1. Abstract

Post-fit residuals of satellite-to-satellite tracking measurements of the GRACE and GRACE-FO missions obtained after a common estimation of orbit and gravity field parameters should ideally contain measurement noise with a behavior that meets expectations for the involved sensors. In reality, obtained GRACE and GRACE-FO post-fit range-rate residuals represent a complex superposition of different effects, e.g. of instrumental, environmental and geophysical nature. In this contribution, we focus on the geophysical signals in the post-fit residuals of the LUH GRACE and GRACE-FO time series. We apply band-pass filtering to extract the geophysical signal buried in the residuals and analyze the most distinctive signatures for their spatial and temporal behavior.

2. Data

In this contribution we analyze GRACE and GRACE-FO K-band range-rate post-fit residuals covering the time span 2003-2022. The residuals are obtained as part of the recovery process of monthly solutions [1]. For orbit propagation (state-of-the-art) models were used, among them FES2014B [2] (ocean tides) and AO018-RL06 [3] (non-tidal atmosphere and ocean, atmospheric tides).

3. Exemplary Residuals (Jan. 2008/2021)

![Graph](image)

Fig. 1: (left) Power spectral density of exemplary GRACE and GRACE-FO residuals.
Fig. 2: (right) Time series of GRACE and GRACE-FO residuals. Blue: full signal; red: band-pass filtered signal containing geophysical information.

4. Mean Filtered Residuals

![Graph](image)

Fig. 4: Mean of absolute filtered K-band range-rate post-fit residuals. Band: 1-9 mHz. Colorbar in m/s.

5. K-band Range-Accelerations

For the purpose of a better localization of the geophysical effects, we will have a look on K-band range-accelerations. We band-filter the range-rate residuals from 5e-7 Hz to 5 mHz. Then the filtered range-rate residuals are numerically differentiated with the help of a moving window polynomial of degree 6.

6. Regional Analysis of Range-Accelerations

The residual range-accelerations are analyzed in four exemplary regions (see Fig. 5).

For each region a daily RMS of the range-acceleration residuals is computed (see Fig. 6).

![Graph](image)

Fig. 6: Time series of regional daily RMS of range-accelerations in the Amazon basin.

7. Conclusions

Studying GRACE and GRACE-FO range-rate and range-acceleration post-fit residuals is important for understanding residual tidal and non-tidal mass variations.

References


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