

Interactive comment on “Different approaches to model the nearshore circulation in the south shore of Oahu, Hawaii” by Joao Marcos Azevedo Correia de Souza and Brian Powell

Anonymous Referee #2

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General Comments:

This paper explores the nearshore circulation differences that arise from forcing the ocean model with wave model output (one-way) compared to coupling the ocean and wave models together (two-way). For this comparison, the authors chose to model the south shore of O’ahu, building on a model used in several previous studies.

I was struck by the lack of statistics and model/observation comparisons used to evaluate the simulations. I recognize that comparing these two methods (one-way and two-way) of incorporating waves into the model with each other and using the ocean model only simulation as the base case will reveal robust features in the circulation and differences in the circulation due to wave-current interactions and model coupling. The

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authors state there were no observations in the study area during the two experiments but reference a study using the lower resolution model system that was compared to satellite observations. I appreciate this reference but think expanding it to include more information (e.g. RMSD) would be valuable. Also, the term “validate” is used throughout the manuscript. I think “evaluate” is more accurate because no model perfectly reproduces the circulation, but recognize that this is my own personal preference.

Specific Comments:

Title: Oahu vs O’ahu – “O’ahu” is mostly used in the body of the paper, whereas “Oahu” used in the title and a few times in paper. Please be consistent throughout.

Section 2.1: Provide more details about the boundary conditions. You specifically mention the southern boundary of the high resolution nest, but what about the other boundaries? The manuscript says both “The southern boundary is forced by the barotropic tide, surface gravity waves, and the circulation from the coarser...” and “Eleven tidal constituents ... were introduced as a separate spectral forcing in the outer grids”. Please clarify if tidal forcing was applied to the lower resolution grids and then propagated through the boundary conditions into the higher resolution grid, or if the high resolution nest included tidal forcing whereas lower resolution grids did not.

Page 4, line 19: I like your description of the vertical layers and domain depth. Please add the ROMS model minimum depth.

Page 4, line 23: “. . .coarser 200m parent-grid” does not seem to match “ROMS circulation models of approximately 250m, 1km, and 4km resolutions” (page 4, line20).

Page 4, line 23: “forced by. . . surface gravity waves” – Are the surface gravity waves in the ROMS model or in SWAN and then coupled using MCT?

Section 2.2: Please state the SWAN grid domain used in this application. Which resolution ROMS grid is used, or is a new grid of a different domain/resolution used for the SWAN simulation? If a different domain/resolution was used, please explain this

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choice.

Page 13, line 28: “. . .significant improvements to the coupling. . .” – how do you know the coupling improves the simulation without comparisons of the ocean/wave model simulations to any observations? I assume that the two-way coupled solution is better, and I think other papers have reached that conclusion as well. You have nicely expressed how the WAVEFORCE and WAVECOUPLE solutions differ, but to show improvement I think observational comparisons may be necessary or describe how the coupled solution improves from the wave-forced simulation.

Minor Issues/typos:

Page 2, line 25: “Each of these issues can be significant. . .” I think you want another word than “issues” - perhaps features, phenomena or factors?

Page 2, line 28: “. . .circulation/waves model. . .” → “. . . circulation/wave model. . .”

Page 3, line 25: “interaction in the south shore” → “interaction off the south shore”

Page 6, line 30: “. . . what was found. . .” → “. . . which was found. . .”

Section 2.2: Include statistical comparison of the SWAN model output compared to NDBC 5 buoys in the area (and/or with Figure 2). Does the SWAN grid cover the entire model domain or only the high resolution South Shore of O’ahu nest?

Section 2.3: Is the WAVECOUPLE case, is the two-way feedback only the highest resolution nest? Page 7, lines 20-25: “Figure 2 shows good agreement between the measured and modeled. . .” –include statistical comparison.

Page 9, line10: “Oahu for the experiments period” → “Oahu during the experiment’s period”

Page 11, line 28: “stokes drift” → “Stokes drift”

Page 11, line 33: “Fig./reff11.”

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Page 13, line 31: “when aiming on resolving” → “when aiming to resolve”

Page 14, line 2: “should be view as” → “should be viewed as”

Figure Comments:

Figure 1: Label the colorbars, and include grid resolutions in caption.

Figure 2/3: Peak wave direction units: degrees (from true north, or east?). Include statistical comparison.

Figure 4: Since the domain for each subplot is the same, tick label latitudes only on the left column and tick label longitudes only on the bottom row. Include a bold row label (similar to Figure 5) for “Experiment 1” and “Experiment 2” on the left side for clarity. Or to be consistent with future plots that have Experiment 1 in column 1 and experiment 2 in column 2 and use bold label for the property being plotted (direction or Hs) and respective colorbar on right. For consistency with other figures, corner subplot labels (a,b,c,d) could be white boxes, but this is personal preference.

Figure 5: Since the domain is the same for each subplot, tick label latitudes only on left subplots and tick label longitudes only on the bottom row. Label experiment on the top of each column. Label the colorbar.

Figure 6: same suggestions as figure 5.

Figure 7: same suggestions as figure 5. Also, the plotted field for (a-d) is not labeled by the colorbar or stated in the figure caption. Also, include reference vectors for Stokes drift and total surface velocity. Subplots (e,f) include KE units and may want to note the order of magnitude difference (10⁴ vs 10⁵).

Figure 8: same suggestions as figure 5. For continuity, make the “waveforce-nowave” labels same format as previously. Also for continuity, place colorbar to the left of subplots and label.

Figure 9. Since x and y tick labels are the same, only label y-axis ticks on the left

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column and x-axis ticks on the bottom row. X-label “distance from coastline (m)”. Add Experiment 1/2 column labels. Consider flipping the x-axis so that distance starts at zero on the right and moves offshore, which is similar to the horizontal map. May consider making the “zero-line” bold or more distinct.

Figure 10 caption: “breaking ($W m^{-2}$) for the” → “breaking ($W m^{-2}$) for the” (add space)

Figure 10: Only label y-ticks on the left plot. For continuity, may consider plot labels (a,b) in northeast corner like other plots.

Figure 11: Consider flipping the x-axis so that distance starts at zero on the right and moves offshore, which is similar to the horizontal map. Move subplot labels (a,b,c,d) to the northeast corner for continuity with other figures. Remove x-axis tick labels of the top row. May consider removing y-ticks in the middle between plots, since both y-axes are the same.

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