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Ocean Science Discussions

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

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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 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.

Author: First of all we would like to thank the reviewer for the detailed comments. We made an effort to take them all into consideration and believe it greatly helped to improve the manuscript quality. We added information on the validation (or evaluation) of the outer domains. The inner domains, however, could not be evaluated due to the lack of observations. We agree with the reviewer, and the term validation was substituted by evaluation throughout the manuscript.

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.

Author: We now use only O'ahu, following the hawaiian spelling.

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.

Author: This information is added to the section 2.1. In fact, surface gravity waves are included in all open boundaries. The tides are forced as tide components in the barotropic velocites and water level at the open boundaries and as tidal potential at every grid point. 11 constituents are used for such. The TPXO model was used to obtain the tide harmonic constituents for the outer grids, and harmonic analysis of the outer grid results was used to generate the constituents for the near shore domain. Section 2.1 – Page 4 line 8 to page 6 line 3

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

Author: The minimum depth is 0.5m to account for the shallow reef areas. We didn't use any wet/dry scheme – maybe something to consider for future work. Page 4 lines 25 and 26

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).

Author: Corrected – 250m. Page 4 line 30

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?

Author: We modified this sentence since ROMS is not forced with surface waves – SWAN is. In the WAVEFORCE case, the waves from an independent SWAN run are imposed as a separate forcing to ROMS. In the WAVECOUPLE case, SWAN and ROMS run together (coupled). Page 4 lines 29 and 30.

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 choice.

Author: The SWAN domain is exactly the same used for ROMS. Page 6 line 20

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.

Author: We agree with the reviewer, and this comment came more from an impression of the general results – being speculation. That said, this comment was modified so it still express the care one should take with computational cost without the affirmation that one simulation is better. Page 14 line 28

Minor Issues/typos:

Author: All typos were corrected following the reviewer comments.

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?

Author: The inner grid is exactly the same used for ROMS. The outer grid results evaluation was improved, and rmsd in relation to the NDBC buoys were included in a new table (Table 1). Page 8 lines 20 to 23.

Section 2.3: Is the WAVECOUPLE case, is the two-way feedback only the highest

resolution nest?

Author: Yes, all coupling (WAVEFORCE and WAVECOUPLE) are run only for the near shore domain.

Page 7, lines 20-25: “Figure 2 shows good agreement between the measured and modeled” –include statistical comparison.

Author: Rmsd information was added in Table 1.

Author: All the following typos were corrected and figures modified according to the reviewer comments. In some cases we opted for not adding the labels to the colorbars, when there was not enough space in the figure to add it without making the figure confuse. In these cases the unitis were clearly expressed in the caption.

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.”

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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