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 one of the consequences of the long-term mass redistribution that occurs between the Earth system components. 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. Since 1976 satellite Laser Ranging (SLR) data have recorded the global nature of these variations. In this presentation, the secular variations in the zonal harmonics up to degree 7 are presented. The results are determined by analyzing SLR data from 8 geodetic satellites during the 33-year period from January 1976 to May 2009. Analysis of the monthly solution for J2 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, which are climate, related. The results indicate that determination of the secular variation of J2 is affected by the recent large decadal variation. The sequence of monthly and long-arc solutions is used to obtain estimates of the zonal rates (up to degree 7) and the associated uncertainty.