

## Space-time reference systems for monitoring global change and for precise navigation in space

Models (5 February 2013)

	Phenomenon	Model	References (in IERS Technical Note 36)
General	Speed of light	299792458 ms <sup>-1</sup>	Tab. 1.1
	Gravitational constant of the Earth	3.986004418 × 10 <sup>14</sup> m <sup>3</sup> s <sup>-2</sup>	
	Equatorial radius of the Earth	6378136.6 m	
	Dynamical flattening	3273795 × 10 <sup>-9</sup>	
	Time system	terrestrial time: TT, barycentric time: TCB	
	Terrestrial reference frame (a priori)	ITRF2008/IGb08/SLRF2008/VTRF2008	Chapter 4.2.4; Altamimi et al. (2011)
	Celestial reference frame (a priori)	ICRF2	Chapter 2.2; IERS Technical Note 35
	Ephemerides	JPL ephemerides DE421, if possible	Folkner et al. (2009)
Station coordinates	Solid Earth tides	conventional routine from Dehant & Mathews	Chapter 7.1.1.1
	Permanent tide	conventional tide free system	Chapters 1.1, 7.1.1.2
	Solid Earth pole tide	polynomial trend for mean pole offsets (IERS2010)	Chapter 7.1.4; Tab. 7.7
	Ocean pole tide loading	Desai (2002), if possible	Chapter 7.1.5
	Tidal ocean loading	FES2004; HARDISP.F; CoM-corrected values	Chapter 7.1.2
	Non-tidal ocean loading	not applied	Chapter 7.2
	Tidal atmospheric loading	model (Bernese format) provided by J. Böhm applied	Chapter 7.1.3
	Non-tidal atmospheric loading	model (Bernese format) provided by J. Böhm applied	Chapter 7.2
Earth orientation parameters	A priori EOP	IERS 08 C04 <a href="http://hpiers.obspm.fr/iers/eop/eopc04/eopc04_IAU2000.62-now">http://hpiers.obspm.fr/iers/eop/eopc04/eopc04_IAU2000.62-now</a>	Bizouard and Gambis (2011)
	Interpolation of a priori polar motion	linear interpolation	
	Interpolation of a priori UT1	(1) reduction to UT1R and LODR	Chapter 8.1; Tab. 8.1
		(2) linear interpolation using UT1R and LODR	Chapter 8.1; Tab. 8.1
		(3) conversion to UT1 and LOD	Chapter 8.1; Tab. 8.1
	Interpolation of a priori nutation	linear interpolation	
	Subdaily ocean tidal effects	IERS2010, Eanes (2000)	Chapter 8.2
	Atmospheric tidal effects	not applied	
	Precession-nutation model	IAU 2006/2000A	Chapter 5.6; Mathews et al. (2002)
Free core nutation	not applied, if nutation parameters are estimated; IERS 08 C04 corrections, if nutation parameters are not estimated	Chapter 5.5.5	
Subdaily nutation	IERS2010; Ray et al. (1994)	Chapter 5.5.3.2	
UT1 libration	Brzezinski and Capitaine (2003)	Chapter 5.5.3.3	

Gravity field	A priori terrestrial model	EGM2008	Chapter 6.1; Pavlis et al. (2012)
	A priori lunar model	Konopliv et al. (2001)	
	Solid Earth tides	Mathews et al. (2002)	Chapter 6.2.1
	Permanent tide	conventional tide free system	Chapters 1.1, 6.2.2
	Ocean tides	FES2004	Chapter 6.3; Lyard et al. (2006)
	Solid Earth pole tide	IERS2010	Chapter 6.4
	Ocean pole tide	Desai (2002), if possible	Chapter 6.5
	S1/S2 atmospheric tides	model (Bernese format) provided by J. Böhm applied	
	Non-tidal atmospheric effect	model (Bernese format) provided by J. Böhm applied	
Troposphere (microwave)	Hydrostatic a priori model	computed from 6-hourly ECMWF grids; account for the station and mean grid height differences	Kouba (2008)
	Hydrostatic mapping function	hydrostatic VMF1	Chapter 9.2; Boehm et al. (2006)
	Wet a priori model	none; wet delay estimated	
	Wet mapping function	wet VMF1 = wet VMF	Chapter 9.2; Boehm et al. (2006)
	A priori gradients	none; gradients estimated	
	Gradient mapping function	Chen and Herring (1997)	Chapter 9.2
Trop. (SLR)	A priori model	Mendes and Pavlis (2004)	Chapter 9.1
Ionosphere	Earth's magnetic field	IGRF-11	Finlay et al. (2010)
	First order effect	accounted for by linear combination of multi-frequency observations	Chapter 9.4
	Second order effect	Fritsche et al. (2005) using IGRF-11	
	Third order effect		
	Ray bending	IERS2010	Chapter 9.4.1; Equation (9.37)
Relativistic model	Schwarzschild terms	IERS2010	Chapter 10.3; Equation (10.12)
	Lense-Thirring precession	IERS2010, if possible	
	Geodesic (de Sitter) precession	IERS2010, if possible	
	Gravitational time delay	Shapiro (1969, 1971)	Chapter 11.2; Equation (11.17)
GNSS effects	Phase center corrections for satellite and receiver antennas	<a href="ftp://igs.org/igscb/station/general/igs08_1711.atx">ftp://igs.org/igscb/station/general/igs08_1711.atx</a>	Chapter 7.3.3
	Receiver antenna heights	IGb08.snx + IGSMail/IGSSTATION	
	Horizontal antenna excentricities	IGb08.snx + IGSMail/IGSSTATION	
	Satellite attitude model	nominal attitude; exclude shadow crossings	
	A priori radiation pressure	none	
	Phase wind-up	Wu et al. (1993)	

SLR effects	Center of mass corrections (laser reflector array offsets)	standard corrections from <a href="http://ilrs.gsfc.nasa.gov/missions/spacecraft_parameters/center_of_mass.html">http://ilrs.gsfc.nasa.gov/missions/spacecraft_parameters/center_of_mass.html</a>	
	Range/time biases	ILRS_Data_Handling_File.snx	
	Arc length	7 days	
VLBI effects	Thermal telescope deformations	Nothnagel (2009)	Chapter 7.3.2
	A priori tropospheric gradients	MacMillan and Ma (1997), provided in SINEX format, if available for a specific station; none otherwise	
	Gravitational sag	not applied	