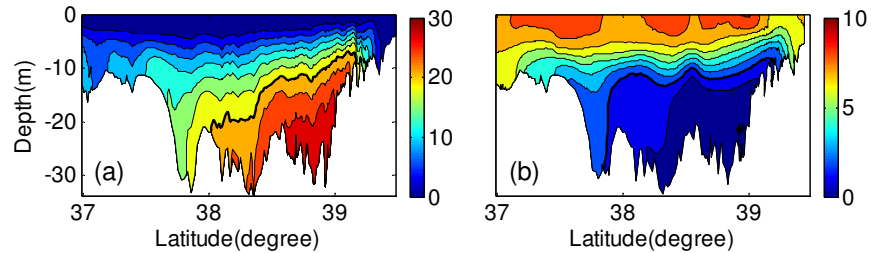


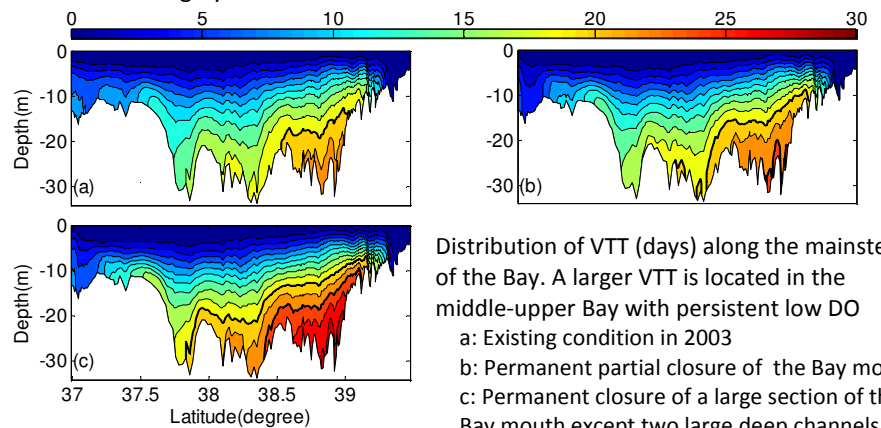
# Influence of Storm Surge Barrier on Vertical Transport Time and Hypoxia

The vertical transport time (VTT) is a timescale used to measure the required time for transporting surface saturation dissolved oxygen (DO) water to the bottom. Its variability in summer indicates the influences of external physical forcings on summer DO in the Bay. The interannual variations of the VTT depend on freshwater discharge, tide, and wind. A short VTT indicates a fast DO aeration, which reduces hypoxia volume in the Bay (Shen et al., 2013). We used the VTT to quantify the influences of storm surge barriers on the bottom water DO in the Bay for this study.

- Closing the Bay mouth with a storm surge barrier only during hurricane events has a minor influence on the vertical transport time.
- Building a permanent storm surge barrier will result in an increase of VTT (ranges from 5-8 days) that will degrade DO conditions in the Bay.

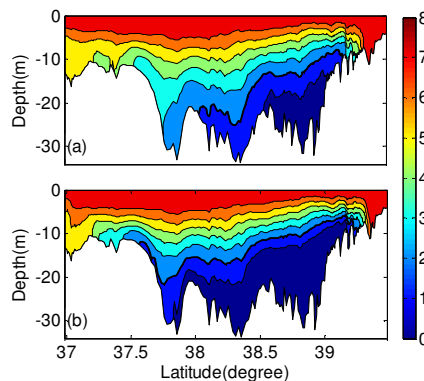


The distributions of long-term averaged (a) summer vertical transport time (days) and (b) DO (mg/l) have very similar patterns along the mainstem of the Bay. High VTT corresponds to low DO in the middle and upper Bay regions. VTT and the bottom DO are highly correlated.



Distribution of VTT (days) along the mainstem of the Bay. A larger VTT is located in the middle-upper Bay with persistent low DO  
a: Existing condition in 2003  
b: Permanent partial closure of the Bay mouth  
c: Permanent closure of a large section of the Bay mouth except two large deep channels.

Construction of a permanent storm surge barrier will affect the VTT. The magnitude of influence depends on barrier size. With closure of a large portion of the Bay mouth, the VTT will increase by more than 5 days in summer resulting in a decrease of oxygen near the bottom.



With construction of a large permanent barrier at the mouth, DO condition will be further degraded during the summer (bottom panel (b)) comparing to the current condition (upper panel (a))