3.5 Product Centres

3.5.1 Earth Orientation Centre

This section presents the activities and the main results of the Earth Orientation Centre located at Paris Observatory over the year 2010. According to the IERS Terms of Reference, the Earth Orientation Centre is responsible for monitoring Earth orientation parameters including long term consistency, publications for time dissemination (DUT1) and leap second announcements. Earth Orientation Parameters (EOP: Polar motion, Universal Time (UT1), Length of Day (LOD) and Celestial pole offsets) are made available to a broad community of users in various domains such as astronomy, geodesy, geophysics, space sciences and time.

EOPs are given in the form of combined solutions obtained from the Technique Centers (IGS, IVS, ILRS and IDS). Various solutions are computed: a long-term solution (IERS C01) since 1846 and the Bulletin B given at one-day intervals published monthly with a 30 day delay. Bulletin B is updated in the operational C04.

Another issue is the maintenance of the consistency between the EOP system and the terrestrial reference frame. So far, Earth Orientation Parameters and the terrestrial frame are separately computed. This leads to increasing inconsistencies between both of them. At the end of 2009, these inconsistencies were small but significant for polar motion (about 100 μas). All IERS reference solutions (C01, Bulletin B, C04 as well as Bulletin A derived by the Rapid Service/Predictions Center, US Naval Observatory) were recomputed and aligned to the EOP solution associated to the current ITRF2008 (Altamimi et al., 2011)

Combined daily series: Bulletin B and 05 C04, statistics over 2009–2010

This section gives statistics (Tables 1 to 3) in term of formal errors and WRMS of the combined technique centres and individual solutions with respect to the combined solution Bulletin B and 08C04 over the year 2010. The procedure to achieve the Bulletin B and IERS C04 combined solution is described in Gambis (2004) and Bizouard and Gambis (2009). Only combined solutions derived by the various technique centres are used in the combinations. Statistics concerning individual series are only given as a feedback to the analysis centres.

New format of Bulletin B since January 2010

Bulletin B issued by the IERS EOP Centre was more than 20 years old in 2009. Following a survey among the scientific community, a new presentation is available since January 2010. The new Bulletin B and its content description are available respectively at

<ftp://hpiers.obspm.fr/iers/bul/bulb_new/bulletinb.dat>

and

<ftp://hpiers.obspm.fr/iers/bul/bulb_new/bulletinb.pdf>.

Table 1: Estimated accuracies of individual solutions compared to the combined solutions Bulletin B and 08 C04 over 2009–2010. The satellite techniques provide information on the rate of change of Universal Time contaminated by effects due to non modelled orbit node motion. VLBI-based results have been used to minimize drifts in UT estimates. The star (*) is attributed to series entering the final combination.

Individual solutions		Estimated uncertainties				
		Time	Terrestrial Pole	UT1	LOD	Celestial Pole
			μas	μs		μas
VLBI – 24 h						
EOP (AUS)	01 R 01	3–4d	225	11.4		125
EOP (BKG) *	03 R 02	1–4d	146	8.9		70
EOP (GSFC) *	07 R 01	1–4d	110	9.2		64
EOP (IAA)	05 R 02	1–4d	170	9.6		100
EOP (MAO)	03 R 01	1–4d	155	7.8		110
EOP (OPA)	07 R 01	1–4d	345	10.5		155
EOP (USNO)	06 R 02	1–4d	115	7.8		70
EOP(IVS) *	02 R 01	1–4d	149	4.6		38
VLBI – Intensive						
EOP (BKG) *	03 R 02	1–3 d		18.0		
EOP (GSFC) *	06 R 01	1–3 d		17.3		
EOP (SPBU) *	05 R 01	1–3 d		11.8		
EOP (USNO)	05 R 01	1–3 d		19.1		
SLR						
EOP (ASI)	03 L 02	1d	168		39.4	
EOP (IAA)	02 L 01	1d	189		19.6	
EOP (MCC)	97 L 01	1d	200		–	
EOP (ILRS)*	05 L 01	1d	170		38.4	
GPS						
EOP (CODE)	98 P 01	1d	27		13.1	
EOP (EMR)	96 P 03	1d	48		22.8	
EOP (ESOC)	96 P 01	1d	62		16.8	
EOP (GFZ)	96 P 02	1d	38		14.4	
EOP (IAA)	01 P 01	1d	177		30.7	
EOP (JPL)	96 P 03	1d	45		19.5	
EOP (NOAA)	96 P 01	1d	84		13.2	
EOP (SIO)	96 P 01	1d	45		19.2	
EOP (IGR) *	07 P 01	1d	32		7.7	
EOP (IGS) *	96 P 02	1d	25		8.7	
DORIS						
EOP (IGN)	05 D 01	1d	485			

Table 2: Mean and standard deviation of the differences between various combined techniques solutions and Bulletin B over 2009–2010

EOP	IGS Comb – IERS 08C04		ILRS Comb – IERS 08C04		IVS Comb – IERS 08C04	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
X (μas)	–4	26	–2	166	–1.7	133
Y (μas)	16	24	–23	119	130	168
UT1 (μs)					–1.1	4.1
LOD (μs)	0	8.7	9.6	39.4		
$D\psi \sin\varepsilon$ (μas)					4	32
$D\psi$(μas)					–45	38

Table 3: Mean and standard deviation for Pole components and UT1 of the differences between various combined solutions and Bulletin B over 2009–2010

EOP	Unit	Bull A – Bull B		Comb JPL – Bull B	
		Mean	Standard deviation	Mean	Standard deviation
X	μas	–37	40	–2	38
Y	μas	67	39	3	27
UT1	μs	–1	10.9	–4	12.7

The content of Bulletin B is:

1 – DAILY FINAL VALUES AND PRELIMINARY VALUES OF x, y, UT1–UTC, dX, dY
and their respective uncertainties. The angular unit is milliarcsecond (mas), time unit is millisecond (ms).

2 – DAILY SMOOTHED VALUES OF CELESTIAL POLE OFFSETS (dPsi1980, dEps1980)
with respect to IAU 1980 precession-nutation model and their uncertainties.

3 – EARTH ANGULAR VELOCITY: DAILY VALUES OF LOD, OMEGA AT 0hUTC
LOD: Excess of the Length of Day – 86400 s TAI
OMEGA: Earth angular velocity

4 – INFORMATION ON TIME SCALES: TAI–UTC, leap second announcements

5 – SUMMARY OF CONTRIBUTED EARTH ORIENTATION PARAMETERS SERIES

Long-term series: C 01 (1846–2010)

EOP(IERS) C 01 is a series of the Earth Orientation Parameters given at 0.1 year interval from 1846 to 1889 (polar motion only) and 0.05 year interval from 1890 until now (polar motion, celestial pole offsets, UT1–UTC since 1962). For many decades, the observations were made using mostly visual and photographic zenith telescopes. Since the advent of the space era in the 1960's, the new geodetic techniques were used for geodynamics. Now, the global observing activity involves Very Long Baseline Radio Interferometry (VLBI), Lunar (LLR) and Satellite Laser Ranging (SLR), Global Positioning System (GPS) and more recently DORIS.

The C 01 series was recomputed in the course of 2010 to be consistent with the reference system associated with ITRF2008. It is a composite series based on following temporal solutions:

1846–1899: Fedorov et al. (1972) polar motion solution derived from three series of absolute declination programs (Pulkovo, Greenwich, Washington).

1900–1961: Vondrak et al. (1995) solution derived from optical astrometry analyses based on the Hipparcos reference frame. The series gives polar motion, celestial pole offsets and Universal Time (since 1956).

1962–2008: BIH and IERS solutions (BIH and IERS annual reports).

Mean Pole with respect to the IERS reference origin

The analyses of the observations of space geodesy require performing the transformation between both terrestrial and celestial frames via the Earth orientation parameters. Gravity field models include the tesseral coefficients C21 and S21 coefficients. These terms describe the position of the Earth's figure axis with respect to the Terrestrial Reference Frame. This axis should coincide with the observed position of the rotation pole averaged over the same time period.

The mean polar motion is affected by a long-term drift westward (in the direction 70.7 deg West, rate: 4.2 mas/yr). The mean rotation axis with respect to the IERS Terrestrial Reference Frame can be considered as the long-term trend obtained after filtering out the Chandler and seasonal terms, every year from 1900 to 2009 (Shiskin et al., 1965). Figure 1 represents the polar motion over 2006–2010 and the path of the mean pole since 1900. The coefficients of the IERS (2010) mean pole model are available in Conventions 2010 (Petit and Luzum, 2010). The table is regularly updated and is available at the following address:

<http://hpiers.obspm.fr/eop-pc/>

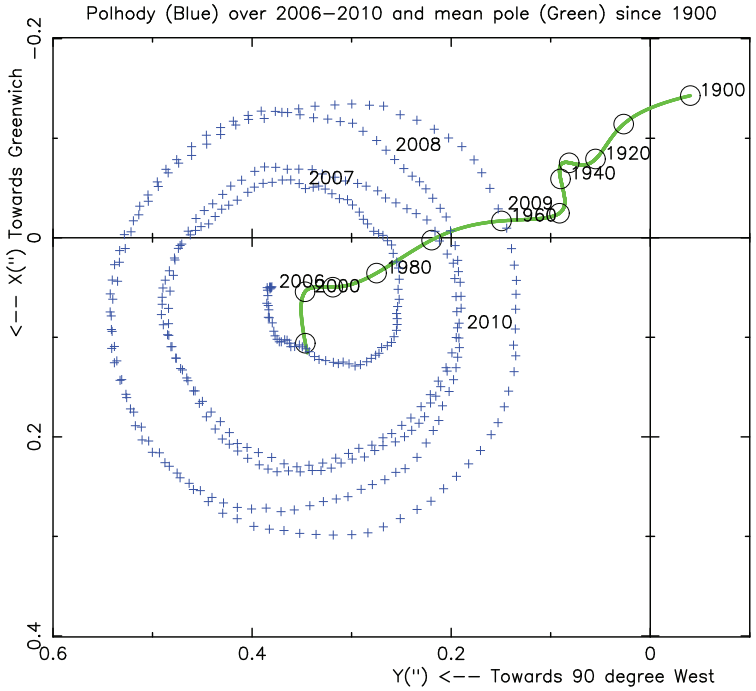

Fig. 1: Mean polar motion (Green line) over 1900–2010 and Bulletin B polhody over 2006–2010 (Blue dots)

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