

Earth Syst. Sci. Data Discuss., referee comment RC1  
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## **Comment on essd-2021-128**

Anonymous Referee #1

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Referee comment on "Towards a regional high-resolution bathymetry of the North West Shelf of Australia based on Sentinel-2 satellite images, 3D seismic surveys, and historical datasets" by Ulysse Lebec et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-128-RC1>, 2021

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### **General Comments**

The authors have produced an impressive dataset, filling a clear data gap and need in NW Australia. The manuscript demonstrates a pragmatic integration of a wide array of bathymetric and spatial data sets to create a comprehensive coverage of the NW Shelf region. The temporal approach to using a recognised empirical SDB method is well thought through, and leverages both the temporal and ancillary data aspects. My comments below are mainly focused on the satellite derived bathymetry component of the work.

I recommend the manuscript for publication, with minor revisions as below.

### **Specific Comments**

- Digital Elevation Model (DEM) vs Bathymetry

Throughout the manuscript there seems to be alternating use of the concept of a digital elevation model/elevation and a bathymetry model/depth. Initial description in line 63 describes a DEM, but most figures and discussion thereafter refer to bathymetry/depth. This leads to things being mixed up (e.g. Figures 4, 9 and 11) where images use depth/bathymetry and the profile charts use elevation. Sticking with just bathymetry/depth I think would help with consistency and interpretation. I would also specify the datum in each figure (MSL).

- The concept of Extinction depth

I think the work would benefit from a better discussion around the use of the concept of Extinction depth. Firstly, a description of what this concept physically means, and how this relates to similar concepts such as Optical Depth used by other satellite derived bathymetry methods would be helpful to the non-remote sensing reader. References around these concepts and statements (e.g line 340) should be included. Second, a bit more clarity around the target coefficient of correlation (line 344), how this is decided, and if it is the same for each image (why/why not) is needed.

- Filtering images in the stack and deriving the correlation coefficient

In section 5.3.4 a process is described that essentially filters images that have outlier 'temporal effects' present (as illustrated in Figure 9). There does need to be more clarity in lines 379-383 around how a correlation coefficient threshold for each image is determined. Is there a lower threshold for an image near a river mouth with a regular sediment plume. If so, doesn't that still make that data less reliable?

I think the authors also need to discuss/acknowledge how this process relates to the error

correction process described in 5.3.3. As the error correction already corrects the bathymetry based on a surface error model in comparison to the calibration points, if you are then looking at a correlation model based on this corrected bathymetry, the process is at risk of becoming circular and less valid. For example, it seems that in a turbid estuary, the error model process would do its best to correct the underestimated bathy values (in a regional surface sense) back to the calibration points. Running a correlation then for image QA/QC on these already corrected outputs needs a bit more justification I think.

- Use of pixel based Standard Deviation layer

The inclusion of a pixel based standard deviation layer in the data product is a very useful tool, and I think should be used more in the manuscript, as it is only mentioned as an afterthought in line 418 and Section 8. Already in Figure 9(c), we can see the expected increased variance in the single image solutions as depth increases. Showing an image illustrating this based on the standard deviation layer would be very informative. Likewise, an image figure would help illustrate how a higher variance of the product would be expected in dynamic and/or turbid estuaries, helping to back up statement such as line 443.

In my opinion, this SD layer is as useful in terms of the user assessing the accuracy of the SDB product as the validation to the LADS data. To add further value to the statement on mean SD in line 419, I would suggest extracting a graph/table that shows the mean SD for pixels based on depth intervals (ie. Model depth SD for pixels 0-2m, 2-5m, 5-10m etc etc). This would be extremely helpful to the end user.

## **Technical Corrections**

Line 49 – Please explain ‘indirect’ datasets, the meaning is not particularly clear.

Figure 6 – In description, it should be made clearer that the Australian Bathymetry and Topography refers to the Regional Data in panels b and c.

Lines 288, 323 and elsewhere – Including the band centre wavelengths for the Sentinel 2 bands described would be helpful.

Lines 305 – 312 – A rewording and perhaps further explanation I think would help to explain what is meant by abnormal values and the rationale for avoiding them (ie. Dry season in the North?)

Line 325 – Please elaborate on what is meant by speckles (ie pixel based glint, signal/noise artefacts)

Figure 8 – I think 'seismic' may meant to be 'satellite'

Line 376 – Perhaps 'statistical analysis' instead of 'statistics'

Figure 9 – Would benefit from inclusion of the true colour image of this example to visually show the temporal artefacts concept the author is trying to highlight.

Line 433 - use of 'constrained' rather than 'tied' perhaps