Geosci. Instrum. Method. Data Syst. Discuss.,
https://doi.org/10.5194/gi-2018-50-RC1, 2019

Geoscientific Instrumentation Methods and Data Systems Discussions

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

Anonymous Referee #1

Received and published: 29 January 2019

The twin-satellite mission GRACE has been orbiting the Earth for more than 15 years between 2002 – 2017. GRACE represents an entirely novel observing concept where a suite of very different and highly precise sensors are essential for deriving accurate time-series of time-variable global gravity fields. Many of those sensors were specifically designed for that ground-breaking mission, and even after spending 15 years on the analysis of this data record, there are still many systematics to be identified.

The single sensor most critical for reaching the objectives of the GRACE mission is the precise K-band ranging instrument which is at the focus of the present manuscript. The authors introduce an analysis frame-work based on multiresolution wavelet analysis that allows them to identify systematics in the range-rate residuals that were previously unknown to the scientific community. The paper also indicates that knowledge of those

systematics have been used successfully to tailor parametrizations used in the gravity field retrieval which contributed to a substantially reduced noise floor in the GRACE series processed by the group at TU Graz.

I therefore believe that the paper is a valuable description of a visual analytics frame-work for long data records of a highly sophisticated space-based instrument aiming at the observation of global change. The contribution fits well into the scope of GI. A few comments given below might nevertheless be considered in order to further shape its character as a methodological paper and make it more accessible to a larger audience. I therefore recommend that the paper should undergo a minor revision before publication.

(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 focussing on the view-point instead of the feature identified. From my point of view, there is no need to distiguish between systematics previously known (Fig. 9 and 10) and newly discovered (all other examples) by means of specific sub-sections.

(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).

(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 substantinated 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.

(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 benefitial 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?

A few minor points might also be considered during the revision:

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

(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.

(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.

(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.

Dransch, D., Köthur, P., Schulte, S., Klemann, V., Dobslaw, H. (2010): Assessing the quality of geoscientific simulation models with visual analytics methods - a design study. - International Journal of Geographical Information Science, 24, 10, pp. 1459-1479. DOI: http://doi.org/10.1080/13658816.2010.510800.

Chen, Q., Poropat, L., Zhang, L., Dobslaw, H., Weigelt, M., van Dam, T. (2018): Validation of the EGSIEM GRACE Gravity Fields Using GNSS Coordinate Timeseries and In-Situ Ocean Bottom Pressure Records. - Remote Sensing, 10, 12, 1976. DOI: http://doi.org/10.3390/rs10121976.
