Using ICE with any "Delta-T"

USNO ICE computes Celestial Navigation Bodies positions and height corrections from User defined Positions.

Non User selectable ICE Delta-T values "δT_{ice}" are gradually *shifting away from currently observed "Delta-T" values*.
Sooner or later this nuisance is to make *ICE* obsolete while on the other hand *ICE* has some very nice features.

Nonetheless, there does exist a simple repair patch …

It is possible to compute all such *ICE* data for any chosen Lat_{ch}, Lon_{ch}, UT_{ch} and δT_{ch} through feeding *ICE* with *fictitious* UT_f and Lon_f (Lat unchanged) as long as such *fictitious elements* fulfill both conditions:

(1) - **Celestial Bodies Equatorial coordinates (α and δ) to remain computed for the same TT**

Since TT = UT + δT, this implies: $UT_{ch} + \delta T_{ch} = UT_f + \delta T_{ice}$. Hence:

$$UT_f = UT_{ch} + (\delta T_{ch} - \delta T_{ice})$$

(2) - **From the *fictitious Position* all Bodies LHA's to remain unchanged**

Since (1) already guarantees that all Equatorial coordinates have remained unchanged, therefore LHA Aries is to remain the same as in the real/*chosen* world. This implies an adequate shift in Longitude equal to the angle covered by GAST during the ($\delta T_{ch} - \delta T_{ice}$) time interval. Hence:

$(Lon_f - Lon_{ch})$ in arc minutes = $(\delta T_{ch} - \delta T_{ice})$ in seconds of Time * 1/4 * (366/365)

For ($\delta T_{ch} - \delta T_{ice}$) positive, the shift from chosen Longitude into *fictitious Longitude* is towards the WEST.

As a consequence all ensuing Celestial Bodies local positions and computed corrections remain unchanged whether seen from the real world/chosen position at UT_{ch} or seen from the *ICE fictitious position* at UT_f.

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Example: For 2021 Oct 19th, 21:59:27 UT, with δT_{ch}= +70.1 s from N41°18.4' / W072°30.0' (*real world* environment)

Real World environment computations using δT_{ch}= +70.1 s

Full 3D parallax computation

Object	GHA ° '	Dec ° '	Hc ° '	Zn °	NAL Refr '	SD '	PA '	Sum '
SUN	**153 39.08**	**S 10 18.43**	**- 0 15.19**	**256.45**	**-34.03**	**16.06**	**0.15**	**-17.82**
MOON	**339 48.26**	**N 04 02.62**	**+ 0 38.86**	**85.18**	**-34.03**	**15.03**	**55.09**	**+36.09**

Fictitious environment computations using ICE with δT_{ice}= +88.1 s

($\delta T_{ch} - \delta T_{ice}$) = -18 s . From (1) : $UT_f = UT_{ch} + (\delta T_{ch} - \delta T_{ice})$ = 21:59:27 - 00:00:18 ⇨ ***UT_f = 21:59:09***

From (2) : $(Lon_f - Lon_{ch})' = (\delta T_{ch} - \delta T_{ice})_s$ * ¼ * (366/365) = - 4.5' ⇨ ***Lon_f = W072°25.5'***

Celestial Navigation Data for 2021 Oct 19 at 21 59 09 UT (GMT) Delta T = 88.1 seconds N 41 18.4/W 72 25.5

Simplified 2D parallax computation and data by courtesy from Mr. Dave Walden

Almanac Data					*Altitude corrections*			
Object	***GHA*** ° '	***Dec*** ° '	***Hc*** ° '	***Zn*** °	***Refr*** '	***SD*** '	***PA*** '	***Sum*** '
SUN	***153 34.6***	***s10 18.4***	***- 0 15.2***	***256.4***	***-34.0***	***16.1***	***.1***	***-17.8***
MOON	***339 43.8***	***n 4 02.6***	***+ 0 38.9***	***85.2***	***-34.0***	***15.0***	***55.2***	***36.2***

Conclusion: *Same corrections with minor non-significant .1' difference due mainly to Parallax computation (2D vs. 3D).*

Nov 05th, 2021 - Antoine M. "Kermit" Couëtte - antoine.m.couette@club-internet.fr