

Charged particle drag on the LAGEOS satellites

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In order to characterise the LAGEOS dynamical behaviour to the mm level, a study has been made on an important contributor to the LAGEOS non-gravitational perturbations problem: the charged particle drag (CPD), with its two main components, direct collision and scattering drag. Simulations of this effect take into account: spatial and temporal variations of the plasmatic parameters (temperature and concentration of its constituents), spacecraft potential variations caused by both the eclipse passages and the parameters mentioned above, and solar and geomagnetic conditions. Furthermore, recent theoretical improvements by the authors concerning scattering drag overcome previous limitations allowing for a complete formulation of the problem. In addition, the electromagnetic force due to the interaction between internal currents and the Earth's magnetic field has been calculated, albeit its value makes this contribution negligible ($0.1 \text{ } \mu\text{m s}^{-2}$).

For each satellite the lifetime CPD instantaneous acceleration is computed. The plasmatic parameters have been obtained from the SCTIP semi-empirical model. Results show that maximum amplitudes for LAGEOS-I are larger than those for LAGEOS-II, due to the almost (magnetically) polar orbit configuration for the former satellite. Furthermore, the calculated instantaneous values exceed those provided in previous studies. Results also show the large impact of high solar activity as well as high magnetic activity on the accelerations. These results will be used in a refined orbit computation in a subsequent investigation.