The new GESLA-3 tide gauge data set and its quality control for tidal studies

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The new GESLA-3 tide gauge data set

Released November 2021
91,021 years from 5,199 records
The new GESLA-3 tide gauge data set

Temporal distribution

(c) Temporal distribution of records by start year:
- < 1850: 6
- 1850-1900: 48
- 1900-1950: 271
- 1950-2000: 2818
- 2000-2015: 1470
- > 2015: 506

(d) Number of records over time for GESLA-3, GESLA-2, and GESLA-1.
Impact of record length in tidal computation

Changes in M2
Quality control of tide gauge records

Impact of errors on estimates of tidal amplitudes
[along European coastlines]
Corrections of datum jumps
Corrections of datum jumps

![Graph showing corrections of datum jumps with sea level (m) on the y-axis and years from 1975 to 2025 on the x-axis, with jumps at specific years marked.](image-url)
Corrections of datum jumps

bari-bar-ita-ispra
Corrections of time shifts

Sea level
Storm surge
Corrections of time shifts

![Graph showing storm surge and maxima](image_url)
 Corrections of time shifts

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Sea level

Storm surge

Storm surge (m)

Jan 07  Jan 14  Jan 21  Jan 28  

2015
Corrections of time shifts
Corrections of time shifts

Storm surge (m)

Sea Level
Tides

Jan 07 Jan 08 Jan 09 Jan 10 Jan 11 Jan 12 Jan 13 Jan 14 Jan 15
2015
Corrections of time shifts

The diagram shows a plot of storm surge over time, with a focus on the months of January from 2007 to 2015. The y-axis represents storm surge in meters, ranging from -2 to 3 meters. The x-axis represents the years from 2007 to 2015, with specific dates marked for each year.

The plot includes three lines:
- A gray line labeled "Sea Level".
- A blue line labeled "Tides".
- A blue dashed line labeled "Corrected tides".

The corrected tides line appears to have been adjusted from the tides line, possibly to account for time shifts or other corrections applied to the data.
Corrections of time shifts

![Graph showing corrections of time shifts with a storm surge plot and labels for sea level, storm surge, and corrected storm surge. The graph indicates a correction of 0.5 m.](image_url)
<table>
<thead>
<tr>
<th>DATUM JUMP CORRECTIONS</th>
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<tbody>
<tr>
<td>Tide gauge records with datum jumps</td>
<td>219/1022 (21%)</td>
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<tr>
<td>Average (median) magnitude of max jump</td>
<td>1,5 m</td>
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<th>TIME SHIFT CORRECTIONS</th>
<th></th>
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<tbody>
<tr>
<td>Median percentage of corrected periods</td>
<td>8%</td>
</tr>
<tr>
<td>How many records with corrections in yearly maxima?</td>
<td>342/1022 (33%)</td>
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<tr>
<td>From those, how many maxima corrected (median)?</td>
<td>9%</td>
</tr>
</tbody>
</table>
Amplitude of the main tidal constituents with and without time shift corrections

Uncorrected

Corrected

Difference
To conclude:

• GESLA 3 improves temporal and spatial coverage → updated tidal constituents at tide gauge sites (soon to be released through GESLA website)

• A non-negligible number of tide gauge stations display timing problems that alter the tidal computation.

• Tidal amplitudes of M2 show differences of the order of ~1 cm (up/down) when corrections for time shifts are applied.