Review of

Can satellite altimetry observe coastally trapped waves on sub-monthly timescales?

Marcello Passaro

General comments

The manuscript focuses on the potential of improved altimetry products to detect coastally trapped waves (CTW). So far, those waves were identified using tide gauge data that is very accurate with a high temporal resolution but sparsely spaced along the worlds coastlines. The manuscript successfully demonstrates that new products are able to show how CTWs propagate anticlockwise along the eastern Australian coast.

The author uses a combination of standard (correlations, EOFs) and (to me) less known techniques (image processing) to arrive at their conclusion. I find the argumentation convincing but I think the presentation of the results could be improved (see below).

I would like to thank the reviewer for the constructive feedback. Below, I provide a point-by-point response to the comments. The revised sections in the manuscript are highlighted in red.

Specific comments

Line 68: Remove parentheses for Woodham et al.

Done

Figure 1: I found the green rectangle a bit hard to see. Consider a different color and thicker lines.

A thicker line is used in the new version

Line 68: Can you say something about the temporal resolution of this dataset, and how this compares to the other datasets used in this study?

The temporal resolution of BRAN2020 is now reported: “The latest version, BRAN2020, is used. It simulates the period from 1993 to 2023 using a near-global, eddy-resolving ocean model with a 10-km spatial resolution and daily temporal resolution”. Concerning the other datasets (altimetry), I have treated the issue in different sections, for example in the introduction: “Secondly, although these grids are currently released at a daily rate, previous literature has defined their effective temporal resolution to be about one month”

Line 71: what kind of sea surface height data is assimilated? Remote- sensing data I assume?

I now specify: "…and sea surface height (from satellite altimetry)"

Line 86: To be clear: The major difference between CMEMS and MIOST is the inclusion of the swath-altimeter data in MIOST? Both, MIOST and CMEMS use the MIOST technique to solve the mapping problem? I found that a bit confusing and would recomment choosing a different short name for what is now the MIOST product.

Your understanding is correct. I adopted the suggestion by renaming the MIOST product as "$MIOST_{SWOT+nadir}$", which is the same convention used in the following, related paper:

Ballarotta, M., Ubelmann, C., Bellemin-Laponnaz, V., Le Guillou, F., Meda, G., Anadon, C., Laloue, A., Delepoulle, A., Faugère, Y., Pujol, M.-I., Fablet, R., and Dibarboure, G.: Integrating wide-swath altimetry data into Level-4 multi-mission maps, Ocean Sci., 21, 63–80, https://doi.org/10.5194/os-21-63-2025, 2025.

Line 95: Here you assume that CTWs have periods between 7 and 29 days? Can you justify this? Have most of the CTWs observed so far fallen in that range? (Aydın and Beşiktepe, 2022, state that CTWs typicall fall into the 8-16d range and I'm wondering why you extend your range to 29 days.)

Aydın and Beşiktepe, 2022, is a paper analysing CTWs in the Black Sea. I use the same filtering as in Woodhman et al., 2013, which is focused on our same area of study and uses the same reanalysis: "In order to isolate the principal CTW frequencies, the Bluelink data were filtered using a fifth-order Butterworth bandpass filter, with frequency cutoffs (3 dB) at 0.035 and 0.15 cycles per day (cpd). This passes oscillations in the range 28.6–6.7 days."

Equation 7: T is the number of time steps but also denotes the transposed matrix X', right? Maybe choose another letter for the number of time steps (N?) to avoid confusion.

Done

Line 146: "The TG clearly shows…": is this from visual inspection only or is there more evidence?

I have rephrased in the following way: "A visual inspection of the TG data reveals oscillations with a period of approximately 10 days and amplitudes ranging from 5 to 10 cm."

Figure 2: Legends: A bit pedantic but could you show the TG first or last in the legend? As it is the ground truth. Also, one legend might be enough – the filtered/unfiltered can be in the titles for the two panels. The time step is days?

All the suggestions have been applied to the new version

Line 148: Have you already shown that the variability seen in the data is due to CTWs? Maybe based on previous literature? Or is it only an assumption at this point? Could the oscillations be caused by something else?

I added the following clarification: “For the purposes of this section, it is assumed that the observed oscillations represent the signature of CTWs, which are known to dominate sub-monthly variability in the study region (see Introduction). This assumption will be further examined in the following sections.”

Line 172-173: In the previous paragraph you identified Bermagui as the TG with the lowest correlation of the filtered time series with the altimetry data. It seems a bit unfair using that one for the 2D validation. I understand that you choose the southernmost location and that it shouldn’t matter as the shelf gets wider northward. But could you still justify that choice?

The justification is added in the form of the following paragraph: “Bermagui is chosen because it is the southernmost location in the domain, in order to highlight, through lag-correlation, the spatial footprint of coastally trapped waves traveling northward. However, the same statistics have been produced for every TG station, and the corresponding figures can be found in the Appendix”

Figure 5: For better readability consider giving the distance from first point in kilometers on the x-axis. Also, you could have a marker on the x-axis to show the approximate location of the tide gauges such that the Hovmöller diagrams are easier to relate to the maps in Figure 4. In addition, for consistency, use the same labels for the time (y-) axis as in the other figures, i.e. time steps (which are days, I presume?) instead of actual dates.

I have adopted both suggestions concerning x-axis and y-axis. I have not added the tide gauge locations, since I find this confusing given that the tide gauge data are not used in the Hovmöller diagram.

Line 193: The EOF analysis is very informative but I think it needs to be explained better, particularly the spatial EOFs. You can compare them to the correlation maps in Figure 4 at lag 0 –there, you clearly see a see-saw on the shelf which is consistent with the first spatial EOF (of Bluelink, at least).

I have strongly modified the EOF analysis in order to improve the explanations. I have now adopted the complex EOF (CEOF) analysis and updated both methodology and discussions. In this way, the results of the CEOF are now shown by considering phase, wavelength and period of the signals. Moreover, the recostructed signal is shown in an “Hovmöller aesthetic”, to match this suggestion with the requests from the other reviewer. The CEOF analysis is also extended to the whole shelf, in order to better represent the spatial structures.

Also, the figures need to be improved:

Figure 6:

- Shouldn't either the EOF amplitude or the PC amplitude have a unit (m)? That would be useful and would make the results more physical.

The first CEOF is now shown in terms of reconstructed signal to make the results more physical, the amplitude has therefore "m" as unit.

- upper panel: what is the location index and how does it relate to the distance in Figure 5?

The distance is now shown in the same way for all the plots and in "km" as suggested by the reviewer

- lower panel: time steps is days?

Done

Figure 7: The information to be conveyed here is interesting but I wonder if you could do it differently? Instead of showing one panel for each day with all three datasets how about showing only three panels, one for each dataset. In the panels the EOFs could be shown for each time step (using different shades of blue/red/green) so that the anticlockwise rotation becomes very clear.

- as above, what is the location index and how does it relate to the distance in Figure 5?

- I think a unit is missing here

Figure 7 has now changed significantly and I tried to combine the suggestions coming from both reviewers. I now show the reconstructed signal over the entire shelf region from the three datasets from three specific days corresponding to the major CTW event. In the appendix, the same is shown also for the original filtered signal before the CEOF.