Field and modeling studies of salt marshes in Bombay Hook National Wildlife Refuge, Kent County, Delaware.

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We provide an overview of ongoing field and modeling efforts in the tidal salt marshes within the Bombay Hook National Wildlife Refuge (BBH), located along the western shore of Delaware Bay. Salt marshes in BBH are vulnerable to large storms and sea level rise, and have experienced significant degradation over the past 50 to 75 years. The impact of historical modifications to the marsh and a range of possible remedial steps to leading to a healthier marsh environment are being investigated through this study. The complex system is composed of upland habitats, freshwater impoundments and extensive tidal wetlands. The field observations in this study include extensive bathymetric surveying in channels, current velocity measurements using ADCPs deployed in several major channels, tide gauges mounted on marsh platform, and rapid-sampling pressure gauges deployed in a large tidal flat area located within the marsh and isolated from the open water of the Bay. For the modeling study, we have used the unstructured grid model, FVCOM, which covers the entire marsh system with sufficient grid resolution to resolve small channels and creeks. The grid bathymetric data in channels is based on data collected during an extensive bathymetric survey. The topographic portion of the grid is extracted from LiDAR data sets. We have implemented sophisticated Artificial Neural Network techniques to remove the vegetation bias, well validated against ground truth survey. The model is driven by current and surface elevations derived from a larger scale ROMS model of Delaware Bay, along with local wind input. The Delaware Bay model incorporates tidal forcing along the outer model boundary (located at the 100m isobaths on the shelf edge), fresh water discharge introduced at the head of the Delaware River at Trenton, and model results archived from the HYCOM model in order to take remotely-forced subtidal processes into account.
The model is validated using surface elevations at four tidal gauges and the ADCP current velocity data. Model performance for predicting flooding/draining processes during normal and storm conditions has been examined using the data collected on the marsh platform. Ongoing work is examining model estimated of residual circulation patterns and ebb/flood dominance in the complex, multiply-connected system. We are also investigating the application of subgridding strategies in order to improve modeled hydraulic connectivity between channels and enclosed marsh platform areas, which are presently isolated to too great a degree by channel boundary levees, suppressing inundation and drainage processes in the model relative to field observations.