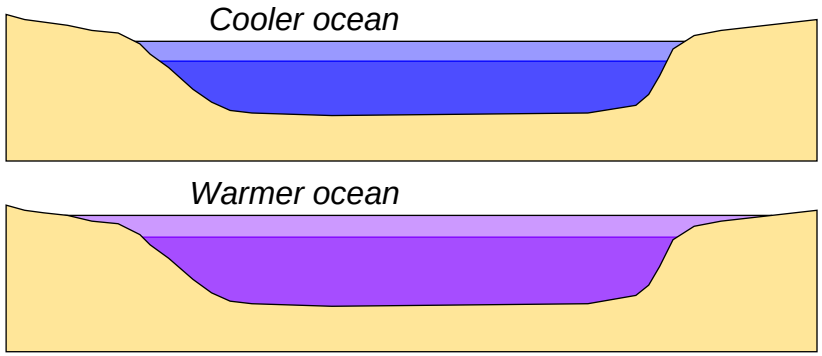
Possible causes of sea-level change

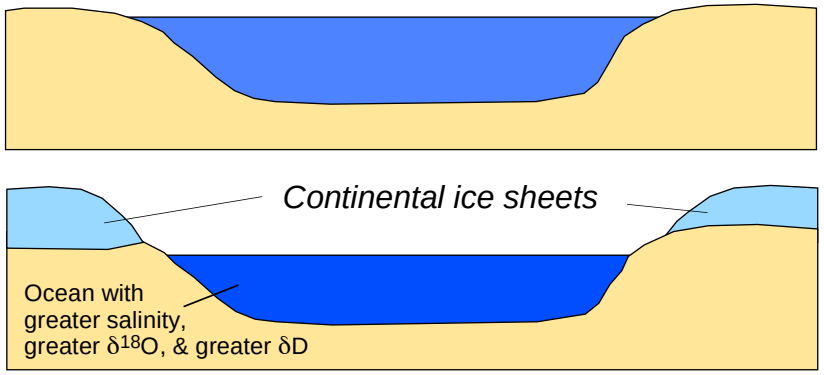
Sea level is known to have changed at geologic time scales. This page uses very schematic cartoons to present four possible causes, with emphasis on their different vertical and temporal scales.

1. **Warming** of ocean's water and thermal expansion



This causes SL change of **centimeters to meters.** Warming of water above the thermocline could be effected in a matter of years by mixing by waves and currents; warming of water below the thermocline requires circulation through the deep oceans and thus takes thousands of years.

2. Storage of ocean's water as ice in **ice sheets**



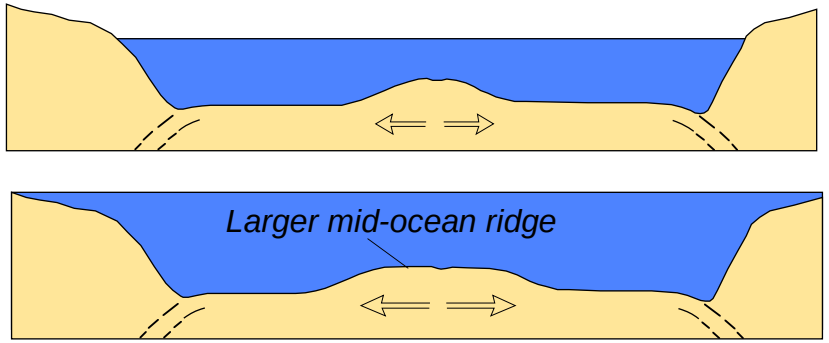
This causes SL change of **tens of meters to 200 meters.** Growth of ice sheets typically takes tens of thousands of years to lower sea level, whereas melt-out and sea-level rise can occur over thousands of years. Note that only this mechanism changes the *amount* of H_2O in the oceans.

Volume of water in the oceans changes

Volume of the ocean basins changes

3. Changes in rate of **sea-floor spreading**

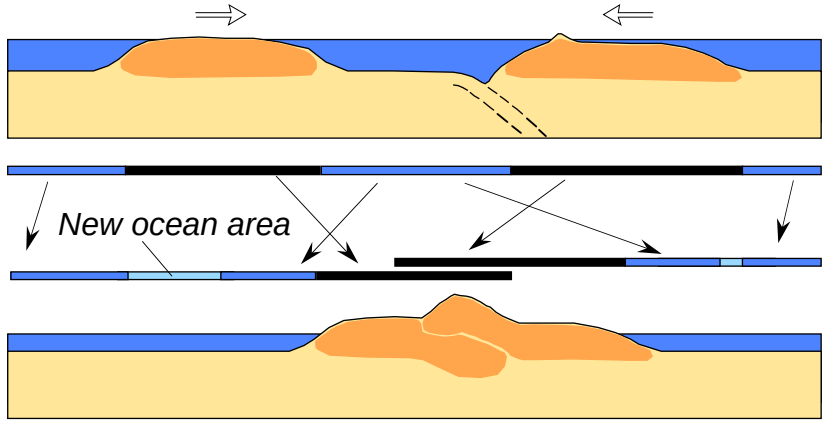
(More young, and thus hot, and thus expanded oceanic crust at MORs occupies more of the volume of the ocean basins)



This causes SL change of **hundreds of meters.** Correlation of lowering of sea level over the past tens of millions of years with slowing of seafloor spreading makes this model attractive.

4. **Continent-continent collision**

(Stacking of continental crust causes reduction of area of continents, leaving a greater oceanic area and thus volume)



This causes SL change of **hundreds of meters.** Correlation of lowering of sea level over the past tens of millions of years with Himalayan collision, and correlation of lower Late Paleozoic sea level with the assembly of Pangaea, make this an attractive model. In addition, it is possible that continent-continent collision could lessen the global rate of sea-floor spreading, so that Causes 3 and 4 could coincide.