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Interannual and annual variations in the long-wavelength gravity field from GRACE and SLR

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Temporal variations of the Earth's gravity field have been observed by studying the perturbations of orbiting satellites using Satellite Laser Ranging (SLR) for over twenty years. The Gravity Recovery And Climate Experiment (GRACE) mission is opening a window on details of the global mass budget and will have better clarity than earlier missions, but it will not assess the state of the Earth's water mass budget prior to the mission, especially over the critical last quarter of the 20th century. However, GRACE will serve as a measuring stick by which the existing gravity change observation technologies can be calibrated, thereby leveraging GRACE into the historical record of seasonal to decadal scale observations of gravity. The first step in applying GRACE to the problem of improving the historical record is to assess the level of agreement with the SLR and Doppler Orbitography and Radio Positioning Integrated by Satellite (DORIS) derived time variable gravity data series. This set of comparisons is focused on the annual and inter-annual signals up to spherical harmonic degree 4 (wavelengths of $>$5000 km), as well as a look at the differences between the mean signals. Comparisons have shown reasonable agreement in terms of the component time series such as C/S2,1, as well as the net annual and semiannual variations. Geographically, similar results are seen through a typical year in terms of equivalent water mass height over the Amazon, the monsoons in Southeast Asia, and Africa, Europe, and Western Asia.