Accommodating Sea Level Rise in Coastal Engineering Functional Design

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Around the Atlantic, Gulf, and Pacific coasts of the United States, sea level is rising relative to land by a typical value of 1 ft/century. Annual fluctuations can greatly exceed this rate. Coastal engineering functional design for maintenance of existing projects and for new projects should accommodate relative sea level rise (RSLR) if the project has a lifetime exceeding on order of a century. Water levels in the Great Lakes, although under some anthropogenic control, can also vary appreciably with changes in precipitation and eustatic sea level. Such time scales are applicable to local government and federal projects. For example, Coney Island, NY, beach nourishment began in 1922, and many jetties and navigation channels in the United States have been in existence for more than a century, some as much as 150 years. As a coastal engineering community, we must begin incorporating longer time scales into engineering design with consideration of regional and environmental sustainability, such as for regional sediment management and wetland conservation. The Intergovernmental Panel on Climate Change Fourth Assessment Report (2007) forecasts an increase in eustatic sea level from about 0.6 to 1.9 ft by 2100, and change in climatic conditions may increase the frequency and severity of storms, as well as local precipitation trends. Here, we present examples for treating RSLR in a broad range of applications illustrating both direct and indirect responses of the coast. Examples are given next.

1. Beach nourishment. Beach nourishment is flexible and relatively insensitive to a moderate rise in sea level, with perhaps a 10% influence as compared to other factors causing erosion. Sediment-retention structures require consideration in planning for RSLR. Analysis of long-term shoreline change must account for the contribution by RSLR, again typically a 10% effect.

2. Jetties. Maximum wave height will increase with increasing depth at a jetty, but submergence may increase the structure's stability instead of the expected decrease. On the other hand, less stable sections of a jetty will become exposed to larger waves and be more prone to damage. Increased structure permeability and overtopping for longshore sand transport, increased wind-blown sand transport over the shoreward end of the structure, and flanking by a shoreward-migrating swash zone are also issues.

3. Coastal inlets and navigation channels. Increased tidal prism with increasing bay area will enlarge the volume of the ebb and flood shoals, removing sand from the beach to meet this demand. Analysis of bathymetric change occurring over long time intervals requires adjustment for RSLR.

4. Wetlands. Wetlands can respond to modest rates of RSLR (order of 1 ft/century), a process requiring open bay margins, if sediment sources (mineral and organic) are available for vertical accretion. Larger rates of RSLR will drown wetlands.

5. Barrier islands. Overwash and breaching (island breakup) can occur with various advantages and disadvantages. A long-term planning question is under what conditions barrier islands can be allowed to migrate and seal an estuary.

The presentation will discuss these types of projects and give examples to illustrate response under RSLR, methods for rehabilitation, and functional design considerations.

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Biographic Information

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