The study is novel and could be worth publication after minor-to-major revisions.

We are grateful to the reviewer for the detailed and constructive comments that helped us to improve our manuscript. The manuscript has been revised to comply with the reviewer's comments and suggestions.

General comments:

The presentation of the major findings and results as associated with the key figures should be more adequately outlined and addressed. Now it often appears too brief as it rushes from one figure and relatively short explanation and discussion to the next. This should be improved.

We thank the reviewer for raising this aspect. First, we want to stress that the paper has been written in the aim of being as concise and compact as possible. Indeed, the BFN-QG method was already described in a recent work (Le Guillou et al., 2021) published by some of the authors of this paper and tested using an Observing System Simulation Experiment (OSSE). Similarly, the validation strategy involving an Observing System Experiment (OSE) was already presented in a previous work (Ballarotta et al 2020) also published by some of the authors of this paper. That is why the figures are used in a way to support the main messages more than providing deep analysis. Still, we agree that the figure explanations and discussions could be more extended and better organized. We made consistent changes to do so:

- Figure 1 is removed, as it was not discussed in the manuscript.

- The paragraph starting at line 118 has been modified to better discuss Figure 2.

- We add some text to better present Figure 3 in the paragraph starting at line 134:

  "*Figure \ref{fig:03} shows maps from BFN-QG and DUACS, for one single day, with a SARAL/AltiKa altimeter track superimposed. SARAL/AltiKa SLA observations and SLA interpolated from both maps onto the satellite track are shown in the middle panel. In the case presented here, the BFN-QG result fits the independent observations SLA^{ind} better than the DUACS product.*"

- Section 4 has been reformulated to allow a deeper analysis of Figures 3, 4 and 5. Figure 3 is discussed in a first paragraph to assess the performances qualitatively. Then, two paragraphs are added to present quantitative diagnostics, each specific to one metric (RMSE and PSD). After, we present Figures 3 and 4 by adding this sentence:

  "The results of the quantitative evaluations are reported on Figures \ref{fig:04} and \ref{fig:05}. Figure \ref{fig:04} shows the number of observations per box, the spatial distribution of $RMSE_{BFN-QG}$ and R for all scales and for the mesoscales. Figure \ref{fig:05} the PSDs and the PSD scores."

The paragraph starting at line 157 has been rephrased to better discuss Figures 4 and 5.

- Section 5.1 has been modified to better discuss Figures 6, 7 and 8.

Does the choice of the 1.5 layer QG model impact the results in any way? In other words, are there other modes than the first baroclinic mode that might be influecing the dynamics and variability in the greater Agulhas Current region? Is it possible to find discussion of this in the literature? Need some more consideration.

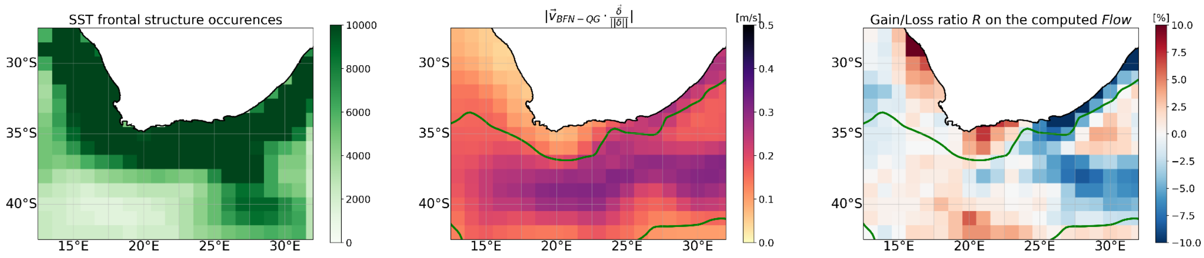
Yes, higher baroclinic modes influence the dynamic in the Agulhas Current region, although the QG dynamics —and therefore SSH dynamics— is principally captured by the first baroclinic mode (Fu and Flierl 1980; Shafer Smith and Vallis 2001). We deeply think that the performances of the assimilation procedure rely on the balance between the density of observations and the complexity of the dynamical model. Simulating the dynamics of higher baroclinic modes would greatly decrease the controllability of the dynamical model with only sparse along-track altimetric data and hence reduce the performances of the reconstruction. However, as the just-launched SWOT mission will considerably increase the density of SSH observations, we plan to assimilate these future data in multiple layers QG models to improve the reconstruction of the SSH dynamics. This perspective has been added in the last section of the manuscript, following the Reviewer's last general comment.

Line 210 comments on the Agulhas Current area and claim that it is characterized by weak advection of the frontal structures. However, in view of the area (Figure 9) the presence of Natal pulses can propagate southwestward on the nearshore side of the Agulhas Current core while highly rich and complicated dynamics occur in the retroflection area where eddies are often shed and also sometimes reintegrated into the retroflection. These areas are characterized by advection and sometimes rapid occurrances and closing of frontal structures. So the statement must be refined to better balance these conditions.

We thank the reviewer for this very relevant remark. The manuscript has been modified accordingly.

In Figure 10: The black line in the 3 panels seems to be contours of the land-ocean boundary. Must be explained. A bit strange to see values within boxes that are completely inland.

Indeed the black lines refer to the coastline. The colored pixels "inland" are due to different definitions of the coastline in the diagnostic algorithm and the plotting function. This mismatch has been solved for all figures in the manuscript, see hereafter an example for Figure 10.



(new) Figure 10 with the inland pixels removed

In the discussion and conclusion it would be worthwhile to comment on possible use of SWOT and Sentinel-1 image data to further strengthen this study approach.

We agree with the Reviewer to add a paragraph in the conclusion section to discuss the opportunities (and challenges) to exploit synergies between conventional altimetry and other space-borne data to improve the reconstruction of surface currents. First, we discuss the opportunity of the next-generation altimetric mission (e.g. SWOT) to improve the reconstruction of geostrophic currents (e.g. Le Guillou et al., 2021). Second, we discuss the possibility to use Sentinel-1 to assimilate radial ocean surface velocities (e.g. Moiseev et al., 2020). Third, we add some last comments about using satellite tracer data (such as SST or Chlorophyll) to better constrain the reconstruction of total surface currents (e.g. Rio et al., 2018).

Specific editorial comments:

The submitted paper is attached with red-markings suggesting update of the text.

The additional editorial comments have been taken into account in the updated version of the manuscript.

Additional edisotrial comments:

Agulhas Current should always be with captial C.

Be consistent in use of reference to figures (Fig., Figure, figure, I prefer Figure).

Equation 10: The expressions in the exponent should have larger font. Difficult to see properly.

The space scale symbol D (in equation 10) must for consistency also be used in Table 1 (nudging space scale).

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