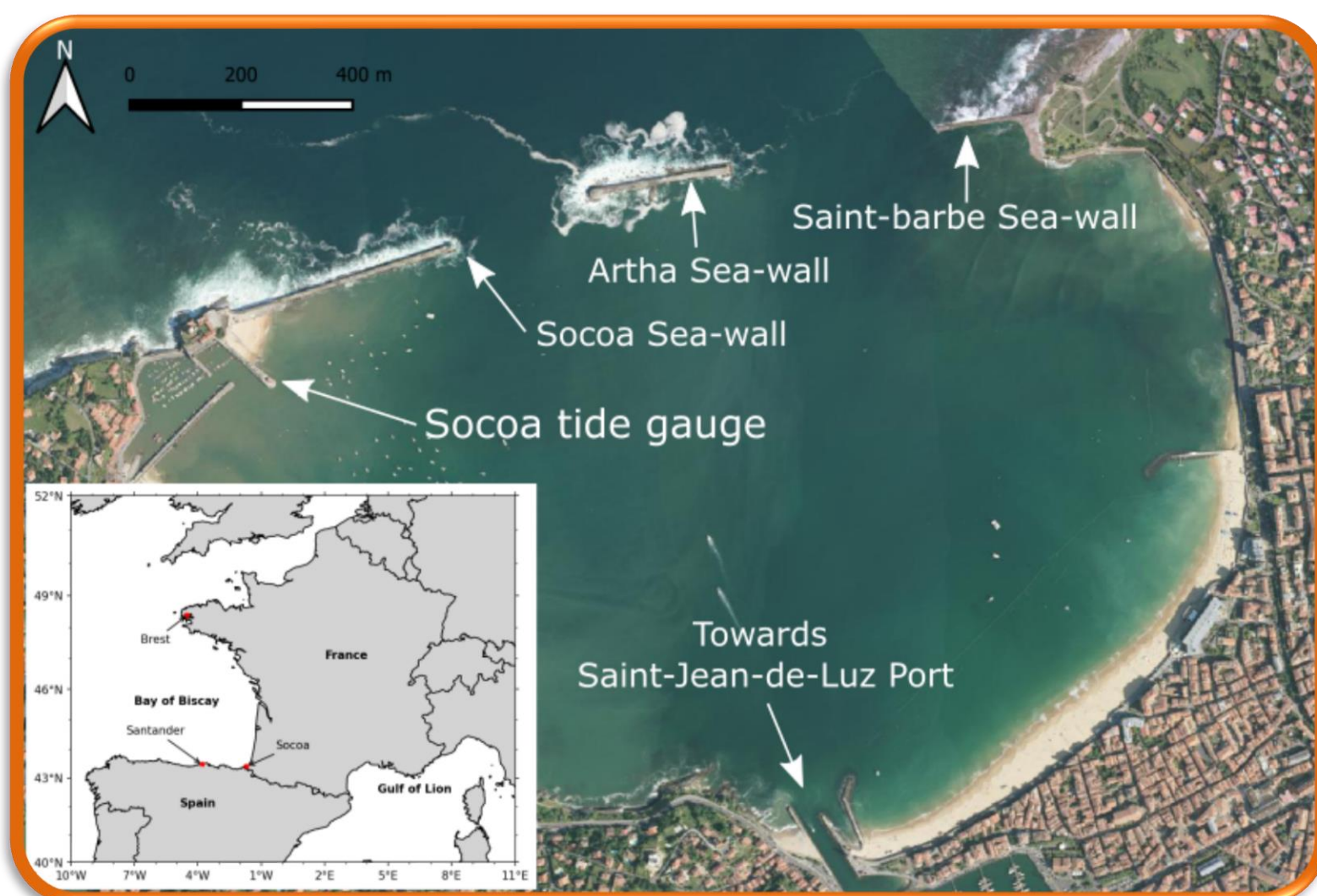


# Recovery of a high-resolution Sea level record from 1875 at Saint Jean-de-Luz (French-Basque coast)

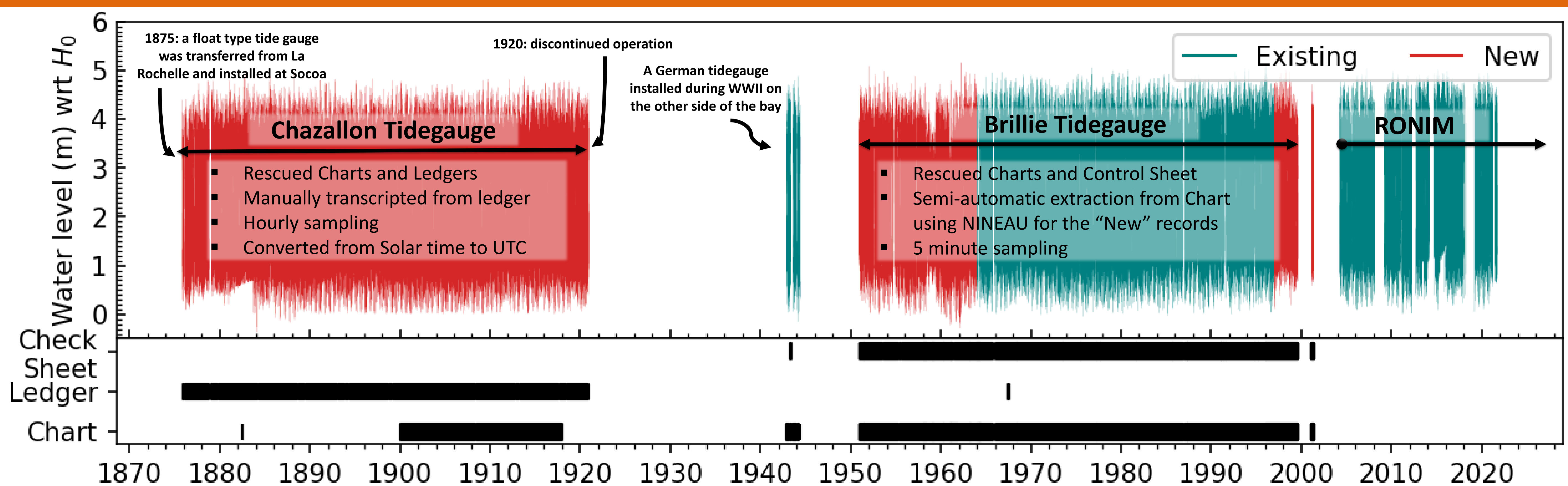
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- Historical archives of sea level observations in France has been shown to substantially contribute to extend the available sea level records [1, 2].
- Such records is valuable for long-term assessment of sea level, tide, and extreme sea levels [2, 3].
- Socoo (Saint Jean-de-Luz) has a permanent tide gauge station operated since 1875. However, currently available record starts only from 1964 [1].
- The objective of the current work was to apply data archaeology -
  - to rescue the papers records by storing them into digital media.
  - to extend the available sea level record to a new century long timeseries.

Scan me!

4 Archives | | 541 Ledgers, 2477 Charts + Metadata rescued | | ~50 years of new record



## Datum Consistency

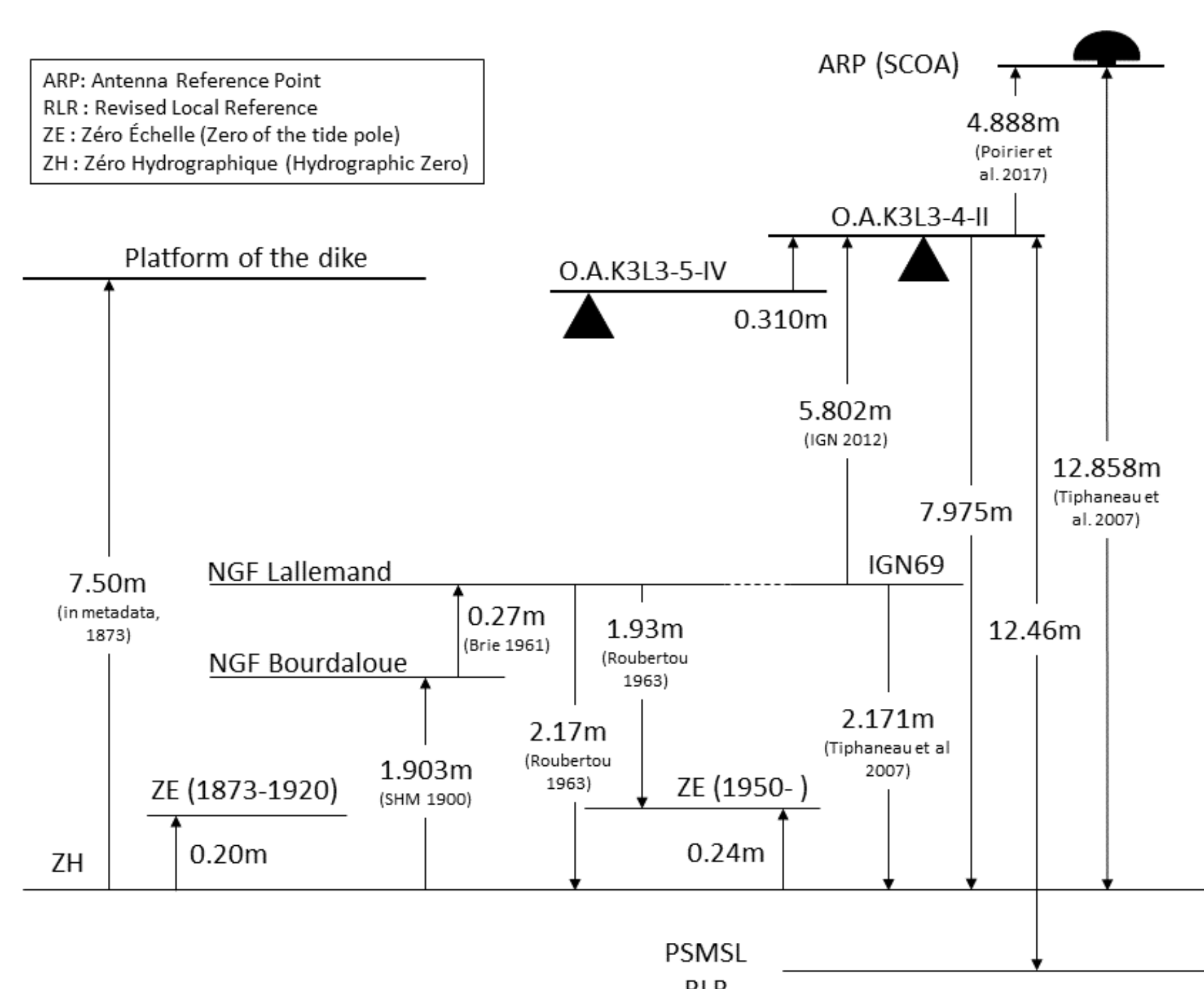


Fig 1: Vertical datum continuity at Socoo derived from hydrographic survey reports.

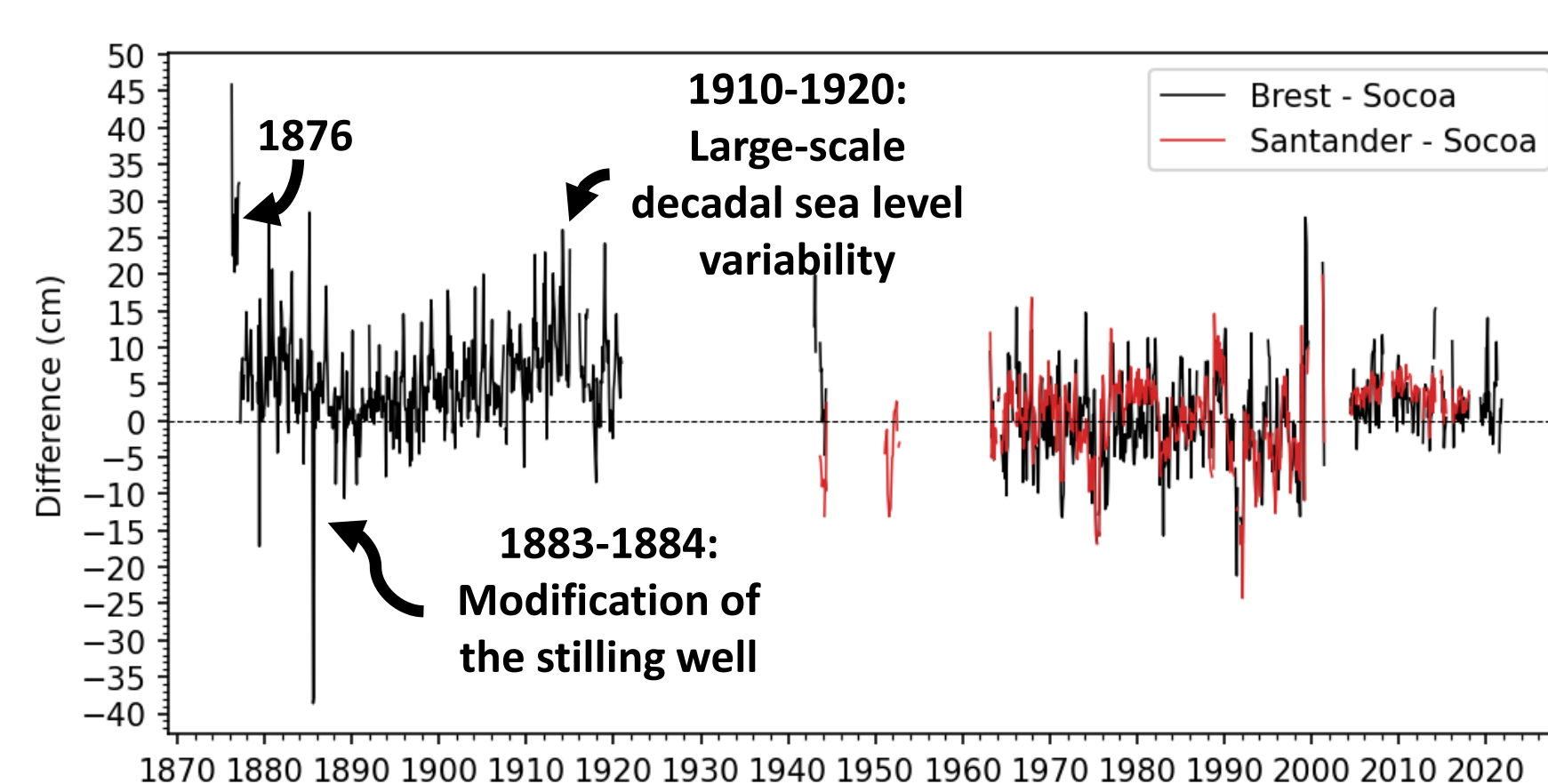


Fig 2: Buddy checking of the monthly mean sea level with Brest (black) and Santander (red). No stepwise datum shift is observed for Socoo timeseries. The increase during early 20<sup>th</sup> century is related to the wind-driven decadal sea level variation (Calafat et al. 2012). Monthly mean sea level is computed with PSMSL rules for Brest from hourly dataset, and monthly PSMSL dataset is used for Santander.

## Corrections and Data Quality

### Method

1. Visual inspection
2. Harmonic analysis
3. Residual analysis

Cross referenced  
with rescued  
metadata

### Corrections

- Time correction
  - Slowed down clock by constant lag/advance [Method 2, 3]
- Height corrections
  - Transcription error [Method 1, 2, 3]
  - Date swap error [Method 1, 2]

### Uncorrected/flagged data

- Uneven slow-down of the clock
- Malfunctioning of the floating device
- Siltation and blockage in the stilling well (Fig 3).

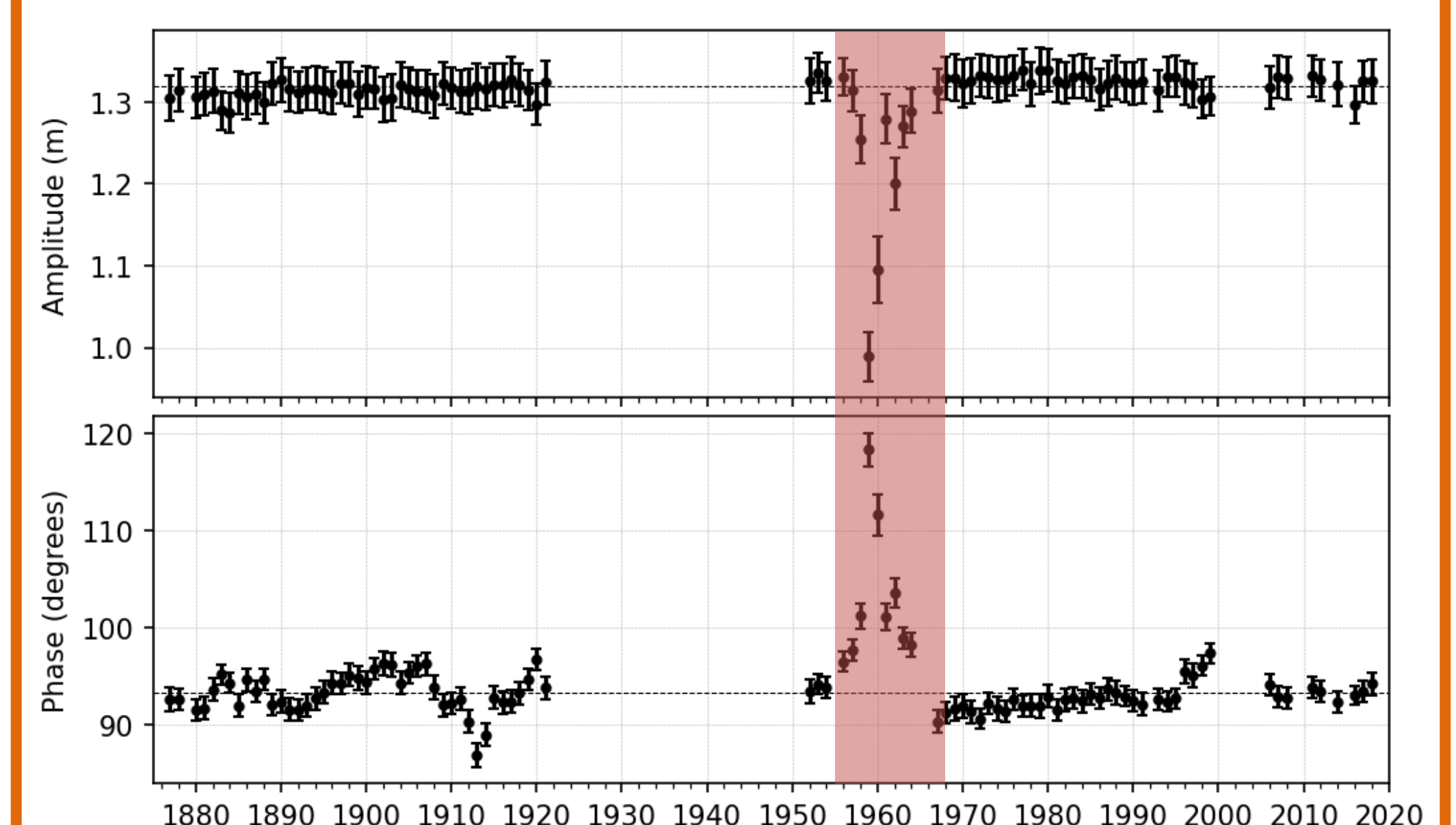


Fig 3: M2 amplitude (top) and phase (bottom) for yearly segments clearly shows strong degradation of the recording around 1960 which is attributed to siltation.

## Trend Analysis

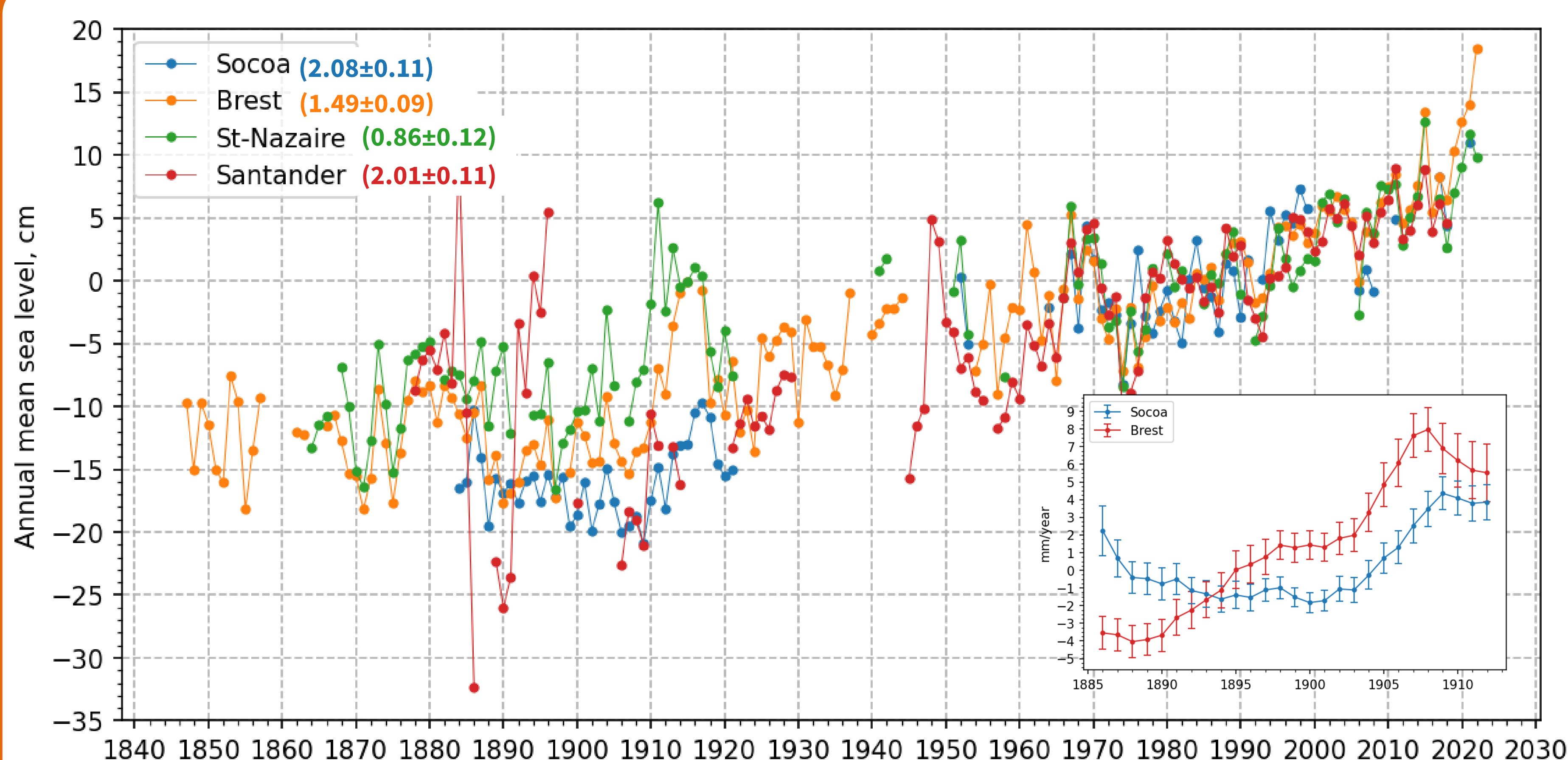


Fig 4: Annual mean sea level for 3 nearby stations of Socoo (blue) – Brest (orange), St-Nazaire (green), Santander (red). The estimated trend for 1900-2018 is shown in parenthesis. Inset: Running trend analysis for Socoo and Brest shows an inflexion point in late 19<sup>th</sup>/early 20<sup>th</sup> century.

## References

1. Pouvreau, N.: Trois Cents Ans de Mesures Marégraphiques En France: outils, Méthodes Et Tendances Des Composantes Du Niveau de La Mer Au Port de Brest, PhDthesis, Université de La Rochelle, 2008.
2. Wöppelmann, G. et al.: Brest Sea Level Record: a Time Series Construction Back to the Early Eighteenth Century, Ocean Dynamics, 3, 487–497, doi:10.1007/s10236-005-0044-z, 2006a
3. Calafat, F.M. et al.: Trends in Europe storm surge extremes match the rate of sea-level rise. Nature 603, 841–845, doi:10.1038/s41586-022-04426-5, 2022.