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Assessment of GRACE-FO Laser Ranging Interferometer measurements

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The performance of Gravity Recovery and Climate Experiment Follow□On (GRACE-FO) laser ranging interferometer (LRI) system is assessed in both space and frequency domains. With LRI's measurement sensitivity being as small as 0.05 nm/s^2 at GRACE-FO altitude we perform a thorough assessment on the ability of the instrument to detect real small-scale high-frequency gravity signals. Analysis of range acceleration measurements along the orbit for nearly one year of daily solutions suggests that LRI can detect signals induced by mass perturbation up to 26 mHz, i.e., ~145 km spatial resolution. Additionally, high frequency signals that are not adequately modeled by dealiasing models are clearly detected and their magnitude is shown to reach 2-3 nm/s^2. The alternative K□band microwave ranging system (KBR) is also examined and results demonstrate the inability of KBR to retrieve signals above 15mHz (i.e., shorter than ~200 km) as the noise of the KBR range acceleration increases rapidly. Overall, the first stream of LRI measurements shows that the high signal to noise ratio allows for detection of mass transfers in finer scales, however the ability to fully exploit the high-quality signal measured by the LRI in Level 2 products is still constrained by noise of background models and other onboard instrumentation and measurement system errors.

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