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Inferring regional surface mass anomalies from GRACE KBRR data by energy integral approach

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Abstract: GRACE mission provides an effective technique to detect the mass redistribution through its effects on Earth gravity. Although the mass anomalies on the earth's surface inferred from the monthly average of the spherical harmonic coefficients has been largely successful, this approach has not revealed the submonthly time scale information and fundamental resolution of the GRACE observations. As the GRACE K-band range rate (KBRR) can reveal the local signature more sensitively, the regional recovered approach based on regional basic function is offered to recovery the local mass redistribution with submonthly and high spatial resolution. We established an approach to estimate regional surface mass anomalies by inverting GRACE-based potential difference anomalies at satellite altitude. Spatial constraints versus spherical distance between the mass concentrations are introduced to stabilize the linear system to eliminate the effects of the north-south striping. The efficiency of our approach has been validated using a closed-loop simulation study over South America. It is demonstrated that spatial constraints assist the solutions on reducing striping error inherent in the measurement configuration and temporal aliasing. Finally, time series of 10-day and 30-day regional surface mass anomalies over Tibet plateau also prove to be consistent with independent hydrological models. The time series of mass anomalies reveal the seasonal changes in the source area of three rivers and the accumulation in the north-east Gan-Qing block and Tibet block.
Keywords: regional surface mass anomalies, GRACE KBRR, spatial constraints

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