Geophysical Research Abstracts
Vol. 18, EGU2016-10452, 2016
EGU General Assembly 2016
© Author(s) 2016. CC Attribution 3.0 License.

Effects of the observed J_2 variations on the Earth's precession and nutation

José M. Ferrándiz, Tomás Baenas, and Santiago Belda
Universidad de Alicante, Space Geodesy Group, Dept. Matematica Aplicada, EPS, Alicante, Spain (jm.ferrandiz@ua.es)

The Earth's oblateness parameter J_2 is closely related to the dynamical ellipticity H, which factorizes the main components of the precession and the different nutation terms. In most theoretical approaches to the Earth's rotation, with IAU2000 nutation theory among them, H is assumed to be constant. The precession model IAU2006 supposes H to have a conventional linear variation, based on the J_2 time series derived mainly from satellite laser ranging (SLR) data for decades, which gives rise to an additional quadratic term of the precession in longitude and some corrections of the nutation terms. The time evolution of J_2 is, however, too complex to be well approximated by a simple linear model. The effect of more general models including periodic terms and closer to the observed time series, although still unable to reproduce a significant part of the signal, has been seldom investigated.
In this work we address the problem of deriving the effect of the observed J_2 variations without resorting to such simplified models. The Hamiltonian approach to the Earth rotation is extended to allow the McCullagh's term of the potential to depend on a time-varying oblateness. An analytical solution is derived by means of a suitable perturbation method in the case of the time series provided by the Center for Space Research (CSR) of the University of Texas, which results in non-negligible contributions to the precession-nutation angles. The presentation focuses on the main effects on the longitude of the equator; a noticeable non-linear trend is superimposed to the linear main precession term, along with some periodic and decadal variations.