The 5^{th} IVS General Meeting Proceedings, 2008, p. 199–202

WEB Tools and WEB Service of the IERS Earth Orientation Centre

Christian Bizouard, Oliver Becker

Observatoire de Paris / SYRTE, France

Abstract. Since 2003 have been developed on the web site of the Earth Orientation Center (http://hpiers.obspm.fr/eop-pc) 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, Earth rotation matrix, comparison of EOP series, and analysis of the geophysical excitation responsible of the Earth rotation fluctuations. Those interactive tools are now completed by web service, that are downloadable executables of which input data on located on our web server.

1. Introduction

One task of the Earth Orientation Center located at the Paris Observatory is to archive various sets of Earth Orientation Parameters (EOP) obtained throughout 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 (sec. 4, 6) 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 [1], thank to the dynamical language PHP [2] and Apache Server. Following sections are devoted to the description and potentiality of those tools. For routine tasks, downloading of our data by the use of those tools or FTP may appears heavy. To escape to such a concern we started develop web service (sec. 7).

2. Drawing of the EOP

Our first endeavour has been focused on the selection and the graphical representation of the EOP, first of all. 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, correspondent quantity free from zonal tides effect,
- UT1–TAI, correspondent quantity free from zonal tides effect,
- excess of the length of day (LOD), correspondent quantity free from zonal tides effect,
- 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,
- time derivative of x pole coordinate,
- time derivative of y pole coordinate.

These EOP parameters can also be printed on the web browser rather than drawn.

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). This comparison can be done for a selected set of the most representative EOP series: combined EOP series (long term C01, operational C04 and Bulletin A); operational series by techniques (9 GPS, 14 VLBI, 7 SLR, 2 DORIS, 1 optical series). After selection of two series and the period for comparison, both series can be compared graphically and their differences can be put into a ASCII file, plotted (with statistics), submitted to FFT or least square fit of any harmonic component and polynomial trend.

4. Numerical Analysis of the EOP

The here-above mentioned series can be drawn and treated by using various tools of numerical analysis: interpolation, spectral analysis, periodogram, least squares fit of any harmonic component and polynomial, Vondrak smoothing, Singular Spectral Analysis. The implementation of these tools is based upon an interface toward FORTRAN and C executables, especially the C library MIMOSA developed by S. Lambert (Observatoire de Paris).

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 semi-diurnal effect associated the oceanic tides.

6. Excitation of the Earth Rotation

Among all the users, geophysicist will have particular interest in the interactive comparison of the atmospheric and oceanic 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. Until now the choice of atmospheric and oceanic data is restricted to NCEP reanalysis model and ECCO model respectively, but we project to extend that choice in the future.

7. Web Service

Since 2008, a user can obtain download on his computer executables, of which the run calls EOP or related data on the Paris Server hpiers.obspm.fr during the execution. That avoids to open web page or FTP connection for downloading the basic data, and that simplification is precisely the essence of web service. Executables are designed for Windows (work in the command line mode with the MSDOS windows) and Linux. Until now we proposed two downloadable executables.

- First one permits to obtain the EOP (combined series C04) from the civil date.
- Second one permits to obtain the Earth Orientation Matrix from the international terrestrial reference system to the international celestial

reference frame at a given instant. It can be helpful for tracking celestial body from ground station with a high precision.

Once downloaded such executables can be integrated in any kind of program: FORTRAN, C, C++, Perl, PHP and do not require the knowledge of the location of the underlying data, which are automatically downloaded from our server.

8. Conclusion

Interactive tools on web for studying the Earth rotation have been developed at the Earth Orientation Center of the IERS since 2003. 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 inter-comparison of the involved time series. This is also an easy way to watch at the last fluctuations of the Earth rotation, and to detect possible episodic effects. We have started to develop web service which allow the user to get the most recent real time data without any programming. Design of more sophisticated tools according to the needs of the VLBI community and more specifically specialist of the Earth rotation will continue in the future.

References

[1] http://hpiers.obspm.fr/eop-pc.

[2] http://php.net.