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Secular variations in the low degree gravity field from 33-year SLR data

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The secular changes in the Earth's gravity field are the consequence of the long-term mass redistribution that occurs in the "geophysical fluids" on or within the Earth system components. A significant component of these geophysical phenomena are due to the readjustment of the Earth to glaciations, including, the postglacial rebound, and the mass change associated with the glacial and polar ice sheets. Satellite Laser Ranging (SLR) data have recorded the global nature of these variations for over three decades. Analysis of the monthly solution of J2 derived from a 33-year time series of the SLR data, indicate that in addition to the secular, 18.6-year tidal and seasonal variations, the Earth's dynamic oblateness (J2) has undergone significant interannual and decadal variations. The secular variation of J2 as determined from the linear trend of the J2 variation is affected by the recent large decadal variation. A solution for the secular variations in the zonal harmonics up to degree 7 were determined by analyzing SLR data from 8 geodetic satellites over the 33 year period from January 1976 to March 2009. A set of the lower degree and order geopotential coefficients (including degree 1) derived from the SLR data is analyzed and compared with the monthly solutions from GRACE data.