

The Precise orbital determination of Earth satellites: a tool for investigating the atmosphere ?

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In the present decade Earth's explorer missions like CHAMP, GRACE and GOCE are going to dramatically improve the knowledge of the Earth's gravity field. Such improvement has lowered indeed the threshold of gravity field uncertainties which affects the orbital motion of Earth satellites.

Previously it was demonstrated that subtle effects due to Earth tides, atmospheric drag, solar radiation pressure and general relativity which before were choked by the gravity field uncertainties, now prevails on classical gravity field uncertainties.

Thus with the present work we try to prove that the tremendous improvement of the gravity field models could make feasible the use of precise orbit determination of Earth satellites as a tool for sensing a global changes of some key atmosphere parameters like refractivity and extinction. Furthermore the huge number of running Earth's satellites and combinations of their orbital parameters (namely the nodes) in a gravity field free fashion (GF-free) can magnify the solar radiation pressure acting on high Earth's Satellites (like GPS or Etalon satellites) and its smooth modulation through the Earth's atmosphere (penumbra). We would remind that The GF-free technique is able to cancel out with n satellite orbital parameters the first $n - 1$ even zonal harmonics of the gravity field. We outline that the GF-free technique was before widely applied for measuring subtle general relativistic effects like the gravitomagnetic field.