How the storm surge impacts a coastal bay system?

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Shallow waters are highly susceptible to coastal storm surges, and thus a comprehensive understanding of physical dynamics is substantial to coastal management and nearby communities. Given that physics-based models are more suitable in the highly dynamic and complex coastal and estuarine system than the data-driven methods, this work reviews the state-of-the-art storm surge modeling and its influencing factors. Three cases were applied under strong wind conditions and during hurricane events in a lagoonal system of the Maryland Coastal Bays (MCBs). A three-dimensional (3D), wave-current coupled FVCOM was then applied to the MCBs in the second case during Hurricane Irene (2011). With the inclusion of wave effects (e.g., wave radiation stress), the underestimated storm surge (e.g., 20 cm for the 1.01 high water surface elevation mark) was reduced by half (i.e., 10 cm or 10%). Then a nested 3D storm surge model FVCOM was used to simulate the storm surge during the passage of Hurricane Sandy (2012) over the MCBs. It concluded that winds are important in storm surge simulation. Further investigations reveal that a nesting model could provide necessarily remote forcing from a large domain and maintain the intricate shoreline and bathymetry of the inner domain in a lagoonal system. In the future, more effort and work of storm surge modeling could be focused on the comparison using alternative wave-current coupled mechanisms (e.g., vortex-force formalism), and considering the effects of turbulent mixing processes.