Precise modeling of solar radiation pressure acceleration for spherical geodetic satellites

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Solar radiation pressure (SRP) is one of the largest non-conservative perturbation factors for Earth-orbiting satellites. The magnitude of the acceleration is proportional to the area-to-mass ratio of the satellite, and also varies in accordance with the characteristics of the reflection of sunlight on the satellite surface. This study aims to improve the SRP model on spherical geodetic satellites based on the specifications of the shape and the surface material. We look into the time series of estimated SRP coefficients of Ajisai, LAGEOS-1, LAGEOS-2, and BLITS with the space-geodetic analysis software "c5++." In particular, the C_R estimates of Ajisai show a clear semi-annual pattern whose amplitude amounts to about 0.7% of SRP acceleration. This is explained well by precisely modeling its non-spherically symmetric cross-sectional area and its non-spherically symmetric surface material. Our study is extended to LAGEOS-1, LAGEOS-2, and BLITS and the long-term behavior of SRP coefficients are related to the optical properties of the surface material.