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Supplementing the GRACE Mission with Time Variable Gravity Variations from Satellite Laser Ranging

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The analysis of Satellite Laser Ranging (SLR) data can provide an invaluable supplement to the GRACE mission by monitoring the lower degree portion of the time-varying gravity field to bridge the anticipated gap between GRACE and the proposed GRACE Continuity Mission. Monthly estimates of the long-wavelength gravity variations have been determined from analysis of the SLR tracking of five geodetic satellites. These estimates are a part of the process that routinely determines monthly J2 estimates for GRACE science applications. Comparison shows a good agreement between the estimates from GRACE and SLR for the annual mass variations (up to degree and order 5). There is particularly good agreement for the larger signals associated with the significant seasonal mass changes over the Amazon and other areas. In addition, the recent ice-mass loss over Greenland and Antarctica is observed by the SLR measurements. The spatial resolution of the current estimates is limited by the number of appropriate SLR targets. The upcoming launch of the LARES satellite orbiting at $\sim$1400 km altitude (in a orbit inclination of $\sim$70 degrees) is expected to improve the SLR satellite constellation for separating the gravity signals. Current efforts for improving the model for the non-gravitational effects are directed towards reducing their impact on the time variable gravity estimates. An additional opportunity for improving the resolution of the gravity field estimates could be possible if at least one of the GRACE satellites is capable of continuing to collect GPS tracking and Accelerometer data. The progress on these issues as well as plans for future activities are summarized in this presentation.