

**Online Webinar Series 3/21: Geoscience****8 April 2021****Holocene Sea Level:  
What Happened  
Along Our Coast for  
the Last 10kya****SPEAKER****Dr Fatin Izzati Minhat**

Dr Fatin is a lecturer under Marine Science Department in Universiti Malaysia Terengganu (UMT). She obtained her BSc, MSc and Doctorate from Universiti Sains Malaysia and UMT respectively with special research interest in application of benthic foraminifera as indicators of sea level changes in Malaysia. Her main area of expertise is in marine science and micropalaeontology.

**Fatin Minhat**

April 7, 2021

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# Holocene Sea level : What happened along our coast for the last 10kyr?

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Fatin Izzati Minhat (PhD)

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## Introduction

- BSc. Applied Biology (Aquatic) (USM,2010)
- MSc. Marine Science (USM, 2013)
- PhD. Oceanography (UMT,2016)





## The International School of Foraminifera

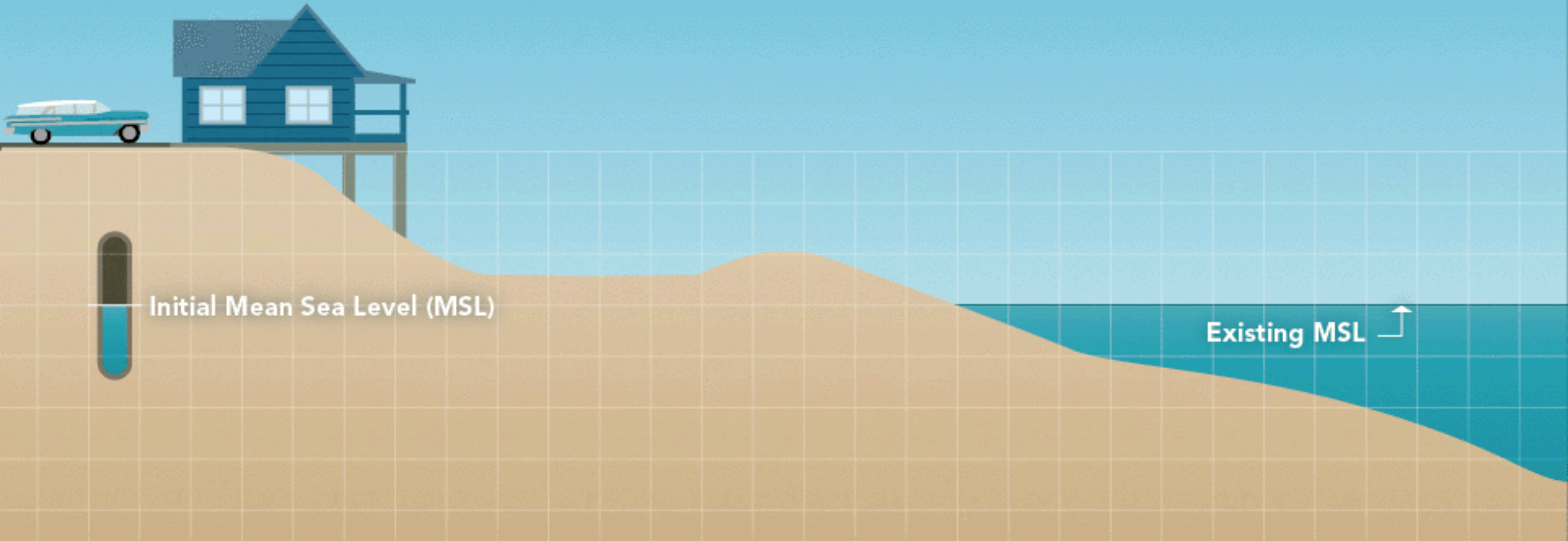




**K-T (K-Pg) boundary**



## Coastal Dynamics of Sea Level Rise (SLR)



# What is sea level changes?

- The changes of water level relative to land elevation.
- The increase of water level (sea level rise) or the decrease of water level (sea level fall) happened numerous time throughout the geological time.

# Observatory vs Experimental

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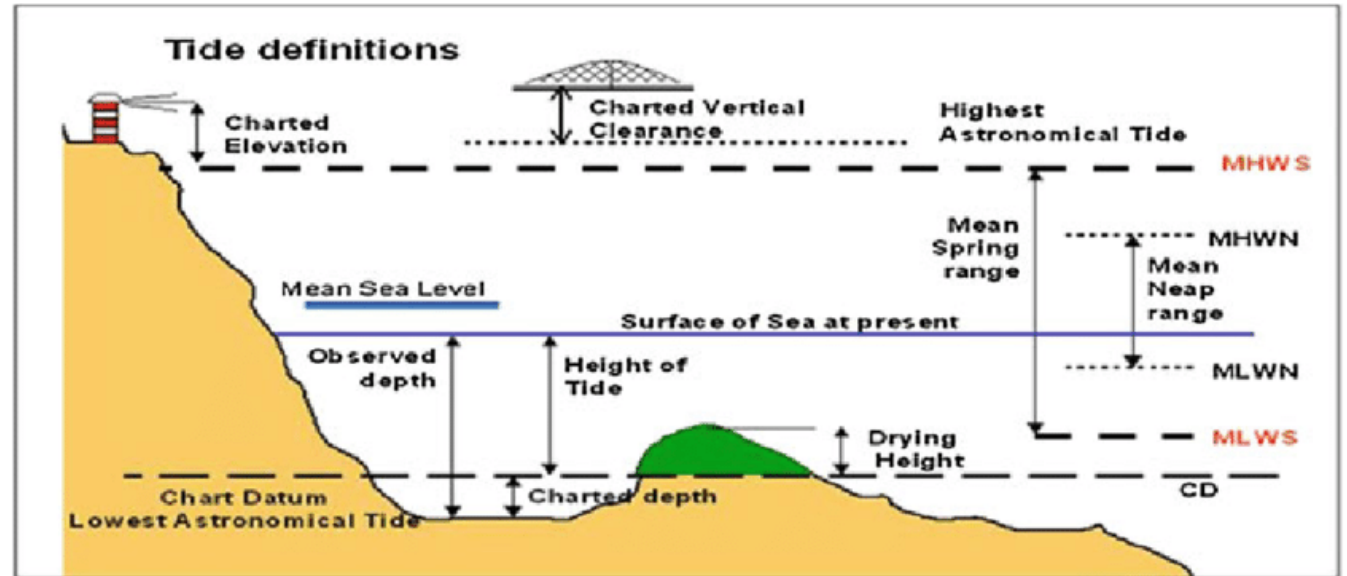
Sea-level study is an  
observatory science.





# How do we measure sea level changes?

- Sea level is primarily measured using tide stations and satellite laser altimeters.
- Tide stations around the globe tell us what is happening at a local level – the height of the water as measured along the coast relative to a specific **point on land**.
- **The point on land is known as geodetic datum.**
- Satellite measurements provide us with the average height of the entire ocean. Taken together, these tools tell us how our ocean sea levels are changing over time.

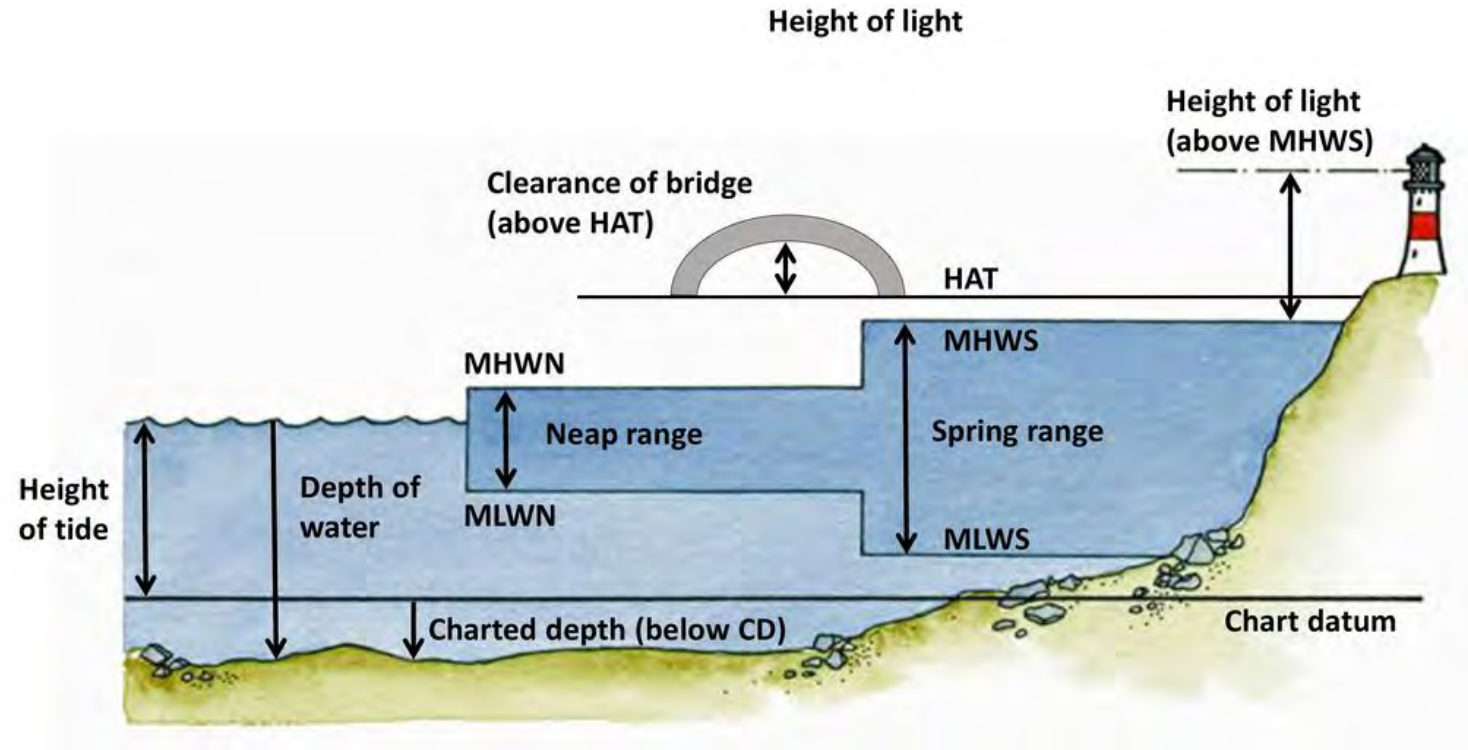




# Geodetic datums

- A geodetic datum is an abstract coordinate system with a reference surface (such as sea level) that serves to provide known locations to begin surveys and create maps.
- Vertical datums are used as a reference level to which bathymetric soundings are referenced for nautical charts.

Tidal terms







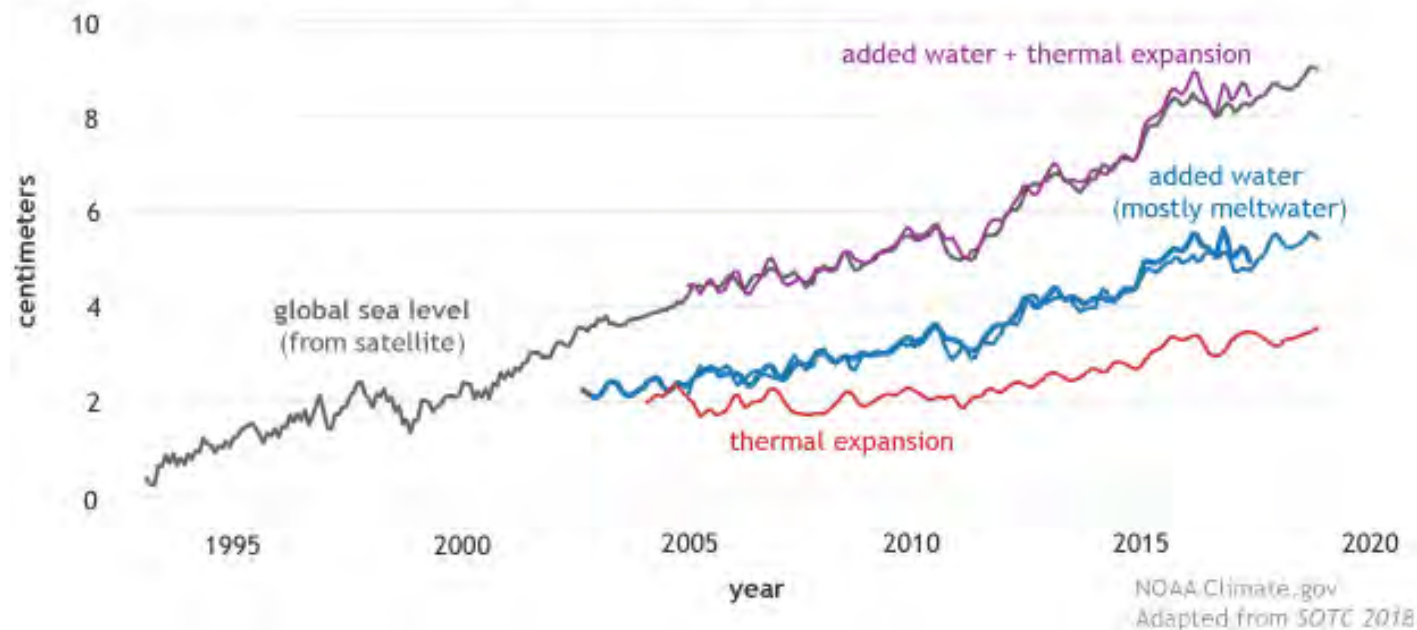
**How do we  
measure  
past sea  
level?**

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# Global mean sea level rise

Contributors to global sea level rise (1993-2018)



- Sea level has risen 8–9 inches (21–24 cm) since 1880.
- In 2019, global sea level was 3.4 inches (87.61 mm) above the 1993 average – the highest annual average in the satellite record (1993-present). This is an increase of 0.24 inches (6.1 mm) from 2018.

<https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level#:~:text=Global%20mean%20sea%20level%20has,of%20seawater%20as%20it%20warms.>

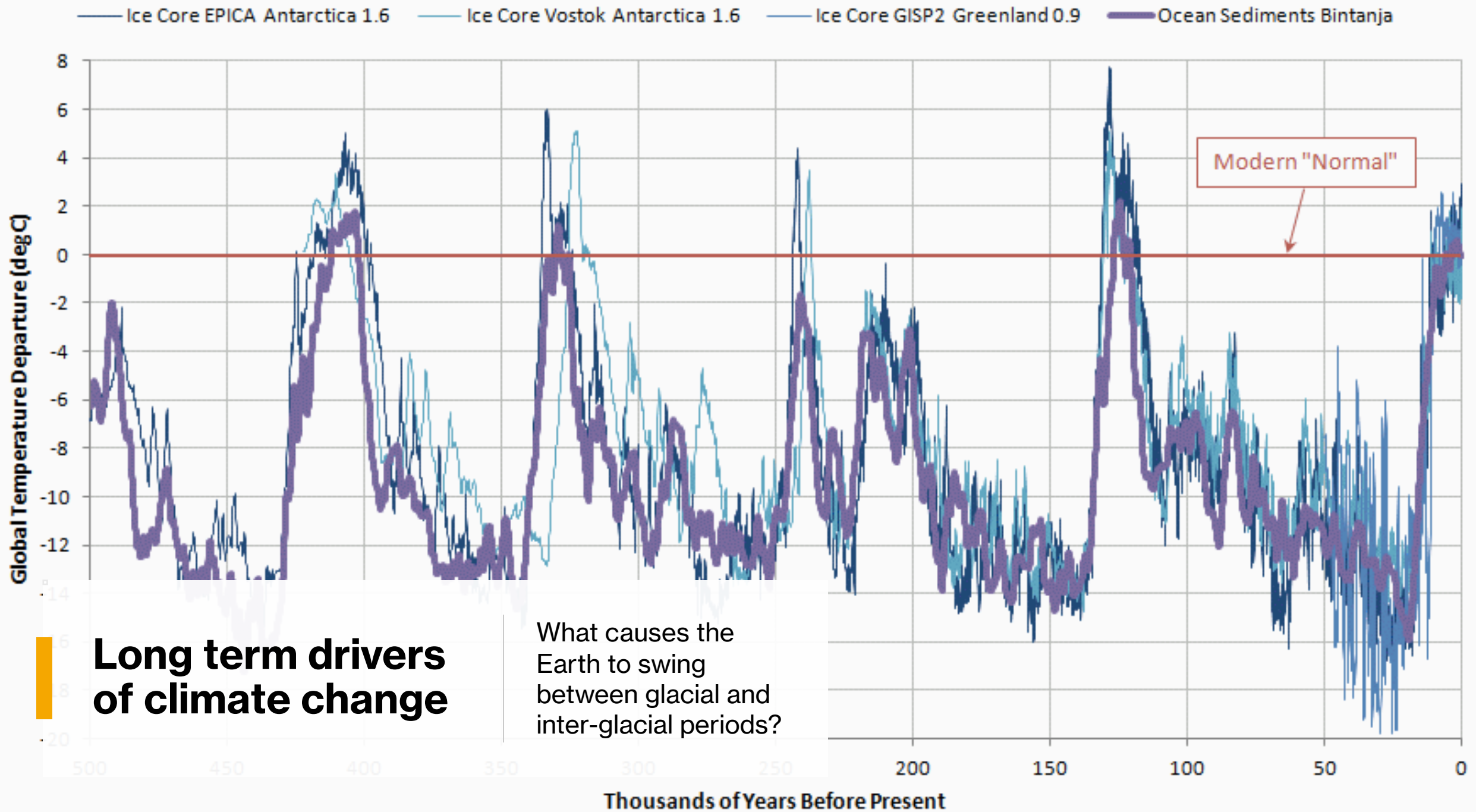


# Long term vs Short term drivers





**Let's Kahoot**





# Short term drivers





## Factors affecting global sea level changes

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- Melting and building up of glacier.
- When glacier and ice-sheet melt, the water enter ocean basins.
- When glacier build up, lots of water store as ice.
- Thermal expansion. The heat absorbed by the ocean causes the water molecules to expand. Adding volume to the ocean.



**ice sheet**

**sea**



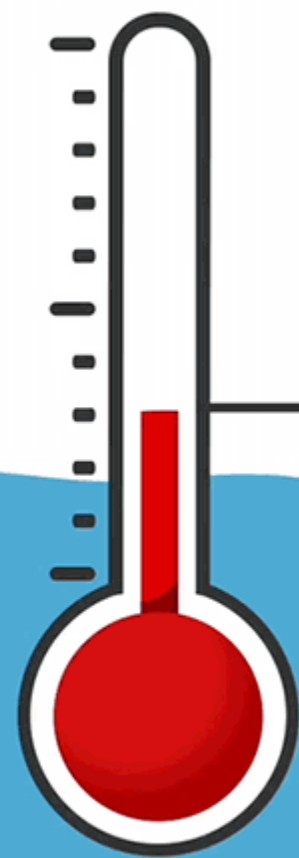




## Factors affecting global sea level changes

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Temperature Decreases



# Factors affecting local sea level changes

- Several local factors determine the rise and fall of local sea level pattern.
- These factors include land subsidence, ocean currents, tidal pattern, variations in land height and local climates.
- Land subsidence is the sinking of land area due to massive weight of cities and extraction of ground water.
- Ocean currents and tidal patterns changes with climate. Extreme climatic event such as typhoon and storm may cause higher local sea level.



## Climate Change

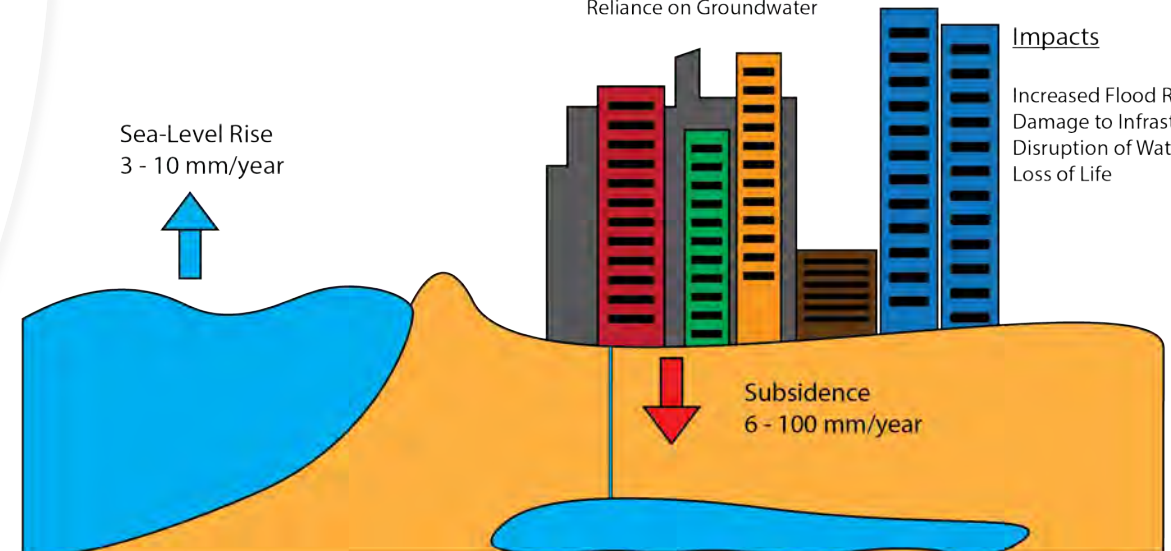
Accelerated sea level rise  
Extreme weather events

## Socio-economic Development

Urbanization and Population Growth  
Increased Water Demand  
Reliance on Groundwater

## Impacts

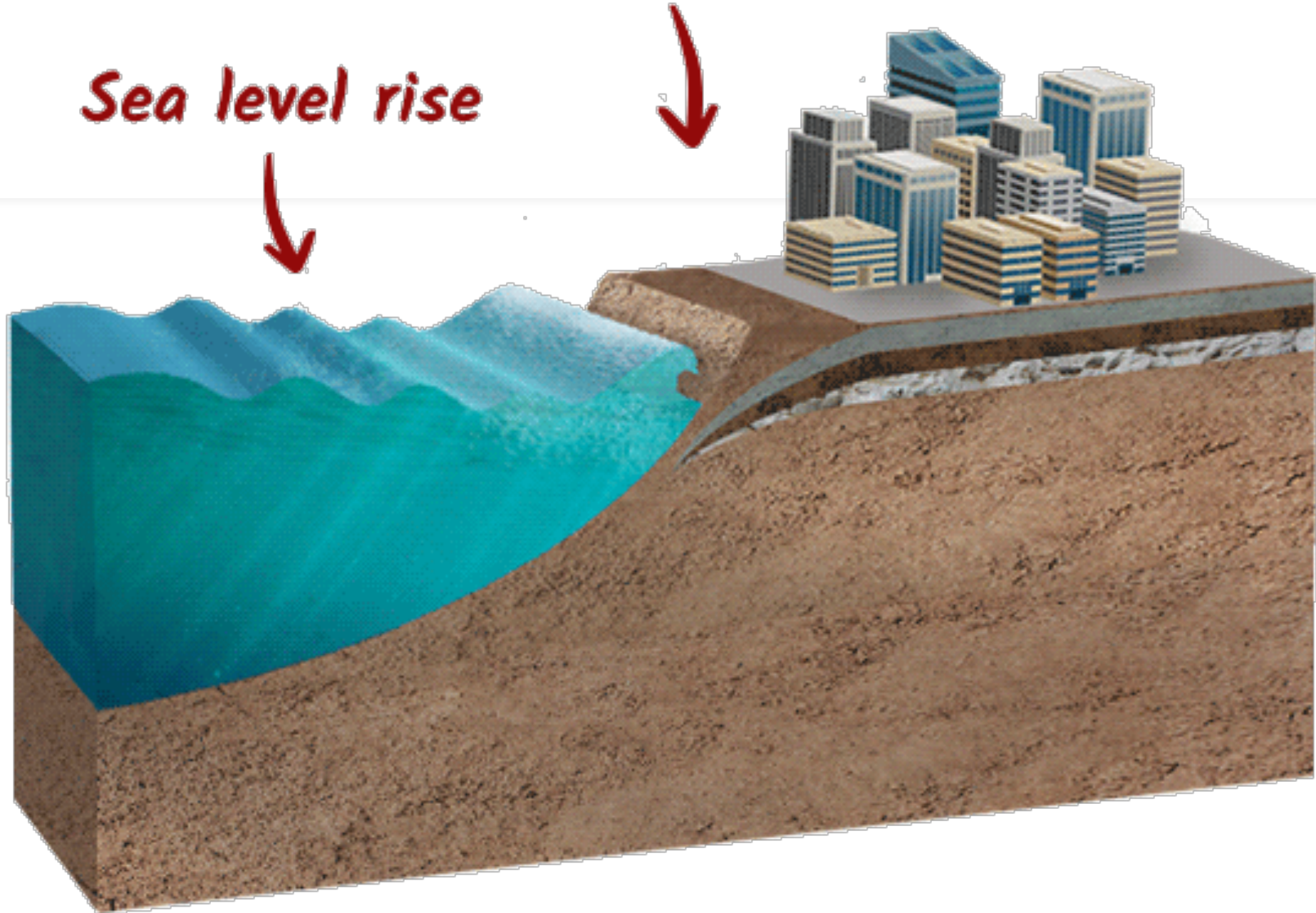
Increased Flood Risk  
Damage to Infrastructure  
Disruption of Water Management  
Loss of Life



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*Land sinkage*

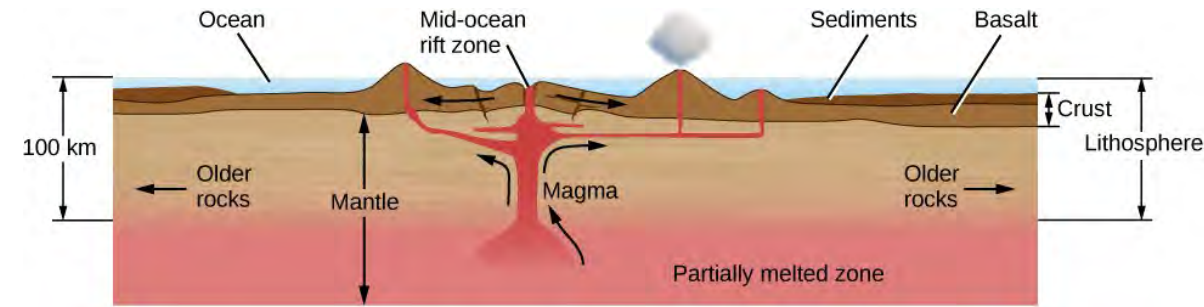
*Sea level rise*



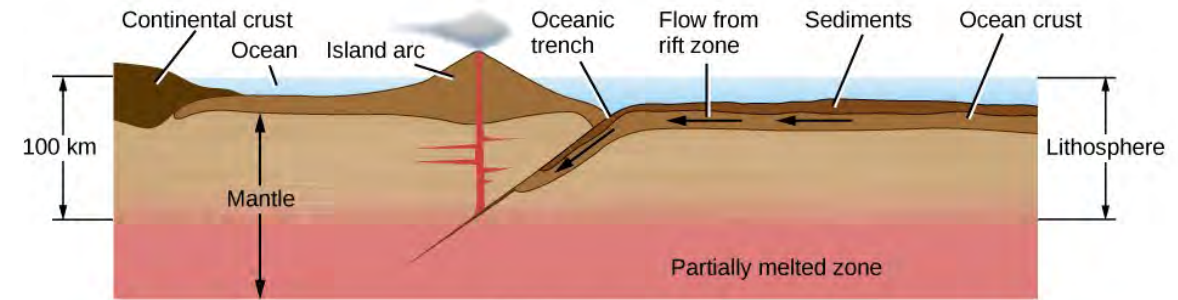


# Factors affecting local sea level changes

Variation in land height- vertical land movement and isostatic adjustment.



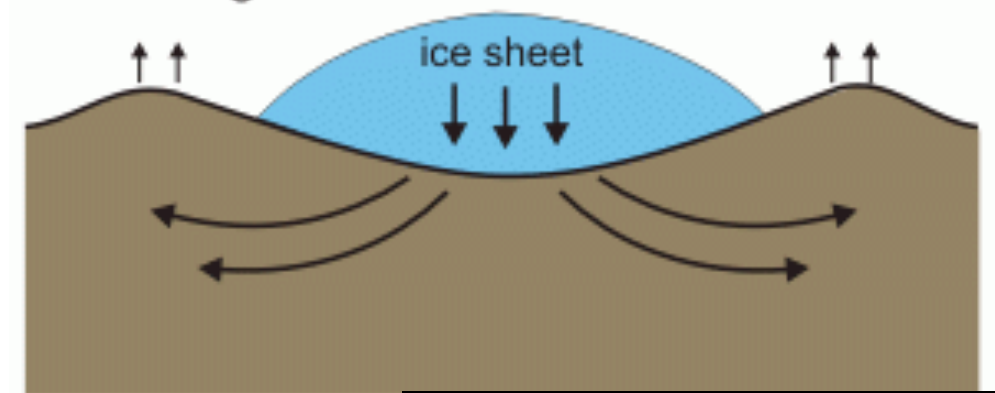
Rift zone



Subduction zone

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## a. Peak glaciation



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**What are the implications  
of sea level changes?**





- Coastal flooding
- Extreme storm surge.
- Ecosystem destruction
- Coastal erosion
- Many large cities are subjected to sea-level rise

