################################## Reviewer 1 ##################################

This paper presents some procedures that help in making vertical land displacements useful as complementary data to GRACE for inverting hydrological loads, including noise analysis, using discrepancies between GPS and GRACE to detect missed GPS offsets, and an improvement of the CMC Imaging method of Kreemer and Blewitt (2021). The data produced is ultimately very useful for researchers interested in hydrologic loading. Where will the VLD time-series be available?

Thank you for your comment. We provide the data repository in the Data Availability Section: "Data Availability: The data product described in the manuscript is available in zenodo (https://doi.org/10.5281/zenodo.8184285)."

Possible issue with Correlation presentation:

The calculation of correlation between GPS and GRACE (per watershed) is not clear to me, given that you have X GPS time-series and Y GRACE mascon time-series. I suspect there is a missing step, that doesn't seem to be explained: how GRACE data is translated to VLD at the station level. Please explain that.

Thank you for your comment.

0. We derive GRACE(-FO) VLD fields (lon, lat, Up displacement) using Eq. 1 (described in Davis et al., 2004) for each month that GRACE(-FO) was available starting in 2006 (because our GPS timeseries begin in 2006).

1. Subtract the reference period (09/2012) from each monthly up field.

2. GRACE(-FO) fields are estimated at a 0.5-degree spatial resolution (Eq.1). Thus, we extract GRACE(-FO) estimates at the station level by interpolating the vertical displacement from the nearest 0.5-degree grid point neighbors to the station's location.

We added the following sentences in the main text.
JPL releases gridded mascon fields, to derive spherical harmonics (C and S in Eq. 1). We transform fields of equivalent water height to normalized harmonic coefficients using the inverse of Eq. 9 in Wahr et al. (1998). Like GPS, we subtract the GRACE(-FO) vertical displacement field of September 2012 from each monthly field to establish a common reference basis. GRACE(-FO) fields are estimated at a 0.5-degree spatial resolution (ϕ, λ in Eq.1). Thus, we extract GRACE(-FO) estimates at the station level by interpolating bilinearly the vertical displacement from the nearest 0.5-degree grid point neighbors to the station's location."

Furthermore, I don't see how a poor correlation can be attributed to a single station (as the case for St. Lawrence) ; this is assuming that the authors didn't mean to say that there was a missed GPS offset in all of the time-series, which seems unlikely.

You are right. The issue with the missed offset affected almost 25% of the stations located in the St. Lawrence watershed. We revised the manuscript and provide the exact number of stations affected (62) relative to the total number of sites in the watershed (243) (See Line 272).

Minor points:

Line 85. Kreemer and Blewitt did not introduce the term CMN, but rather used the term CMC (common mode components), which was first introduced by Tian and Shen (2016)

True. Thank you. We changed the reference to Tian and Shen, 2016.

Line 118. Originally is not used properly in this contextLine 118. "layout" should read "lay out"

Thank you. Done!

line 126-127: "We overcome CMC's limitation of include spatially correlated hydrology signals...". This sentence is grammatically not correct, nor is the context clear: which limitation? That includes both noise and unmodeled signal?

We strive to isolate noise from signal, thus we were interested in deriving the common-mode component reflecting surface hydrology signals and removing it from the respective GPS timeseries. We revised the sentence accordingly: We build on the existing CMC algorithm to remove hydrology signals from the error estimate by deriving surface loading signals from a hydrology model and removing them from the GPS up displacements (see Section *3 for more details)*.

Line 192: I think P_lm is missing in front of "are the associated Legendre polynomials"

Thank you. The typo is now fixed.

Line 220: "*A* and *B* being the amplitude and phase". That is not how formula 2 is written, which is erroneous, should be A*cos(2*pi*t+B)

Thank you. The typo is now fixed.

Line 302-303: "We identified the need for antenna offset corrections (in the case of Great Lakes)". Before the St. Lawrence watershed was named in this context, now Great Lakes. Later (line 458) Lake Michigan is mentioned. Which is it?

Thank you. The sites are located in the Great Lakes region of the State of Michigan, which belongs to the southern west end of the St. Lawrence watershed. To avoid confusion, we refer consistently to the sites, as "sites located in the Great Lakes region" and we provide some more detail on the number of the stations affected by the offset issue.