INTERACTIVE EARTH ROTATION THROUGH THE WEB

CH. BIZOUARD
SYRTE/UMR8630-CNRS
Observatoire de Paris, 61 avenue de l'Observatoire, 75014 Paris, France
e-mail: christian.bizouard@obspm.fr

ABSTRACT. On the WEB site of the Earth Orientation Center (http://hpiers.obspm.fr/eop-pc) we propose a panel of interactive tools devoted to the study of the Earth rotation : selection and plots of the Earth Orientation Parameters (EOP), numerical analysis of these parameters, real time Earth rotation matrix, comparison of EOP series, and analysis of the geophysical excitation in the Earth rotation fluctuations.

1. INTRODUCTION

One task of the Earth Orientation Center located at the Paris Observatory is to archive various set of Earth Orientation Parameters obtained thourough the world, to validate them, and then to provide by combination a reference series (C04). Whereas pure numbers can satisfy engineer only interested in getting the matrix from the ground to the frame where the satellite orbits are computed, physicist or astronomer need graphical representation and numerical analysis for investigating the astronomical or physical process underlying the Earth rotation variability. For the user it is quite a waste of time to extract time series from the WEB, and then to process them by his own numerical and graphical means. Actually, such tools have been set up on the web site of the Earth Orientation Center, http://hpiers.obspm.fr/eop-pc, thank to the dynamical language PHP and Apache Server. Following sections are devoted to the description and potentiality of these tools.

2. DRAWING OF THE EOP

Our first endeavour has been focused on the selection and the graphical representation of the EOP, first of all, the reference combined series C04. Presently it is possible to draw any time series : combined, operational, long term EOP time series, between two selected dates, with choice of the format of the date (civil date / modified julian date / besselian year). The considered cases are the following :

- polar motion x time series
- polar motion y time series
- polhody (x,-y)
- UT1 - UTC

- UT1 - TAI
- Excess of the lenght of day (LOD)
- Earth rotation rate (only for reference combined series C04)
- Nutation offset in longitude $d\psi$ time series, with respect to IAU 1980 nutation model
- Nutation offset in longitude $d\varepsilon$ time series, with respect to IAU 1980 nutation model
- Nutation offsets $(d\psi \sin \varepsilon_0, d\varepsilon)$ in the mean equatorial plane
- Nutation offset dX time series, with respect to IAU 2000 nutation model
- Nutation offset dY time series, with respect to IAU 2000 nutation model
- Nutation offsets (dX, dY) in the mean equatorial plane

These EOP parameters can also be printed on the WEB browser rather than drawed. An useful option allows the user to remove from the length of day the well modeled contribution of the zonal lunisolar tides.

3. COMPARISON OF EOP SERIES

One important task of our service is to provide comparison of the operational EOP series with respect to the combined series C04 (standard deviation, bias). Now this comparison has been extended to any kind of series, long term or operational, and time interval for the comparison can be chosen. The differences between series can be either plotted or submitted to FFT or least square fit of any harmonic component and polynomial trend.

4. NUMERICAL ANALYSIS OF THE EOP

Numerical analysis of the EOP is presently available through the WEB. It is restricted to long term series (at least 3 years of data), including the combined C04 series. The proposed tools are the following : data selection, data plotting, spectral analysis, periodogram, least squares fit of any harmonic component and plynomial, Vondrak filtering, Singular Spectral Analysis. The implementation of these tools is based upon an interface toward FORTRAN and C executables, especially the C library MIMOSA developped by S. Lambert.

5. ROTATION MATRIX

For practical purposes or tests we provide the rotation matrix from the terrestrial frame to the celestial frame including a prediction of 6 months. Such tool is of primary interest for geodesy or orbitography. We provide also derived parameters, especially the component of the instantaneous rotation vector within the crust or the celestial reference frame. It is possible possible to set independently polar motion, UT1-UTC and nutation offsets to zero, as well to include diurnal and semidiurnal effect associated the oceanic tides.

6. EXCITATION OF THE EARTH ROTATION

Among all the users, geophysicist will have particular interest in the interactive comparison the atmospheric angular momentum to the total excitation found in polar motion, length-of-day

and nutation. The time interval can be selected, but also the Chandler frequency, the Free Core Nutation frequency, and their respective quality factors, which are critical parameters for computing the equatorial excitation functions.

7. CONCLUSION

To our knowledge interactive tools on WEB for studying the Earth rotation were not available. By a few "clicks" they provide a clear and flexible representation of the phenomena involved in the Earth rotation, as well as fast numerical analysis and intercomparison of the involved time series. This is also a easy way to watch at the last fluctuations of the Earth rotation, and to detect possible episodic effects. We hope to design far more sophisticated tools in the near future.

Aknowledgements : our thanks to J. B. Nguyen, who has set up Appache Server, T. Carlucci for his advises in PHP programming, and S. Lambert for making available the library MIMOSA.

8. REFERENCES

http://hpiers.obspm.fr/eop-pc
http://php.net