

Ocean Sci. Discuss., referee comment RC2
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Comment on os-2021-80

Anonymous Referee #2

Referee comment on "Simultaneous estimation of ocean mesoscale and coherent internal tide sea surface height signatures from the global altimetry record" by Clément Ubelmann et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-80-RC2>, 2021

This manuscript tackles an important question which is how to separate well the mesoscale variability from the internal tides in the altimetric record, with a focus on the internal tide component which is coherent. The approach is innovative, and the results are tested first on artificial fields, and then on the real altimetric sea level record, with a validation and estimation of the skill with recent data not used in estimating the solution (for the internal tides).

The approach relies on a set of assumptions on the respective spectral characteristics of the meso-scale variability and the tidal characteristics. The tests are done assuming a certain spectral shape of the meso-scales and tides which follow the classical (linear) dispersion characteristics and are low order (1 or 2, depending on the tidal mode). The tests indicate that with these assumptions, the joint inversion approach (which is numerically rather heavy) performs better than separate approaches.

I wonder whether the authors could go further and estimate how much the gain depends on the spectral shape. After all, it originates from the overlay of the time-space spectra of the meso-scales and of the tides. One can also wonder how sensitive is it to the exact shape of spectrum. It could be interesting to test different shapes overlapping more or less.

What is the impact of the assumptions on spectral characteristics for the mesoscales, as well as for using a specified dispersion relationship with modal decomposition, extending only to order 2 or 1 depending on the tidal component, of course compounded by the use of a (spatial) Hamming window. The width of this window has to have an impact. What fully motivates the choice?

Section 3.1.1 summarizes the choices made in Ubelmann et al (2021) in a few sentences.

This is fine not to present in details what is in this paper, but one is left a little bit wondering about what has been done. I was in particular wondering whether the choice to fit the covariance on the altimetry mapping covariance, which filters out some of the smaller oceanic spatial scales has an impact on the internal tide solution. Also, when mentioning the full altimetric record, it should be indicated what is the data set. I assume that the adjustments between the different altimetric missions (and other corrections and filtering of the data along track, but that I am less sure) are performed before hand. Have these steps (if done) some implication on the internal tide characteristics that will be afterwards retrieved.

My other comments are minor and could easily be fixed:

- 107: For each component k...
- 115: index p should be explained.
- 142 'only mode-1 is considered...'
- 155: '(sources and sinks)'
- 157: 'not too large'
- 162: I assume '(upper panel) ...'
- 182, I don't understand the end of the sentence?
- 203: 'for each component'
- 207: I am not sure I got the end of the sentence: why 'supposedly'?
- 210: 'the stationary persists' (word missing?)
- 249: why is the Cryosat-2 mission specifically mentioned at this point (and not earlier)
- 257: 'could be an interesting next step...'