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Impact of temporal variations of the gravity field on the polar motion derived from SLR data

Florent Deleflie (1), David Coulot (2), Bertrand de Saint-Jean (1), Olivier de Viron (3), Pierre Exertier (1), and Olivier Laurain (1)

(1) Observatoire de la Côte d'Azur. GRGS, Geoazur, Av. N. Copernic, F-06130 Grasse (Florent.Deleflie@obs-azur.fr, +33 493405333), (2) nstitut Géographique National / LAREG – GRGS, ENSG-LAREG 6 et 8 Avenue Blaise Pascal, Cité Descartes, Champs sur Marne, F-77455 Marne la Vallée , (3) Université Paris Diderot – Institut de Physique du Globe de Paris – Géophysique spatiale et planétaire – Bâtiment Lamarck, 5 rue Thomas Mann, F-75205 Paris Cedex 13

In this paper, we use SLR data tracked by the ILRS network over the last twenty years to derive time series of Earth Orientation Parameters, as well as time series of low wavelengths of the Earth's gravity field. The work is based on post-fit residuals analyses, performed with the stacking of weekly-orbital arcs of the constellation of geodetic spherical satellites, and a least-square fit of dynamical model of spacecraft motion to the tracking data.

This paper aims at evaluating the impact of satellite orbital errors in the time series delivered by ILRS, and through the polar motion time series in particular. The framework is the 1mm accuracy level goal. Two approaches are led in parallel. In the first approach, EOP and the degree 2 time series are deduced simultaneously by inverting the whole normal equation system coming from the stacking of each weekly orbital arc. This means that the accuracy of each orbit is not questioned, except though empirical parameters, when inverting the normal system. In the second approach we determine long time series of EOP with orbits propagated and adjusted with a-priori values of the Earh gravity field determined from the first step. This second approach is supposed to provide better EOP time series than the first one, assuming that the orbital plane of each satellite is modelled more accurately.

Time series are then analyzed and compared. We show in particular the impact of the Earth gravity field modelling, accounting or not for the temporal variations, with annual and semi-annual periods, deduced from the GRACE mission. EOP time series a priori values come from IERS, or from geodetic excitation time series. The EOP time series that we obtain are compared to what is predicted by geophysical models, as well.