

Response to Reviewers

Manuscript: "Dataset of daily vertical displacements observed by GPS between 1994 and 2023 for hydrogeodetic studies over Europe" by Klos et al.

We thank both reviewers for their careful reading of the manuscript and for their constructive comments, which have helped us improve the clarity and completeness of the paper and of the associated dataset description. Below we reproduce each comment followed by our response. We also highlighted in yellow all changes we made within the manuscript.

Reviewer 1 (Vagner Ferreira)

We thank the reviewer for the positive overall assessment of the dataset and manuscript, and for the specific, constructive comments below.

General comments:

The authors could, but are not obligated to, release the cleaned, non-decomposed daily displacement time series in addition to the three temporal-scale benchmark products to increase reusability beyond the authors' specific decomposition scheme.

Response: We thank the reviewer for this suggestion. We have decided not to release these time series, since we intend to use this dataset for further analyses.

Specific comments:

1. Sect. 2.1: Albeit the tidal (IERS2010, permanent tide retained) and non-tidal atmospheric/oceanic loading (GFZ/ECMWF-MPIOM) and GIA (ICE6G-D) corrections are clearly stated, and InSAR is explicitly tied to IGS14 (p.7, lines 247–249), the reference frame origin convention (CM, CF, or CE) used for the Love-number/Farrell (1972) forward modeling of hydrological, SLR+DORIS, GRACE, and GLWS displacements is never specified. Since NGL/IGS14 GPS coordinates are nominally CM-referenced while Farrell-type load Green's functions are conventionally formulated in CF, please confirm/state that all forward-modeled series share a common frame consistent with the GPS solution, or apply a degree-1 (geocenter) correction, otherwise a frame mismatch could bias the reported comparisons, especially the trend/long-term signals.

Response: We thank the reviewer for raising this important point. We confirm that all forward-modelled displacement series (hydrological model/eCLM, SLR+DORIS, GRACE, and GLWS) are expressed in a frame consistent with the GPS solution used (IGS14/NGL). We have added the following clarifying sentence to Section 2.2: "Load-induced displacements are computed in the same frame as the GPS solution (IGS14), and the degree-1 (geocenter) term is treated consistently across all forward-modelled series to avoid a frame mismatch with the GPS-observed displacements."

2. Step 1 (~line 150): Step 1 (~line 150) fixes the pre-processed set to 4,443 stations. Step 17 (~line 190) states that requiring >1 year of overlapping hydrological-model coverage "reduces the number of stations to 4,117." However, Figures 5 and 6 both report trends that are "estimated for 4,443 GPS locations." The trend maps should align with the two figure captions in Step 17. Furthermore, Step 1 (~line 150) needs clarification; it says, "It is worth mentioning that only 60 of these stations have a length of less than 3 years," which is unclear whether "these stations" refers to the 4,443 retained stations or the full 6,259 candidate set. Please specify the figures explicitly and revise them, i.e., 6259, 80%, 60, and 4443.

Response: We thank the reviewer for identifying this inconsistency. We have revised the text to make the station counts consistent throughout Section 2.3. To clarify the steps we take: of the initial 6,259 candidate GPS stations processed by NGL, 80% (i.e., ~5,007 stations) satisfy the minimum record-length criterion of one year; after further excluding

stations with excessive missing values, outliers, or offsets that could not be explained physically, 4,443 stations remain at the end of Step 1. This set of 4,443 stations is the one that is fully pre-processed (i.e., Steps 2-15) and used to produce the trend maps in Figures 5 and 6, which show GPS-observed (and, for comparison, GRACE-derived and GLWS-predicted) trends independent of the hydrological-model-based benchmark classification. The further reduction to 4,117 stations described in Step 17 applies only to the subsequent correlation-based classification into the three benchmark subsets (short-term/seasonal/long-term; Steps 17-20), because this step additionally requires temporal overlap with the CLM5 model output. We have revised the sentence in Step 1 to read: "It is worth mentioning that only 60 of the 6,259 candidate stations have a record length of less than 3 years."

3. Step 6 (~line 170): The authors are encouraged, not obligated, to release the cleaned, non-decomposed daily displacement time series (post outlier/offset/loading correction, pre-wavelet-decomposition) referenced in Step 6, in addition to the three temporal-scale benchmark files. It could also contain the formal uncertainties for each epoch. I believe this would increase the dataset's reusability beyond the specific decomposition scheme proposed.

Response: We are grateful for this comment. We have decided not to release these time series at this stage, since we intend to use this dataset for further analyses. We therefore provide only the final displacement products at the three temporal scales, which are directly usable for hydrogeodetic applications.

4. Lines ~290: Some sentences are slightly repeated. Where it reads "It is also worth noting that trends observed via GPS encompass all phenomena... reflect only hydrological loading" is just restated as "It is also worth noting that GPS-observed trends include local ground subsidence, while GRACE-derived and GLWS-predicted trends represent hydrospheric loading only." Keep one version only by merging them.

Response: We agree and have merged the two sentences into one, which now reads: "It is also worth noting that GPS-observed trends encompass all phenomena, including local land subsidence, whereas GRACE-derived and GLWS-predicted trends represent hydrospheric loading only." The duplicate sentence has been removed.

5. Lines 330-345: The sentence "After this drought, we see a decrease in GPS-observed displacements and a wet period from 2003 to 2007..." through "...but not fully captured by SLR and DORIS-based water storage" is almost a repetition of the preceding sentences, which read "After the drought, we see a decrease... All datasets remain consistent until 2007..." This might be a leftover editing, and please revise that.

Response: We thank the Reviewer (and Reviewer 2, who independently flagged the same issue) for catching this editing error. We have removed the duplicated sentences describing the 2003-2007 wet period and the post-2007 drought, retaining only the first occurrence. The paragraph now proceeds directly from the first description of the 2003-2007/2007 events to the new material on the 2019 decrease in GPS-observed displacements not captured by SLR/DORIS.

6. Trend estimation / dataset files: The dataset does not report uncertainties (e.g., standard errors) for the GPS or GIA trend estimates in "Trend GPS & GIA.txt", nor for the displacement values in the three benchmark folders. Since trends are derived via least-squares, please add a column with formal trend uncertainties (ideally accounting for the noise model, e.g., power-law + white noise) or explicitly state in the readme why they are omitted. This is important for users to assess the significance of subsidence/uplift signals.

Response: We thank the reviewer for pointing this out. We agree that formal trend uncertainties are valuable for assessing the significance of the reported subsidence/uplift signals. Therefore, we added a column into "Trend GPS & GIA.txt" file with GPS trend uncertainties. We have also included a description of how the trends, and their uncertainties were estimated in the "readme" file.

7. Data availability: No repository name, DOI, or file format/naming convention is provided in the text, as ESSD requires per journal policy. Furthermore, the DOI (10.18150/68WQXO) provided in Kłos & Bogusz (2026) is returning "DOI Not Found." Please check that.

Response: Thank you for bringing attention to this issue. Indeed, we had published the data as a draft version accessible only to reviewers, as we did not want to publish it before the article was published. The data will be released as soon as the paper is accepted. The version for the reviewers is still available.