

# NON-RIGID EARTH ROTATION SERIES

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## SUMMARY

The last years a lot of attempts to derive a high-precision theory of the non-rigid Earth rotation was carried out. For these purposes the different transfer functions are used. Usually these transfer functions are applied to the series representing the nutation in longitude and in obliquity of the rigid Earth rotation with respect to the ecliptic of date. The aim of this investigation is a construction of the new high-precision non-rigid Earth rotation series (SN9000), dynamically adequate to the DE404/LE404 ephemeris over 2000 years, which are expressed as a function of Euler angles  $\psi$ ,  $\theta$  and  $\phi$  with respect to the fixed ecliptic plane and equinox J2000.0. *The early stages of the previous investigation:* 1. The high-precision numerical solution of the rigid Earth rotation have been constructed (V.V.Pashkevich, G.I.Eroshkin and A.Brzezinski, 2004), (V.V.Pashkevich and G.I.Eroshkin, Proceedings of Journees 2004). The initial conditions have been calculated from SMART97 (P.Bretagnon, G.Francou, P.Rocher, J.L.Simon,1998). The discrepancies between the numerical solution and the semi-analytical solution SMART97 were obtained in Euler angles over 2000 years with one-day spacing. 2. Investigation of the discrepancies is carried out by the least squares and by the spectral analysis algorithms (V.V.Pashkevich and G.I.Eroshkin, Proceedings of Journees 2005). The high-precision rigid Earth rotation series S9000 are determined (V.V.Pashkevich and G.I.Eroshkin, 2005 ). *The next stage of this investigation:* 3. The new high-precision non-rigid Earth rotation series (SN9000), which are expressed as a function of Euler angles, are constructed by using the method (P.Bretagnon, P.M.Mathews, J.-L.Simon: 1999) and the transfer function MHB2002 (Mathews, P. M., Herring, T. A., and Buffett B. A., 2002).

## CONCLUSIONS

1. The exact expressions for the algorithm of Bretagnon et al. (1999) are obtained. 2. The new semi-analytical solution of the non-rigid Earth rotation SMN (SMART97 + MHB2002) is derived. 3. The high-precision non-rigid Earth rotation series SN9000, which are expressed as functions of Euler angles and are dynamically adequate to the ephemeris DE404/LE404 over 2000 years, are constructed. The geophysical models of SMN and SN9000 solutions includes the same effects that model MHB2002. The discrepancies between S9000 and SN9000 minus discrepancies between SMART97 and SMN for the Newtonian case (Dynamical case) and for the relativistic one (Kinematical case) depicted in Figure 1. *The comments to Figure 1:* Kinematical solution of the rigid Earth rotation= Dynamical solution of the rigid Earth rotation + Geodetics corrections; Dynamical solution of the non-rigid Earth rotation= Dynamical solution of the rigid Earth rotation + Transfer function; Kinematical solution of the non-rigid Earth rotation (SMN) = Dynamical solution of the non-rigid Earth rotation (SMN) + Geodetics corrections; Kinematical solution of the non-rigid Earth rotation (SN9000)= Kinematical solution of the rigid Earth rotation (S9000) + Transfer function.

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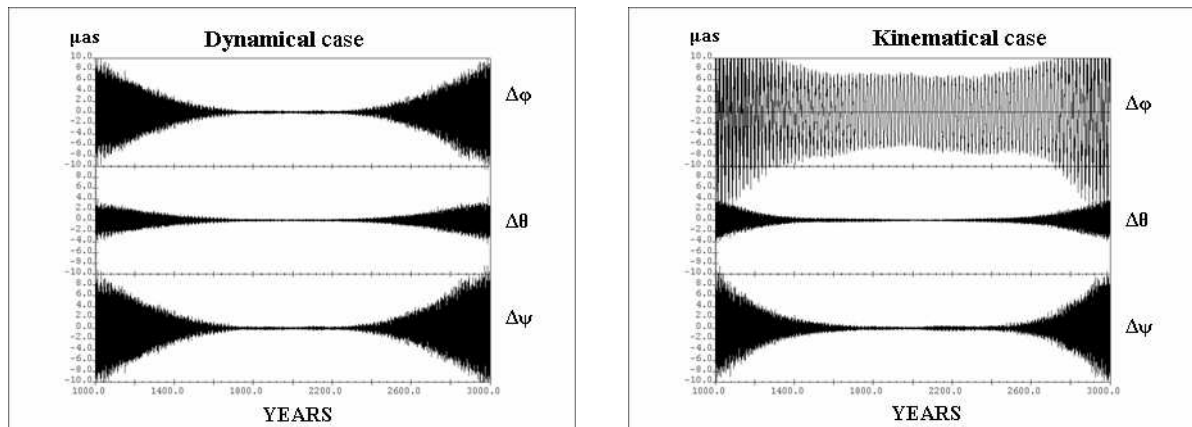


Figure 1: The discrepancies between S9000 and SN9000 minus discrepancies between SMART97 and SMN.

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