A Comment on Fundamental Geodetic Constants

by Erwin Groten*

(1)	Velocity of light in vacuo:	$c = 299\,792\,458\ ms^{-1}$ (defining constant)
(2)	Newtonian gravitational constant:	$G = (6.672\,59 \pm 0.000\,30) \cdot 10^{-11}\ m^3\ s^{-2}\ kg^{-1}$
(3)	Geocentric gravitational constant (incl. mass of atm.):	$GM = (398\,600.4415 \pm 0.0008) \cdot 10^9\ m^3\ s^{-2}$
	(in TDB):	$GM = 398\,600.4356 \cdot 10^9\ m^3\ s^{-2}$
(4)	Mean angular velocity of Earth's rotation :	$\omega = 7\,292\,115 \cdot 10^{-11}$ rad s^{-1} (rounded)
(5)	Zonal second-degree geopotential parameter (tide-free):	$J_2 = (1082.6269 \pm 0.0006) \cdot 10^{-6}$
	(incl. zero-frequency tide):	$J_2 = 1082.6362 \cdot 10^{-6}$
(6)	Geopotential at the geoid:	$W^0 = (62\,636\,857.5 \pm 1.0)\ m^2\ s^{-2}$ (Bursa et al.)
		$W^0 = (62\,636\,856.26 \pm 1.0)\ m^2\ s^{-2}$ (Rapp)
	Geopotential scale factor:	$R_0 = W^0 / GM = 6\,363\,672.40 \pm 0.1)$ m
(7)	Mean equatorial radius of Earth's ellipsoid:	$a = (6378\,136.55 \pm 0.1)$ m
(8)	Parameter H = (C-(A+B)/2) in precession constant:	$H = 0.003\,272\,9567 \pm 2 \cdot 10^{-9}$
(9)	Mean equatorial gravity:	$g_e = (978\,032.74 \pm 0.08) \cdot 10^{-5}$ m s^{-2}
(10)	Earth's polar flattening (tide-free):	$1 / f = 298.258 \pm 0.001$
	(with indirect zero-frequency tide incl.):	$1 / f = 298.257 \pm 0.001$
(11)	Factor of potential of centrifugal force:	$q = (3461.390 \pm 0.002) \cdot 10^{-6}$
(12)	Equatorial flattening:	$1 / f_1 = 91\,500 \pm 100$
(13)	Longitude of semi-major axis of equatorial ellipse:	$\lambda_1 = -(14.95 \pm 0.05)\ °$
(14)	Moments of inertia of Earth (tide free):	$A = (8.0094 \pm 0.0003) \cdot 10^{37}\ kg\ m^2$
		$B = (8.0096 \pm 0.0003) \cdot 10^{37}\ kg\ m^2$
		$C = (8.0358 \pm 0.0003) \cdot 10^{37}\ kg\ m^2$
		$Ma^2 = (2.4301 \pm 0.0001) \cdot 10^{38}\ kg\ m^2$
(15)	Temporal change of J_2:	$\dot{J}_2 = -(2.6 \pm 0.3) \cdot 10^{-9}\ cy^{-1}$
(16)	Lunar tidal acceleration:	$\dot{n} = -(26.3 \pm 0.5)\ "\ cy^{-2}$ (general)
		$\dot{n} = -(25.9 \pm 0.5)\ "\ cy^{-2}$ (for JPL-model)
		$\dot{n}$ (semidiurnal) $= -(22.4 \pm 0.6)\ "\ cy^{-2}$
(17)	Long-term total deceleration (rounded):	$\dot{\omega} = -(5.0 \pm 0.3) \cdot 10^{-22}$ rad s^{-2}
	(caused by $\dot{J}_2$ (long-term)):	$\dot{\omega}_{rel.} = +(1.29 \pm 0.28) \cdot 10^{-22}$ rad s^{-2}

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