

Comments on 'Extension of high temporal resolution sea level time series at Socoa (Saint Jean-de-Luz, France) back to 1875'

Abstract

This paper presents the extension of sea level data at Socoa (France) back to 1875. New sea level data come from historic ledgers (i.e. record books with handwritten hourly sea levels) and charts (i.e. paper maregrams from old mechanical tide gauges). Both these supports were recovered from national and local archives, through extensive research. Important efforts were undertaken to reconstruct a continuous and consistent time series. Documents were scanned and digitalized, either manually or semi-automatically. Time data were converted to UTC time system. Successive vertical datum were investigated, to check that there was no jump between historic datasets vertical reference. An intensive quality control allowed to correct the data when needed (e.g. height or time correction). In addition, the sea level data were flagged when doubtful, e.g. during periods of slowing down of the clock, during periods of siltation of the stilling well (1956-1963 and late 1990's) or when the floating device seemed to possible malfunction. The final hourly sea level dataset consists of ??? [not mentioned in the paper ?] years of data (instead of 54 years (not mentioned in the paper?) at present), spanning from 1875 to 2021. This new historic dataset will be useful for sea level climate studies, investigating variability, trends and long-term changes in mean sea level, tide and/or extreme surges.

General comments

This work is an important effort of data archaeology, which is essential for climate studies, and we strongly recommend to publish it. The data were not only recovered, but also corrected and flagged when wrong or doubtful (which is a very time-consuming task). The paper is well structured and generally quite easy to follow. However, some parts are not always very clear and the general writing could be improved (see below in detailed comments). Some arguments could also be added to demonstrate in a stronger way the importance of data archaeology, see for example Talke and Jay (2017). Another general comment: the results of this study being the sea level datasets, the raw and final datasets should be described more precisely in the Data availability section (or somewhere else in the paper), and in the given repository (see below in detailed comments). For example, the temporal resolution (5', 15' or 1h) of each dataset (raw data, digitized data, final dataset) is not always very clear (see details in specific comments). Finally, the perspectives could be further developed, detailing for example how many stations could be recovered along the French coasts and/or how many station-years are available in archives. This could potentially motivate future investigations.

Reply:

Thank you for your thorough review of our paper on the extension of sea level data at Socoa (France) back to 1875. We appreciate your positive feedback and the recommendation to publish our work after revision. We have carefully considered your comments and suggestions, and we would like to address them as follows:

- Writing and organization: Several changes has been suggested in the "Specific comments" regarding the organization of certain segments of the manuscript. We agree that these changes will improve the readability. We will carefully review the entire manuscript and make necessary revisions to improve the writing clarity and overall structure. We acknowledge that the introduction and the conclusions can benefit for further development, the subsection of the time conversion can be reduced, and trend

analysis can be further developed. We will also incorporate the references that you suggested regarding the importance of data archaeology (e.g., Talke and Jay 2017).

- Description of data availability: We agree that the “Description of the data availability” does not clearly indicate the various timeseries that we produced. We will improve the description of data availability by clarifying the associated files for raw and final dataset, incorporating a detailed header on the final dataset, and expanding the readme in the data repository to explain the content of the files.
- Specific comments: We propose to revise the current manuscript based on the other suggestions provided in “Specific comments”. A point-by-point reply to the Specific comments are given below.

Specific comments.

- line 9 “ledgers and charts” we suggest to precise somewhere what we are talking about, describing ledgers (record books with handwritten hourly sea levels) and charts (paper marigrams from old mechanical tide gauge)

Reply: We propose to revise line 9 as –

“We have catalogued water level records stored in ledgers (handwritten record books) and charts (marigrams from mechanical float gauge), as well as other associated documents (metadata), in a thorough research of national and local archives.”

and the terms are further elaborated in Section 2.1 :

“...In common with all to float tide gauges, the displacements of the float due to high-frequency changes in water level is reduced through mechanical design and the resulting sea level variation is recorded on a paper chart controlled by a clock (IOC 1985).

...

Two types of historical water level records have been found for the Chazallon tide gauge period – 1) a subset of charts, 2) transcriptions into ledgers. The ledgers are 32x49cm paper documents containing transcriptions of water levels obtained by inspection of the charts by an operator.”

- line 12 “at hourly (for ledgers) to 5-minutes (for charts) sampling” it is not clear what is the temporal resolution of the raw dataset/final dataset, once corrected and flagged. This could be clarified in the paper, for example Table 1 (with 2 columns, sampling of raw data/sampling of the final data), or in the Data availability section, as the choice is made further to digitize only hourly values.

Reply: Thanks for pointing this out. As we have finally retained only hourly sampling in the distributed long-term dataset, it is more meaningful to mention hourly timeseries in line 12. This change will be reflected in the revised manuscript as –

“Based on this large set of rescued documents, the Socoa time series has been further extended back in time by about 40 years, at hourly sampling.”

- line 13 "Analysis of the precise levelling information reveals that the datum of the tide gauge site has been stable", it should be mentioned that we are talking about vertical datum continuity, to avoid any confusion with the vertical stability of the ground.

Reply: We propose to revise the line as following to avoid any confusion.

"Analysis of the precise levelling information allowed an assessment of the continuity of the vertical datum".

- line 15 the data flag could be mentioned in the abstract: despite "siltation is found to be a recurrent problem of the stilling well", such periods were successfully identified, and corresponding data were flagged as doubtful

Reply: Following your suggestion, we propose to rewrite the statement in line 15 as following –

"Although the overall timeseries is generally of good quality, siltation of the stilling well has been found to be a recurrent problem and has impacted some part of the record. Such impacted periods were successfully identified and flagged as doubtful in the distributed dataset".

- line 29 "data archaeology" (without capital letter), possible additional reference to:

UNESCO/IOC 2020. Workshop on Sea Level Data Archaeology, Paris, France, 10-12 March 2020. Paris, UNESCO, IOC Workshop Reports, 287, 39 pp. English. (IOC/2020/WR/287)
<https://unesdoc.unesco.org/ark:/48223/pf0000373327>

Reply: "Data archaeology" will be changed to "data archaeology" in the submitted revised manuscript, and the suggested reference will be added.

- line 46: "GMSL rise also raises questions regarding associated long-term changes in tide" the beginning of the sentence (GMSL rise) suggests that GMSL rise is the main driver for changes in tide, but it is not the only one, and the following examples (Pouvreau et al., 2006; Colosi and Munk, 2008) do not really conclude that MSL rise is the driver of observed changes in tide: Pouvreau et al. (2006) did not find any significant trend in M2, but rather an oscillation of amplitude 1.1 cm and period 141 years, which remains unexplained; Colosi and Munk (2006) attributed changes at Honolulu to a 28° rotation of the internal tide vector in response to ocean warming. Other papers discuss more directly the impact of MSL rise on tide (e.g. Pickering et al., 2012, Idier et al., 2017; Schindelegger et al., 2018). We rather suggest a general introduction to this paragraph (as for ESLs, see next paragraph), e.g. "Long-term sea level datasets are needed to investigate changes in tide...".

Reply: Thank you for your suggestions regarding this paragraph. We agree that for the message we are trying to convey, e.g., evaluation of the impact of long-term sea level rise and associated changes in tide, this paragraph is not well-suited. We will revise this paragraph accordingly by considering your suggested references (this comment, and the following two), and the paragraph line. Additionally, we will also revise the discussion to better communicate the necessity of long records for studying the changes in tide.

- line 49: "Pouvreau et al. (2008)" should be Pouvreau et al. (2006) or Pouvreau (2008)?

Reply: That's correct, it will be corrected to Pouvreau et al. (2006).

- more generally for this paragraph on tide changes, some research works show that changes are not linear but rather with break points, which is a strong argument to go back to the XIXth century when possible. This could be discussed further in the introduction. See for example the values of M2 at Eastport, Portland, New-York in the 1860s, which are not consistent with the large increase observed in the XXth century (Talke et al., 2014; Ray and Talke, 2019; and Fig 2b in Pineau-Guillou et al., 2021).

Reply: See our comment above.

- more generally, for the paragraph on extreme sea levels, it is well known that extremes vary at first order with MSL. Letetrel et al. (2010) is mentioned here for Marseille, but many others demonstrated it at larger scale, e.g. Menendez and Woodworth (2010), Wahl and Chambers (2015), Marcos and Woodworth (2017). The same way, IPCC (2021) reported that sea level rise is the first driver of changes in extremes sea levels. More interesting, once this contribution is removed, storm surges display large strong interannual and multidecadal variability, and it is challenging to separate the long-term trend from the natural variability (i.e. climate variability in link for example with the North Atlantic Oscillation). In other words, trends detected on a short period could be the signature of the multidecadal variability rather than a long-term trend. These are strong arguments to go back to the XIXth century in sea level data, and could also be discussed further in the introduction. Another argument is that for extreme value analysis, longer times series means uncertainties reduction, which means a better risk assessment.

Reply: Thank you for the suggestions on our paragraph on the ESL, and discussions on the necessity for long-term sea level records for better understanding of the ESL drivers. We will incorporate your suggested discussion into the introduction in the revised manuscript. We will also revise and broaden the references in this paragraph.

- line 58 "They illustrate how long-term sea level can help to separate the relative contribution of climate, and local changes." I would rather say that they separated the contribution of the natural variability (climate variability linked with the North Atlantic Oscillation) with a long-term trend (which remains unexplained).

Reply: We propose to revise this line as follows –

"The authors demonstrated that using long-term sea level datasets we can separate the contribution of natural climate variability (linked to the North Atlantic Oscillation in that case) with long-term trend which remains unexplained."

- lines 73-74: the temporal resolution (hourly ?) of present Socoa record could be added

Reply: The temporal resolution of the dataset is mostly hourly, with high-resolution (1 min) data available for the recent period (from 2011). We will revise line 74 to incorporate this information.

- line 91: move "rescued" before "in this study", and this unclear sentence should be rephrased

Reply: We will rephrase this line into :

"The following subsections provide descriptions of each instrumentation period, along with detailed information about the data and metadata of sea level observations rescued in this study."

- lines 102-104 this paragraph could be moved at the end of previous paragraph (line 99), which also describes the tide gauge. Next paragraph rather refers to water level records.

Reply: We will update this paragraph to follow the paragraph in line 98 as suggested in the revised manuscript.

- line 106: what is the difference between Chazallon/Brillie tide gauge, is it the same mechanism?

Reply: Yes, they have similar mechanisms, but different implementations (Figure 2c,d).

- line 107: "large type model", are there other models?

Reply: There are two models, large type, and small type – as described in Roubertou (1955). The main difference is in the size of the paper, 50cm and 20cm height for large and small type gauges respectively. Consequently, by design large type model allows a larger reduction ratio (water level range to paper height) compared to the small type.

- line 120-126: this refers to a tide gauge from 1942-1944, whereas the paragraph is "1950 to 2004" which is confusing. This could be moved to another subsection. It could also be rewritten more clearly, and it could be mentioned explicitly that these data are finally considered (though the tide gauge location is different).

Reply: Since no other documentation was found regarding this tide gauge, we merged this as an additional information to 1950-2004 period. We agree that this action made the text a bit confusing. To rectify it, following your suggestion, we propose to insert a new short sub-section at 2.2 describing this data segment only.

- line 125: "the other side of the Socoa bay", location on Fig. 1?

Reply: This information is based on the account of local historians, and no accurate location is known. We will try to incorporate the approximate location in Fig. 1.

- lines 127-151: what is the temporal resolution of modern instrumentation?

Reply: The modern instrumentation currently has a sampling period of 1min, with multiple data flows (not currently mentioned in the manuscript). We will revise the section to incorporate the information regarding the current temporal resolution.

- Table 1: we suggest a separate column for the "Sampling" and "Time System"

- Table 1: "Sampling" column, are we talking about the sampling of raw data? Digitized data? Final dataset? This is not clear in the text.

- Table 1: What means "Highres and hourly" mentioned in column 1 since 2011, whereas the corresponding "Sampling" is 1 hour?

Reply: The objective of the Table 1 is to list the various instrumentation periods, data medium, and temporal sampling of the raw observation. We will update Table 1 in the revised manuscript with the following modifications :

1. "Sampling" and "Time System".
2. Updating the table caption to "Overview of the instrumentation periods, original data storage medium, sampling period and time system of the raw observations". We will also update the paragraph at line 150 to clarify the column names, and their relation to the data analysed in the paper.
3. Update the sampling of charts to 'continuous' to reflect that the temporal resolution of the recorded data.
4. Update the last row to reflect the availability of the high-res data (available since 2011).
5. Additional columns to indicate if the data is rescued, digitized, and the sampling during digitization.

- Fig. 2 (b): Chazallon, Brillie and modern instrumentation periods could be mentioned on the figure (suggestion)

Reply: Thank you for your suggestion. We will add this information into Fig. 2(b).

- lines 166-216: the structure of these two paragraphs is not clear. "3.1.1 Ledgers" rather introduces the Chazallon period (ledgers and charts description, even if charts are not used) and "3.1.2 Charts" introduces the Brillie charts. Please restructure moving the charts description from 3.1.1 to 3.1.2, or change the titles accordingly.

Reply: We will revise the manuscript by moving the chart descriptions of Chazallon period in 3.1.1 to 3.1.2. In the revised manuscript, subsection "3.1.1 Ledgers" will only describe the digitization of ledgers, and subsection "3.1.2 Charts" will describe the digitization of charts.

- line 176 "hourly intervals" for ledgers (to speed up the digitization process), whereas as 15 mn is the sampling in Table 1, again please clarify the temporal resolution of each dataset (see previous comment)

Reply: We recognize the confusion here. We propose to update the table (Table 1) as described above to incorporate more segmented information on the temporal resolution on the source and the temporal resolution after digitization.

- line 184: the whole recovered archive "is scanned" could be "was of sufficient quality to be scanned", which was not the case for Chazallon-era charts.

Reply: Line 184 will be revised accordingly.

- line 187: "for applying corrections, where appropriate" it is not clear here which corrections are we talking about

Reply: We recognize that the statement is not clear here. Essentially, the metadata were used to properly reference the time of the charts during the digitization process, and to correct deviation related to clocks. L187 will be simplified into the following –

Most charts were accompanied by check sheets. These documents contain relevant information on time and water level at the time of changing a chart. Available check sheets were converted into digital form by a photo camera and later used as metadata for identifying problems, especially related to the slowing down of the clock (See Section 4.2).

- line 194: "several categories" could be detailed as an introduction of the paragraph, for example "3 categories depending on their conditions (good, mildly or strongly damaged from mould, faded)"

Reply: We will update the line with:

"During the scanning phase of the charts, the charts were visually sorted into 3 categories depending on their conditions (good, mildly or strongly damaged from mould, faded).

- line 210: "the overall process was time-consuming", yes, and this could even be a separate paragraph to underline this aspect (suggestion)

Reply: We will consider your suggestion to update this section in the revised manuscript

- lines 227-246: this paragraph on time conversion is quite long and not very concise, it could be rewritten in a simpler way. The equation of time $E(t)$ gives the time difference between Apparent and Mean Solar Time, it can be expressed as a function of (M,t) , with $M=6.240060 + 6.283019552t$. We consider the formulation of the Bureau des Longitudes (2011) for $E(t)$, despite it is applied for 1900-2100.

- line 246 "minor errors", which order of magnitude?

- line 254: no capital letter at "typically"

- for this section on time conversion, it should be clearly mentioned at the beginning of the section that the objective is to convert the time in UTC (if correct)

Reply: Thank you for your suggestions. The other reviewer also expressed a similar opinion about this section being too long. We will substantially simplify this section in the revised manuscript.

The choice of Equation of time proposed by Bureau des Longitudes (2011) to convert time before 1900 only causes an error in the order of a second, hence negligible. We will precise this in the revised manuscript.

In the revised version, we will also clearly mention the objective of the section being the conversion of the time to UTC.

- line 267: 3.3 should rather be "Vertical datum continuity" ?

Reply: We will revise the title to "Vertical datum continuity".

- line 274: "it was possible to reconstruct the relationship of the tide gauge and tide pole zeros to the current benchmarks" not clear what is the tide gauge zero here, are we talking about the Chart Datum?

Reply: By tide gauge zero, we meant the ZH (zéro hydrographique) – line 268, which is the chart datum. The tide gauge was also equipped with a tide-pole for visual monitoring and comparison. The zero level of the tide-pole (ZP) was not at ZH and not the same throughout the recording

period. We will revise line 274 to better reflect when we are talking about the ZH (chart datum) and about the ZP.

- lines 288-290 the origin of the difference of 18 cm for Chart Datum is not clear, does that come from heavy siltation?

Reply: Yes. In the 1961 survey (Brie 1961), the tide gauge was heavily silted, which caused the difference. This discrepancy is then rectified 2 years later, during another survey in 1963.

- line 291-292: "It appears that this tide pole is a different from the tide pole during (1873-1920), and the hydrographic zero at 24cm below the zero of the tide pole." The sentence is not clear, and should be rephrased. Possibly, the presence of the two tide poles could be introduced earlier, rather than at the end of the paragraph?

Reply: We propose to revise the section with the following changes –

1. "...Additionally, the practice in France is to include a tide pole and set its zero to the ZH or chart datum (Woppelmann et al. 2006b), but this procedure was not adopted for the Socoa tide poles. We have found two records of tide poles over the full observation period. For each tide poles, its zero-measurement mark of the poles (ZP) is referenced at different height from the ZH."
2. Revised line 291-292: "The ZP was measured at -1.93m NGF Lallemand, and the ZH at 24cm below the ZP".

- lines 293-300: this paragraph is not very concise, and could be rephrased

- line 301: this is the main result of the section, it could be mentioned at the beginning of the paragraph, for more clarity

Reply: We propose to keep all the content of the said paragraph as it was one of the main contradictory information from the historical document. We propose to rephrase as following -

"All available documents suggest there was no change in the definition of ZH at Socoa. One false alarm was a letter dated 9 October 1968 addressed to Shom, where it was mentioned that the "zero of the tide pole" (zero de l'échelle) is located at -2.178m relative to NGF Lallemand datum, and the primary benchmark located at 5.822m NGF Lallemand datum. This was identified as a mistake based on a survey conducted in 2007, which measured the height of Oak3L3-4-II to be 5.805m IGN69 (Tiphaneau et al. 2007). NGF-IGN69 is the current levelling datum established by IGN over 1962-1969. The reported difference between the datum of NGF-Lallemand and NGF-IGN69 is 0m (Grid 1245, https://geodesie.ign.fr/content/fichiers/grillesorthonormales/GrilleOrthoNormale_Ouest.pdf, last accessed 19-07-2020). Currently, the hydrographic zero (ZH) is reported to be 7.975m below the Oak3L3-4-II benchmark, and 2.171m below NGF-IGN69 datum (Poirier et al. 2017)."

- lines 308-319: this paragraph on flags could be a dedicated subsection "Data quality flag".

Reply: In the revised manuscript, we will restructure this paragraph in a dedicated "Data quality flag".

- line 304 "Following these two steps..." the sentence is unclear, it should to be rephrased

Reply: We proposed to revise line 304-305 as following –

“In the preceding section, we have adjusted the records in order to have a consistent time system and a common vertical datum (ZH) all along the timeseries. These two steps resulted in the generation of a merged timeseries, which was subsequently assessed to detect any potentially erroneous or suspicious values in terms of height and/or time (IOC, 2020).”

- line 316: “The idea is like...” it should be reformulated

Reply: We propose to reformulate the line as follows –

“The concept is similar to the flag accompanying the PSMSL data (<https://www.psmsl.org/data/obtaining/psmsl.hel>).

- line 328: “tide gauge journal”, ledger?

Reply: During Chazallon tide gauge period, a journal was kept at the tide gauge (Section 2.4 Supplemental metadata), which is referenced here. In the revised manuscript we will incorporate a cross-reference to Section 2.4 to avoid confusion.

- lines 339-342: this paragraph should be moved to the end of the section, as it introduces the following section

Reply: This reorganization will be incorporated into the revised manuscript.

- line 344: “hourly values” again, please mention more clearly the time resolution of the datasets (e.g. Table 1 refers to 15 mn, see previous comments)

Reply: The revised manuscript will reflect the changes (explained in previous comments and replies) on Table 1 and associated text to better separate the characteristics of the recorded data, and the data that has been used.

- line 349: “The applicable corrections are applied as described above.” Why mention this here, whereas previous section (4.1) already focused on corrections?

Reply: We will revise this subsection by – 1) reorganizing the paragraphs at the end of Section 4, 2) drop first two lines from Section 4.2.1.

- line 351: it is difficult “to” apply

Reply: This typo will be corrected in the revised manuscript.

- line 352: “These values are flagged as values with low confidence (third bit in the flag set to 1)”, which order of magnitude of the slowing down of the clock? Is it possible to mention how many of the data are concerned? (for example in %).

Reply: This is only a small percentage of the data (around 3%). The magnitude varies from 1-2 minutes to as high as 10-12 minutes. We will add this relevant information into the text.

- lines 354-357: The title “Delayed rising/falling curve” should rather be “Possible malfunctioning of the float device” (to be consistent with other titles, referring to the potential problems rather than their impact on data). Does this malfunctioning of the floating device leading to delayed rising/falling curve has been already reported and referred? If yes, the references could be added.

Reply: We will update the “Delayed rising/falling curve” with “Occasional malfunction of the floating device”. In our knowledge, this problem has not yet been reported.

- lines 358-392: “4.2.3 Siltation” This paragraph on siltation could be more concise, giving clearly the periods with problems of siltation, and mentioning which data were flagged accordingly.

- line 361: “The first major siltation problem with the data recording was noticed within the first few years of operation” which years? This problem of siltation does not seem to appear on Fig. 5?

- line 365: “After starting the reoperation of the tide gauge in 1950, the stilling well exhibited siltation and blockage related problems (Robertou 1963).” Same question, on which period exactly? Are we talking about 1956-1963?

- lines 380-382: siltation problems are mentioned during 1956-1963 and 1996-2000. It is not clear how these problems were solved, was there any intervention on the tide gauge? This could lead for example to recommendations to avoid this type of problems.

Reply: Following your suggestions in the above mentioned comments, we propose to rewrite this section in the revised manuscript by explicitly mentioning the times, and when the flags are applied.

- line 383: “4.3 Buddy checking” this section is mainly “Buddy checking for vertical datum continuity” and could be part of Section 3.3 Vertical datum continuity (or at least, the title could be more precise)

- line 385: “The difference with nearby...” precise monthly mean sea levels differences

Reply: This precision will be incorporated into the revised manuscript.

- Fig 6: the legend is unclear and should be rewritten. Difference between monthly MSL at Socoa and Brest (black) and Santander (red). The fact that MSL over the period 1965-2000 has been removed should also be mentioned.

Reply: We will update the legend with clear labels. Similar to other authors (e.g., Marcos et al. 2021, Ozturk et al. 2018) – we propose to replace “Brest-Socoa” with “Brest” and “Santander-Socoa” with “Santander”. We will also incorporate the information that the mean has been removed in the caption clearly. In the text, it is stated in line 395-396.

- line 408: “However, in the Santander minus Socoa timeseries (red), we see a jump during (1976-1980), indicating a potential shift of 5 cm during that time at Santander.” It is not useful to repeat again “in the Santander minus Socoa timeseries (red)” (already in previous sentence)

Reply: We will revise this sentence by rephrasing the sentence as follows –

“In the Santander timeseries (red), a small persistent jump is seen during 1976-1980 compared to Brest (black). This indicates a potential shift of 5 cm during that time at Santander.”

- line 408: why focus on this “jump”, whereas there are others similar, as for example in the 1990’s?

Reply: We focused on this jump due to its persistence over multiple years. As we stated in the previous line, difference with Santander typically follows the difference with Brest, which includes the sharp differences in 1990, for example. During 1976-1980 period, one can spot a consistent shift in the mean differences.

- line 409-411 “Recently, Marcos et al. (2021)...for Socoa.” this comment should rather be at the beginning of the paragraph, when introducing the data (line 395 for example).

Reply: In the revised manuscript this line will be reorganized as suggested.

- lines 412-425 the section “5. Trend analysis” is very short (around 10 lines), it is difficult to consider it as a full section, and it does not seem to be completely finished. Supplementary “5 Inflexion point analysis” could be added in this section (rather than in the Supplementary). Why is this analysis conducted only over the 1875-1920 period rather than on the full period? What are the possible causes of these inflexion points?

Reply: Thank you for suggestion on expanding this section. We will update this section accordingly in the revised manuscript.

As we were referring to the work by Woppelmann et al. (2006a), and Woodworth (1999) where reported an inflexion point around 1880s, we focused on analysing the 1875-1920 period.

Multiple drivers may contribute to this inflexion point – decadal variability, long-term climate variability, sea level acceleration. As we already discuss in the manuscript, the decadal sea level variability during early 20th century is found to be linked with the atmospheric modes of the North Atlantic (Calafat et al. 2012). This is potentially the main driver for this inflexion point. Jevrejeva et al. (2008) shows that there is a prominent 60-year climatic variation in the trend (acceleration-deceleration). During the analysis period (1875-1929), the global pattern is a deceleration until around 1910. However, the North-east Atlantic shows a strong deviation from the global pattern with an earlier reversal to acceleration around 1900 (Jevrejeva et al. 2008, Figure 3). Lastly, the global trend in sea level rise may have further contribution on the timing of the inflexion point. While the exact timing of the start of global acceleration of trend due to sea level rise is not accurately answered yet, studies points towards sometime in the early 19th century (Church et al. 2006, Jevrejeva et al. 2008), putting our analysis period in the middle of the onset of global sea level acceleration and the present.

- line 412: “The trends estimates” Trends of which data? Hourly final datasets?

Reply: Yes, we used the final hourly dataset for Socoa, and reprocessed it using PSMSL rules into a yearly mean timeseries before computing the trend. We acknowledge that this is not explained in the manuscript. We propose to revise this section with this relevant processing information, reorganizing the inflexion point analysis to the main text.

- Table 2 Period “Available”, which is the period available for each harbour?

Reply: We will revise the table to incorporate this information as a footnote.

- line 414: "The benefit of a long time series is clear here – longer the time series, tighter the error bar.", yes, another benefit is that changes are not always linear, and inflexion points can be investigated, as shown in the analysis below.

Reply: Yes, we agree. We will incorporate it into the text in the revised manuscript.

- line 426 Data availability This section is of great importance as the final sea level dataset is the main result of the study. Details should be given to be more precise. Note that there are many files in the repository, the readme is quite short, and there is no detailed header in the final file.

This section could at least: give the name of the file corresponding to the final sea level dataset, as well as its vertical reference, time system, level units, start date, end date, number of years with data.

In addition, concerning the file itself, it would be very useful for users to have this essential information in the header (which is not the case in the repository), and add the 4-bit quality flag in a third column (Time/Sea Level/Flag)

Reply: We agree with your comments. We will revise the files to better incorporate the headers.

We decided to disseminate most of the necessary data to replicate this study (except the scanned documents). We acknowledge that this makes the repository quite heavy in terms of the number of files. We will highlight the final timeseries file in the Data availability section and we will revise the readme file in the repository to better explain the content of each file/directory.

- lines 431-450 the conclusion section is also very short. It could be improved, with a better description of what has been done, and a development of possible perspectives. A synthesis of the corrections/flags would be appreciated. What are the main corrections? Which percentage of data is finally corrected? What are the periods flagged for siltation?

Reply: Thank you for your detailed suggestions. We will take all of the suggestions into account to revise the conclusion section.

- line 434: "international sea level databanks", such as?

Reply: We will revise this statement to incorporate the databanks – particularly PSMSL.

- line 437: "siltation" periods of siltation that are flagged?

- line 438: "associated corrections", synthesis of these corrections?

Reply: We will update the conclusion in the revised manuscript to incorporate the siltation periods and a synthesis of the applied corrections.

- line 438: "final sea level dataset" very brief description of the file (see previous comments)

- line 438 "raw data" very brief description of the file, as the differences between raw data and final data are not always very clear in the paper (see previous comments)

Reply: We will expand the “Data availability” section in the revised manuscript to incorporate brief descriptions of these files.

- lines 448-450: “there are many more stations in France where the existing sea level record could be extended” this paragraph could be developed, which stations have already been identified? How old are these data? How many additional years could be extracted?

The perspectives could be further developed, at national and/or international scales. For example, Talke and Jay (2017) reported that “more than 6,500 station-years of previously lost or forgotten tide data have been identified” (<http://archives.pdx.edu/ds/psu/21294>)

Reply: While the actual available/rescuable data at a station is hard to quantify before doing the data inventory. For France an estimate could be found on the Shom inventory, available at <http://refmar.shom.fr/dataRescue/>. More than 60,000 documents have been identified and accurately inventoried in France (Latapy et al., 2022) and about 70% have already been scanned. However not all of them had been digitized and thousands of documents still remain to carefully inventory and scan.

Thank you for your suggestion on further developing this paragraph, and we revise this paragraph to incorporate the above-mentioned information.

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