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College of Science – Applied Geology Department
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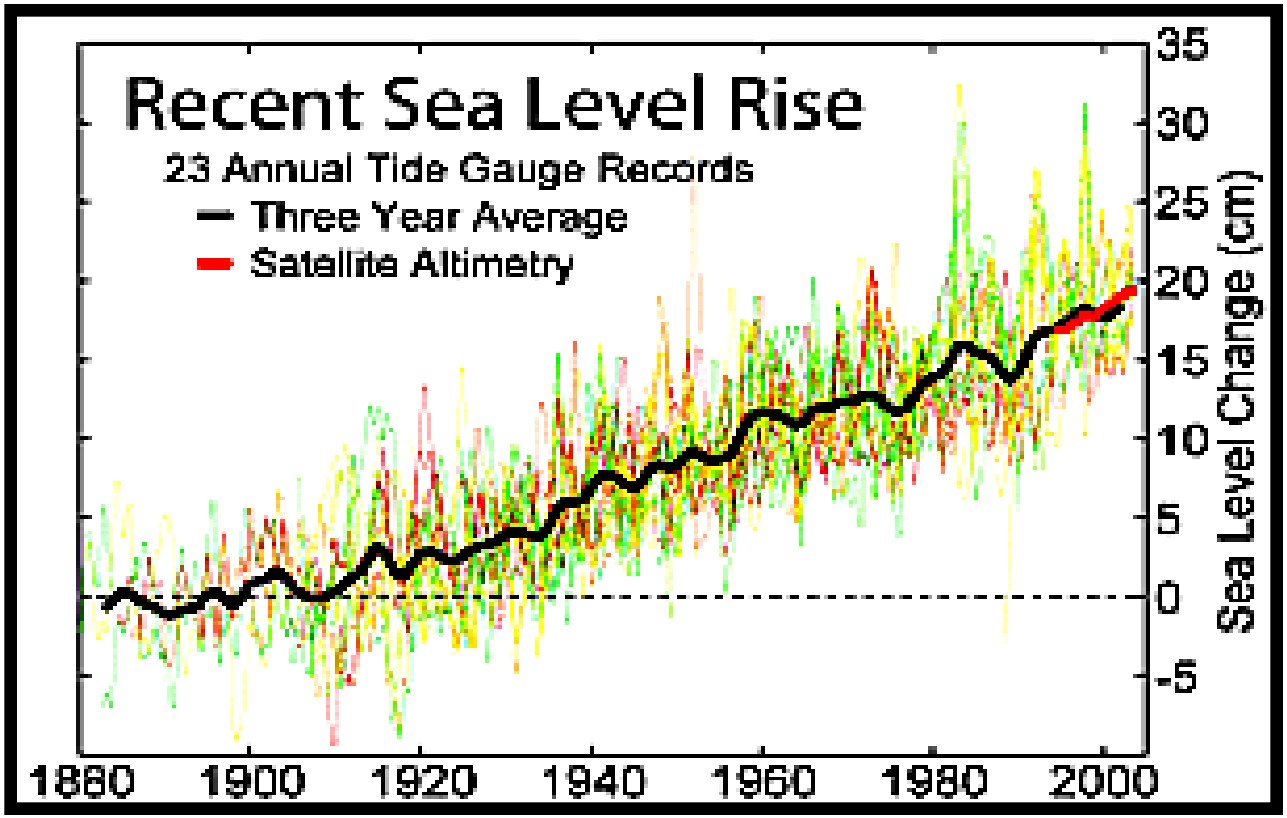
4th Stage

Quaternary

Lecture 6: Sea Level Changes

Sea Level Changes During Quaternary

The level of sea level changed at Quaternary periods with the time of high temperature , the sea level was between 4 and 6 meters above its current level. This may have been due to the fact that a large part of the ice sheet that today covers the western part of Antarctica did not yet exist. sea level rose at an average rate of around 1.8 mm per year over 1961 to 2003 and at an average rate of about 3.1 mm per year from 1993 to 2003 .

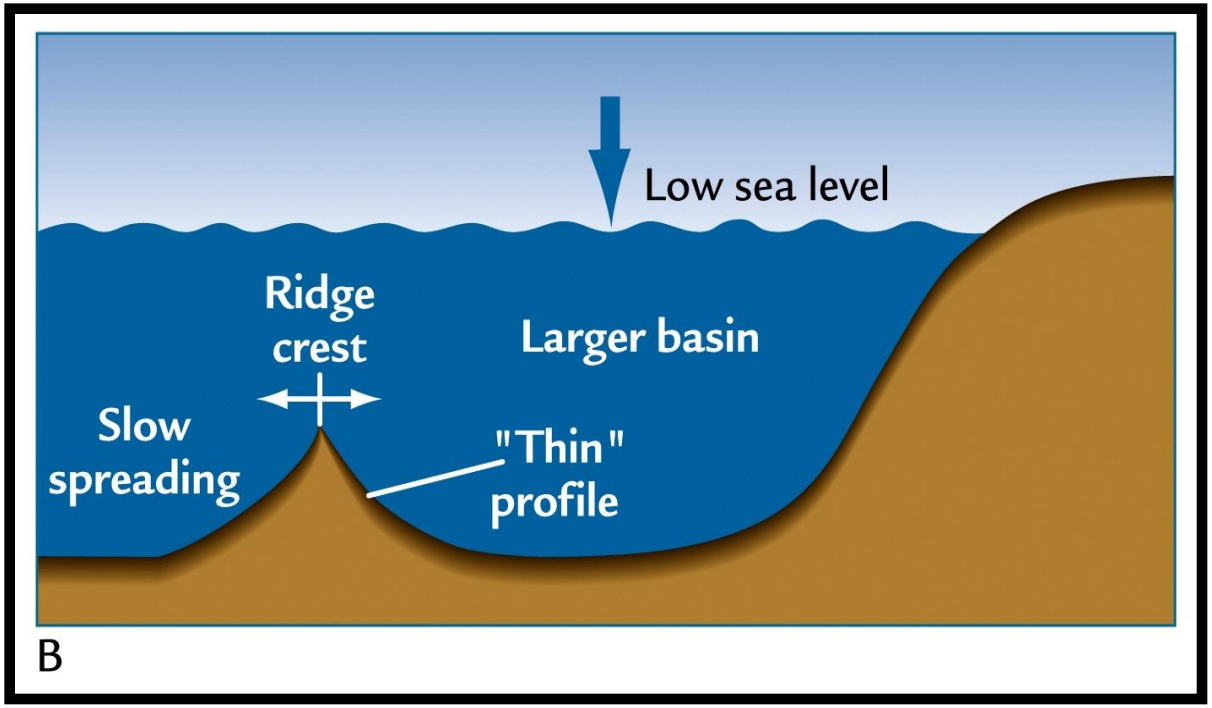


because of many factors effected the global weather.

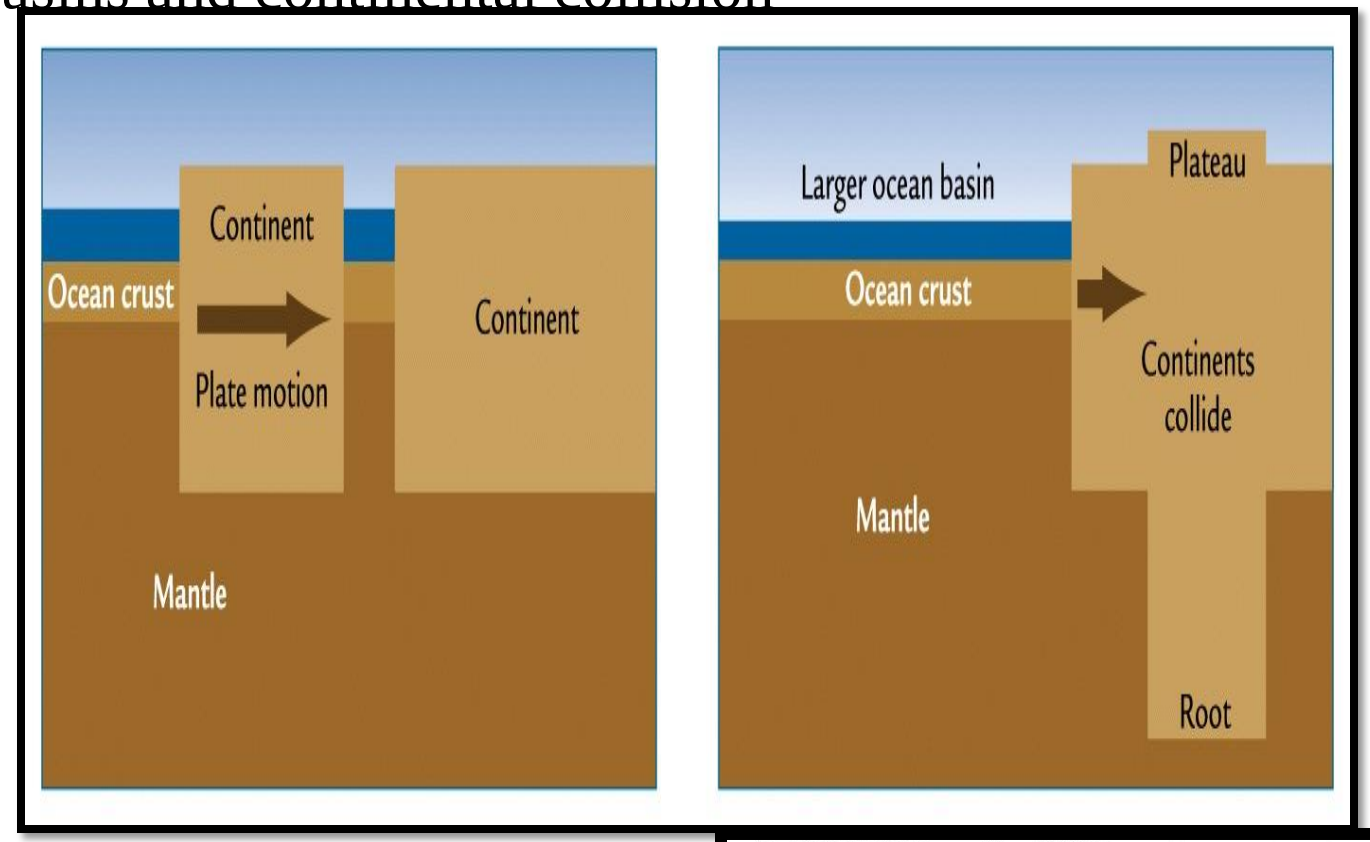
1 – General tectonic changes

The sea floor spreading collision between plate tectonics caused extend the seas area and later reduce the sea level . Rate of sea spreads 16cm/year can held about 6 % of all the water come to oceans of glacial melting.

The other factor of tectonic – the lifting of oceanic sediment and bottom . Modern spreading – 3-4 cm/yr

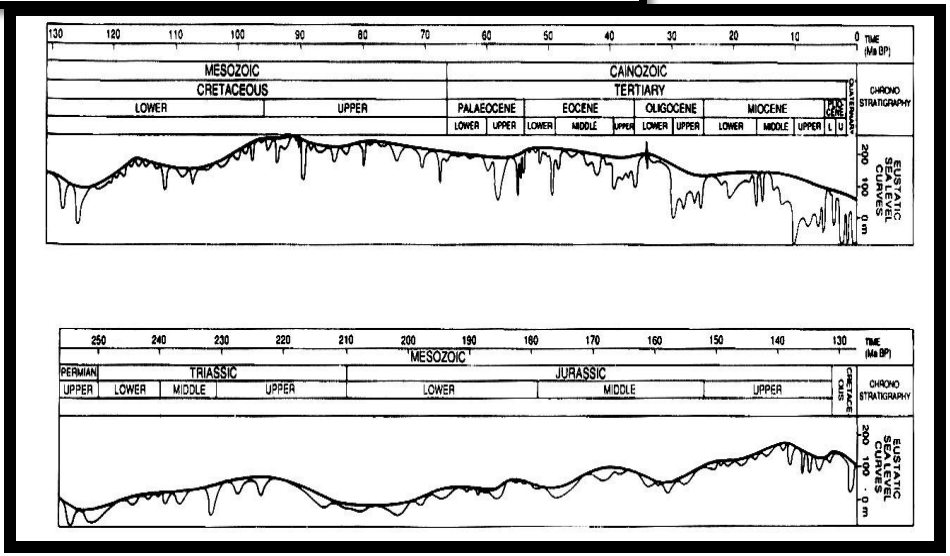


Ocean basins and continental collision



Global tectonic effects on RSL

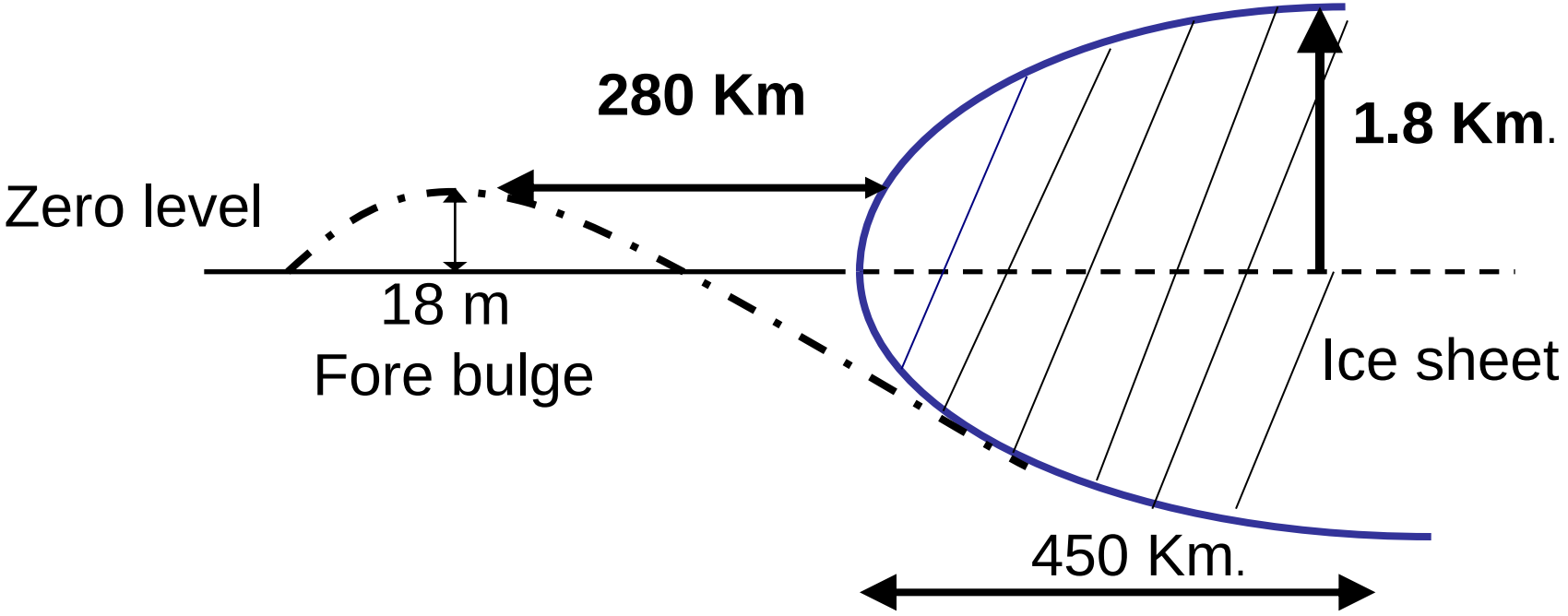
1 Ma to 100 Ma

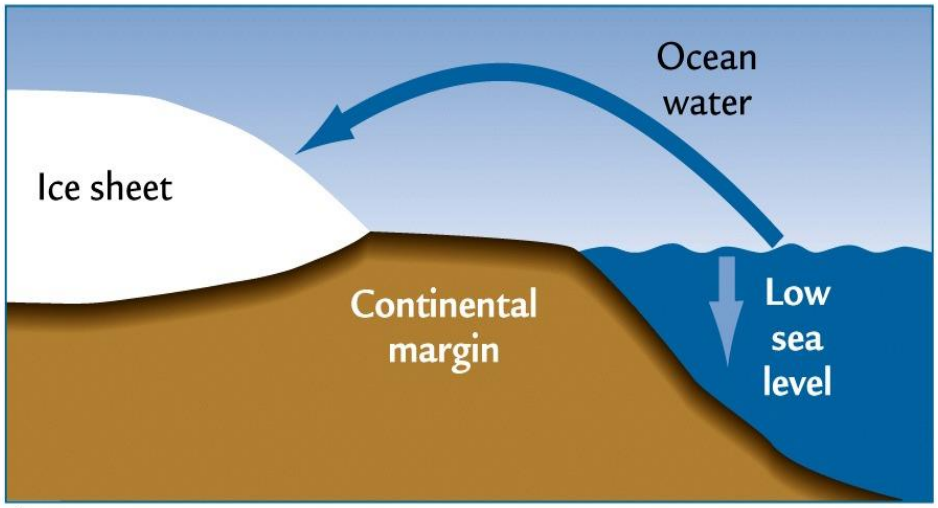


2 – Glacial Isostacy

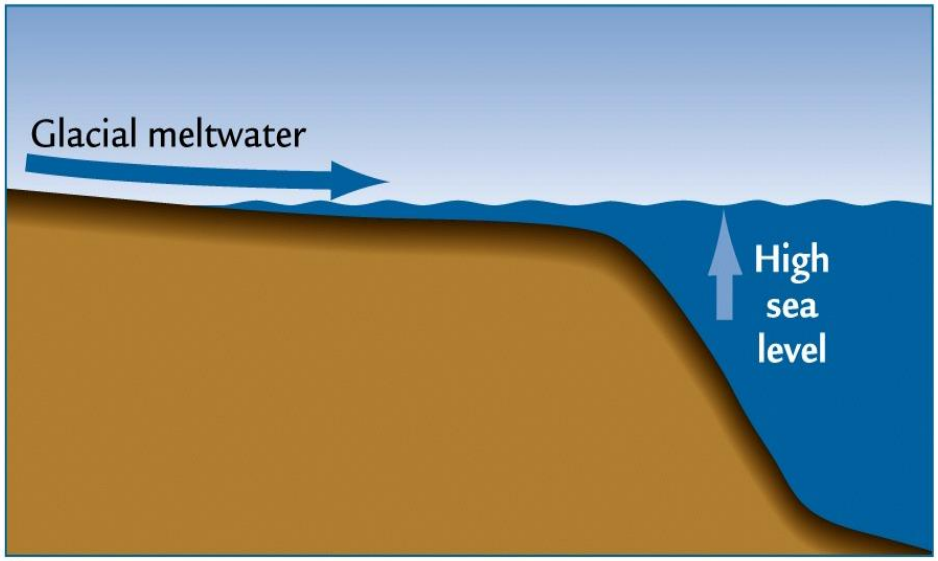
The loading and unloading may change the earth surface .

When the ice begin to melt the weight become lighter So the earth surface go up to new level with the shoreline not because the lower of water but by uplift of ground .

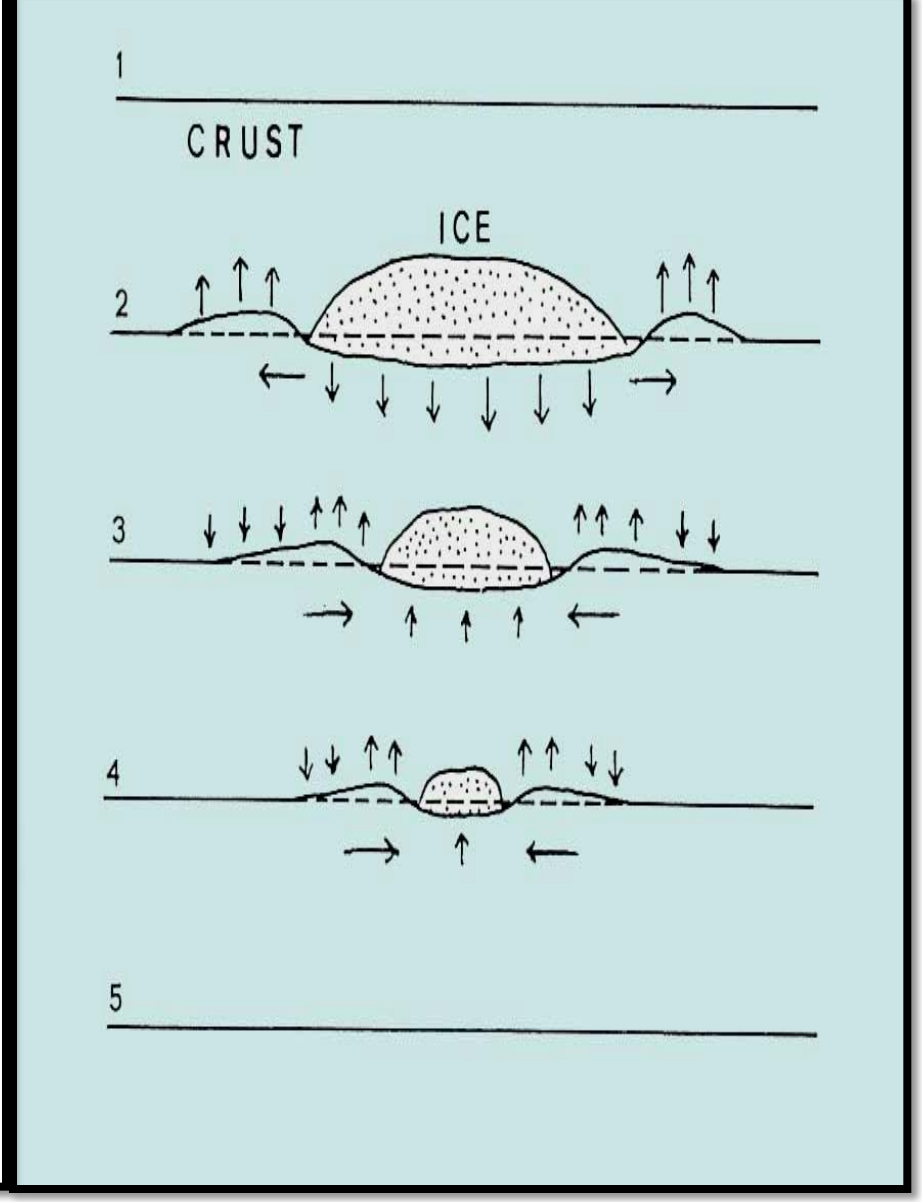



Ocean water
Ice sheet
Continental margin
Low sea level

A


Glacial meltwater
High sea level

B


1
CRUST
ICE
2
3
4
5

3 – Hydroisostacy

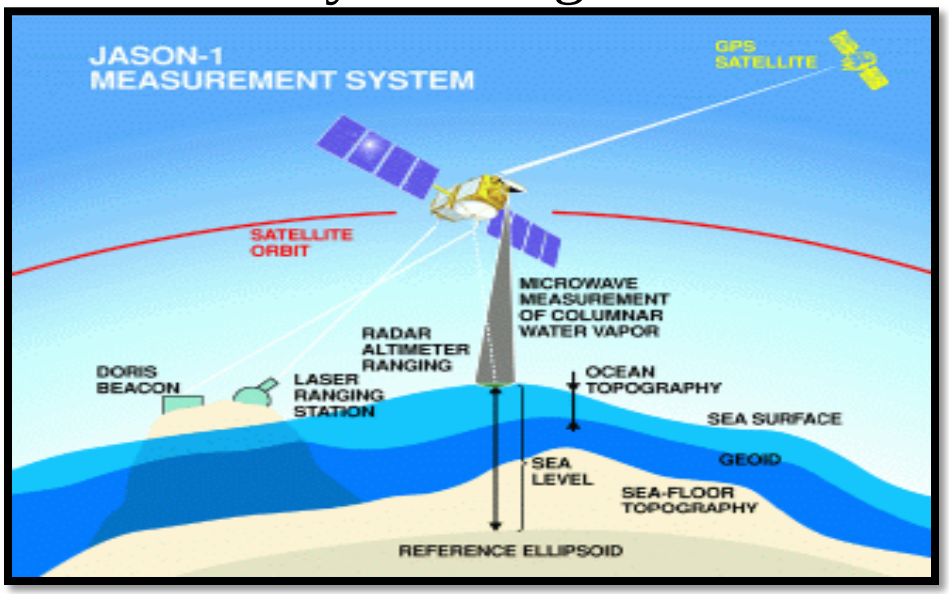
Not very effective factor , the idea about it – some water of oceans change to Glacial at continents that cause decrease the load to the bottom of oceans so will get up . And opposite case caused opposite effect , but the total area of oceans very huge so no clear effect can notice . The bottom of ocean rise up 8 mm while the while the rise continental surface 16 m .

4 – Geoidal changes

Not calculated with high accuracy . It’s mean the level of sea surface not unique as we expect , its change by effect of many factors , as the tidal daily change (lower point near Maldevs islands and highest at pacific oceans different about 180 m) .

That mean NO shore lines fixed at all the world and no shore can consider the Zero reference to other . Any changes may happen to worlds can effect strongly to the water level .

Geometry of satellite altimetry defining the Geoid



5 – Glacial Eustatic movement in sea level due to Glacial and deep glaciations

The most important factor , The water at glaciations periods move from oceans to ice places and the water level become drop down. And come back to ocean at warm periods when the ice melt this rise up the water level again .

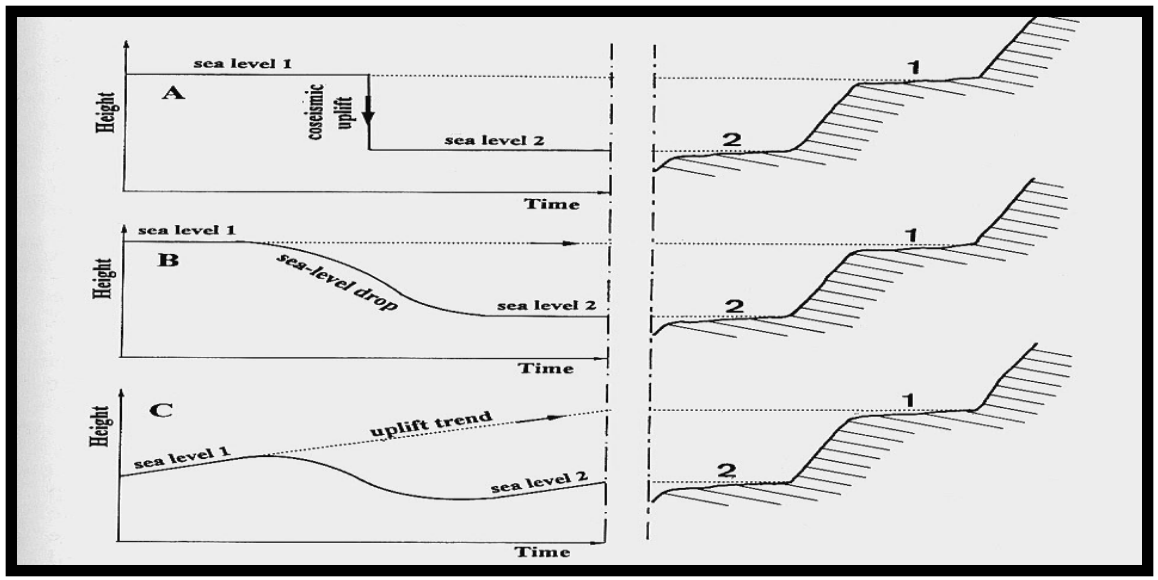
At last glacial period (Pleistocene) the water drop down about 135 m.

Before 6000 years ago the sea level stay almost about the present level with huge quantities of ice at northern and southern seas . If all that ice melt the new sea level will rise up about 50 – 70 m. with no consider to isostacy effect but with calculate it the level become 35m.

Before the Pleistocene the level was 130m.

The general slope of sea level get down 1mm/13 year that mean 1 km. / 13 million year and this not the real situation we can see today . So must be another factor fixed the level of water which is (depression of sea bottom)

Cutting coastal terraces Several options for the same terrace setting



Sea level stages name

Stage	high sea level name	Height
Holocene (6000y)	Flandrian	+ 2 - 3
Würm		
R / W	Monastirian	early +18
Riss		
M / R	Tyrrhenian	late +32 early +45
Mendel		
G / M	Maliazzian	+ 56
Günz		

References

Glacial and Quaternary Geology
http://www.colby.edu/geology/GE354/Index_GE354.html

Internet Remote Sensing Lectures sites