Review of the paper “Contribution of a constellation of two Wide-Swath Altimetry Missions to Global Ocean Analysis and Forecasting” (os-2021-108)

General remarks:

The main purpose of this article is to assess the added value from assimilating altimeter data from two future wide-swath altimeters (WiSA) in a high-resolution global ocean forecasting system. The assessment is based on results from Observing System Simulation Experiments (OSSEs). The experimental results provide evidence that the wide-swath altimeters can substantially improve the analysis and forecast of mesoscale features.

The article is generally well written and easy to read. However, in view of the idealized nature of the experimental framework, the authors should be more nuanced in their discussion and conclusions regarding the expected impact of WiSA in operational data assimilation. A major simplification in the experiments is in the representation of WiSA observation errors, which is unrealistically simple compared to expected error sources in wide-swath altimetry, as modeled by the SWOT simulator. Only uncorrelated KaRIn noise is accounted for, with no justification as to why the other significant error sources (roll errors, phase errors…) are neglected. In particular, the roll and phase errors have a highly spatially correlated component, which needs to be adequately accounted for in the data assimilation system in order to be able to assimilate this high-resolution data-set effectively. The authors should at least recognize this important issue in the discussion, especially as this requires non-trivial developments to existing data assimilation systems.

Specific remarks:

1. Section 1, line 7. “*and has convinced more than thirty thousand expert services and users worldwide.*” Do the authors mean “*attracted*” instead of “*convinced*”?
2. Section 1, line 26. “*The main limitation of SWOT is, however, related to its long-time repeat period*.” What about the limitations of existing data assimilation systems to properly assimilate high-resolution SWOT observations?
3. Section 3.1, line 18. “*The second model is used to assimilate synthetic observations from the NR in a so-called Free Run (FR)*.” A free run usually refers to a simulation that does not assimilate data, yet here we are told that it does assimilate data. If so, then which data are assimilated. Please clarify.
4. Section 3.2, p4, lines 33 until end of paragraph. “*The simulator models the most significant errors that are expected to affect the data… In this study, we only use the estimated WiSA KaRIn noise*…”. Related to my main general remark above about the observation error specification, please provide more justification of this choice and discuss the implications.
5. Section 3.2. The noise level of WiSA is expected to be larger than that of SWOT (p3, last paragraph). Have the authors adjusted the SWOT simulator parameters to prescribe larger errors indicative of those of WiSA?
6. Section 3.4. “*OSSE2 (not presented here) is similar to OSSE1….*”. If the results of OSSE2 are not presented then the authors can remove the reference to this experiment.

7. Section 4.1, line 11. "*The temporal evolution of the SSH variance error over the global ocean*…". It is unclear what is meant by "*variance error*". Is this the mean squared error (MSE); i.e., the global average of the squared differences between OSSE and nature run fields (with the mean removed)? A simple formula could help here. This is important as several diagnostics in the paper are based on this quantity. If it is the MSE then why present the squared errors instead of the root mean squared errors (RMSE) (or standard deviation), which is more common and easier to interpret since it has the same physical units as the field itself. It will affect the percentage error reductions reported in the paper; e.g., the reported reduction of 54% becomes 24% when considering the reduction of RMSE (or standard deviation).
8. Section 4.2, lines 37-38. "…*errors are characterized for specific time and space scales.*" Please give some detail on how the time and space scales have been separated. Presumably the authors are using a filter of some sort.
9. Section 4.2, p8, lines 17-18. "…*was based on filtered SSH fields*…". Please provide some detail on how the fields are filtered.
10. Section 5. "*Results confirm the high potential of such a configuration. Flying a constellation of two wide-swath altimeters will provide a major improvement*…". This is an idealized study so alternative wording should be used to be less definitive; e.g., "*Results suggest the high potential…*" and "*should provide a major improvement*". Proper assimilation of these observations will require effective data assimilation systems, beyond the current state of the art. More sophisticated treatment of observation errors (correlations and biases), improved background error covariances, and adequate treatment of model bias in data assimilation are important requirements in this respect. Uncertainty in the mean dynamic topography also remains a major issue for the assimilation of all forms of altimeter data (nadir as well as wide-swath).
11. Section 5, p9, line 25. "*Surface current forecast errors should be equivalent to today's surface current analysis errors*…". I don't understand this statement. Forecast errors with what lead time?
12. Many of the figure labels are difficult to read. Please use a larger font.

<u>Minor corrections</u>:

1. P1, line17. "point out" (?) instead of "recall"
2. P1, line 33. Remove "system".
3. P3, line 36. "What is the relationship between "a feature diameter" and "wavelength"?
4. P5, line 9. "*in situ*".
5. P5, line 14. "a free simulation".
6. P5, line 17. "model corrections".
7. P5, line17. "velocity field".
8. P5, line 26. "profile".
9. P6, line 6. "in Figure 3".
10. P6, line 25. "SST" (use previously defined acronym).
11. P6, line 31. "nadir" (not "Nadir" to be consistent with rest of article).
12. P6, line 33. "in the global".
13. P7, line 21. "Bonaduce et al. (2018)".
14. P8, line 6. "where" and "and" should not be in italics.
15. P8, line 6. "signals j where j refers to the experiment".

16. P8, line 38. “components.” (missing period).
17. P15, Figure 4 caption. “black lines,” and “altimeters”.
18. P24, Figure 13 caption. “comparing temperature and salinity”, not “zonal and meridional velocities”.