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Improved GRACE preprocessing methodologies: impact on monthly gravity field solutions

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The GRACE (Gravity Recovery and Climate Experiment) satellite mission provides K-band ranging (KBR) measurements between the two twin satellites GRACE-A and GRACE-B for the purpose of gravity field recovery. Although the accuracy of gravity field solutions has evolved considerably during the last years, there still remains an offset between the present error level and the predicted GRACE baseline accuracy. Efforts are made to identify the remaining error sources.

Both unmodeled errors within the Level-1B data products related to the alignment and outliers within the GRACE observations are potential contributors to the error budget.
As the precise inter-satellite pointing is one of the essential requirements for the KBR ranging, we combine both angular accelerometer and star camera data (ACC1B, SCA1B) in a least squares approach to improve the satellites' attitude determination. As a result, the high frequent noise of the attitude data is decreased significantly. In order to benefit from the improvements on the sensor data level, other error sources and disturbances within the GRACE observations have to be identified. Based on these results, we show that even after more than 12 years of mission operation, improved modeling and preprocessing methodologies (e.g.: sensor fusion, outlier detection within the ACC1B data) contribute substantially to the overall accuracy of the recovered monthly gravity field solutions.

The purpose of the presented work is to understand and reduce the impact of possible error sources on the GRACE gravity field recovery.