

## **Hydrological Changes in Tidal Estuaries due to Anthropogenic Effects**

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### **Abstract**

Tidal changes in flat coastal zones and estuaries are of high importance for coastal engineering. Due to increases in size and speed of ships in the last decades, German and most other European navigation channels in tidal estuaries have been deepened. A partly deepening of the Ems navigation channel in the Ems estuary to the ship yard of Papenburg was carried out in the last years. For the near future a storm surge barrier is planned. Before such a decision is made the ecological long-term effects in the tidal estuary have to be examined. The water levels in a tidal estuary are influenced by man-made or anthropogenic effects in the estuary itself but also by the eustatic variations of the global sea level and the changes in tidal dynamics in the German Bight. The tidal water levels are also influenced by variations of the fresh water discharge, especially in the upper part of the estuary. In the Ems estuary tremendous changes in the tidal system have been taken place during the last decades.