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Coastal change as a function of geological settings, natural forcings and anthropogenic drivers – comparative modeling approaches for management strategies

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Coastline change is influencing the human society globally since prehistoric times (Harff et al. [1]). At present, the elaboration of management strategies for the coastal zones is closely related with numerical modelling and requires a categorization of natural processes based on the geological setting. The interrelation of geological built up and tectonics, sediment supply and hydrographic forcing for the generation of accommodation space determine the position of a coastal zone in the classification system of morphodynamically controlling factors. According to the global pattern of relative sea-level change depending on glacio(hydro)-isostatic adjustment of the Earth's crust to changing load of ice and water, two regions have been selected for a comparative study: The isostatically controlled Baltic area and the East Asian marginal seas which have not been affected by glacial ice load during the Quaternary. The relative sea-level change record of the Baltic area in conjunction with the geological build up of the coast and meteorological driving forces can be used to separate two main compartments of coastline change and morphodynamics for the Baltic Sea: The regressive (uplifting) Fennoscandian Shield in the North, and the transgressive (subsiding) wave-shaped coast in the South. The Bohai Sea and its Yellow River Delta serve as a key area to study river-dominated coastal systems. In the South China Sea, the Pearl River mouth stands for a coast affected by oceanographic conditions and in particular tides, but also riverine sediment supply and oceanographic longshore transport. The position of a coast within the four-dimensional system of the main influencing natural factors (isostasy / waves / tides / rivers) is not stable, but varies on different time scales due to changes of the natural environment and anthropogenic forcing: The fate of the Baltic Sea coasts depends on the location either in the uplifting North or the subsiding South. Due to anthropogenic effects, the Yellow River mouth starves since several decades of sediment supply because damming up-streams reduces the discharge of suspended matter to the Bohai Sea. Therefore, the influence of wave- and tide-dynamics is replacing fluvial influences increasingly. The Pearl River mouth which shifted during the Holocene from a river-dominated delta to a tide-dominated estuarine environment tends to return to river-dominance. This tendency of decreasing tidal influences has been accelerated by anthropogenically induced coastline advance since 1970s. For each of these exemplary zones special model implementations can be used to describe the change of coastal morphology. Together with climate projections these models can be applied for future coastline

scenarios as valuable tools to be deployed for Coastal Zone Management.

Reference:

[1] Harff J et al. (eds) (2016) *Geology and Archaeology: Submerged Landscapes of the continental shelf*: Geological Society, London, Special Publications 411, 294 p.