

Sea Level Changes

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Introduction :

By Changes in sea level we mean the fluctuations in the mean sea level, i.e., the average level of the sea surface the data for which is derived from a series of continuous records of tidal oscillations over a considerably long period of time. Thus the changes in sea level may also be termed as a relative change in sea level. During a relative rise in sea level either the land or the sea surface may undergo upliftment or subsidence or both may rise and fall at the same time.

Study Objectives :

The present study has the following objectives, to study the Discussion of the Sea Level Change.

Data Base & Methodology :

The data has been furnished from the related articles, research papers. Some data has furnished the websites & as well as time magazine. For the present research paper the primary and secondary sources have been used. Materials from various libraries have been collected. The articles regarding to it have been read thoroughly. The descriptive and analytical research methods has been used for this research paper.

Discussion of Sea Level Changes :

The major categories of Change in sea level are mentioned below :-

1. Eustatic changes occur when the volume of sea water changes due to factors such as global warming and melting of ice sheets rise in sea level or ice ages fall in sea level.
2. Tectonic changes occur due to a change in the level of land . These changes occur due to the following factors :-

a) Isostatic changes which take place due to addition or removal of load e.g. during ice ages landmass subsided due to the tremendous load exerted by the glacial ice as a result there was an apparent rise in sea level. On the other hand the landmass of scandinavia is still rising as the glacial ice is being removed.

b) Epeirogenic movement occurs due to broad scale tilting of continents which may result in the rise of one part of the continent in relation to the mean sea level even as the other part may subside causing an apparent rise in sea level.

c) orogenic movement is related to folding and flexuring (stretching of a part of the earth's crust) of the lithosphere which results in the formation of lofty mountains and an apparent fall in sea level.

Relevance of the study of sea Level Changes :-

The study of sea level changes is important. It provides key evidences regarding climate change and also enables us to draw a benchmark for estimating the rates of tectonic upliftment in the past geological periods. Sea level directly influences the rate and pattern of erosional and depositional processes in the coastal areas. By studying the fluctuations of sea level it becomes possible to assess the suitability of coastal locations for industrial development.

Evidence in Support of Sea Level Change :-

The sea level changes in the quaternary Period are reconstructed by using the following methods.

Elevated shorelines such as raised beaches suggest a fall in sea level in that region in the past. The exact age of the changes in sea level is ascertained from the application of radiometric techniques on the materials found in those raised beaches. Submarine canyons prove that once there was a relative rise in sea level because they are formed only in submerged conditions.

Mechanisms of the Change in Sea Level :- The fluctuations of sea level involve three basic mechanisms changes in ocean water volume changes in ocean basin volume changes in the geoid i.e. the shape of the earth.

Changes in the Volume of ocean water :- The present sea level would rise by about 60 to 75 m if the ice in Antarctica melts, whereas the Greenland ice cap would contribute about 5 m rise in sea level. It is assumed that in such a case the added load of ocean water would lead to the sinking of the ocean floor due to isostatic compensation. So the total rise of sea level would be about 40-50m. However the isostatic adjustment of the land and the ocean is still not clear due to lack of data.

Change in the volume of the ocean basin :- Changes in the volume of ocean basin and the resultant changes in sea level were an important event of the Mesozoic Era and early Cenozoic Era. Such changes occur due to the following factors.

1. Changes in the volume of mid-oceanic ridges.
2. Accumulation of sediments on the ocean floor
3. Impact of orogenesis
4. Drying out of small ocean basins

Short Term Changes in Global Sea Level :- Short term changes occur during a year. Commonly seasonal variations of 5-6 cm in sea level are observed in a year. But the fluctuations of sea level reach 20-30 cm. or more in almost all coastal areas of the world. Even if the causes of such short term changes are not known the fluctuations of sea level may be due to a complex

interaction of the following factors :-

1. Marine water density
2. Atmospheric Pressure
3. Velocity of ocean currents
4. Ice formation and fall in sea level
5. Piling up of water along windward coasts.

Reference :

1. Jump up^ What is "Mean Sea Level"? (Proudman Oceanographic Laboratory).
2. Jump up^ Solomon et al., Technical Summary, Section 3.4 Consistency Among Observations in IPCC AR4 WG1 2007; Hegerl et al., Executive summary, Section 1.3: Consistency of changes in physical and biological systems with warming in IPCC AR4 SYR 2007.
3. Jump up^ US National Research Council, Bulletin of the National Research Council 1932 page 270
4. Jump up^ "Eustatic sea level". *Oilfield Glossary. Schlumberger Limited*. Retrieved 10 June 2011.
5. Jump up^ Bruce C. Douglas (1997). "Global Sea Rise: A Redetermination". *Surveys in Geophysics* 18 (2/3): 279–292. Bibcode:1997SGeo...18..279D. doi:10.1023/A:1006544227856.
6. Jump up^ Bindoff, N.L.; Willebrand, J.; Artale, V.; Cazenave, A.; Gregory, J.; Gulev, S.; Hanawa, K.; Le Quéré, C.; Levitus, S.; Nojiri, Y.; Shum, C.K.; Talley, L.D.; Unnikrishnan, A. (2007). "Observations: Oceanic Climate Change and Sea Level" (PDF). In Solomon, S.; Qin, D.; Manning, M.; Chen, Z.; Marquis, M.; Averyt, K.B.; Tignor, M.; Miller, H.L. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
7. Jump up^ US Federal Aviation Administration, Code of Federal Regulations Sec. 91.121