General comment:

The manuscript entitled "Moana Ocean Hindcast – a 25+ years simulation for New Zealand Waters using the ROMS v3.9 model" by Souza et al. presents an extensive model-data comparison of a high-resolution ocean model for the New Zealand region. The comparisons highlight the improvements of the high-resolution simulation over the global data-assimilative model used for boundary conditions. The manuscript is well-structured, moving from the large-scale to the coastal ocean, however it is my opinion that minor changes are needed before this manuscript can be considered for publication.

I appreciated the manuscript for being well-structured and for trying to present a substantial amount of information in a succinct way. However, in doing so some of the results aren't explored in any detail and some of the model-data comparisons are glossed over (e.g. SST). The Conclusion sections is a bit disappointing. This section could be improved by a) highlighting the strengths and short-comings of the model and b) by including some of the ways in which the model can be improved on.

Specific comments:

Page 1, Line 20: The authors state that the New Zealand fishing industry is expanding to include coastal aquaculture. New Zealand already has extensive coastal aquaculture activities based around three marine species: salmon, mussels and oysters. However, the Government's Aquaculture Strategy aims to a) expand and improve the existing aquaculture activities, b) advance land-based aquaculture and c) extend aquaculture into the open ocean by 2035. The aquaculture industry in New Zealand are already exploring moving further offshore (so-called open ocean aquaculture) due to coastal warming and the impacts of marine heat waves.

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 to claim that it will be revolutionary is an exaggeration.

Page 2, Lines 48-49: What do the authors mean by "7 days forecasts daily"? Were daily forecasts created for a period of 7 days?

Page 3, Line 74: Please clarify what you mean by mass structure

Page 6, Line 104: Please be more specific with respect to the local sources that were used for the model bathymetry.

Page 6, Line 107: The authors mention that PGE associated bottom velocities were used to determine which grid cells required bathymetric smoothing. Since this is not a commonly used method in ROMS, please provide more details about this method.

Page 6, Line 118: You use Souza et al. (2020) to justify using CFSR for the atmospheric forcing. However, Souza et al. (2020) only compared the ocean component of CFSR to other ocean models and did not look at the atmospheric component. Is there any evidence that the atmospheric component of CFSR out-competes other atmospheric reanalysis products such as JRA-55 in the New Zealand region?

Page 10, Lines 208-209: Please be more specific with regards to the location of the high and low SSH centres and the large-scale currents hindicated by these SSH centres?

Page 12, Line 230: The authors note that it is interesting that the hindcast reproduced the 2018 temperature peak. This suggest that they didn't expect the model to reproduce this event. Please elaborate why this is particularly noteworthy.

Page 12, Line 234-235: The authors mention that the bias pattern is similar to that found for GLORYS in Figure 7 of Souza et al. (2020) but then don't give an explicit description of the biases in the Moana Ocean Hindcast shown in Figure 6.

Page 13, Lines 238-240: While (a) and (b) **are the result** of intrinsic limitations of the model. Also, the section number for the section addressing (c) is missing. Point (c) is listed as "issues related to the observations of SST from satellites close to the coast and in a region notorious for its high cloud coverage", yet Section 3.4.2. which I suspect is suppose to look at this limitation in more detail only looks at daily sea surface temperature at a number of coastal stations around New Zealand, and doesn't examine the limitations of satellite SST close to the coast.

Page 13, Table 3: RMSE and MAE are standard statistics used in model validation but are often calculated in different ways. Furthermore, maximum-absolute-error is not a commonly used statistic. I recommend that the equations for all the statistics presented in the manuscript are included.

Page 14, Line 251: Was the model output used for the comparison co-located in space and time with the temperature and salinity profiles or was the time-averaged model output extracted at the location of the profiles?

Page 14, Line 259-260: The phrasing makes this sentence hard to understand. I think the authors are trying to say something along the lines of "Despite the difficulty in asserting the reasons behind such differences, the differences seem to be in part related to the surface forcing from CFSR and in part due to the boundary conditions from GLORYS.

Page 17: The section on MLD really gives a nice description of what is observed in the observations and how the model differs from these observations. It would have been really good if this same approach was used throughout the manuscript.

Page 19, Lines 309-311: It is clear from the statement here that you are cognisant of the fact that volume transport calculation are sensitive to the horizontal and vertical extent over which it is calculated. Was any effort made to try and match the sections used here to the spatial extent over which transport has been calculated in the literature for a better comparison?

Figure 11: Can you provide any explanation for some of the large differences observed between the observations and the model (e.g. stations 10-15 in subplot G)?

Page 27, Line 425-426: "Satellite-derived annual cycles show coastal regions around New Zealand differ from…" This sentence is hard to understand due to the phrasing and requires some clarification.

Page 28, Line 431-432: Here you claim that additional analysis of the coastal SST time-series are needed to understand the latitudinal decrease in SST and this might certainly be the case. However, one contributing factor to the latitudinal decrease would be a change in the background surface water masses as one moves from north to south with warm sub-tropical water in the north and cooler sub-Antarctic water in the south.

Page 28, Line 444: "The model results outperform the global models in the coastal region". This is a very generalised statement that can't really be backed up by any of the results presented in the manuscript. The results presented here only compares the temporal mean SSH and variance of SSH of the Moana Ocean Hindcast to that of one global model, GLORYS.

Technical corrections:
Page 2, Line 24-25: Move the second set of references (e.g. Chaput et al. 2022; Silva et al., 2019) to the end of the sentence.

Page 2, Line 27: **an** important source

Page 2, Line 53: replace 'bibliography' with 'literature'

Page 3, Line 56: Change 'Marine Heat Wave' to marine heatwave as used throughout most of the manuscript.

Page 3, Line 57: Remove the quotation marks around "sea surface temperature"

Page 3, Line 59: Please provide the name of this western boundary current

Page 3, Line 68: Please define DA the first time that it is used. A reader familiar with ocean modelling and forecasting will know that it stands for Data Assimilation but someone new to the field might not necessarily know this.

Page 3, Lines 72-76: Please provide references to substantiate these statements.

Page 3, Line 74: **Three K**ings Islands

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

Page 3, Line 92: Unbold 5km resolution

Page 3, Line 94: Chatham **I**slands

Page 3, Line 94: **three** New Zealand main islands

Page 3, Line 95: **western** boundary

Page 3, Line 100: Change following development to subsequent development.

Page 6, Line 101: 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.

Page 6, Line 122: **(**Lellouche et al. 2021**)**

Page 6, Line 123: 1 day^{-1}

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.

Page 6, Line 132: global ocean **reanalyses**

Page 7, Line 144: **the** Mercator Ocean

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

Page 7, Line 160: The Moana Ocean Hindcast ~~hindcast~~

Page 7, Line 186: Change forward to onward

Page 9, Line 195: collected by ~~the~~ New Zealand's

Page 9, Line 202: (NZ-OOS; **O**'Callaghan et al., 2019)

Page 10, Line 210: **es**pecially in the region

Page 10, Line 211: "constitutes in" change for something else.

Page 10, Line 215-217: Including a schematic representation of the currents around NZ would make it easier on the reader to follow along.

Page 12, 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.

Page 12, Figure 4 caption: G**L**ORYS

Page 12, Lines 223-224: The phrasing makes this sentence hard to understand.

Page 12, Line 225: pattern is ~~the~~ similar

Page 12, Line 231: events with duration **on** the order

Page 13, Lines 243: 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 3.

Page 14, Line 253: Please elaborate on 'the aggregated information' that is presented

Page 14, Line 256: with values ~~in~~ general**ly** under 1ºC

Page 14, Line 257: compare well ~~to~~ with

Page 14, Line 259: As shown in the RMSE profile **(Figure 7)**

Figure 7 caption: A zoom ~~in~~ of the

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.

Page 17, Line 273: Indicate the location of the plateau and other features mentioned in the manuscript on Figure 1.

Page 17, Line 281: model**'s**

Page 17, Line 285: It appears that a reference is missing here.

Page 17, Line 288: Chiswell et al. (2015) **and** Stevens et al. (2019)

Page 17, Lines 299-301: The phrasing of this sentence makes it very hard to understand. The description in Table 4'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.

Table 4: The offshore sections need to be relabled A-D to match the sections in Figure 10 and west of section 4 should be capitalised. Also, the Cook Strait section is not indicated on Figure 10.

Page 19, Line 307: Change relative to corresponding

Page 19, Line 308: carried **out** to date

Page 19, Line 314: I would suggest including the transports reported in the literature for the different currents in Table 4 for easy comparison.

Page 19, Line 315: Change Following to Below

Page 19, Line 316: "remote based" I suggest changing it so that it is clearer that it is volume transport calculated from remotely sensed data.

Page 19, Line 318: Include a cross-reference to Table 4 for the transports reported here.

Page 21, Line 322: using **a** significantly

Page 21, Line 324: along **the** same
Page 21, Line 324-325: 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)."

Page 21, Line 328: Add a cross-reference to Table 4 for the transports reported here.

Page 21, Line 330: The model volume transport calculated for the ECC south 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 used by Fernandez et al. (2018)?

Page 21, Line 356: It looks like a reference is missing here.

Page 21, Line 355: same location as **for** the section

Page 21, Line 348: carried **out** between ~~years~~ 1993 and 2000

Page 21, Line 353: cross-sectional transport~~s~~ **through** the Cook Strait

Page 22, Line 356: Include a cross-reference to Table 4 for the transports reported here.

Page 22, Line 367: 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.

Page 22. Line 369: Results from **the** harmonic analysis

Page 23, Line 377: "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.

Page, 24, Line 390: 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.

Page 25, Line 402: Was the modelled data extracted at the grid cell closest to the station locations?

Page 27, Line 421-422: The phrasing makes this sentence hard to understand.

Page 27, Line 424-425: 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.

Page 27, Line 431: This sentence would read better if it is split in to i.e. "...decrease with latitude in both observations and model. Future ..."

Table 6 caption: I recommend splitting the last sentence of the caption in two.

Page 28, Line 439: unbold Moana Ocean Hindcast

Page 28, Line 443: series of **analyses**