Review: "Global satellite gravity data products for prompt detection of short-term Mass Change (MC)"

General:
This paper joins an alternative trend in using directly range-acceleration reduced observations as a means to detect mass changes on the Earth's surface. Here, the work focuses on presenting a global time series dataset of Line-of-Sight Gravity Differences (LGDs) from (1) KBR/LRI reduced observations, (2) synthesised monthly solutions (i.e. L2), and (3) synthesised from a climatology model (i.e. climatology from monthly L2) for GRACE-FO only (2018-2024).

I recommend that this paper be returned to the authors, subject to many **technical corrections**, which are required to make the article and dataset more reproducible.

Abstract:

1) Line 16: Well, if it is at satellite altitude level, it is not "in-situ". Please rephrase.
2) Line 17: Be specific, which LGD dataset in particular? The monthly L2 or climatology will surely not show any sub-monthly signals.
3) Line 19-20: not entirely sure where 5-6 days comes from? This would mostly refer to a relatively "good" ground coverage.
4) Line 23: Please rephrase "termination", due to the ground repeat properties of the orbit, this is not fully accurate.

Introduction:

1) Line 70: Additionally, one essential aspect of these "daily" solutions is that, effectively, their temporal resolution is not "daily" due to temporal correlation.
2) Line 107: "minimally affected by modeling and post-processing," this is can be highly debatable. To have useful LGD datasets, you need to choose a de-aliasing product (AOD1B), an ocean tide model (there are many), a static gravity field, time filtering is also an essential aspect (how to remove low and high frequency noise?), …
3) Line 109: it does enhance temporal resolution however the spatial resolution is purely limited to the latitudinal coordinate.
4) Line 112: again provide some rationale/explanation/source for the 5-6 days.

Section 2:

2.1:
1) Provide some more details on how did you manage the "interpolation" between consecutive AOD1B 6/3hourly solutions.
2) The same but slightly different mention of how the tidal ocean model is evaluated should be made more explicit.

2.2:
1) provide the numerical differentiation algorithm for completeness and reproducibility
2) same for the temporal frequency filtering.
3) make explicit what part of the reference gravity field are these LGDs w.r.t. Conventionally speaking one should only remove the static part such that the full temporal gravity field signal would be conserved in your dataset.
4) Line 186: actually the transfer function can be used up to 0.9 mHz, with 1 mHz being a highly conservative loss of signal.
5) Line 186-187: not very understandable which "higher frequencies" you mean. Provide more explicitly the band-pass range.

2.3:
Line 199-207:
- what is the rationale to use CSR's monthly solutions? In your case and selection of ocean tidal (and static) models, the best would be to use TU Graz's solutions. A rationale should be provided, and a check of the effect of different solutions should be conducted.

- second, I see an issue with the truncation of a field with a max degree 96 to degree 60. You will have several issues related to truncation errors. Why not just take a field with max degree 60 in the first place? I see that this could be quite an issue.
- provide the Release of the CSR solutions + citation for reproducibility.
- what is the difference between KBR/LRI residuals and L2 below frequencies of 1 mHz? Why is this replacement even made, please provide some form of rationale for this.

Line 209-213:
Beware that now your climatological fit is also influenced by the effect related to the prior mission (GRACE). Did you remove any solutions in this climatological fit? And if yes, which ones and why (not)?

Before synthesis/climatological fit, did you perform any form of filtering (i.e. Gaussian, DDK, …)?

2.4:
What filter was used? What are the variables used for it? This information is missing.
You are not showing the signal below 1 mHz, which you mention needs to be replaced by L2. I would this needs to be added for clarity and completeness.

Line 241: explain what you mean by "a full-spectrum gravity change signal is sought after.". Which degrees are currently being "removed" or filtered. This should be made explicit for data users.

Section 3:

3.1.

1) What is the reasoning for using .txt as a file format? Aren't there more space efficient data formats which would aid in the usage of this dataset?
2) How were the mid longitude, latitude and most importantly altitude computed? This is important information because there is a difference between simple altitude mean (i.e. (alt_1+alt_2)/2) and the more geometrically relevant mid altitude due to the orbital curvature. This needs to be added (especially due to the fact that LGDs are related to altitude).
3) Please provide a source of any form to explain the lack of days/files for KBR.

3.2.

1) again essential to mention which components of GOCO06s are used here.
2) provide rationale why the signal you see is hydrological in nature. Reference? Rationale?
3) Line 295: what do you mean by climatological average? This is just the evaluation of LGDs from climatological fit of L2 SH solutions. Needs to be rephrased.
4) I would highly recommend to provide more descriptions and rationale on what is actually observed and not only mentioned as "Their differences are mostly from the instantaneous gravity changes with respect to the monthly mean gravity as reflected by the L2 solutions." This needs some mention and explanation.
5) Line 298: make it more precise. These are extreme events w.r.t the climatological fit but still at monthly resolution.
6) Line 299: "possibly"? This is insufficient. Is this during the monsoon season? Explain.
7) Line 305-307: provide a reference for the LRI comment.
8) Line 308: "ultra-long"? I would rephrase to simply long-wavelength signals (about below degree/order 5).
9) Line 309: please quantify what this fraction is?
10) I highly recommend the use of quantification of signal power (i.e. RMS) to be able to better understand the "power" of the different types of LGD signals.

3.3.

1) Line 311-315: I recommend providing the difference plot to see/verify/validate that these signals are as they should be.
2) Please make the colorbar and its label bigger.

3.4.

1) Figure 8: increase the size of the colorbar and its label.
2) Lines 370-375: I do not follow what/why you are Gaussian filtering the time series. Please rephrase and improve for readability.

Section 4:

4.2.
Very interesting methodology of standardisation.

1) Line 477:" evident short-term wiggles" rephrase and provide quantification.
2) Line up to 481: you did not see the effects of the so-called lobes of the LGD observable. Lobes also make the localization of geophysical signals in small regions much more complicated.
3) Line 488: it is unclear what you mean by "sub-monthly" dynamics when mentioning the L2 based solutions. These are monthly by definition.
4) I would highly recommend adding these indices as supplement datasets.

Section 5:

5.1.

1) I would recommend of adding these difference in ocean tidal models as there are significant in frequency domain.
2) Explain still the benefits of using GOCO06s either way if you either way remove frequencies above 10 mHz for the more "reliable" KBR version.
3) The noise models you are providing are not very accurate and do not follow the noise-dominated section of the spectrum. This must be revised. The simple noise models are clearly not appropriated. There are other "better" analytical models. Please provide the low-frequency noise models too.
4) Given all of these findings, I would provide these results in a summarizing table with a certain "prediction" of total uncertainty. Without the latter it is very difficult to understand what the uncertainty is.

5.2.

1) Here it is essential to mention (highly incomplete):
    a. What is the EWH derived from? Which solution? This needs to be made explicit as a must.
    b. Which post-processing steps were made to result in these EWH time-series? (i.e. filtering? …)
    c. Which LGD is used here? The full band LGD? This needs to be made explicit.
    d. Make explicit by RMS or any other measure than R^2 what the errors of the relationships estimated are.
2) What solution do you propose to correct for such effects? These seem to be quite significant (i.e. LGDs at 450 km are not similar to 550 km).
3) What other orbital effects do you believe could affect the LGDs. Explain why did you limit yourself to these two.

Conclusion:

1) Provide more explanations on uncertainty, this is an essential component of your dataset.
2) Similar for LGD-EWH relations. Make sure you explain what solution was used here.
3) Again not sure about this "climatological mean".
4) Another essential aspect related to altitude and offset effects needs to be added for completeness.