Errata in The Explanatory Supplement to the Astronomical Almanac (3rd edition, 1st printing)

Last update: 22 November 2017

Pg. xxxiii, Contributing Authors:
For "Barnard Guinot", read "Bernard Guinot".

Pg. 11, §1.2.3, 1st paragraph, 2nd sentence:
The sentence is misleading. The end of the sentence should read, "..., the Earth moves in its orbit so an additional rotation is necessary to bring the Sun back to the meridian."

Pg. 11, §1.2.3, 1st paragraph, last sentence:
The end of the sentence should read, "... and must be determined from observations."

Pg. 12, Eq. 1.5:
The equation should read:

$$\mathrm{LAT} = \mathrm{LST} - \mathrm{RA\ Sun} + 12^{\mathrm{h}} \tag{1.5}$$

Pg. 12, Eq. 1.6:
The equation should read:

$$\mathrm{UT} = \mathrm{GST} - \mathrm{RA}\ U + 12^{\mathrm{h}} \tag{1.6}$$

Pg. 27, Chapter 1, 1st bullet:
For "Stages 5, 6, and 7 would be...", read "Stages 5 and 6 would be..."

Pg. 27, Chapter 1, 2nd bullet:
For "Stages 3 through 7 can be...", read "Stages 3 through 6 can be..."

Pg. 91, §3.7, 2nd paragraph, penultimate sentence:
The beginning of the sentence should read, "Knowing that the year 1 B.C. was characterized by S=9, G=1, I=3, Scaliger computed..."

Pg. 135, Figure 5.6:
Two elements of the figure are in error:
1. The labels for x and y are incorrectly described. The x label should read "**x** (east)" and the y label should read "**y** (north)".
2. Angle a beginning position is wrong. The beginning position for angle a should be on the line in the azimuth direction in the horizontal plane.

Pg. 135, Figure 5.6:
Angle a beginning position is wrong. The beginning position for angle a should be on the line in the azimuth direction in the horizontal plane.

Pg. 142, State plane coordinates paragraph:
The conversion between the International foot, meter, and U.S. survey feet has a typographical error. The sentence should read:
". . . (1 International foot = 0.3048 m = 0.999 998 U.S. survey feet exactly)."

Pg. 155, Eq. 5.83:
The first factor in the numerator is in error. The equation should read:

$$N_{nm} = \left[\frac{(n-m)!\,(2n+1)\,(2-\delta_{m0})}{(n+m)!}\right]^{1/2} \tag{5.83}$$

Pg. 191, Chapter 5 References:
The title to the Feltens (2009) article is wrong. Strike the word "azimuth"

Pg. 200, Eq. 6.2:
The matrix $\mathbf{R}_2(\theta)$ is incorrect. It should read:

$$\mathbf{R}_2(\theta) = \begin{bmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix} \tag{6.2}$$

Pg. 200, Eq. 6.4:
The first rotation matrix is in error. It should read:

$$\mathbf{W} = \mathbf{R}_3(-s')\ \mathbf{R}_2(x)\ \mathbf{R}_1(y) \tag{6.4}$$

Pg. 207, §6.3, 1st paragraph:
Strike the sentence, "It is also equivalent...", including Eq. 6.6.

Pg. 207, Table 6.1:
Multiply all of the values for C'_k by (-1).

Pg. 208, Eq. 6.8:
The middle portion of the equation should be dropped. It should read:

$$E_o(T) = \theta - \mathrm{GAST} \tag{6.8}$$

Pg. 209, Eq. 6.13:
The sign of element $\mathbf{B}_{3,2}$ is in error. The matrix should read:

$$\mathbf{B} = \begin{bmatrix} 0.999\,999\,999\,999\,994\,25 & -7.1\times10^{-8} & 8.056\times10^{-8} \\ 7.1\times10^{-8} & 0.999\,999\,999\,999\,996\,95 & 3.306\times10^{-8} \\ -8.056\times10^{-8} & -3.306\times10^{-8} & 0.999\,999\,999\,999\,996\,208 \end{bmatrix} \tag{6.13}$$

Pg. 210, Figure 6.2(d):
One tickmark is mislabeled. For "$Y = -50°$", read "$Y = -5°$".

Pg. 211, Eq. 6.14 and following line:
The units of the coefficients are incorrect. It should read:

$$\begin{aligned} \Delta\psi - \Delta\psi_{2000A} &= \left(0.4697\times10^{-6} - 2.7774\times10^{-6}\,T\right)\Delta\psi_{2000A} \\ \Delta\varepsilon - \Delta\varepsilon_{2000A} &= -2.7774\times10^{-6}\,T\,\Delta\varepsilon_{2000A} \end{aligned} \tag{6.14}$$

where T is in centuries and -2.7774×10^{-6} is in cy^{-1}.

Pg. 214, Figure 6.4:
Topmost angle label is in error. It should read, "$180° - \Pi_A - \psi_A$".

Pg. 216, Table 6.3

Three individual elements of the table are in error:
1. ψ_A coefficient for units of (arcsec/cent.^{3}) should read $-0.001\,140\,45$.
2. ω_A coefficient for units of (arcsec/cent.) should read $-0.025\,754$.
3. χ_A coefficient for units of (arcsec/cent.^{3}) should read $-0.001\,211\,97$.

Pg. 217, References to figures:

There are five references to figures on this page. It should be noted that Fig. 6.6 is an enlargement of the area near the equinox in Fig. 6.3, designed to make the details more easy to see. To give a clearer idea, the five references should be, in order: (see Fig. 6.3 and 6.6), (see Fig. 6.6), (Fig. 6.3), (Fig. 6.6), and "...in Fig. 6.3 and Fig. 6.6."

Pg. 227, Table 6.6:

The symbol D Argument should read, "The mean elongation of the Moon from the Sun".

Pg. 228, Eq. 6.51:

Individual matrix elements $\mathcal{X}, -\mathcal{X}, \mathcal{Y}$, and $-\mathcal{Y}$ have the wrong signs. The equation should read:

$$\begin{aligned} \mathbf{NPB}_{\mathrm{CIO}} &= \mathbf{R}_3(-s)\mathbf{R} \\ &= \mathbf{R}_3(-s) \begin{bmatrix} 1 - a\,\mathcal{X}^2 & -a\,\mathcal{X}\,\mathcal{Y} & -\mathcal{X} \\ -a\,\mathcal{X}\,\mathcal{Y} & 1 - a\,\mathcal{Y}^2 & -\mathcal{Y} \\ \mathcal{X} & \mathcal{Y} & 1 - a(\mathcal{X}^2 + \mathcal{Y}^2) \end{bmatrix} \end{aligned} \tag{6.51}$$

Pg. 229, Eq. 6.53:

A factor in the last line of the equation is incorrect. It should read:

$$s = \ldots - 0\farcs072\,574\,11\,T^3 + 2\farcs798 \times \ldots \tag{6.53}$$

Pg. 229, paragraph following Eq. 6.53:

The paragraph should read: "Approximate formulae for the position of the CIP—accurate to 0.1 mas—and the CIO locator—accurate to 0.5 μas—are found on pages B46 and B47 of *The Astronomical Almanac*."

Pp. 235 – 236, Eqs. 6.64, 6.69 – 6.72 :

Equation 6.64 and Eqs. 6.69 – 7.72 were originally computed using a pre-release version of the Capitaine, Wallace and Chapront (2005) paper. Updated equations, consistent with the final Capitaine, Wallace and Chapront paper, are given below.

Pg. 235, Eq. 6.64:

Equation 6.64 should read:

$$\mathrm{GMST}(D_U, T) = \ldots - 1\fs997\,07 \times 10^{-6}\ T^4\ - \ \ldots \tag{6.64}$$

Pg. 235, Eq. 6.69:

Equation 6.69 should read:

$$\begin{aligned} s_{JC} &= \frac{\partial GMST}{\partial T} + \frac{\partial GMST}{\partial T_U} \\ &= 8\,640\,184.794\,4783 + 0.185\,544\,22\,T - 8.8 \times 10^{-8}\,T^2 \\ &\quad - 0.000\,007\,9883\,T^3 - 1.23 \times 10^{-8}\,T^4 \text{ s} \,. \end{aligned} \tag{6.69}$$

Pg. 236, Eq. 6.70:
Equation 6.70 should read:

$$\begin{aligned} s_d &= 86\,636.555\,367\,405\,291 + 5.079\,9239 \times 10^{-6}\,T - 2.4 \times 10^{-12}\,T^2 \\ &\quad - 2.1871 \times 10^{-10}\,T^3 - 3.36 \times 10^{-13}\,T^4 \text{ s} \end{aligned} \tag{6.70}$$

Pg. 236, Eq. 6.71:
Equation 6.71 should read:

$$\begin{aligned} r' &= 1.002\,737\,909\,344\,968\,64 + 5.879\,5417 \times 10^{-11}\,T - 2.8 \times 10^{-17}\,T^2 \\ &\quad - 2.5313 \times 10^{-15}\,T^3 - 3.89 \times 10^{-18}\,T^4 \text{ d} \ . \end{aligned} \tag{6.71}$$

Pg. 236, Eq. 6.72:
Equation 6.72 should read:

$$\begin{aligned} \frac{1}{r'} &= 0.997\,269\,566\,334\,878\,91 - 5.847\,4783 \times 10^{-11}\,T + 2.8 \times 10^{-17}\,T^2 \\ &\quad + 2.5175 \times 10^{-15}\,T^3 + 3.87 \times 10^{-18}\,T^4 \text{ d}^{-1} \ . \end{aligned} \tag{6.72}$$

Pg. 241, Eq. 6.92:
Equation 6.92 should read:

$$\mathbf{r} = \mathbf{R}_1(-y)\ \mathbf{R}_2(-x)\ \mathbf{R}_3(\text{GAST})\mathbf{r}_0 \tag{6.92}$$

and strike the remainder of the sentence and the sentence immediately following.

Pg.264, Eq. 7.39:
Equation 7.39 should read:

$$\sin\Delta\theta = \frac{(V/c)\sin\theta}{\sqrt{(1 + 2(V/c)\cos\theta + (V/c)^2)}} = \frac{V}{c}\sin\theta - \frac{1}{2}\left(\frac{V}{c}\right)^2 \sin 2\theta + \cdots \tag{7.39}$$

Pg. 275, Eq. 7.76:
Equation 7.76, for $\mathcal{Z}$, should read:

$$\mathcal{Z} = \sin\epsilon\cos\psi\sin\bar{\phi} + \cos\epsilon\cos\bar{\phi} \tag{7.76}$$

Pg. 292, Eq. 7.128:
The parallax factor is not needed in this equation. Equation 7.128 should read:

$$\mathbf{U} = \mathbf{u}_\text{B}(t) - \mathbf{E}_\text{B}(t) \tag{7.128}$$

Pg. 302, Chapter 7 References:
A reference is missing. Add: "Mueller, I.I. (1969). *Spherical and Practical Astronomy as Applied to Geodesy.* New York, NY: Ungar."

Pg. 411, last paragraph, 3rd sentence:
The sentence should read: "Those of the other planets and Pluto[5] are based on Harris (1961) for all but Jupiter, whose $V(1,0)$ value is from Irvine et al. (1968).

Pg. 413, Table 10.6:
Some values are inconsistent with the sources quoted on pg. 411. The modified table is given below. Bodies with changes are highlighted.

Body	$V(1,0)$ (mag)	V_0 (mag)	$\Delta m(i)^a$ (mag)
Mercury	-0.60	—	$0.0498\,i - 0.000488\,i^2 + 3.02 \times 10^{-6}\,i^3$
Venus[b]	-4.47	—	$0.0103\,i + 0.000057\,i^2 + 0.13 \times 10^{-6}\,i^3$
Venus[c]	0.98	—	$-0.0102\,i$
Earth	-3.87	—	$0.0130\,i + 0.000019\,i^2 + 0.48 \times 10^{-6}\,i^3$
Mars	-1.52	-2.01	$0.016\,i$
Jupiter	-9.40	-2.70	$0.005\,i$
Saturn	-8.88	$+0.67$	$0.044\,i$
Uranus	-7.19	$+5.52$	$0.002\,i$
Neptune	-6.87	$+7.84$	—
Pluto	-1.01	$+14.90$	—
Io	-1.68	$+5.02$	$0.46\,i - 0.0010\,i^2$
Europa	-1.41	$+5.29$	$0.0312\,i - 0.00125\,i^2$
Ganymede	-2.09	$+4.61$	$0.323\,i - 0.00066\,i^2$
Callisto	-1.05	$+5.65$	$0.078\,i - 0.00274\,i^2$

[a] The coefficient i is the phase angle in degrees.
[b] $2.^\circ 2 < i < 163.^\circ 6$
[c] $163.^\circ 6 < i < 170.^\circ 2$

Pg. 421, Eq. 10.32:
Equation 10.32 should read:

$$\cos i = \mathbf{s} \cdot \mathbf{e} \tag{10.32}$$

Pg. 427, Eq. 10.47:
Equation 10.47 should read:

$$SD = 206\,264.8062\,\frac{d_S}{|\mathbf{r}_e|} \tag{10.47}$$

Pg. 428, Eq. 10.49:
The matrix $\mathbf{R}_2(\theta)$ is incorrect. It should read:

$$\mathbf{R}_2 = \begin{bmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix} \tag{10.49}$$

Pg. 430, Eq. 10.52:
The matrix $\mathbf{A}$ has two transcription errors, one each in element A(1,3) and A(2,3). It should read:

$$\mathbf{A} = \begin{bmatrix} \cos\phi\cos\psi - \sin\phi\cos\theta\sin\psi & -\cos\phi\sin\psi - \sin\phi\cos\theta\cos\psi & \sin\phi\sin\theta \\ \sin\phi\cos\psi + \cos\phi\cos\theta\sin\psi & -\sin\phi\sin\psi + \cos\phi\cos\theta\cos\psi & -\cos\phi\sin\theta \\ \sin\theta\sin\psi & \sin\theta\cos\psi & \cos\theta \end{bmatrix}$$

Pg. 433, Eq. 10.67:
The sign in the denominator is incorrect. It should read:

$$\tan\Omega_M = \frac{-\sin I \sin(\Omega + \Delta\psi)}{\cos I \sin\epsilon - \sin I \cos\epsilon \cos(\Omega + \Delta\psi)} \tag{10.67}$$

Pg. 433, Eq. 10.70:
Equation 10.70 should read:

$$\Omega_T = \phi_c + \psi_c - 180^\circ \tag{10.70}$$

Pg. 434, Eq. 10.75:
Equation 10.75 should read:

$$\tan HP' = \frac{\sin z \sin HP}{1 - \sin z \sin HP} \tag{10.75}$$

Pg. 434, Eq. 10.78:
Equation 10.78 should read:

$$SD = \sin^{-1} \frac{R_m}{|\mathbf{r}_m|} \tag{10.78}$$

Pg. 448, Chapter 10 References:
The de Vaucouleurs (1970) book title is in error. It should read, *"Surfaces and Interiors of Planets and Satellites"*.

Pg. 485, Eq. 11.110:
There is a subscript inadvertently included. It should read:

$$D_1 \equiv x^2 + y^2 - (l_1 + m/m_1)^2 \ . \tag{11.110}$$

Pg. 508, third paragraph, first sentence:
For "... Saros, which consists of 233 synodic months...", read "... Saros, which consists of 223 synodic months..."

Pg. 523, first line:
Delete the extra "a" at the end of the line.

Pg. 564, Table 14.5:
There are two errors in the plane triangle portion of the table, equations for s and r^2. They should read:

$$s = (a + b + c)/2$$

and

$$r^2 = (s - a)(s - b)(s - c)/s$$

Pg. 568, 4th paragraph:
A sentence is incorrect. It should read "Two great circles passing through E and Q, each being orthogonal to side EQ, intersect the equator and ecliptic planes at the vernal equinox."

Pg. 592, § 15.1.10:
The sentence is incorrect. It should read "The Julian Day Number of Saturday 2000 January 1 is then 2 451 545 and of Monday −4712 January 1 it is 0".

Pg. 601, Eq. 15.10:
Equation 15.10 should read:

$$V = E/24 - E/25 + (G/12) * (E/25 - E/26) \tag{15.10}$$

Pg. 620, Algorithm 8:
Step 2 should be clearer. It should read "Calculate, using algorithm 5, the Julian Day Number, ...".

Pg. 656, TIO locator definition:
It should read "(denoted by s')".