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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Multiresolution wavelet analysis applied to GRACE range rate residuals" *by* Saniya Behzadpour et al.

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We thank the reviewer for their constructive comments. We address the reviewer's comments point by point in this letter, and corresponding changes will be made to improve the manuscript.

(1) The paper introduces six examples of spatio-temporal structures that reveal either previously known or newly discovered systematics in the GRACE KBRR residuals. The view-point taken to look at the data is very different for each example, and I would recommend to find section head-lines focusing on the view-point instead of the feature identified. From my point of view, there is no need to distinguish between systematics previously known (Fig. 9 and 10) and newly discovered (all other examples) by means

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Discussion paper

of specific sub-sections.

Reply: We understand the reviewer's standpoint here and we do agree on the importance of each viewpoint in introducing our method. However, based on the comments received from the previous submission of the paper, our aim was to emphasize on new findings and insights on the potential error contributors which were not easy to conclude from classic methods.

(2) I see some overlap with methods from the field of visual analytics which might be worth mentioning in the introduction. An example with some remote connection to this study has been published by Dransch et al. (2010).

Reply: We updated the introduction section by adding "The drawback of this framework draw our attention to spatio-temporal approaches, which incorporates data analysis as well as geophysical model validation (e.g. Dransch et al. (2010))."

(3) The summary states that the analysis methods presented here contributed in the end to the improved noise-level of ITSG2016. This claim might be substantiated by citing Chen et al.(2018), who independently validated a range different GRACE releases including ITSG2016 and found particularly low noise levels in the solutions from TU Graz.

Reply: The result of the presented method contributes to the latest GRACE-only gravity field time series from TU Graz, ITSG-Grace2018.

(4) It might be worth to mention in the paper that also other sensors aboard GRACE are required to process gravity fields: Would it be beneficial to use this framework also for accelerometer or star camera analysis? Are there any direct synergies for the analysis of other space missions as, e.g., GOCE?

Reply: We thank the reviewer for highlighting these points. In the discussion section, we added this paragraph in response: "Beside the range-rate observations, the presented framework is also beneficial for the data processing of the other sensors

aboard GRACE or similar satellite missions. The results can potentially detect inconsistent time periods in each set of measurements and provide an initial interpretation of their possible origin."

(5) I'd rather prefer to use 'range-rate' instead of 'range rate'.

Reply: We updated the manuscript accordingly.

(6) It should be mentioned at some point that all KBRR data actually refer to the mid-point of the line-of-sight vector between GRACE-A and GRACE-B, which might be 100 km off the position of GRACE-A. For all plots shown in the paper, however, this offset can be safely neglected.

Reply: The systematic errors in KBR measurements are the sum of different effects from GRACE-A and/or GRACE-B and are mainly caused by the instruments onboard each satellite. Therefore, the errors can sometimes be associated with the GRACE-A or GRACE-B position or a point on the LOS vector, which is not always the mid-point. However, as mentioned by the reviewer, in our analysis this offset is negligible.

(7) p.3 l.21: There is no need to mention the degree 90 or 120 solutions, since those are not considered any further in the paper.

Reply: We applied this correction.

(8) p.5 l.15: Typo: As described... (9) p.6 l.24: Wording suggestion: ...to prove whether or not our... (10) p. 10 l.1: Wording suggestion: The proposed analysis framework confirms known and reveals previously unknown systematics in the residuals that allow for a specifically tailored parametrization in the gravity field retrieval.

Reply to 8-10: We updated the manuscript accordingly.

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