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Title: Physical factors controlling gravity wave evolution in the Delaware Bay and adjacent shelf

Abstract: Delaware Bay and coastal Atlantic Ocean currents and surface waves play a significant role in a myriad of processes related to Delaware Bay/Coast's ecosystem health and hazard resilience. The objective of this study is to systematically assess the physical factors influencing surface gravity waves in the Delaware Bay and on the adjacent shelf with a focus on wind, fetch, swell, and ambient current effects. A coupled wave-ocean community modeling system is used to develop a realistic application for the Delaware Bay and its adjacent shelf. The model is forced by tides, river discharge, remote boundary forcing, and wind. Model results for sea-surface height have been validated against observations from NOAA tide-gauges at four stations in the bay and near the coast at Lewes (Delaware), Brandywine Shoals Lighthouse (Delaware), Cape May (New Jersey), and Atlantic City (New Jersey). Simulations of significant wave height and peak wave period are consistent with observations from two wave rider buoys within the bay and from the NDBC station 44009 outside of the bay. On the continental shelf, waves are infrequently in equilibrium with the local wind forcing, but are strongly influenced by swell waves that propagate remotely into the modeling domain. Consistent with idealized ray tracing theory, waves from the shelf cannot propagate far into the bay. Therefore, bay waves are mainly driven by the local wind field whose direction controls the wave fetch characteristics within the bay. In the bay, relatively strong tidal currents result in significant tidal modulations of both significant wave heights and peak frequency.