

We thank the reviewer for the careful evaluation of the manuscript and for the constructive comments on the model configuration, domain design, interpretation of the wave and current results, and presentation of Fig. 7. These comments helped us clarify several important aspects of the Duck, NC application, particularly the treatment of model boundaries, the limitations associated with the relatively small computational domain, and the interpretation of the coupled-model results. In response, we have expanded the model setup description, clarified the role of the offshore boundary forcing and periodic lateral boundaries, added more quantitative discussion of the wave results, removed unsupported claims regarding the superiority of the 3-D vortex formulation, and revised Fig. 7 and its caption to define the velocity directions and plotting conventions more clearly.

More model setup description: *Could the authors provide a more detailed description of the model setup? Specifically, are open boundary conditions applied to the lateral boundaries (the north and south boundaries) as well?*

Reply: We agree that the boundary-condition description was incomplete in the original manuscript. We have revised the model setup section to clarify that the only open boundary is the seaward offshore boundary. The northern and southern lateral boundaries are not treated as open boundaries; instead, periodic lateral boundary conditions are applied for both SCHISM and WW3. For SCHISM, the observed water elevation at the FRF 8 m station is prescribed along the seaward open boundary, while WW3 uses observed directional wave spectra from FRF_waverider-26m as the offshore wave boundary forcing. We have added these details to Section 3.2.1 to make the model configuration more explicit.

Justification on model domain: *The authors utilize a relatively small model domain that extends only about 10–20 km offshore. This implies that the model results, particularly the nearshore dynamics, will be heavily influenced by the open boundary conditions. Consequently, the simulated storm surge could be driven purely by the open boundary setup. The authors need to justify the choice of this domain size and discuss its potential artifacts.*

Reply: We agree that the limited offshore extent of the Duck domain makes the solution sensitive to the prescribed seaward boundary conditions. We have revised the manuscript to clarify, however, that only the offshore boundary is open; the northern and southern lateral boundaries are periodic for both SCHISM and WW3. Thus, the model is not constrained by separate northern and southern open-boundary forcing.

The relatively small domain was selected to focus on nearshore wave transformation and wave-current coupling within the FRF observational array rather than to perform an independent shelf-scale hindcast of Hurricane Sandy. Because observed water elevation is prescribed along the SCHISM seaward open boundary and observed directional wave spectra are prescribed at the WW3 offshore boundary, the simulated water levels and wave field are influenced by these imposed offshore conditions. We now state this limitation explicitly and interpret the Duck application as a controlled nearshore coupling demonstration rather than as an independent regional storm-surge prediction.

Wave simulation results (Fig. 4): *Regarding the wave simulation results in Figure 4, the model appears to notably underestimate the wave height at the 6m and 8m stations, yet it surprisingly performs very well at the 2m station. At the 2m station, the wave height exhibits a clear semi-diurnal signal; is this due to tidal influence? Additional elaboration and explanation of these model results should be provided. Currently, the manuscript dedicates 12 pages to introductory material and only 1 page to the results.*

Reply: We agree that the original discussion of Fig. 5 (now) was too qualitative. We have expanded Section 3.2.3 to discuss the station-dependent model performance quantitatively using the bias and RMSE values in Table 3.

The revised discussion now notes that H_s remains underestimated at the 6 m and 8 m stations, including in the coupled cases, whereas the agreement at the 2 m station is substantially better. We also discuss the semi-diurnal variation in H_s at the 2 m station. This variability is consistent with modulation of shallow-water wave transformation by the changing water depth associated with the tide; however, the present experiments do not isolate this mechanism from other nearshore processes, so we have avoided attributing the signal solely to tidal modulation.

In addition, we now clarify that FRF_waverider-26m provides the directional spectra used as the WW3 offshore boundary forcing and therefore is not treated as an independent validation station. The revised results section places greater emphasis on the shallower observation sites and discusses possible effects of the limited domain, spatially homogeneous atmospheric forcing, bathymetry, and nearshore wave-transformation processes.

3D Vortex Scheme and Cross-Shore Velocity: The most interesting finding from this study is that the 3D vortex scheme yields a fundamentally different cross-shore velocity field. The authors claim that "3D vortex simulations aligned closely with real observations, capturing the vertical gradients and mixing patterns missing in the Longuet-Higgins approach." However, how is it determined that the 3D vortex simulations are closer to reality? Is there observational data available to support this claim? Furthermore, the simulated cross-shore velocity is extremely large, exceeding 0.5 m/s. Is this physically realistic? What is the maximum cross-shore velocity simulated by the model? In most coastal environments, cross-shore velocity is expected to be much weaker than alongshore velocity.

Reply: We agree that the original manuscript overstated the interpretation of Fig. 7 (now). Direct model-observation comparisons of the vertical current profiles are not presented in this study, and therefore the statement that the 3-D vortex simulation “aligned closely with real observations” was not supported. We have removed this statement, as well as the associated claims of improved realism and accuracy.

Figure 7 is now interpreted only as demonstrating differences in the modeled vertical current structure produced by the Longuet-Higgins and 3-D vortex formulations. We do not use these differences alone to determine which formulation is more realistic.

We have also clarified the cross-shore velocity magnitude. The plotted color scale is limited to ± 0.5 m/s for visual comparison between the two cases, but this is not the maximum modeled velocity. The maximum cross-shore velocity in Case 5 is -2.02 m/s, and the minimum is 1.19 m/s. Values outside the plotted range are saturated. Because no direct current-profile comparison is presented here, we do not interpret the magnitude itself as evidence of physical realism.

Minor comments:

Fig 6: please indicate what is the direction for positive and negative velocity in both alongshore and cross-shore velocities. Also add x and y labels.

Reply: We agree. Figure 7 has been revised to identify the horizontal distance in kilometers, the vertical coordinate in meters, and velocity in m/s. The caption now also defines the sign convention for the local current components. Positive cross-shore velocity is directed along a bearing of 71.2° true, and positive alongshore velocity is directed along a bearing of 341.2° true. The caption also specifies that the section extends from the shoreline to the FRF_awac-6m station, whose location is shown in Fig. 3.