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Solid Earth Discussions

Interactive comment on "Impact of terrestrial reference frame realizations on altimetry satellites orbit quality, global and regional sea level trends: case ITRF2014 versus ITRF2008" *by* S. Rudenko et al.

Anonymous Referee #1

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Review of "Impact of terrestrial reference frame realizations on altimetry satellites orbit quality, global and regional sea level trends: case ITRF2014 versus ITRF2008" by Sergei Rudenko, Saskia Esselborn, Tilo Schöne, and Denise Dettmering.

This paper discusses what the title says, namely the impact of a new reference system called ITRF2014 on sea level change observed by satellite altimetry. The conclusion is that the errors originating from orbit determination on the observed sea level reduce somewhat. The problem is investigated for TOPEX/Poseidon, and subsequent altimeters Jason-1 and Jason-2. In general, this paper is rather technical and unfortunately

not very exiting to read. I have some general comments to improve the quality.

Page 2, lines 1-2: I think it is better to not only mention the uncertainties, but also to mention the physical range of the sea level signal. Another aspect is that all used altimeter satellites only provide coverage between 66N and 66S, a part of the globe is missing, namely in the polar seas and also on the continental shelves.

Page 2, line 12-13: Merge the sentences

Page 2, line 17, "has been shown to have a noticeable impact" noticeable could be read as large or significant, but your study does not show this, the effect of orbit determination uncertainties on sea level rise observed by the altimeters is small. For semantic reasons you could better say, it is observable or detectable, but avoid to suggest that it is significant because it is not.

Page 2, line 18-19: "While Beckley et al . . . 2014" : In my opinion this sentence does not add new information to your paper. Remove it I would say.

Page 2, line 31-32: "They found that . . . mm/year" so this is more significant than what you mention, could you perhaps explain why their results differ from yours?

Page 3, line 2-3: "Therefore, in this paper . . . realization", this is repetition of information, these repetitive episodes make the paper uninteresting to read.

Page 3, line 7: Do your orbits for T/P, J-1 and J-2 satisfy the criteria of GDR-E which is the latest standard I believe? Where are the differences? Where are the common points? This should be discussed in your paper.

Page 4, line 1 under table 1: "non-linear station motions" please name it for what it is, it is called a (post) seismic deformation model in ITRF2014, is it the same as what you mention under the third point under table 1?

Page 5, line 2 under table 2: repair this sentence, for instance, the RMS of SLR to T/P did not change significantly when we switched from ITRF2008 to ITRF2014.

Page 5, line 15-16: did you focus on exactly the same ILRS stations and IDS beacons during the comparison? If this is not the case then I wonder about the realism of this comparison.

Page 5, line 17-18: It is not entirely clear what you mean with internal consistency of satellite orbits, this should be better explained. During orbit overlaps the trajectory is computed with the same gravity field, the same forcings apply on the satellite, the same station coordinates are used etc, so all possible common effect will cancel.

In table 3 I recommend to use ITRF 2008 and ITRF2014 consistently where you speak about VER11 and VER13. Below the table you describe exactly, in words, what the readers already see in the table. I do not understand why this information needs to be repeated.

Line 14 page 6, what makes a crossover point valid?

Lines 3-5 page 7: Did you ever investigate the choice of the time variable gravity model behavior on this? The same question could be asked about figure 2.

Figure 3 on page 9: this is too much of an excel like image in my opinion, the quality should be improved.

Table 4 and 5: either use ver11 and ver13, or use itrf2008 and itrf2014, but not the double referencing to ver11/itrf2008 and ver13/itrf2014 like you do now.

Line 2-3 below table 5: repetition of information, see earlier remarks.

Line 3 below table 5: TOPEX is the NASA Altimeter and TOPEX/Poseidon is the mission. I recommend that you use abbreviations like (T/P, J1 and J2). Please change all TOPEX references in the manuscript when you are referring to the mission. Only use TOPEX when you refer to the NASA altimeter on T/P.

Line 10 page 10: The concept of GCEs refers back to Rosborough 1987 who should be referenced. He was the first to start with geographically correlated orbit errors.

Page 11, line 14, use the \times symbol in LaTeX when you write 1x1

Line 9 and 10 on Page 13: TOPEX I and TOPEX II should in my opinion be referred to as TOPEX altimeter side A and side B.

Section 7, conclusions. I do not get the feeling that sea level rise estimates significantly change when ITRF2014 is introduced. The GMSL value is still 3.1+/-0.4 mm/yr (see the university of Colorado website) regardless whether we use the ITRF2008 or the ITRF2014 orbits. What you did improve are the DORIS and SLR residuals, but the improvements are small. Figure 8 shows that there are hemispherical like offsets developing over time, you may what to treat this as a geocenter type of discussion. This will affect the regional sea level estimates, which have larger ranges and error bars.

“Geographically” is hyphenated over a page break (16 and 17).

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