

General

comment:

I commend the authors for adequately addressing the major comments from the first round of reviews. However, it was a bit disappointing to note that none of the technical comments in the pdf were addressed. The amendments done thus far has definitely improved the manuscript, putting it one step closer to publication. It is my opinion that some minor changes and technical corrections are required before this manuscript can be considered for publication.

We would like to thank the reviewer for the helpful and detailed comments. We did our best to take all of them into consideration and were able to respond to most of them. We sincerely hope this brings our manuscript to a state where it can be published by GMD.

Specific

comments:

Page 2, Line 46: The statement “revolutionize the understanding and prediction of ocean processes in New Zealand” seems to be a bit of a bold claim. Regional models like the one described here are well-used to understand ocean processes in a range of environments. I agree with the author’s underlying view that this simulation will significantly contribute to improve our understanding and predictability of ocean processes but the claim that it will be revolutionary at this stage lacks supportive evidence.

We agree with the core of the reviewer comment. The claim to “revolutionize” was simply a quote from the project proposal. That said, the text was modified to state we aim to improve the how we understand and predict the ocean around New Zealand.

Page 2, Lines 48-49: Rephrase “7 days forecasts daily” to make it more obvious that daily forecasts are created for a period of 7 days.

Modified following the reviewer’s comment.

Page 18, Lines 328-330: The phrasing of this sentence makes it very hard to understand. The description in Table 5’s caption makes much more sense. This sentence should be rephrased so that it is easier to understand how the transport was calculated along the sections.

This text has been clarified.

Figure 10: Even though it is stated in the caption that section 8 can not be displayed on the Figure, I think more effort should be put towards indicating where the section is located. Without this information the reader has no idea of where the Cook Strait section is located.

The section was added to the figure

Page 22, Line 360: The model volume transport calculated for the ECC south section is significantly higher than that reported by Fernandez et al. (2018). How does the model volume transport compare to that of Fernandez et al. (2018) if calculated along similar sections as those used by Fernandez et al. (2018)?

A detailed discussion of the differences in calculation methods and the significantly higher transport estimates compared to previous estimates in the literature, including Fernandez et al. 2018, is presented in Kerry et al. 2022. This reference has been included in the text. Here we explain how our estimates of ECC transport are considerably greater than estimates presented to date in the literature where key differences in the calculation methods and locations exist. Specifically, these attempts to

estimate transport use satellite altimetry combined with subsurface observations to estimate the vertical structure of the current, and assume a level of no motion of 2000dbar. However, we show that the ECC extends below 2000m, consistent with other studies that have found substantial velocities below 2000 m in the EAUC and ECC regions. Furthermore, previous estimates have attempted to separate the recirculation driven by the semi-permanent eddies, while our estimates include this recirculation, and transport estimates are highly sensitive to the distance offshore over which transport is calculated. We direct the reviewers to this reference for a detailed discussion with references.

Technical

corrections:

Page 2, Line 25-26: Move the second set of references (e.g. Chaput et al. 2022; Silva et al., 2019) to the end of the sentence.

Modified following the reviewer's comment.

Page 2, Line 29: an important source

Modified following the reviewer's comment.

Page 2, Lines 48-49: I suggest changing 'please visit the project website for details' to 'details available on the project website'

Modified following the reviewer's comment.

Page 2, Line 55: replace bibliography with literature

Modified following the reviewer's comment.

Page 3, Line 58: Change Marine Heat Wave to marine heatwave as used throughout the rest of the manuscript.

Modified following the reviewer's comment.

Page 3, Line 59: Remove the quotation marks around "sea surface temperature"

Modified following the reviewer's comment.

Page 3, Line 60: north of the Subtropical Front

Modified following the reviewer's comment.

Page 3, Line 61: Please provide the name of this western boundary current

East Auckland Current – added to the text

Page 3, Lines 75-78: Please provide references to substantiate these statements.

References were added to each statement.

Page 3, Line 76: Three Kings Islands

Modified following the reviewer's comment.

Page 3, Line 76: Change mass structure to density structure

Modified following the reviewer's comment.

Page 3, Line 80: Change following publications to subsequent publications or future publications.

Modified following the reviewer's comment.

Page 4, Line 90: Replace semi-colon between references with a comma

Modified following the reviewer's comment.

Page 4, Line 94: Unbold 5km resolution

Modified following the reviewer's comment.

Page 4, Line 96: Chatham Islands

Modified following the reviewer's comment.

Page 4, Line 96: three New Zealand main islands. Single-digit numbers should preferably be spelled out.

Modified following the reviewer's comment.

Page 4, Line 97: western boundary

Modified following the reviewer's comment.

Figure 1: Puysegur

Modified following the reviewer's comment.

Page 6, Line 103: Unbold 50 vertical layers. Also, ideally a sentence should not start with numerical digits but if it does then the number should be written out.

Modified following the reviewer's comment.

Page 6, Line 1227 (Lellouche et al. 2021)

Modified following the reviewer's comment.

Page 6, Line 128: 1 day-1

Modified following the reviewer's comment.

Page 6, Line 128: Change warm-up period to spin-up period. Did the model reach a steady state after just 1 year's integration? I suspect that it did but it did.

Modified following the reviewer's comment. Yes, the model was actually stable after less than that. But we chose 1 year to be conservative.

Page 7, Line 137: four readily available global ocean reanalyses

Modified following the reviewer's comment.

Page 7, Line 139: four of the

Modified following the reviewer's comment.

Page 7, Line 145: SST was defined in the introduction so there is no need to do it again here.

Modified following the reviewer's comment.

Page 7, Line 149: the Mercator Ocean

Modified following the reviewer's comment.

Page 7, Line 150: can be determinant factors for the representation of the the sea surface height

Modified following the reviewer's comment.

Page 7, Line 155: representation of the the

Modified following the reviewer's comment.

Page 7, Line 165: The Moana Ocean Hindcast hindcast

Modified following the reviewer's comment.

Page 8, Line 175: Table 1, and a description of each is provided in the next subsections

Modified following the reviewer's comment.

Page 8, Line 184: SST has already been defined thus no need to define it again.

Modified following the reviewer's comment.

Page 8, Line 191: Change from to including

Modified following the reviewer's comment.

Page 8, Line 192: Replace the semi-colons with commas.

Modified following the reviewer's comment.

Page 8, Line 193: Change forward to onward

Modified following the reviewer's comment.

Page 9, Line 202: collected by the New Zealand's

Modified following the reviewer's comment.

Page 10, Line 209: (NZ-OOS; O'Callaghan et al., 2019)

Modified following the reviewer's comment.

Page 10, Line 217: Add the acronym for the East Auckland Current here.

Modified following the reviewer's comment.

Page 10, Line 220: especially in the region

Modified following the reviewer's comment.

Page 10, Line 220: If the acronym EAUC is included in line 217 as suggested then you can just use the acronym here.

Modified following the reviewer's comment.

Page 11, Lines 226-227: Combine these two sentences: leading to stronger variability, and less is left

Modified following the reviewer's comment.

Page 11, Line 234: Unbold 40 days

Modified following the reviewer's comment.

Page 11, Line 235: altimetry maps at the equator

Modified following the reviewer's comment.

Page 11, Line 236: days around New Zealand

Modified following the reviewer's comment.

Page 11, Line 238: pattern is the similar

Modified following the reviewer's comment.

Page 11, Line 241: inter-annual variability

Modified following the reviewer's comment.

Page 11, Line 242: variability at Figure 3, Caption: from the free-running Moana Ocean Hindcast (left), the data-assimilating

Modified following the reviewer's comment. Also added parenthesis for the GLORYS and AVISO.

Figure 4: In Figure 3, the first panel was the Moana Backbone followed by GLORYS and then AVISO. It would make it easier to follow along if the order is kept the same between figures.

We were unable to change the order of the subplots, since this would require re-processing a large amount of data to re-generate the figures. Since this does not compromise the text understanding, we opted to keep the original figure.

Figure 4 caption: GLORYS

Sorry, but I did not understand the reviewer suggestion.

Page 13, Line 244: events with duration on the order

Modified following the reviewer's comment.

Page 13, Line 253: While (a) and (b) are

Modified following the reviewer's comment.

Page 13, Line 256: These two regions

Modified following the reviewer's comment.

Page 13, Line 261: summarized in Table 4

Modified following the reviewer's comment.

Page 13, Lines 262: Please rephrase this sentence so that it is clearer that SSH errors are similar to that from global simulations, while SST performs better. It will also help if the statistics for GLORYS is included in Table 4.

We modified the sentence for clarity. We chose not to add the GLORYS statistics, since these are already included in a previous publication. The idea here is to focus on the evaluation of the Moana Hindcast against observations as much as possible.

Figure 6, Caption: These relate to the fact that

Modified following the reviewer's comment.

Page 15, Lines 269-273: This seems a bit out of place here. I would suggest adding this information in a more succinct way (e.g. only the formulas) into the caption of Table 4.

I tried to add the equations to the caption, but it looked too cramped up and without enough space to explaining the variables in the equations. Therefore, I ended up opting to keep the original text.

Page 15, Line 281: with values in generally under 1°C

Modified following the reviewer's comment.

Page 15, Line 282: below the mixed layer. These compare well to with

Modified following the reviewer's comment.

Page 15, Line 284: As shown in the RMSE profile (Figure 7)

Modified following the reviewer's comment.

Page 15, Line 288: large scale water mass structure

Modified following the reviewer's comment.

Figure 7 caption: Moana Ocean Hindcast simulation in relation to... A zoom in of the

Modified following the reviewer's comment.

Page 16, Line 302: Indicate the location of the plateau and other features mentioned in the text on Figure 1.

Locations were added to the map in Figure 1.

Figure 8: At first glance it is a bit confusing to have the depth-ranges used to generate the subplots as the label on the y-axis when in fact the y-axis represents latitude.

This figure follows the same logic as in previous publication looking at global simulations performance. Therefore, for comparison's sake we decided to not change it.

Figure 8: Caption: The differences are divided into slabs... deep waters (1000-2000m – bottom row). A geographic distribution pattern is evident in the model result differences

Modified following the reviewer's comment.

Page 18, Line 310: model's

Modified following the reviewer's comment.

Page 18, Line 314: (Elzahaby et al. 2021)

Modified following the reviewer's comment.

Page 18, Line 317: Chiswell et al. (2015) and Stevens et al. (2019)

Sorry, but couldn't figure how to do this in LaTeX.

Page 18, Lines 336: comparisons with estimates presented in the literature. We limit the model assessment

Modified following the reviewer's comment.

Page 18, Line 336: Change relative to corresponding

Modified following the reviewer's comment.

Page 18, Line 337: carried out to date along the eastern margin of the NZ

Modified following the reviewer's comment.

Table 5: The offshore sections need to be labeled A-D to match the sections in Figure 10 and section 4 should be changed to West coast of North Island. Also, the Cook Strait section is not indicated on Figure 10.

The table was modified accordingly and the Cook Strait section was added to Figure 10.

Page 21, Line 344: Change Following to Below

Modified following the reviewer's comment.

Page 21, Line 345: "remote based" I suggest changing it so that it is clearer that it is volume transport calculated from remotely sensed data.

Modified following the reviewer's comment.

Page 21, Line 347: Include a cross-reference to Table 5 for the transports reported here.

Reference added.

Page 21, Line 351: using a significantly

Modified following the reviewer's comment.

Page 21, Line 353: along the same

Modified following the reviewer's comment.

Page 21, Line 353-354: This sentence is hard to comprehend. I suggest rephrasing it to something like "These values are also consistent with a volume transport of 8-15 Sv derived from Argo float trajectories in the same region (Bowen et al., 2014)."

Modified following the reviewer's comment.

Page 21, Line 357: Add a cross-reference to Table 5 for the transports reported here.

Reference added.

Page 22, Line 375: same location as for the section

Modified following the reviewer's comment.

Page 22, Line 376: CTD surveys

Modified following the reviewer's comment.

Page 22, Line 377: carried out between years 1993 and 2000

Modified following the reviewer's comment.

Page 22, Line 382: cross-sectional transports through the Cook Strait

Modified following the reviewer's comment.

Page 22, Line 384: Include a cross-reference to Table 4 for the transports reported here.

Reference added.

Page 23, Line 395: Everywhere else throughout the manuscript it is referred to as the Moana Ocean Hindcast. I suggest changing ROMS hindcast to Moana Ocean Hindcast to keep it consistent throughout the manuscript.

Modified following the reviewer's comment.

Page 23, Line 397: Results from the harmonic analysis

Modified following the reviewer's comment.

Page 23, Line 398: constituent;

Modified following the reviewer's comment.

Figure 11) Figure 11: The black and red markers are different sizes with the red markers larger than the black markers. Is there a reason for this? If not, then I suggest making the markers the same size.

The markers have different sizes to make them visible when overlapping.

Page 24, Line 407: Root-Mean-Square-Error (RMSE). Abbreviations should be written out at the first instance where they are used and not towards the end of the manuscript.

Modified following the reviewer's comment.

Page 24, Line 412: The RMSE of the phase error

Modified following the reviewer's comment.

Page 24, Line 413: The phase of the semidiurnal (diurnal) constituent error, K2 (P1) had an RMSE phase of

Modified following the reviewer's comment.

Page 25, Line 416: indicator of such oceanic processes such as

Modified following the reviewer's comment.

Page 25, Line 420: Everywhere else throughout the manuscript it is referred to as the Moana Ocean Hindcast. I suggest changing ROMS hindcast to Moana Ocean Hindcast to keep it consistent with your vocabulary.

Modified following the reviewer's comment.

Page 25, Line 420: time series from three locations

Modified following the reviewer's comment.

Page 25, Line 426: denoted by MSE

Modified following the reviewer's comment.

Page 25, Line 429: for example, North Cape (SLATG12, not shown),

Modified following the reviewer's comment.

Page 26, Line 432: Was the modelled data extracted at the grid cell closest to the station locations? If so, this should be included in the manuscript for both the temperature and sea level stations.

Yes, the simulation results were extracted from the closest valid (water) grid point. This was included in the manuscript for both the SSH and Temperature comparisons.

Page 26, Line 439: Portobello; Figure 13 G, I)

Modified following the reviewer's comment.

Page 28, Line 451:452: I suggest rephrasing this sentence to make it clearer that the model underestimate the seasonal cycle (i.e. cooler (warmer) temperatures in summer (winter) than observed) at these stations.

Simply stating that there are differences in the temperature doesn't transmit the information that these are only about 0.25°C. therefore, we decided to keep the quantitative differences and added a sentence reflecting the reviewer comment.

Page 28, Line 454-455: I suggest rephrasing the second part of this sentence e.g. is potentially unresolved in a regional-scale oceanic model of this resolution due to land-air-sea processes.

Modified following the reviewer's comment.

Table 7 caption: I recommend splitting the last sentence of the caption in two.

Modified following the reviewer's comment.

Page 28 (0), Line 468: unbold Moana Ocean Hindcast

Modified following the reviewer's comment.

Page 28 (0), Line 472: series of analyses

Modified following the reviewer's comment.

Page 28 (0), Line 473: Replace shore with coastal temperature and tidal

Modified following the reviewer's comment.

Page 29 (1), Line 482: calibrated for the New Zealand region

Modified following the reviewer's comment.

Page 29 (1), Line 482-483: I suggest rewriting this sentence to say that it could lead to improvements of the model solution on the continental shelf.

Rephrased.

Page 29 (1), Line 485: Remove the dash at the start of the sentence.

Removed.