Sediment moving upstream along the bottom may also be derived from marine sources, as noted. The strength of this upstream current is often enhanced by the inequality between the flood and the ebb flows induced by the usually observed distortion of the tidal wave. Inasmuch as the low water depth is often significantly less than the depth at high water, the speed of the propagating tidal wave is higher at high water than at low water. This typically results in a higher peak flood velocity than peak ebb velocity and a shorter flood period than ebb period. Such a situation tends to enhance the strength of the upstream bottom current, and the sediment is sometimes transported to regions upstream of the limit of seawater intrusion.

The estuarine sedimentary regime is characterized by several periodic (or quasi-periodic) time-scales. These are: a) the tidal period (diurnal, semi-diurnal, or mixed), b) lunar (spring-neap) cycle, c) yearly cycle, and d) periods greater than a year. Of these, the first is the fundamental period which characterizes the basic mode of the sediment transport phenomenon in an estuary. The second is important from the point of view of determining net shoaling rates in many cases of engineering interest, and by the same token the third and the fourth time-scales are involved in considerations of long-term stability and shoaling in estuaries, as for example due to sea level rise.

Predictive capability for estuarine sedimentation can be illustrated by considering two case studies, Atchafalaya Bay, Louisiana, and Savannah River estuary, Georgia. The Atchafalaya River, a distributary of the Mississippi River, discharges into this bay. In recent years, the delta at the mouth of the river has grown dramatically. A study of the bay and adjacent waters was carried out to predict the rate at which the delta will evolve in the short term (<10 years) and the long-term (50 years), and the manner by which that evolution will affect flood stages, navigation channel shoaling, and the environmental resources of the area (McAnally et al., 1985).

Several factors combined to make the Atchafalaya Bay study unusually complex. They included the long period over which predictions had to be made; the migration of the region of delta growth from lacustrine to estuarine to marine environments; a hydrodynamic regime that is variously dominated by river flows, wind-induced currents, tides, waves and storm surges; and the combined deposition of sediments from the sand, silt and clay classes. The