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Deceleration in the Earth's oblateness and ice sheet mass changes

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For over three decades, satellite laser ranging (SLR) data have recorded the long-term variations in the long-wavelength components of the Earth's gravity field. A significant part of this signal is due to the readjustment of the solid Earth in response to the mass change associated with the formation and melting of the polar ice sheets. Two decades ago, the only clearly detectable secular signal was a linear trend in the Earth's dynamical oblateness, characterized by the gravitational degree-2 zonal spherical harmonic J2. Analysis of the most recent time series of 30-day SLR-based estimates of Earth's dynamical oblateness indicates that the long-term variation of J2 appears to be more quadratic than linear in nature for the period from 1976. Although the primary trend is expected to be linear due to global isostatic adjustment (GIA), there is an evident deceleration (=18($\pm$1)e-13/y**2) in the rate of the decrease in J2 during the last few decades, likely due to changes in the rate of the global mass redistribution associated with the melting of mountain glaciers and polar ice sheets as well as mass changes in the atmosphere and ocean. This paper presents a global constraint on the ice sheet mass changes during the past three decades based on the secular variations in the low-degree coefficients determined from SLR data.