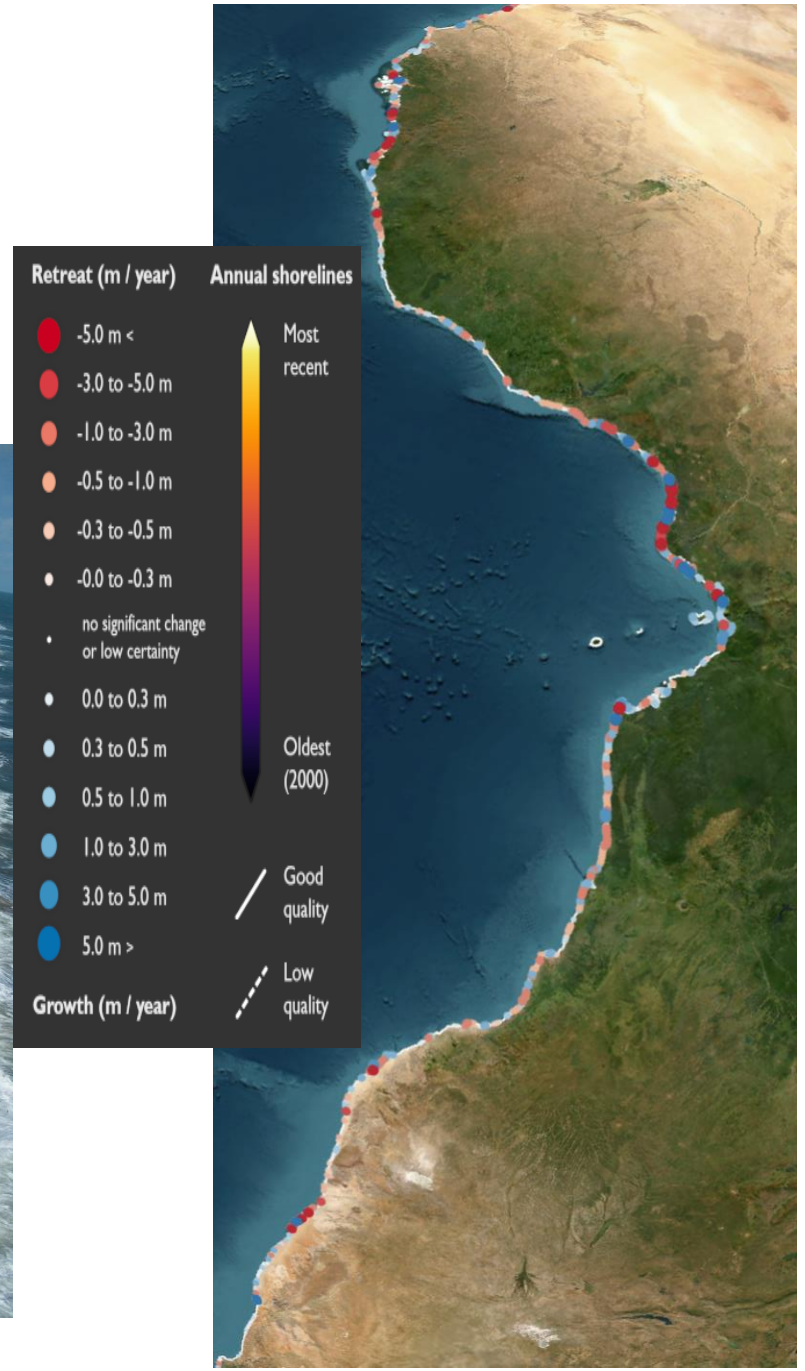


Subsidence observed along the coastline of Ghana, Volta Delta

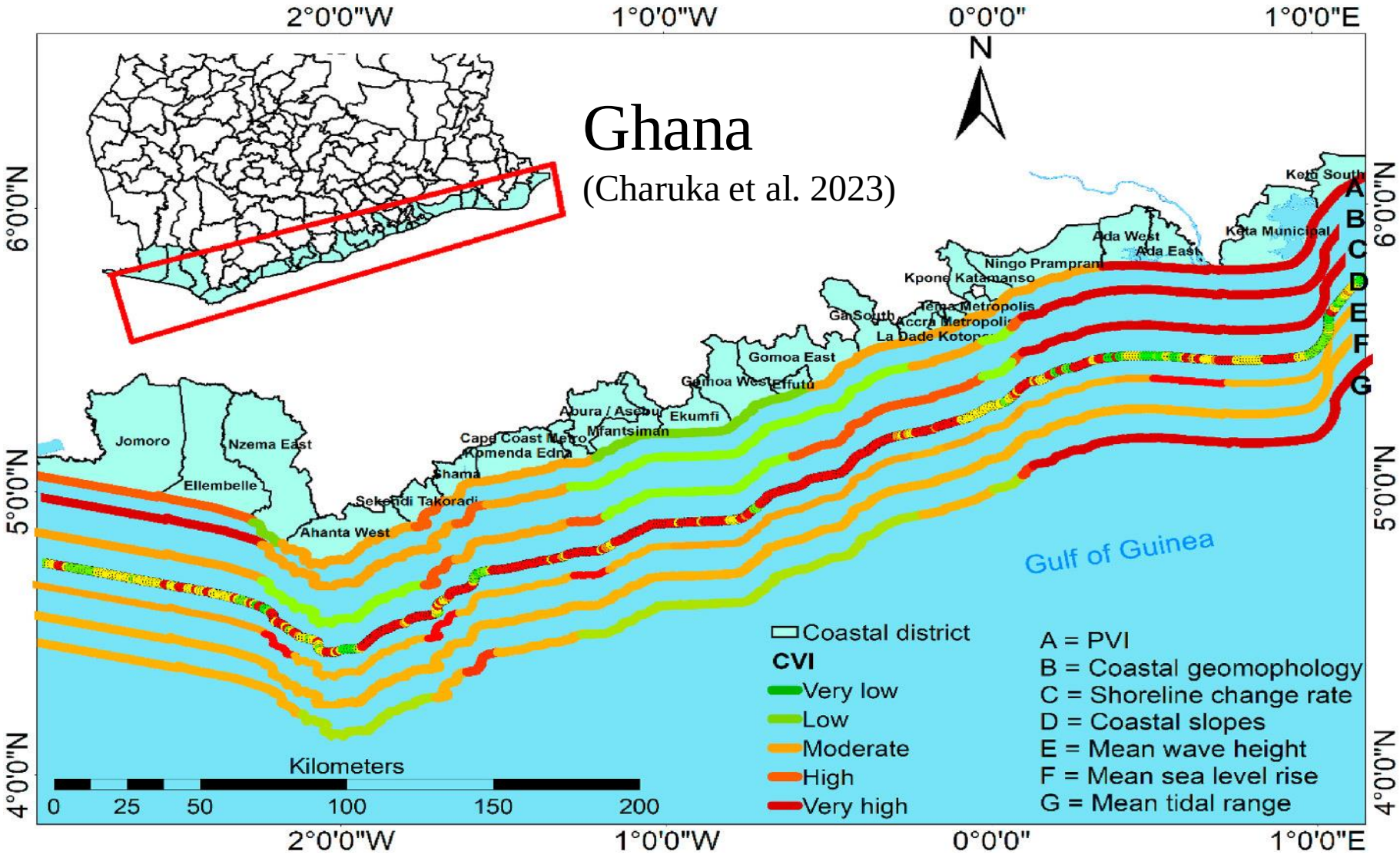
Brempong et al. 2023.

Coastal erosion hazard

- ✓ All the countries erode at different rates.
- ✓ Erosion ranges up to 5 m on global scale but could be up to 100 and 250 m as reported for Cape-Lopez to Port-Gentil in Gabon



Ghana's coast is eroding due to waves, sea level rise, tides, topography, etc. as they can enhance erosion and flooding



Sea level rise and climate change

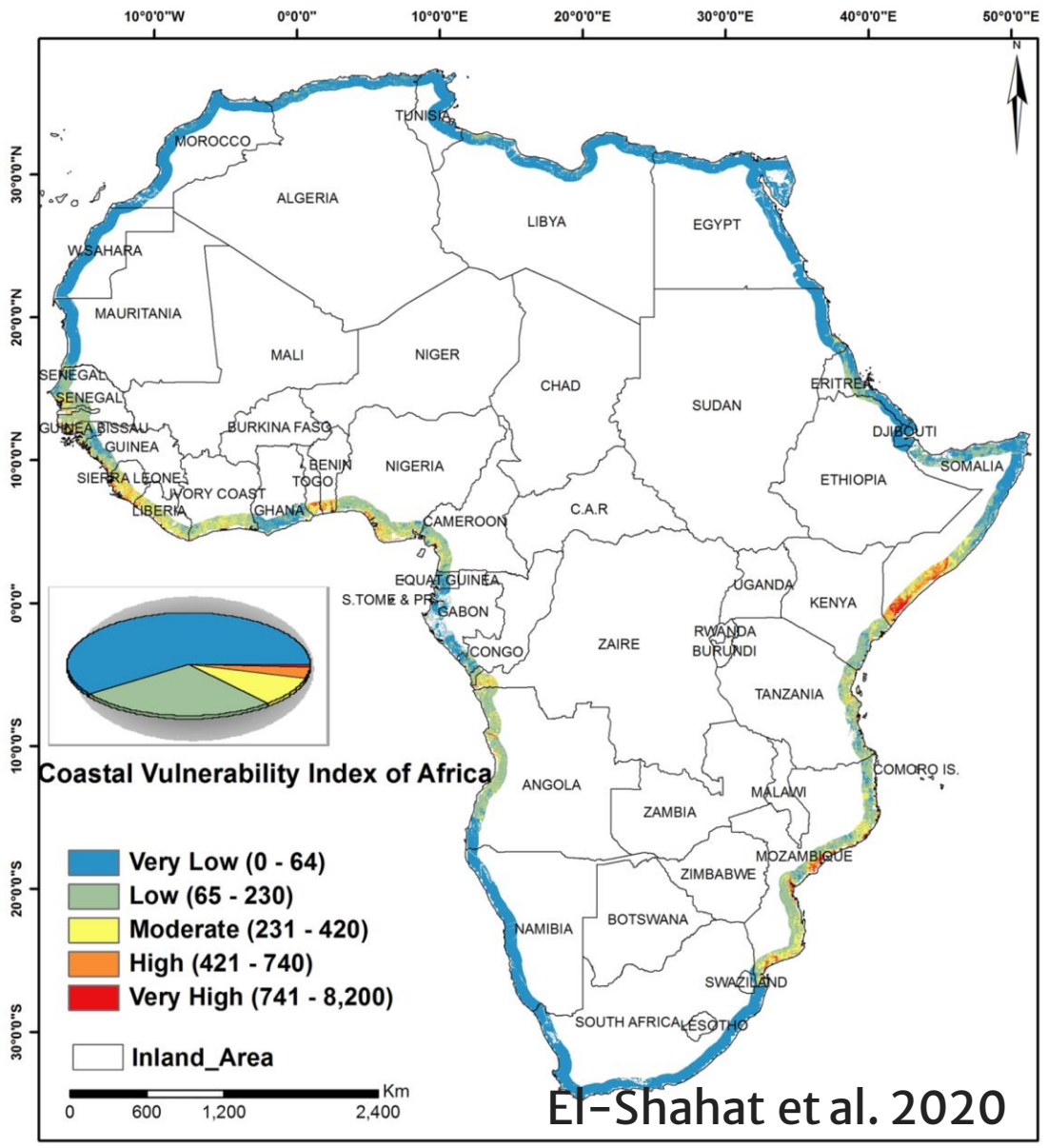
- ✓ All hazards are related to climate change
- ✓ Increasing wave heights

- ✓ Intensifying floods

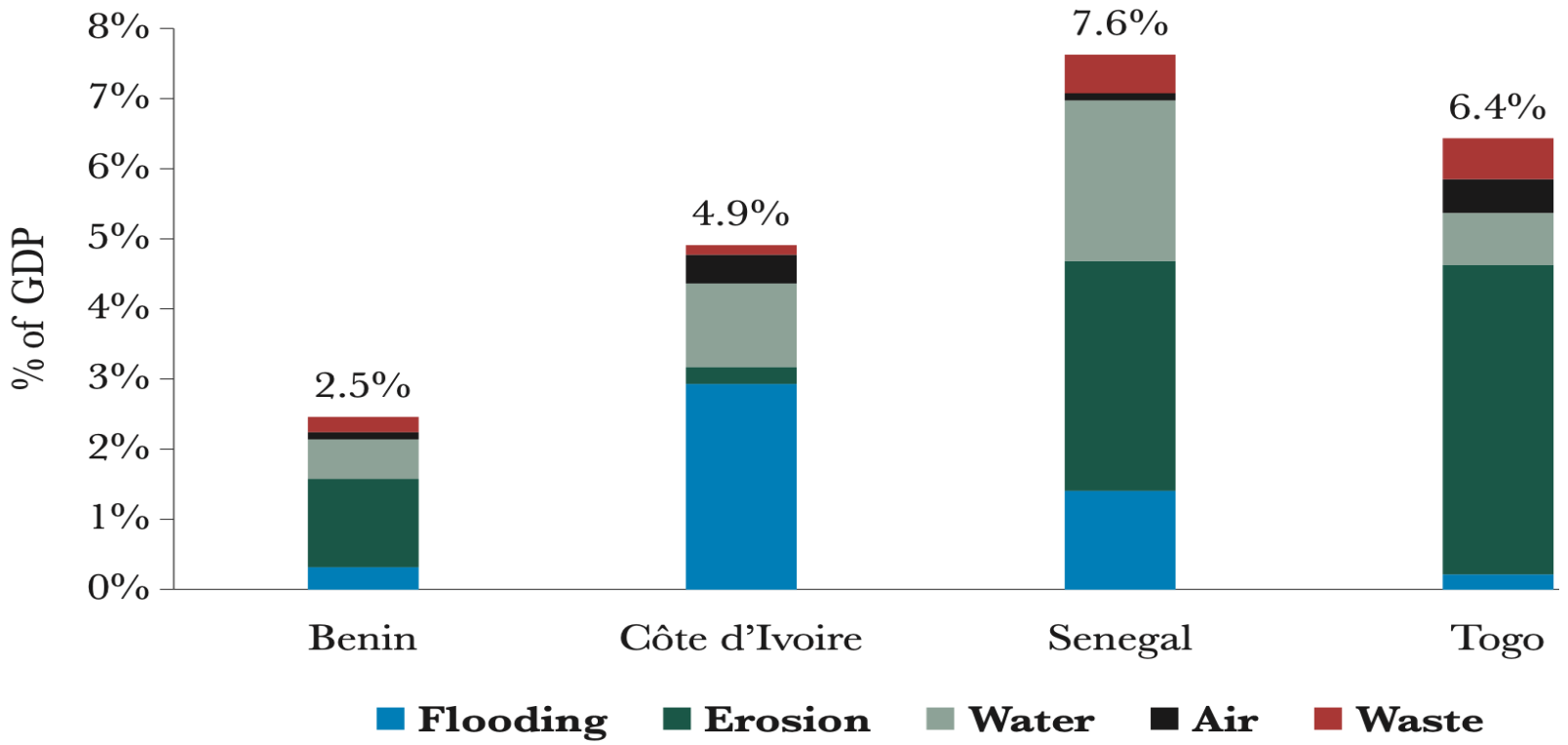
- ✓ Salt water intrusion: The movement of saline water into freshwater aquifers, via overtopping and infiltration

- ✓ Renders coastal areas vulerable
- ✓ Inundation of low-lying beaches

- ✓ Coastal Floods are enhanced by extreme coastal water level



Effects of hazards on GDP (source: World Bank site)



Source: World Bank estimates

E.g., Bolle *et al.* (2021) estimated that coastal erosion and flooding risks amount to US $ 47 million per year in Ghana

Coastal hazards

Other concerns:

- ✓ Coastal zones are complex, highly dynamic environments subjected to different processes and interactions (marine, continental, biological, etc.);

- ✓ The concentration of populations, economic activities, and transport systems in coastal zones render these environments highly vulnerable to pollution of all types.

- ✓ Climate variability coupled with human-induced changes, will affect ecosystems severely. Forecasts indicate that population migration towards the coast will continue.

- ✓ In addition, the main socio-economic activities are commonly concentrated in coastal zones;
- ✓ A large proportion of the world's coastline is eroding at significant rates

Current adaptation: Soft and hard

Human Alterations on Coastal Areas

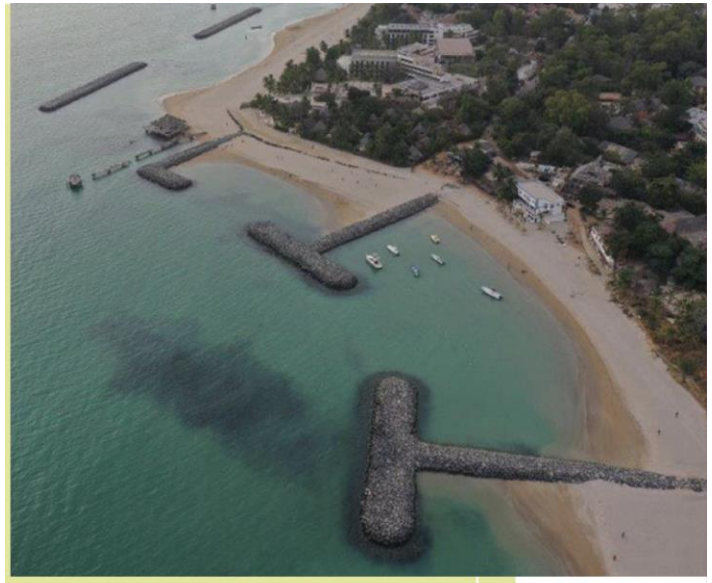
- ✓ Dams - less sediment reaches river mouth
- ✓ Artificial structures - built to stabilize beaches
- ✓ Dumping tons of sand up-current from beach, doesn't work
- ✓ Keeping the sand in motion and inhibiting its deposition in the navigation channel

Dune construction /rehabilitation in Mauritania

Dune Rehabilitation in Mauritania. Photo: Modestine Victoire Bessan/IUCN

Dune rehabilitation in St. Louis, Sen

Senegal. Photo: AMP de Saint Louis



Groynes in Saly, Senegal. Photo: Senegal World Bank funded Tourism Project (PDTE)

Hazard control measures going forward from EO

- ✓ Develop adaptation strategies for cyclones and flooding
- ✓ Increase emergency response and warning systems in the coastal region
- ✓ Monitor and reduce saline water intrusion
- ✓ Building mitigation infrastructure to strengthen emergency preparedness for reducing the vulnerability of the coastal population
- ✓ Delivering reliable weather, water, and climate information services and improve access to such services

Many thanks for your audience !!!!