Authors answers to EC2 comments/questions/recommandations

(for commodity reasons, we have reproduced the reviewer text in black, changes are in light blue, further action/comment to the revised manuscript in bold blue)

Topic Editor Decision: Publish subject to minor revisions (review by editor) (14 Feb 2021) by Philip Woodworth
Comments to the Author:
14/2/2021

Comments on the revision of this paper.

This paper has been much improved following the comments of the reviewers, and the figures have also been improved. I simply read the paper again and have a remaining large number of small edits which should not take the authors long. There are also a couple of more important issues.

If the authors disagree with any of these comments then I suggest they mail me privately. Otherwise I assume they will be all attended to in a final revision which I will not have read in detail again.

All comments accepted and fixed in revised version. I just reported correction that you might check before I upload the revised paper.

General comment - please see lower down but I got confused why you made comparisons with FES2014a and not FES2014b which is the final product, isn't it? This needs explicitly explaining.

I added some words to explain FES2014a and FES2012 in some inter-comparison diags.

5 Atlas assessment and validation

The validation of the FES2014 tidal atlas is based on a frequency-domain (harmonic) validation of the ocean tide components plus a temporal validation of the total geocentric tide components (i.e. ocean tide plus loading tide). The FES2014b performance is compared to state-of-the-art global tidal models available at the time of the study, namely GOT4v8/GOT4v10, DTU10, TPXO9v2, EOT11A and FES2012 (please note that FES2014c and FES2014b have identical main long period, diurnal, semi-diurnal and sub-harmonics solutions, and the FES2014c long period extension is identical to the one implicitly made inside the prediction software, so the following validations will mention FES2014b only and will hold for FES2014c as well). The FES2012 and Fes2014a atlas have been included in some performance inter-comparison assessments to demonstrate the beneficial impact of the following evolutions: FES2012/FES2014a differences mostly illustrate the improvement coming from the significantly higher accuracy of the FES2014a prior hydrodynamic solution in the assimilated solutions, while FES2014a/b differences mostly illustrate the improvement coming from the FES2014a-derived LSA forcing in the hydrodynamic model and in the assimilated altimetry data processing (tidal loading correction)…

I also added in figure captions:

The accuracy improvement between the FES2012 and FES2014 prior solutions is a key ingredient in the accuracy improvement between the FES2012 and FES2014a assimilated solutions

Detailed comments:

pages 1-2. I ignored these as the title and abstract are slightly different from those on page 3 which I took to be the official versions.

I messed up (duplicated) abstract in last revised version, sorry. Now fixed

31 Lynch and Gray (1977), and continuously developed since, the approach has evolved from application to the deep [?] global ocean, now up to the inclusion of near-shore ..

Inspired from Lynch and Gray (1977), and continuously developed since, the approach has evolved from application to the global ocean, now up to the inclusion of near-shore and estuarine numerical applications, with wetting/drying and non-hydrostatic (surface wave dynamics) capabilities.

15 - you refer to the model grids here, but there is no reference in the text to the Supplementary Figure and its grid. It needs including either here or somewhere.
The targeted resolution for coastal areas is typically 10 kilometres or less in terms of triangle side-length (shown in Figure 1; the mesh details would not be visible on a printed global ocean figure, the authors have provided a zoomable supplementary pdf file available on Ocean Science website https://www.ocean-science.net)

(not yet sure how to refer to the pdf, will check with Anna)

38 what does 'non-free' mean here? Please reword

(actually, this is the only one model ingredient which depends upon a pre-existing ocean tides information in our hydrodynamic simulations)

I feel this paragraph is not complete. Or perhaps it needs a pointer to where the
S1 and S2 issue is discussed lower down.

The numerous difficulties arising from the atmospheric pressure forcing at tidal frequencies (impacting tidal hydrodynamic solutions, de-aliasing corrections and data processing), so additional discussions on S1 and S2 constituent issues are given in the following sections.

18 Because this signal was strongest during the TOPEX-POSEIDON mission - this
needs a reference also.

I think somewhere you have to make it clear what you mean by 'altimetry' i.e that it
has a routine IB correction, unlike tide gauges

lines 18-25 - I found these lines very hard to understand. Please could you look at and
reword?

In altimetry mission observations, the S2 tidal constituent is challenging as it is aliased on the infinite period and thus is not observable by the ERS/EnviSat sun-synchronous orbit as mentioned before. TP-Jason orbit is adequate to the observation of most of the main tidal constituents, however, because of its 58.74-day aliased period, the S2 tide sea surface signal is mixed with the residual Mean Sea Level (MSL) signal visible at the same frequency in the TP-Jason time series, which is linked to the inaccurate account of the β' angle in one or several standards used in MSL computation (Ablain et al. 2010; Zawadzki et al. 2016). Consequently S2 harmonic analysis will be contaminated by this GDR processing-dependent signal (with a possible feed-back through the tidal corrections in the GDRs, making this issue even more intricate). As it is stronger in TOPEX-POSEIDON mission GDRs (as reported in Zawadzki et al., 2016), several analyses have been performed using either the entire TOPEX-Jason time series or only the Jason-1/Jason-2 relatively recent records. But due to the much shorter duration of the latter, the estimation error is larger for the J1-J2 only analysis, and the assimilated solution proves finally to be more accurate (using TG data as sea truth) using the analysis from the entire altimeter series. Notice that thanks to its primarily approach based on an accurate hydrodynamic modelling, further moderately tuned by data assimilation (thus allowing a reduced weight of the data and data errors in the global FES solution), the FES2014 S2 solution is less affected by this residual GDR processing signal than empirical models, with in addition a beneficial effect on reducing the residual MSL error if used for tidal corrections in GDR processing (Zawadzki et al. 2016).

p13, 6 - what does point-by-point clearing mean?

Neither high-latitude data set manual editing nor entire data set rejection were an option, the former being a gigantic task and the latter an extremely damaging loss of data in already poorly documented regions.

34 - 'error compensation story' sounds odd. Can you reword?

first the FES2014 hydrodynamic configuration has been adjusted (i.e. bottom friction and internal wave drag due to barotropic to baroclinic energy conversion, denoted IWD) in simulations using the FES99 LSA, and includes clearly an error compensation contribution, i.e. configuration adjustments compensate for the FES99 LSA defects. Consequently, considering the high level of accuracy of the hydrodynamic solutions and thus the sensitivity to any minor changes, they are not fully appropriate for a simulation forced with another LSA atlas

34-35 sentence 'It might'. I don't understand this. I would drop it. (not dropped but I changed words)

However, the implementation, inside the prediction software, of the inference method to increase the prediction spectrum efficiently compensates for the impact of missing astronomical constituents in the GOT4v10 atlas, so most of the differences in the actual prediction spectrum will be limited to the differences in the availability of compound tide constituents.

Fig 19 - remove the stray script top right in the figure

why does the big ellipse near Adelaide have a gap? Looks like a plotting error

Plots have been reprocessed and captions are updated

Ellipses scales in m/s. Inside line indicate velocity direction at Greenwich transit time, ellipse rotation from inside line to arrow-terminated ellipse contour.

Additional corrections (after iterating with P. Woodworth, see below). All comments and corrections were accepted and corrections were made in the revised pdf.

Hi Florent – I have made some edits below in red (either use or don't use them if you agree or not). Things in [red brackets] means delete.

I didn't understand the (tidal loading correction) mentioned at the end of the first paragraph below.

All the other things were ok.

Thanks for doing all this again.

Phil

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