

**This document contains a cover letter and the point-by-point responses to Reviewer 1 (RC1), followed by the point-by-point responses to Reviewer 2 (RC2).**

Dear Editors and Reviewers,

I am pleased to submit the revised manuscript entitled “A Century of Sea-Level Change in Ireland (1925–2024)” for further consideration in *Ocean Science*.

I would like to note that, while every effort has been made to identify changes in the marked-up versions of both the manuscript and Supplementary Material, the revision represents a substantial overall revision extending beyond changes directly prompted by the reviewer comments. In addition to restructuring the manuscript and transferring detailed material to the Supplementary Material, we have made revisions to the title, figures and captions, tables, terminology, reported sea-level rates, and other aspects of the manuscript. These examples are not exhaustive and reflect both the reviewer suggestions and additional improvements identified during the revision process.

A substantial methodological revision was also undertaken. With the assistance of co-author Meave Upton, who developed the *reslr* package, we extended the site prediction grids to 1925–2024 and calculated site-specific RSL rates directly from the posterior samples of the NI-GAM model rather than relying on derived rate summaries from the original *reslr* output. This approach allows the reported rates and their uncertainties to be derived consistently from the full posterior distributions and incorporates the regional signal, site-level linear trends informed by GIA estimates, and local nonlinear variability within the hierarchical reconstruction. The associated datasets and analysis code will be made publicly available upon acceptance. The underlying datasets will be deposited in Zenodo, and the analysis scripts will be made available through GitHub.

This revised modelling approach, together with updates and corrections to the underlying tide-gauge records, resulted in changes to the site-specific and network-mean/regional RSL rate estimates compared with the original preprint. During the revision process, two datum inconsistencies were also identified and corrected. The Cork record was aligned to the OPW datum, while the Tarbert record was revised using the Carrigaholt extension, which provided greater consistency and avoided the previously identified datum discontinuity. These corrections consequently affected the resulting RSL rate estimates. Additionally, data for 2016–2022 from Bangor and for 1973/1974 from Rossaveel were subsequently recovered from the BODC archive.

We have also revised the manuscript throughout to improve clarity, consistency, and readability. Technical terminology and definitions have been clarified where necessary, sections have been reorganised to improve the methodological workflow, and detailed site-specific material has been moved to the Supplementary Material where appropriate. We have provided a detailed point-by-point response to all reviewer comments, together with a marked-up version of the revised manuscript and Supplementary Material. For clarity, the

marked-up Supplementary Material is appended to the marked-up manuscript from page 86 onwards. The combined tracked-changes document is substantially longer than the clean manuscript and Supplementary Material because of the extensive tracked deletions, rewritten and reorganised passages, and material transferred between the manuscript and Supplementary Material. Consequently, some sections contain substantial strikethrough and replacement text, and the tracked version may appear visually dense and considerably longer than the clean version. Nevertheless, the revised manuscript and Supplementary Material remain clearly legible, and the changes are identifiable throughout.

Kind regards,

Patrick McLoughlin

PhD Candidate

Maynooth University

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## **RC 1. Response to Review by Dr Laurent Testut**

We would like to thank Dr Testut for his thorough and constructive review of our manuscript, as well as for his encouragement regarding the overall scope and importance of this work. We have carefully considered all comments and have revised the manuscript accordingly.

Below, we provide the original reviewer comments followed by our responses.

### **Reviewer comment (RC 1):**

The scope of this article is extremely ambitious and bears much more resemblance to a dissertation manuscript than to an article. The problem is that it is formatted as an article. The scope of the topics covered is very broad; it includes aspects of the digitization of data, the validation of historical and modern data, their referencing to a common datum, the adjustment of these data using a multiple linear regression model to reduce their variability and enable the calculation of long-term trends, the intercomparison of GIA models, and much more. Added to this is the fact that the number of stations analyzed is also significant (more than a dozen). This makes the article very difficult to read and hard to digest. It's truly a shame because the subject is of paramount importance, and it's clear that the work done is substantial. Publishing this article as is would be a real shame, as the underlying work deserves greater visibility and better presentation. I think the best solution is to split the article into two papers (a data paper + a trend analysis paper). The first paper would explain all aspects of the data archaeology work more clearly, describing in greater detail the quality

control steps, the underlying assumptions, and the data validation. The second paper would be dedicated to the analysis of the dataset. My comments below will focus primarily on the data archaeology portion, as the rest of the analysis will depend entirely on the robustness of this work and the confidence we have in the quality of the final dataset.

**Response:**

We thank the reviewer for this thorough and insightful assessment of the manuscript structure. We agree that the current version covers a broad range of methodological components, from data rescue and quality control through to statistical reconstruction and trend analysis, which may initially appear extensive for a single article.

However, we prefer not to split the work into two separate manuscripts at this stage. The strength of the study lies in the continuity between the recovery and validation of historical records and the subsequent RSL reconstruction, as these steps are closely interconnected. Separating these components could reduce the traceability between data development and the final scientific interpretation.

Instead, we have streamlined the main manuscript by transferring detailed descriptions of data digitisation, validation, and processing steps to the Supplementary Material, while retaining the key methodological information required to understand the analysis. We have also improved the manuscript structure by reducing redundancy, clarifying the workflow, and strengthening the links between the methodological developments and the resulting scientific conclusions.

During revision, we also updated the modelling framework, including the direct calculation of site-specific RSL rates from the NI-GAM posterior distributions. The revised analysis now reports posterior mean RSL rates with 95% credible intervals, consistently incorporating the regional signal, linear GIA-related contributions, and nonlinear local variability within the hierarchical reconstruction rather than applying a deterministic GIA removal approach.

In addition, two datum inconsistencies identified during revision were corrected: the Cork record was aligned to the OPW datum, and the Tarbert record was revised using the Carrigaholt extension. These updates improved the consistency of the composite records and resulted in revised RSL rate estimates compared with the original manuscript. We have also identified additional data for Bangor that extend the Belfast record to 2022.

Finally, we have revised terminology throughout the manuscript and expanded definitions where required to improve clarity and ensure that the methodological workflow is communicated more effectively.

## **MAJOR COMMENTS**

### **Major Comment 1 (Page 4: “Data Collection and Digitization”)**

#### **Reviewer comment (RC1):**

Readers can quickly become confused about the source of the data used; it is important to summarize the data in a table or even in Figure 1 to help readers gain a clear understanding of the data used in this study. For example a table summarizing the data collection, the origin of the data (PSMSL, MI, newly digitized, Murdy et al.) and the period would help the reader a lot.

#### **Response:**

We have added Table 1 to Section 2.1 (Data Sources) to provide a clear summary of the data provenance, source, temporal coverage, and supplementary datasets used for each of the six primary tide-gauge records, thereby improving transparency regarding the datasets used in this study. The main text now states: “Table 1 summarises the origin, temporal coverage, and supplementary datasets used for each of the six primary tide-gauge records in this study.” In addition, the detailed datum-adjustment procedures have been moved to the Supplementary Material to improve readability and reduce complexity in the main text.

### **Major Comment 2 (Page 12: “Validation of Tide Gauge data”)**

#### **Reviewer comment (RC1):**

This section is not detailed enough. You should describe exactly the validation protocol more accurately. Why only M2 is computed and not the others tidal constituents ? What do you mean by M2 or z0 of poor quality ? Important information on the evolution of the main tidal constituent both in amplitude and phase would help detecting errors. With regard to the modern observation period (after 1993), comparison with satellite altimetry has demonstrated its ability to aid in data quality control and, in some cases, even to identify offsets in tide gauge records (Ray et al., 2023). I recommend that you use the altimetry data for your validation protocol with the modern data. The daily or monthly gridded data are easy to use and allow for independent verification of average sea levels over the 1993–2025 period.

Ray, R. D., Widlansky, M. J., Genz, A. S., and Thompson, P. R.: Offsets in tide-gauge reference levels detected by satellite altimetry: ten case studies, *J Geod*, 97, 110, <https://doi.org/10.1007/s00190-023-01800-7>, 2023.

gridded altimetry product available : <https://cds.climate.copernicus.eu/datasets/satellite-sea-level-global?tab=overview>

**Response:**

We have substantially expanded the revised Validation of Tide Gauge Data section to provide a clearer and more detailed description of the validation protocol, including the quality-control criteria applied to tidal constituents and associated parameters. Detailed station-specific validation procedures, quality-control decisions, and supplementary assessments have been moved to the Supplementary Material to improve readability of the main manuscript while retaining the full validation methodology.

The revised validation framework includes harmonic analysis of the high-resolution tide-gauge records. Although multiple tidal constituents were considered during harmonic analysis, M2 was selected as the primary diagnostic because it is the dominant and comparatively stable semi-diurnal constituent at the study sites. Its amplitude and phase evolution provide a consistent diagnostic for identifying potential timing errors, record discontinuities, and changes in tidal characteristics. The revised text also clarifies the treatment of poor-quality observations, statistical outlier screening, and station-specific quality-control decisions. Full station-specific results and supporting assessments are provided in the Supplementary Material.

In addition, we have incorporated satellite-altimetry comparisons for the post-1993 period using gridded Copernicus Climate Data Store sea-level products, following the recommendation of Ray et al. (2023). Overlapping tide-gauge and satellite-altimetry records are compared using Alt–TG residuals and trend differences to assess consistency between the two observing systems and to identify potential reference-level instabilities or unexplained discontinuities. Detailed methods and station-specific results are provided in the Supplementary Material.

The Validation of Tide Gauge Data section has been substantially revised and is now presented in Section 3, “Validation of Tide Gauge Data,” of the main manuscript. Detailed site-by-site validation procedures, tidal-constituent assessments, and station-specific quality-control decisions are described in greater detail in the Supplementary Material under

“Validation of Tide Gauge Data: Historical and Modern Records.” The satellite-altimetry validation methodology and results are presented separately in the Supplementary Material under “Satellite Altimetry–Tide Gauge Comparison.

**Major Comment 3 "Page 13 : "4.1. Validation of Tide Gauge Data: Historical and Modern Records"**

**Reviewer comment (RC1):**

In this section, you must explain your data validation process. Why use only the amplitude and phase data from M2 as validation information? For certain stations, you must also use figures to show the trends in M2 (in terms of amplitude and phase) and the months and years that were excluded. This may not be necessary for all stations, but it should be done for certain representative cases.

Page 20 : "4.3. Data Quality Control and Standardization"

**Response:**

In the revised manuscript, we have expanded the validation approach to provide a clearer description of the quality-control framework applied prior to inclusion of records in the sea-level reconstruction, including the rationale for using the M2 tidal constituent and its amplitude and phase as primary indicators of record consistency. The main manuscript now presents the validation workflow, and decision-making process used to assess record quality, while the Supplementary Material provides station-specific examples, figures, and detailed assessments supporting these decisions. We clarify how these tidal characteristics were used to identify potential timing errors, datum inconsistencies, and periods of reduced data quality within the tide-gauge records.

We have also included representative assessments of the temporal evolution of M2 amplitude and phase, together with periods showing deviations from the expected behaviour and excluded intervals, in the Supplementary Material (Figures S4–S11 and Table S2).

Representative examples are provided for Belfast and Cork, which capture contrasting cases of long-duration northern and more complex south-western tide-gauge records. These assessments illustrate the approach used to evaluate tidal consistency and support the quality-control decisions applied during record processing. These additions provide detailed validation of individual records while maintaining readability of the main manuscript.

Detailed station-specific validation procedures, quality-control decisions, and supporting analyses have been moved to the Supplementary Material to improve transparency and allow readers interested in the full validation process to access the additional information.

Finally, the previous Section 4.3 has been restructured, with the overall data quality-control and standardisation framework retained in the main manuscript and detailed station-specific procedures, validation results, and technical assessments provided in the Supplementary Material. The revised manuscript now clearly describes the validation criteria and decision-making framework applied during quality control, while supplementary figures and station-specific analyses provide additional evidence for individual records. Independent validation against satellite altimetry for the modern period (1993–present) has also been incorporated following the reviewer’s recommendation, with the methodology and detailed comparisons presented in the Supplementary Material.

**Reviewer General paper comment (RC1):**

If you choose to produce a data paper, it will be important to provide a raw dataset and a validated final dataset (schedules) with a column indicating data quality (good, bad, suspect). This dataset is worthy of publication in its own right and will serve as a reference for your study on trends, as well as for future studies by other users, and will facilitate its integration into global databases. In this era of data reproducibility and open science, this is an important step in your work.

**Response:**

We agree that the development of a well-documented and quality-controlled tide-gauge dataset represents an important outcome of this study. Rather than separating the work into a dedicated data paper at this stage, we consider that the data construction, validation, and trend analysis are closely interconnected components of a single scientific workflow. Separating these elements could reduce the traceability between individual data-processing decisions, validation procedures, and the resulting sea-level interpretations.

In line with the reviewer’s recommendation, we have strengthened the documentation and accessibility of the dataset through deposition in a Zenodo repository. The repository will be made publicly available upon acceptance of the manuscript and will include:

- the digitized/source-derived datasets used in the analysis, together with their original data provenance;
- the quality-controlled and final processed datasets used in the RSL analysis;
- data-quality flags indicating the status of individual observations or periods (e.g. good, suspect, or excluded);
- supporting documentation describing data sources, digitization procedures, datum adjustments, processing steps, validation procedures, and quality-control decisions.

These additions will improve the reproducibility and future reuse of the dataset, while maintaining the integrated approach required for the scientific objectives of this manuscript. We believe this approach preserves the connection between dataset development and sea-level interpretation while ensuring that the resulting records are accessible for future research and integration into wider sea-level databases.

#### MINOR COMMENTS

##### **Reviewer Minor comment (RC1):**

Page 1 : "peaking at ~6 mm yr<sup>-1</sup> in 2024"

Computing a MSL rate with 1 yr of data does not make sense. See your reference to Hogarth work.

##### **Response:**

These values were originally included only as descriptive indicators of recent variability rather than as long-term trend estimates. In the revised manuscript, we have removed this statement and substantially revised the presentation of sea-level rates and results following updates to the analysis framework. We have also ensured consistency with established literature (e.g., Hogarth et al., 2021), which highlights the importance of sufficiently long records for reliable trend estimation.

##### **Reviewer Minor comment (RC1):**

Page 2 : "~4.5 mm yr<sup>-1</sup> in 2023 compared to 2.1 mm yr<sup>-1</sup> in 1993"

Idem even with GMSL change, 1 year does not really make sens.

**Response:**

In the revised manuscript, we have removed the previous statement regarding short-term MSL rates and revised the presentation of sea-level trends to focus on established multi-decadal estimates.

The revised text now places recent changes in the context of global sea-level observations, noting "Globally, MSL has risen at approximately 3–4 mm yr<sup>-1</sup> over recent decades, with satellite altimetry showing ~3.3 mm yr<sup>-1</sup> over 1993–2021, while shorter-term estimates of ~4 mm yr<sup>-1</sup> over 2006–2016 reflect, in part, interannual variability (Hamlington et al., 2024; Llovel et al., 2023). Evidence further indicates an accelerating trend, from ~2.1 mm yr<sup>-1</sup> in the early 1990s satellite record to ~4.5 mm yr<sup>-1</sup> in recent years (Hamlington et al., 2024), although short-term variability contributes to interannual fluctuations."

**Reviewer Minor comment (RC1):**

Page 2 : "If this trend continues, an additional ~169 mm of global sea-level rise could occur over the next three decades"

Term not consistent with what is said before. Please check.  $169/30 = 5.6$  mm/year ?

**Response**

We have corrected this by removing this statement.

**Reviewer Minor comment (RC1):**

Page 3 : "A minimum of 40 years is generally required to robustly determine trends in MSL (Hogarth et al., 2021)."

Yes that's why 1yr MSL trend is meaningless

**Response:**

In the revised manuscript, we have removed the 1 yr sentence before it to avoid confusion.

**Reviewer Minor comment (RC1):**

Page 3 : "GLAC1D uses physics-based, glaciologically self-consistent ice-sheet simulations (Tarasov et al., 2012), whereas ICE6G models are tuned to fit global relative sea-level (RSL) and crustal motion observations (Peltier, 2015)"

You need to precise that this are GIA model (if they are). All reader are not familiar with GIA.

**Response:**

In the revised manuscript, we have explicitly identified GLAC1D and ICE-6G as Glacial Isostatic Adjustment (GIA) models at their first mention and briefly clarified their role in simulating solid Earth deformation and relative sea-level change. The text has been revised to:

“GIA models, such as GLAC1D, use physics-based, glaciologically self-consistent ice-sheet simulations (Tarasov et al., 2012), whereas the ICE-6G GIA model is tuned to fit global RSL and crustal motion observations (Peltier, 2015).”

**Reviewer Minor comment (RC1):**

Page 3 : "BRITICE-CHRONO"

Idem, you need to give a little more precision on what is BRITICE-CHRONO

**Response**

In the revised manuscript, we have included a brief description of BRITICE-CHRONO, clarifying that it is a reconstruction of the last British–Irish Ice Sheet based on a synthesis of geomorphological evidence and chronological constraints. This clarification will help improve accessibility for non-specialist readers. We have clarified “Regional Bradley-type GIA models, including those based on the BRITICE-CHRONO ice-sheet reconstruction of

the British–Irish Ice Sheet, are specifically calibrated to British–Irish RSL and GNSS (Global Navigation Satellite System) datasets (Bradley et al., 2023).”

**Reviewer Minor comment (RC1):**

Page 6 : "The PSMSL holds a Mean Tide Level (MTL) record for Belfast Harbour, but it does not extend beyond 1963"

It is important to make a comparison with between the PSMSL dataset and the Murty et al. 2015 if that make sens.

**Response:**

We agree that a comparison between the PSMSL Belfast Harbour record and the Murdy et al. (2015) dataset provides a useful assessment of consistency between independent records.

The PSMSL dataset contains processed Mean Tide Level (MTL) observations for Belfast Harbour, whereas Murdy et al. (2015) is based on high-frequency tide gauge observations and provides a higher-resolution reconstruction of the Belfast record. For this study, we retain the Murdy et al. (2015) dataset because it provides the temporal resolution and continuity required for our reconstruction. The analysis period was restricted to 1925 onward due to gaps in earlier observations and the lack of suitable overlapping tide gauge records for this earlier interval.

Following the reviewer’s suggestion, we compared the Murdy et al. (2015) record with the available PSMSL Belfast Harbour records. Although the PSMSL record begins in 1917, we restricted the comparison to 1925 onward to provide a consistent overlapping period with the Murdy et al. (2015) dataset. The comparison includes the PSMSL 1925–1963 record and the PSMSL 1957–1979 record. The PSMSL (1925–1963) record shows good agreement with the Murdy et al. (2015) dataset during their overlapping period, supporting the consistency of the digitised Murdy record. However, the PSMSL (1957–1979) record shows some divergence during parts of the overlapping period, including a relative lowering during the 1960s. This difference may reflect datum inconsistencies or differences in processing between the datasets, consistent with previous observations of step-like discontinuities and nonlinear behaviour in the Belfast Harbour record (Hogarth et al., 2020).

We therefore retain the Murdy et al. (2015) dataset for the reconstruction because of its higher temporal resolution and improved temporal coverage, while using the PSMSL records as an independent comparison of Belfast sea-level observations. The comparison figure is provided here for the reviewer's assessment only and has not been included in the manuscript (Figure X).

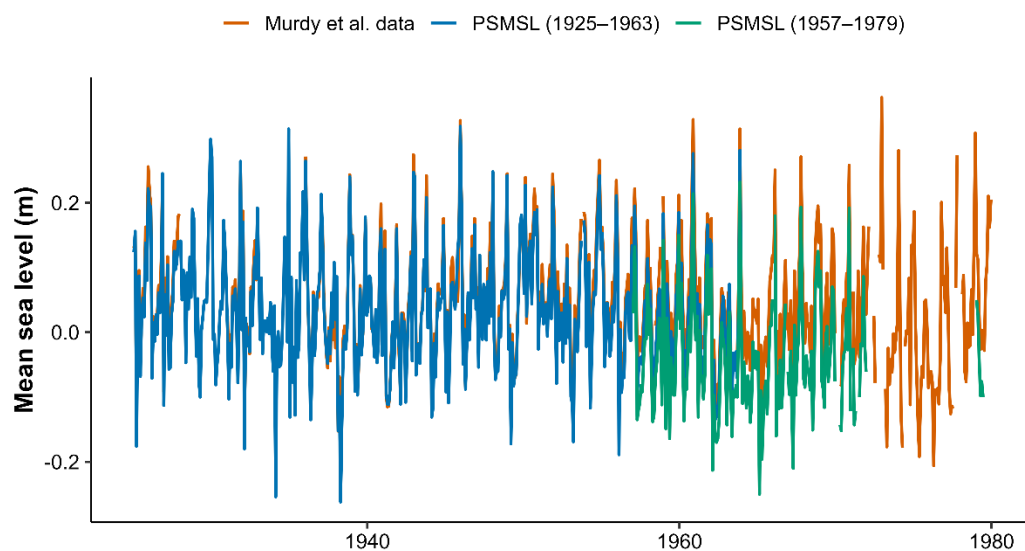


**Figure X. Comparison between the Murdy et al. (2015) Belfast Harbour record and the available PSMSL Belfast Harbour datasets. The PSMSL (1925–1963) record shows good agreement with the Murdy et al. (2015) dataset, whereas the PSMSL (1957–1979) record exhibits some divergence during parts of the overlapping interval, particularly during the 1960s.**

**Reviewer Minor comment (RC1):**

Page 12 : "Statistical outlier detection was systematically applied across all sites by removing values exceeding  $\pm 3$  standard deviations from the mean"

How do you ensure that you don't exclude important data (surge) in your 3-SD test, which seems a bit rudimentary as a validation technique. You should justify and explain this choice.

**Response:**

In the revised manuscript, we have therefore modified the quality-control procedure by applying a more conservative  $\pm 4$  standard deviation threshold. The  $\pm 4$  SD filter is applied only to monthly mean sea-level values and is intended to identify gross observational errors,

such as instrumental problems or corrupted measurements, rather than physically realistic sea-level variability. Values exceeding this threshold were individually assessed before exclusion. This approach reduces the likelihood of removing legitimate extreme events, while still allowing the identification of highly improbable observations.

The revised procedure resulted in the exclusion of only a very small number of observations across the complete dataset, with the primary identified case being November 1990 from Dublin Port, which was considered inconsistent with surrounding observations and likely affected by data-quality issues. No other months were removed using the revised threshold. We consider the  $\pm 4$  SD approach to provide an appropriate balance between removing erroneous observations and preserving genuine sea-level variability, including potential storm-related events.

The manuscript has been revised accordingly:

“A subsequent quality-control step applied a threshold of  $\pm 4$  standard deviations (SD) from the station mean to identify potential outliers within the monthly MSL values. Values exceeding this threshold were assessed before exclusion across all sites. Such exceedances were rare and were interpreted as likely instrumentation or data-quality issues rather than physically plausible meteorological variability (e.g., storm surges), allowing removal of gross observational errors while preserving realistic variability within the records.”

**Reviewer Minor comment (RC1):**

Page 12 : "Both M2 tidal constituents (amplitudes and phase lags) and z0 (mean sea level) values were examined to identify and flag poor-quality observations"

You need to explain more on how you have examined the M2 (amp,pha) to determine if the data are good or not.

**Response:**

The manuscript has been revised to provide a clearer description of how M2 amplitude and phase lag were used for data quality assessment. Specifically, we now clarify that M2 values were evaluated through inspection of monthly variability, assessment of deviations from expected station-specific ranges, and analysis of interannual stability in both amplitude and phase. These criteria were used to identify discontinuities, systematic shifts, and

inconsistencies that could indicate potential data-quality issues. The revised text has been updated accordingly in Section 3 (Validation of Tide Gauge Data; previously Section 4).

We now state: “Where M2 amplitudes or phase lags deviated from the rest of the dataset, monthly M2 values were inspected to identify and flag poor-quality observations. In addition, interannual variability in M2 parameters was assessed, with temporal evolution of both amplitude and phase used to assess datum stability and instrumental consistency across the record. At Belfast, as an example, values falling outside the observed M2 amplitude range (~1.13–1.24 m) were flagged as potential data-quality issues. Similar station-specific assessments were undertaken for the other records. Clearly erroneous spikes (i.e., physically unrealistic or corrupted values) were first identified and removed from the monthly MSL records.” These procedures are further demonstrated through station-specific validation examples and figures provided in the Supplementary Material, where detailed M2 amplitude and phase assessments are presented for individual records.

**Reviewer Minor comment (RC1):**

Page 13 : "For the Belfast record, 1925 was chosen as the starting point instead of 1901–1902"

It seems that this dataset is not available in the global repositories (USHSLC, PSMSL, GESLA) it would be important to make this dataset available to the community for further analysis.

**Response:**

We agree that making the Belfast dataset available would facilitate its reuse and independent analysis. The digitised and quality-controlled Belfast dataset, including the record from 1925 onward used in this study, will be deposited in a Zenodo repository and made publicly available upon acceptance of the manuscript. The dataset will include the associated metadata and data-quality information to facilitate its reuse by the scientific community.

**Reviewer Minor comment (RC1):**

Page 13 : "The tidal record"

In Figure 5 it would be more appropriate to call it a MSL record than a tidal record as tide have been filter out

**Response:**

We thank the reviewer for this helpful suggestion. We agree that the term “tidal record” could be confusing in this context, as the record represents mean sea-level observations rather than the raw tidal signal. We have therefore revised the terminology to “tide-gauge record” where appropriate.

**Reviewer Minor comment (RC1):**

Page 21 : "5. Data Processing and Sea-Level Modelling"

If you decide to split the article into two parts, I'll insert the transition here.

**Citation:** <https://doi.org/10.5194/egusphere-2025-6404-RC1>

**Response:**

In the revised manuscript, we have instead improved the transitions between sections to better guide the reader through the overall workflow and maintain a clear narrative structure. Where appropriate, highly detailed or technical material has been moved to the Supplementary Material to improve readability and avoid unnecessary complexity in the main text.

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## **RC 2. Response to Review by Dr Peter Hogarth**

We would like to thank Dr Hogarth for his thorough and constructive review of our manuscript, as well as for his encouragement regarding the overall scope and importance of this work.

We have carefully considered all comments and have revised the manuscript accordingly.

Below, we provide the original reviewer comments followed by our responses.

**Reviewer comment (RC 2):****General comments:**

Abstract: 10 to 30. A nice concise abstract for a huge and detailed account of painstaking work. General: The heroic scale of the work underlying this paper runs the risk of it being unwieldy for all but the specialist audience, but it is difficult to encapsulate this amount of work in a conventional paper format. It is overwhelming on first read. In agreement with the first reviewer, some of the sections could be compacted by more use of tables like table 2, rather than the explicit but repetitive paragraphs on processing steps for each site. I appreciate it is difficult to be concise but still give sufficient detail to understand each step in the data recovery and analysis. The work on each site alone could merit a single paper, but it would be nice to find a way of keeping the work inside one structure with one point of access. Another alternative to splitting the work is to shift the detailed analysis into a supplement, this could minimise overall restructuring and any major text revision if the target publication permits. An example would be the supplements in some of the Talke and Jay papers e.g.

Talke, S. A., Mahedy, A., Jay, D. A., Lau, P., Hilley, C., & Hudson, A. (2020). Sea level, tidal, and river flow trends in the lower Columbia River Estuary, 1853–present. *Journal of Geophysical Research: Oceans*, 125(3), e2019JC015656. <https://doi.org/10.1029/2019JC015656>

In general agreement with comments from the other reviewer, I recommend the authors consider ways of condensing the paper prior to acceptance, if some way can be found to avoid compromising the significance (in my view) of the overall achievement. In effect this is a recommendation for borderline major restructuring, but more minor content change. Otherwise comments are minor.

Regardless, the additional site data, the focus on areas of Ireland where data is sparse, and more complete picture of Irish sea level presented is crucially important and the results deserve to be published after some consideration of the above. The authors are commended for persevering.

The publication of the digitised records (and complete site time series?) will be a big step forward for Irish and regional sea level studies.

### **Response:**

We thank the reviewer for this very positive and constructive assessment of the manuscript, as well as for recognising the importance of the dataset and its relevance for regional sea-level studies in Ireland. We are particularly encouraged by the reviewer's view that the

underlying work represents a substantial contribution and that the resulting dataset will be valuable for the wider scientific community.

We also agree with the reviewer's assessment that the manuscript is currently dense in places and may be challenging to follow on first reading, particularly for non-specialist audiences.

In line with this and with the comments of Reviewer 1, we have undertaken a substantial revision aimed at improving clarity and readability without compromising the integrity of the analysis.

In particular, we will:

- Relocate detailed or repetitive processing steps for individual stations to the Supplementary Material where appropriate
- Improve the overall structure and narrative flow of the manuscript to better guide the reader through the workflow
- Ensure where possible clearer separation between data processing, validation, and analysis stages

We agree with the reviewer that maintaining a single coherent manuscript is preferable, and we will therefore focus on improving condensation and presentation with a supplementary material addition rather than splitting the work into two or more papers.

We believe these revisions will significantly improve readability while preserving the scientific value of the study.

In addition, we have revised the manuscript throughout to improve clarity and consistency of terminology. Technical terminology has been clarified where necessary, definitions have been expanded where ambiguity existed, and sections of the text have been reorganised to improve readability and ensure that the methodological workflow is clearly communicated.

**Detailed comments (minor).**

**Reviewer comment (RC 2):**

24: Perhaps uncertainty levels as used in line 24 would be better than “~” and 2 decimal point precision used elsewhere. Should line 26 read “a rise of ~6 mm during 2024” or is this a computed instantaneous annual rate similar to that explained later in the text (in which case is the confidence interval large?). A rate or change derived purely from one year of data would

of course be unusable so this needs explaining (or a later explanation pointed to) where the term instantaneous is first used.

**Response:**

In the revised manuscript, we have improved the presentation of sea-level rates by reporting uncertainty using 95% credible intervals (CI) and by clearly distinguishing between instantaneous annual rates and long-term mean rates calculated over multi-decadal periods. We have also revised the discussion of recent short-term variability to avoid implying that single-year rate estimates represent long-term sea-level change.

Following revisions to the modelling framework and updated tide-gauge records, the reported RSL rates have also changed. The revised manuscript now presents rates derived directly from posterior distributions, with uncertainties consistently propagated through the estimates.

**Reviewer comment (RC 2):**

38: It appears to me that the authors are making a point about overall 21<sup>st</sup> Century sea level acceleration based on the global satellite altimetry record, but it's unclear what the uncertainties are, and the rates for given overlapping time periods 1993 to 2021 (Guérou et al., 2023) and 2006 to 2016 (Llovel et al. 2023) are confusing in this context. I believe Llovel et al. were highlighting the impact of interannual variability. As Llovel et al. 2023 cite Guérou et al., 2023, the section “and ~4 mm yr<sup>-1</sup> from 2006–2016” could be removed without further amendment to avoid confusion? The authors then give the instantaneous rates for 1993 and 2023 citing Hamlington et al. 2024 in line 42. I think this best reinforces and supports their point.

**Response:**

In the revised manuscript, we have clarified the interpretation of these overlapping estimates rather than removing them, ensuring that they are presented as complementary multi-period diagnostics rather than independent trend estimates. We retain both the 1993–2021 and 2006–2016 periods because they provide context for variability across different averaging windows.

We agree that this revised structure provides a clearer and more consistent narrative regarding the evolution of satellite altimetry-based sea-level trends. We now say “Globally, MSL has risen at approximately 3–4 mm yr<sup>-1</sup> over recent decades, with satellite altimetry showing ~3.3

mm yr<sup>-1</sup> over 1993–2021, while shorter-term estimates of ~4 mm yr<sup>-1</sup> over 2006–2016 reflect, in part, interannual variability (Hamlington et al., 2024; Llovel et al., 2023). Evidence further indicates an accelerating trend, from ~2.1 mm yr<sup>-1</sup> in the early 1990s satellite record to ~4.5 mm yr<sup>-1</sup> in recent years (Hamlington et al., 2024), although short-term variability contributes to interannual fluctuations.”

**Reviewer comment (RC 2):**

138-139: only the months of June to August were digitised. It’s not completely clear why, and what impact this might have on uncertainties or seasonal effects on annual averages at this site.

**Response:**

The restriction to June–August reflects degraded trace quality and reduced data completeness in other months, which limited reliable digitisation across the full annual cycle. We acknowledge that this seasonal restriction may introduce sampling bias in annual estimates; however, the analysis focuses on multi-year mean sea level and tidal statistics, for which seasonal effects are expected to be limited. The manuscript has been revised accordingly. We have revised to “Historical data for Dún Laoghaire (formerly Kingstown) span 1925–1931 and were obtained from McLoughlin et al. (2024). Additional data for 1932–1933 were recovered from raw marigrams; however, these records are less complete because of degraded trace quality, particularly in 1933, when frequent clock stoppages affected the record. Only June–August were digitized for these years. This seasonal restriction may introduce sampling bias; however, because the analysis focuses on multi-year sea-level trends and tidal statistics, any seasonal signal is expected to have a limited influence on the results. Marigrams were digitized at hourly intervals using WebPlotDigitizer (Rohatgi, 2024), employing the full-grid method described by McLoughlin et al. (2024) for severely distorted images, with an estimated positional accuracy of approximately 1 cm.”

**Reviewer comment (RC 2):**

Figure 5, 6: Are these plots of MSL before seasonal correction? It isn’t clear if the monthly MSL plots have the average seasonal MSL variation removed before the atmospheric adjustments, or whether the regression coefficients (510, Eq. 6) in the annual and semiannual components of the atmospheric pressure adjustments are effectively accounting for the

seasonal MSL variation (i.e. the seasonal MSL variation may have other causes than purely atmospheric even if they correlate). I'm not sure what difference this might make (if any!). Tests using SD (line 545) could easily determine.

**Response:**

We thank the reviewer for this observation. Figures 5 and 6 show the monthly mean sea-level records used during the data-validation stage and therefore represent the data prior to the application of atmospheric-pressure adjustments and subsequent trend analyses. At this stage, the objective was to assess record completeness, identify potential datum inconsistencies, detect timing issues through harmonic analysis, and identify observations requiring exclusion. Seasonal variability and atmospheric effects were addressed subsequently within the correction framework.

To avoid confusion, we have clarified in both the figure captions and the main text that the monthly mean sea-level records shown in Figures 5 and 6 are uncorrected and used solely for validation purposes. We agree that seasonal variability may arise from multiple processes and is not solely attributable to atmospheric forcing. In the subsequent correction step, annual and semiannual harmonic terms were included within the regression model alongside atmospheric pressure and wind terms to account for seasonal variability while estimating the atmospheric contribution. We note in the Supplementary Material that: "Figures presented in this section show the raw monthly mean tide-gauge records used for quality control and validation. No atmospheric, seasonal, or long-term trend corrections were applied at this stage; these adjustments are introduced in the subsequent analysis section.", Figures 5 and 6 are now presented as Figures S6 and S7 following the relocation of detailed validation material to the Supplementary Material.

**Reviewer comment (RC 2):**

576: can linearly interpolate between 20CRv3 1 degree grid points to the exact location instead of averaging (to avoid spatial smearing), although it probably won't make a significant difference here. It will in theory better match ERA5. However -the use of best correlating ERA5 point? Within what spatial range? Why two approaches?

**Response:**

We clarify this in the revised manuscripts (supplement material) by updating the paragraph as follows: "Pre-1940 stations: Belfast and Dublin Port (including Dún Laoghaire) were corrected

using the 20CRv3 reanalysis ( $1^\circ$  resolution), from which surface pressure and 10 m wind components were extracted. Atmospheric variables were calculated as the unweighted spatial mean of all grid cells within a  $\pm 1^\circ$  latitude/longitude window centred on each station to reduce grid-scale noise associated with coarse-resolution reanalysis fields and to provide a stable estimate of regional atmospheric forcing relevant to coastal sea-level variability. Record coverage was Belfast (1925–2010), Dublin Port (1938–1939), and Dún Laoghaire (1925–1933, merged with Dublin Port for 1938–1939).” Although interpolation to the exact station location could reduce spatial smearing, we adopted spatial averaging for 20CRv3 because the coarse  $1^\circ$  resolution does not provide a sufficiently resolved local representation, and the averaging approach provides a more stable estimate of regional atmospheric forcing. The differing approaches between datasets reflect their spatial resolution, with spatial averaging applied to the coarser 20CRv3 ( $1^\circ$ ) data and grid-cell selection used for the higher-resolution ERA5 ( $0.25^\circ$ ) product. We also clarify this in the ERA5 description in the following paragraph “Post-1940 stations: Bangor, Malin Head, Portrush, Cork, Tarbert, Galway, the post-1940 Dublin Port record, Arklow, and Howth were corrected using high-resolution ERA5 reanalysis ( $0.25^\circ$  resolution). For each station, ERA5 reanalysis grid points within  $\pm 0.25^\circ$  of the tide-gauge location were evaluated, and the grid point showing the highest correlation between pressure anomalies and the tide-gauge record over the common overlap period was selected. Surface pressure and 10 m wind components were extracted from this selected grid point, providing a site-specific representation of atmospheric forcing while maintaining consistency with the native spatial resolution of ERA5.”

**Reviewer comment (RC 2):**

597 to 598: Elsewhere in the world, there are often small but consistent pressure offsets between 20CRv3 and ERA5 reconstructions which could create a step in the atmospheric adjustments for MSL. I’m sure this was tested for an overlap period for the two products? - brief details of matching would be sufficient.

**Response:**

The original analysis presented in lines 597–598 assessed the consistency of the merged atmospherically corrected tide-gauge records from Dún Laoghaire and Dublin Port, rather than directly quantifying offsets between the two atmospheric reanalysis products. In response to this comment, we have undertaken an explicit comparison of the 20CRv3 and ERA5 inverse barometer corrections over their overlapping period (1940–2010).

For the Belfast and Dublin/Dún Laoghaire records, the corresponding atmospheric correction series were compared over the overlapping period. The two reanalysis products showed strong temporal agreement, with a small systematic difference between the resulting corrections. This difference was relatively stable through time and did not produce evidence for a transition-related discontinuity. We therefore did not apply a fixed offset between the 20CRv3- and ERA5-corrected records.

We additionally assessed the sensitivity of the resulting RSL trends to the choice and timing of the atmospheric reanalysis. For Belfast, alternative 20CRv3–ERA5 transition configurations were tested, including 20CRv3 through 2010 followed by ERA5 and an earlier transition to ERA5. The resulting trends remained consistent within the associated uncertainty. For Dublin Port, the sensitivity of the early 20CRv3-corrected period and the later ERA5-corrected period was also evaluated. These analyses indicate that differences between the reanalysis products do not require a fixed step correction and are more appropriately treated as a source of methodological uncertainty.

The revised Supplementary Material now includes these additional comparisons and sensitivity analyses, together with the resulting trend estimates (Table S6). The original atmospheric-correction framework has therefore been retained, while the overlap analysis provides an explicit check that the transition between 20CRv3 and ERA5 does not introduce a spurious discontinuity into the reconstructed sea-level records.

**Reviewer comment (RC 2):**

Figure 13: I am unfamiliar with the NI-GAM processing, please forgive my ignorance. What is the significance of the near horizontal alignment of large portions of data points for Belfast, Dublin and Malin Head? To my eye these don't closely follow the 1:1 line at all, but do something else.

**Response:**

We clarify that Figure 6 does not represent a direct point-by-point observational comparison in the sense of a raw 1:1 scatter between independent measurements. Instead, it shows observed relative sea-level (RSL) values against posterior predictive mean estimates obtained from the NI-GAM model under a cross-validation framework.

The near-horizontal alignment of clusters of points for some sites reflects the smoother nature of the NI-GAM posterior predictive mean relative to the observed data. Predictions are

obtained through a spline-based Bayesian reconstruction and averaged over posterior samples within each cross-validation fold. As a result, predicted values exhibit reduced short-term variability compared with the raw observations.

**Reviewer comment (RC 2):**

763: Given long term sea level acceleration and particularly high global and UK rates over the past 10 years, the lower linear rate reported at Belfast relative to Malin Head will likely be due to a longer record starting at an earlier date? This question could be bypassed if rates were compared over an identical (maximum overlapping) period, as this would isolate any regional GIA component, as in the “fair comparison” of Table 8, where any apparent regional differences are reduced (Belfast being the outlier, but having 9 less years of likely highest rate recent data). A point about the need for overlapping periods and start/end times could be made earlier, and the authors could consider condensing the section with rates estimated over differing time periods.

**Response:**

We agree that comparisons of rates derived over different temporal windows can be influenced by record length and the inclusion of recent accelerated sea-level rise. In the revised manuscript, we have addressed this by extending the NI-GAM prediction grids for all sites to a common period (1925–2024), allowing site-specific RSL rates to be estimated consistently over the same temporal interval.

The revised results confirm that the spatial differences in long-term RSL rates are reduced when evaluated over a common period, with lower rates in northern sites such as Belfast and Malin Head remaining consistent with the influence of spatial variations in GIA-related land motion. However, the updated modelling framework also shows that recent acceleration has increased rates across all sites, reducing the relative differences between locations during the most recent decades.

We have clarified in the revised manuscript that rate comparisons should be interpreted in the context of the selected averaging period, as shorter or more recent periods capture the influence of twentieth- and twenty-first-century acceleration differently. The updated presentation therefore focuses on common-period rate estimates (1925–2024) and time-varying instantaneous rates rather than comparisons between rates calculated over different record lengths.

**Reviewer comment (RC 2):**

This is reinforced in the observation (766 to 768) that the rates at Cork, Tarbert and Galway are statistically identical over similar time periods, whilst (773), identical modelled rates are estimated at Belfast and Dublin for the identical 1925 to 2000 period.

If so, any reduced SLR differences could better reflect the small regional GIA differences from the later Peltier model given by the authors ( $-0.07$  to  $0.21 \text{ mm yr}^{-1}$ ).

**Response:**

In the revised manuscript, we have updated the rate calculations by deriving site-specific RSL rates directly from the full NI-GAM posterior distributions (`mu_pred_deriv`), rather than relying on regional-scale rate summaries alone. This approach retains the shared regional signal while incorporating site-specific linear GIA-related contributions and local deviations, allowing spatial differences and uncertainties to be assessed more explicitly.

We also note that the revised temporal framework has contributed to differences in the estimated rates compared with the previous manuscript version. In the revised analysis, RSL rates are derived from the full posterior rate distributions of the NI-GAM model, which combine the regional component, site-specific linear GIA-related contributions, and non-linear local residual variability. This differs from the previous approach, where GIA corrections were applied more deterministically. The updated framework provides a more integrated representation of the uncertainty and spatial variability in the reconstructed RSL rates.

**Reviewer comment (RC 2):**

I think Fig.14 neatly encapsulates any regional differences and perhaps could be referred to to deflect the above points in advance.

Considering Fig. 14, It looks like if the instantaneous rate curves of, for example, Malin Head and Tarbert (far apart spatially) are superimposed, then the very close to constant offset (representing a linear rate difference?) between them could be entirely due to GIA differences. In effect, this mean offset difference could be interpreted as an instrumentation based long term measurement of relative VLM/GIA?

**Response:**

We thank the reviewer for this insightful interpretation of Figure 14 and for highlighting the potential role of long-term vertical land motion (VLM) and glacial isostatic adjustment (GIA) in contributing to inter-site differences. We agree that the near-constant offsets observed between some site-specific instantaneous rate curves, such as Malin Head and Tarbert, are consistent with a persistent component in the modelled rate structure.

However, we clarify that Figure 14 (now Figure 9) represents NI-GAM-derived posterior instantaneous RSL rate estimates and does not provide a direct observational estimate of VLM or GIA. The revised figure shows modelled RSL rates, including the combined contribution of the regional component, site-specific linear (GIA-related) contributions, and non-linear local residual variability, extended over 1925–2024 using the site prediction grids. We note in the caption “Modelled RSL rates (including regional, linear, and local components) across Irish tide-gauge sites (1925–2024).” Wider credible intervals occur at sites where observations do not extend throughout the full reconstruction period.

The persistent offsets between sites are consistent with the influence of the site-specific linear component, which incorporates the prescribed GIA-related contribution, and therefore may reflect the relative influence of long-term VLM differences between locations. However, these offsets should not be interpreted as an independent measurement of GIA or VLM, as they also depend on the model formulation, regional signal estimation, and uncertainty in the underlying tide-gauge observations.

**Reviewer comment (RC 2):**

824: This gives confidence. Similar results reported in other studies over similar periods.

**Response:**

We agree that the consistency of our results with previous studies over comparable periods provides additional confidence in the robustness of the reconstructed sea-level changes. We note, however, that the revised manuscript includes updates to the modelling framework, and underlying tide-gauge processing, which have resulted in changes to some of the estimated rates compared with the previous version. Despite these revisions, the overall spatial patterns and temporal evolution of RSL change remain consistent with previous studies, supporting the robustness of the updated results.

**Reviewer comment (RC 2):**

Figure 15 as presented, however, would also accommodate an unrealistic (in my view) horizontal “no change” trend within the 95% credible interval, whereas the (also similar to other coastlines around North Atlantic) coherence of the pattern of long term change at each site suggests confidence intervals that should be reduced due to averaging over more than one site. I am likely missing something, but still trying to understand why these intervals are so large (approximately  $\pm 100\text{mm}$ ).

**Response:**

We agree that the presentation of this figure could lead to ambiguity in interpreting the width of the credible intervals, particularly regarding the contribution of multi-site information and the distinction between individual-site uncertainty and regional-scale uncertainty.

Following revisions to the modelling framework and the updated presentation of the results, we have removed this figure from the manuscript. We consider that the revised rate analyses, together with the decomposition of the regional, linear (GIA-related), and non-linear local components, provide a clearer representation of the spatial and temporal variability in RSL change and the associated uncertainty. This revised presentation avoids potential misinterpretation of the credible intervals while retaining the key information on long-term sea-level change across the tide-gauge network.

**Reviewer comment (RC 2):**

950 to 954: is  $1.96 \pm 0.1 \text{ mm yr}^{-1}$  any lower than  $2.12 \text{ mm yr}^{-1}$  (assuming similar confidence limits are included)? These look very close, and this could reasonably be reworded. Although corroboration is not always validation, the total number of sites involved in these studies gives higher confidence in these convergent estimates of SLR, as in line 979.

**Response:**

In the revised manuscript, we have reworded this comparison to emphasise the consistency between studies rather than a difference in estimated rates.

Revisions to the modelling framework and rate estimation approach have resulted in revised RSL rate estimates compared with the previous manuscript version. The revised estimates are not directly comparable to the previous values because they are derived using an updated

hierarchical Bayesian framework, a common 1925–2024 reconstruction period. However, the revised analysis continues to show spatial variability consistent with GIA-related differences and a clear acceleration in RSL change during recent decades, in agreement with previous regional sea-level studies.

We further clarify that variations among published estimates can arise from differences in GIA model selection, rate estimation methods, and the temporal windows considered. The convergence of independent studies based on multiple tide-gauge records provides additional confidence in the consistency of the broader patterns of regional sea-level change. However, this agreement should be interpreted as corroboration of regional trends rather than direct validation, given differences in datasets, methodologies, and analysis periods.

We say in the new discussion “Hogarth et al. (2021) reconstructed long-term sea-level records for Great Britain using an extensively augmented and spatially clustered tide-gauge dataset, applying GIA corrections, and reported a post-1900 weighted linear rate of  $2.12 \text{ mm yr}^{-1}$ , with evidence of long-term acceleration from the nineteenth to twentieth century. The mean modelled RSL rate estimated here across the Irish tide-gauge network was  $1.11 \text{ mm yr}^{-1}$  (95% CI:  $0.78\text{--}1.45 \text{ mm yr}^{-1}$ ) over 1925–2024, while the corresponding regional RSL component was  $1.01 \text{ mm yr}^{-1}$  (95% CI:  $0.19\text{--}1.84 \text{ mm yr}^{-1}$ ). The lower mean modelled RSL rate estimated here for Ireland may partly reflect differences in regional sea-level response and GIA-related VLM, while differences in tide-gauge spatial coverage, record length, temporal periods analysed, and modelling approaches limit direct comparison.” Referring to the updated stats and points addressed.

### **Reviewer comment (RC 2):**

981 to 988: an important point is made about unknowns during gaps in individual site data, and “smoothing”, but any doubts about real site specific variability during gaps at one location can be mitigated to some extent (in a probabilistic sense) by considering the actual unsmoothed intersite variability over other overlapping periods of similar time length to the gaps. I assume this must be implicit in the model. It might also be interesting (but not necessary for the paper) to estimate and plot an annual intersite Standard Deviation if enough sites have overlapping years.

**Response:**

We agree that examining overlapping periods across sites provides a useful way to assess regional coherence and the extent to which apparent site-specific variability is supported by observations.

Within the NI-GAM framework, this information is incorporated through the shared regional component and hierarchical structure. During periods when an individual site has limited or missing observations, overlapping observations from other sites contribute to estimation of the common regional signal, while the site-specific component and posterior uncertainty account for remaining local variability and uncertainty.

We agree that an explicit analysis of annual inter-site standard deviation could provide additional insight into spatial coherence; however, we consider this beyond the scope of the present study. The revised manuscript instead evaluates reconstruction performance through cross-validation and posterior uncertainty estimates, which demonstrate that the model provides consistent estimates of regional and site-specific variability.

**Reviewer comment (RC 2):**

1023: Typo here I think, the GIA-free result is Relative SLR (i.e. land surface relative, as would be experienced by local residents and as measured on the actual tide gauges)? Absolute SLR is usually defined as geocentric.

**Response:**

In the revised manuscript, we have corrected the terminology throughout to ensure consistent use of relative sea level (RSL) for tide-gauge observations and have corrected other sea-level terminology where appropriate.

**Reviewer comment (RC 2):**

1045 to 1053 more than validates this study. Well done.

**Response:**

We thank the reviewer for this positive comment. We appreciate that the consistency of our results with previous studies provides additional confidence in the robustness of the analysis. We note that, despite the updates to the modelling framework, and rate estimation approach,

the revised results continue to show similar regional patterns and remain consistent with the previous literature in that example.

**Reviewer comment (RC 2):**

I'll also comment on the suggested use of altimetry in order to identify datum errors through comparison. I discussed this last year with Richard Ray, we concluded that comparison with other tide gauge sites and comparison with altimetry are complementary approaches. As in Richards paper, for post-1993 studies using altimetry gives optimum results for island sites surrounded by deep ocean. For coastal sites on continental shelves as here, and if nearby tide gauges are available, then the tide gauge/tide gauge residuals will usually display lower variability, comparable with best case altimetry/tide gauge comparisons on island sites. If possible, I would try both approaches and use which works best.

**Citation:** <https://doi.org/10.5194/egusphere-2025-6404-RC2>

**Response:**

Following this recommendation, we performed an additional satellite altimetry–tide-gauge comparison over the 1993–present overlap period using gridded sea-level anomaly fields. The comparison showed generally good agreement in temporal variability between the two observing systems, although the magnitude of agreement varied among stations because of differences in spatial sampling, reference frameworks, and coastal processes. However, consistent with the reviewer's comment, differences between altimetry and tide gauges were larger at some coastal sites, reflecting the different spatial scales, reference frames, and coastal processes represented by the two datasets. Therefore, tide-gauge network comparisons remain the primary approach for identifying datum inconsistencies within the Irish coastal network, while satellite altimetry provides an independent validation of recent variability and trends. The additional analysis has been included in the Supplementary Material. Although Ray et al. (2023) provide a more extensive assessment of altimetry–tide gauge comparisons, including detailed investigations beyond the scope of this study, we consider the additional analysis presented here a useful complementary check on the Irish tide-gauge records during the satellite altimetry era.