

Comment on os-2021-55

Anonymous Referee #2

Referee comment on "Sea-level variability and change along the Norwegian coast between 2003 and 2018 from satellite altimetry, tide gauges, and hydrography" by Fabio Mangini et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-55-RC2>, 2021

The authors assess the quality of ALES-retracked altimetry data in terms of reproducing temporal variations of sea level along the Norwegian coast, specifically the annual cycle and the trend, by comparison with available tide gauge data. They then use the altimetry data in combination with observations from hydrographic stations (whith no tide gauge data there) to compare steric height variations to the total sea level variations.

Both issues of the paper, the quality assessment of the ALES-retracked altimetry as well as the analysis of sea level variations along the Norwegian coast are interesting for the reasons stated by the authors. However, both issues need more in-depth consideration. Also the methodology needs some additional descriptions.

It is not totally clear to me why the semi-annual cycle is fitted (eq. 1). It is never addressed anywhere later in the paper (or I have misunderstood). Is it included only to prevent, in case of data gaps, that the running annual mean reveals part of the seasonal signal, or aliasing issues? This has to be explained. If there is a signal with amplitudes comparable to that of the annual cycle, it would also be interesting to see, as additional part of the quality assessment, how, for this frequency, ALES-retracked altimetry compares to the tide gauges.

The authors state that sea level data from the tide gauges have been corrected for geoid height changes with respect to GIA. Is this correction applied to the altimetry data as well? If geoid height change from GIA is considered, then also instantaneous adaptation from changed loading caused by the Greenland ice melt should be included, which will probably outperform the GIA effect in most regions along the Norwegian coast (Siegismund et al, 2020). Why is, at the end, not the full sea level variation budget considered, but only the steric effect? The abstract states performance of the sea level budget. Consideration of the full budget would give the whole study more weight. If this is not intended the authors should explain the reasons to the reader.

It isn't clearly stated how the optimal distances from and along the coast for spatial averaging the altimetry data are found. I guess, a set of distances is defined and the correlations are computed for each element? Please explain.

It would be nice to see a direct comparison of conventional altimetry and ALES-retracked altimetry for the Norwegian coast to see both, the improvements/changes in the observations dependend on location (and specifically distance from the coast) as well as the added value caused by the improvements when investigating spatio-temporal variations of sea level along the Norwegian coast. Direct comparison to Breili et al (2017) is not feasible due to different methodology and period. From the optimization of the distances for the spatial averaging of the altimetry data it seems that inclusion of data more offshore than 20 km, which has been the a-priori fixed maximum distance, could even improve the correlation with the tide gauge data. Has this been tested? That could mean, that conventional altimetry data could be of comparable quality because either the errors of the ALES-retracked altimetry data is still too high near the coast, or temporal variations are coherent for a wide stripe along the Norwegian coast and data away from the coast can do the job as well. So what is really the benefit from using the ALES-retracked data?

Minor issue:

In Figure 1 please mention, that the yellow diamonds are the hydrographic stations, and the red dots are the tide gauges.