

## ***Interactive comment on “Uncertainty in Satellite estimate of Global Mean Sea Level changes, trend and acceleration” by Michaël Ablain et al.***

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RC2: In this paper the uncertainty in the satellite estimate of Global Mean Sea Level changes, particularly referring to the trend and the acceleration has been evaluated. I have read it with attention, finding that its quality is quite good, in my opinion. The English form is generally good but at some sections it needs to be further improved. Moreover, the research group appears to be qualified in the field of satellite oceanography. Nonetheless this, a moderate revision is still necessary for a further improvement of the paper's quality (see specific comments).

Answer to RC2: We thank reviewer 2 for this positive review. In the revised manuscript and the detailed response below we now address the miswording. We thank reviewer

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2 for the detailed reading of our manuscript and for the rewording suggestions.

RC2: The topic of Global Mean Sea Level and its relationships with climate changes has been deeply studied in marine geophysics and satellite oceanography (Ablain et al., 2015; 2017; Abraham et al., 2013; Allan et al., 2014; Aucan et al., 2017; Baki Iz et al., 2018; Beckley et al., 2010; 2017; Boening et al., 2012; Cazenave et al., 2014; Chambers et al., 2010; Chen et al., 2017a; 2017b; Church and White, 2006; 2011; Church et al., 2013; Clark and Primus, 1987; Conrad and Hager, 1997; Curry, 2018; Dahlen, 1976; Dangendorf et al., 2017; Davis and Mitrovica, 1996; Desai et al., 2015; Desbruyeres et al., 2016; Dieng et al., 2017; Esselborn et al., 2018; Farrell and Clark, 1976; Fasullo et al., 2013; 2016; Frederikse et al., 2017a; 2017b; 2018; Gardner et al., 2013; Gornitz et al., 2019; Gregory et al., 2013; Haigh et al., 2014; Hamlington and Thompson, 2015; Hamlington et al., 2013; 2016; 2017; Handoko and Hariyadi, 2018; Hay et al., 2015; Herring et al., 2019; Kay et al., 2014; Kendall et al., 2005; Kidwell et al., 2017; Lickley et al., 2018; Melachroinos et al., 2013; Merrifield et al., 2009; Milne and Mitrovica, 1996; Mitchum, 2000; Mitrovica and Milne, 2003; Mitrovica et al., 2001; Nerem and Fasullo, 2018; Nerem et al., 1999; 2010; 2018; Prandi et al., 2009; Ray et al., 2013; Shepherd et al., 2018; Slangen et al., 2016; 2017; Swart et al., 2015; Spada, 2017; Spada and Galassi, 2016; Tamisiea, 2011; Thompson et al., 2016; Trenberth et al., 2016; Vaughan et al., 2013; Wahr et al., 2015; Wang et al., 2017; Watkins et al., 2015; Watson et al., 2015; Wiese et al., 2016; Wouters et al., 2013). Due to the exceptional abundance of recent scientific literature addressing this research topic, I suggest perhaps to the authors to expand the discussion of their results, taking into account some of the scientific papers listed in the attached references, which have not considered in detail. This could be a general issue to be addressed in the revision of the manuscript.

Answer to RC2: We thank reviewer 2 for suggesting all these publications. This abundant literature address many different scientific questions such as 1) general climate variability (Herring et al., 2019; Kay et al., 2014; Swart et al., 2015) 2) coastal sea

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level (Kidwell et al., 2017, Prandi et al., 2009;) 3) the closure of the sea level budget (Boening et al., 2012; Cazenave et al., 2014, Chen et al., 2017a, Dieng et al., 2017, Fasullo et al., 2013, Watson et al., 2015) 4) the 20th century sea level changes (Aucan et al., 2017, Church and White, 2006; 2011, Dangendorf et al., 2017 Frederikse et al., 2017a, 2018 Gregory et al., 2013, Hamlington and Thompson, 2015, Hay et al., 2015, Ray et al., 2013, Slangen et al. 2017, Thompson et al., 2016) 5) the contributions to sea level change (Abraham et al., 2013, Chambers et al., 2010, Cheng et al. 2017b, Gardner et al., 2013, Desbruyeres et al., 2016;, Shepherd et al., 2018, Wiese et al., 2016; Conrad and Hager, 1997; Hamlington et al., 2013; 2016; 2017; Nerem et al., 1999, Wang et al., 2017; Watkins et al., 2015, , Wouters et al., 2013) 6) GIA (Milne and Mitrovica, 1996, Kendall et al., 2005, Farrell and Clark, 1976; Mitrovica and Milne, 2003; Mitrovica et al., 2001, Tamisiea, 2011) 7) the acceleration in sea level during the altimetry period (Fasullo et al. 2016; Haigh et al., 2014, Nerem and Fasullo, 2018; Nerem et al. 2018) 8) the topex correction (Beckley et al.; 2017) 9) the altimetry corrections (; Esselborn et al., 2018; , Dahlen, 1976; , Desai et al., 2015, Frederikse et al., 2017a; 2017b, Lickley et al., 2018; Melachroinos et al., 2013; Spada, 2017; Spada and Galassi, 2016; Tamisiea, 2011; Wahr et al., 2015;) 10) the detection and attribution of sea level changes (Slangen et al., 2016; ) 11) the earth energy imbalance (Trenberth et al., 2016; Allan et al., 2014;) 12) sea level from tide gauge records (Davis and Mitrovica, 1996; , Baki Iz et al., 2018, Merrifield et al., 2009, Mitchum, 2000;) 13) sea level projections (Clark and Primus, 1987;) 14) the buiding of a satellite altimetry record (Ablain et al., 2015; 2017; Handoko and Hariyadi, 2018; Nerem et al., 1999; 2010; Beckley et al., 2010) 15) and general overviews on sea level science (Church et al., 2013; Curry, 2018; Gornitz et al., 2019; Vaughan et al., 2013;) We want to highlight here that this paper focuses on the uncertainties in sea level estimates from satellite altimetry. As such only a few of these publications are actually relevant for our purpose . Those are the one related to the scientific questions number 7 and 8. We now consider these publications and include them in our manuscript (except for HAigh et al. 2014 and Nerem and Fasullo 2018 which adress the question of the acceleration in

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the sea level response to GHG emissions while we address in our paper the question of sea level changes in reponse to any forcing and to internal variability. As such these two publications are not relevant to our paper). We thank reviewer 2 for pointing these missing references.

RC2: Moreover, the relationships among the sea level changes and the subsidence of the basin, both to a regional and to a local scale have not been analyzed. I suggest perhaps to add in the discussion a short paragraph (half one page) clarifying which are the relationships existing between the oceanographic aspects and the geological processes controlling the sea level fluctuations. This discussion will represent a main added value further improving the quality of the paper. In particular, I think that the relationships between the water column and the height of the sea bottom, as controlled by subsidence, both isostatic and tectonic, need to be clarified.

Answer to RC2: This is done now on line 365 (see revised revision)

RC2: I suggest to the authors to carefully avoid the English grammar repetition and to avoid to be redundant, as it happens in some sections of this manuscript.

Answer to RC2: We have the English grammar mistakes in the revised revision. Please see the specific comments below

Specific comments

RC2: I suggest to eliminate the quotations of references in the abstract of the paper. Usually, the abstract does not include any quotation. Answer to RC2: corrected

RC2: I suggest to put the quotation of references in the paper in a chronological order, not alphabetical one, if not strictly required from the journal. Answer to RC2: This is not possible as the journal requires an alphabetical order

RC2: The discussed needs to be expanded taking into account recent literature and geological aspects, as mentioned in the general comments. The conclusions need to be consequently expanded. Answer to RC2: Please see our answer to the general

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comments above

RC2: The captions to figures need to be carefully revised and corrected. Answer to RC2: Done as suggested by reviewer 2 in his specific comments. Please see our answer to the specific comments

Please also note the supplement to this comment:

<https://www.earth-syst-sci-data-discuss.net/essd-2019-10/essd-2019-10-AC2-supplement.pdf>

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Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2019-10>, 2019.