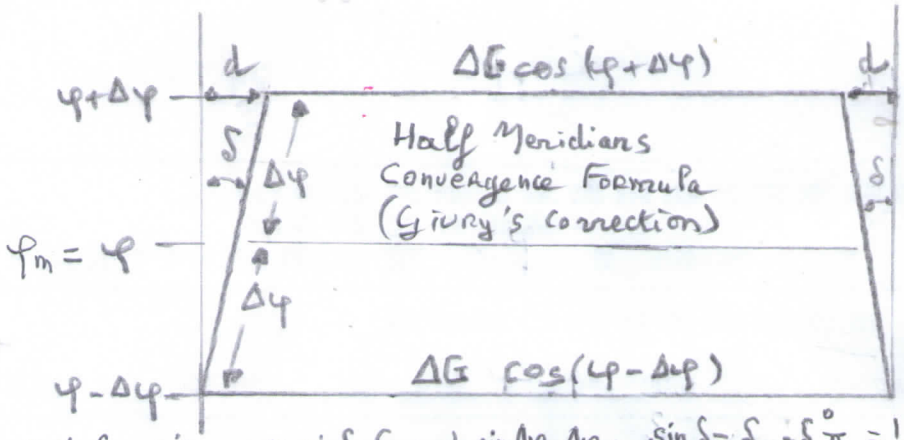


$\Delta G\left[\cos(\varphi-\Delta\varphi)-\cos(\varphi+\Delta\varphi)\right]=2d$

$\Delta G\, 2\sin\varphi\sin\Delta\varphi = 2d$

$d = \Delta G \sin\varphi \sin\Delta\varphi$

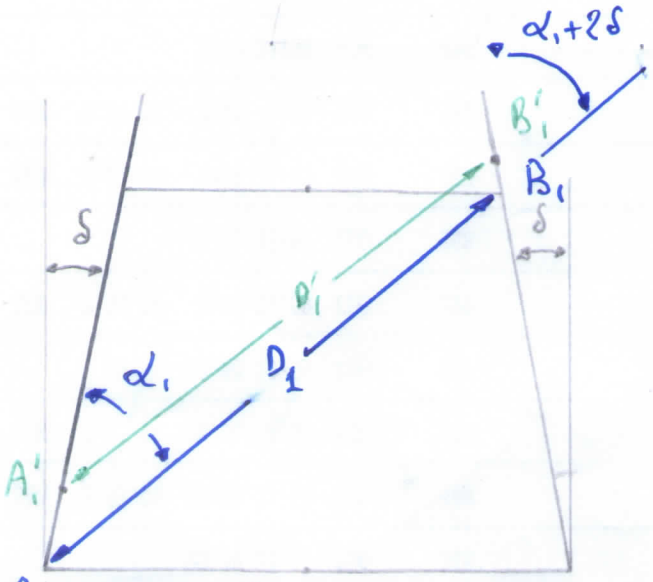
$\sin\delta = \frac{d^\circ}{2\Delta\varphi^\circ} = \frac{1}{2}\frac{\Delta G^\circ \sin\varphi \sin\Delta\varphi}{\Delta\varphi^\circ}$

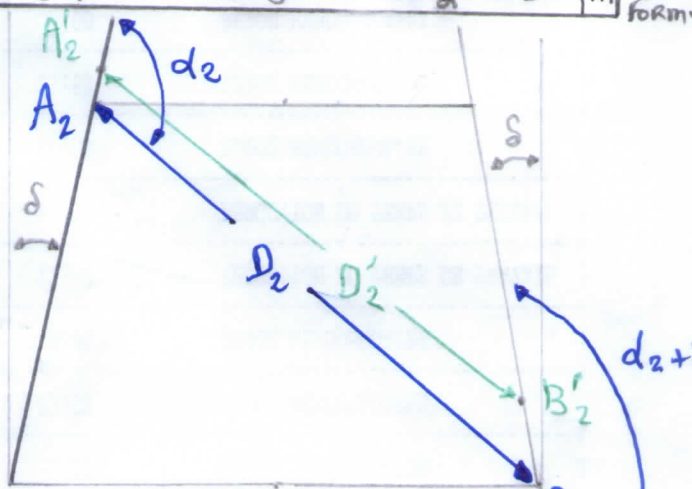
$\delta_{rad} = \delta^\circ \times \frac{\pi}{180}$ $\quad \Delta\varphi^\circ = \frac{\Delta\varphi_{rad}}{\pi} \times 180$

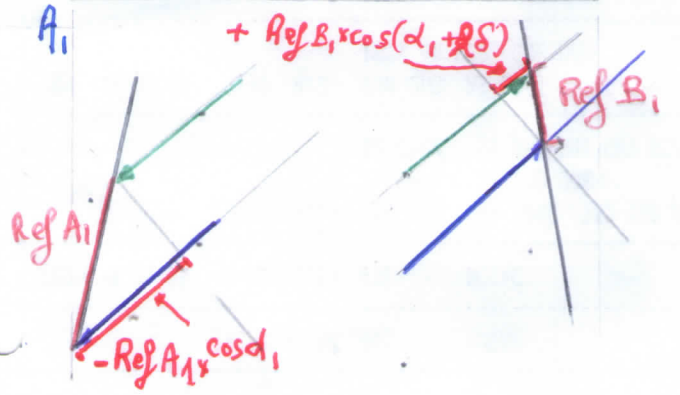
With δ and $\Delta\varphi$ small: $\sin\delta = \delta_{rad}$ and $\sin\Delta\varphi = \Delta\varphi_{rad}$. $\quad \sin\delta = \delta_{rad} = \delta^\circ\frac{\pi}{180} = \frac{1}{2}\Delta G^\circ \sin\varphi \sin\Delta\varphi \times \frac{}{\Delta\varphi_{rad}\times 180}$

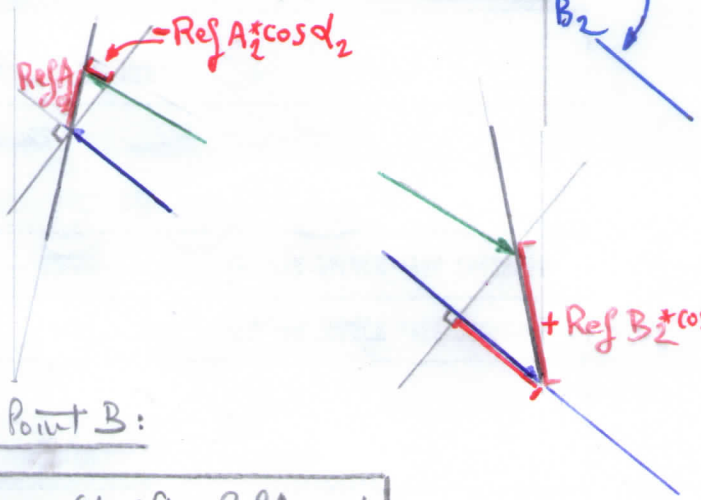
$\delta^\circ = \frac{1}{2}\Delta G^\circ \sin\varphi \times \frac{\sin\Delta\varphi}{\Delta\varphi_{rad}}$, $\frac{\sin\Delta\varphi}{\Delta\varphi_{rad}} \approx 1$

Half Meridians convergence: $\delta = \frac{1}{2}\Delta G \sin\varphi_m$ Givry's formula









From Leftmost Point A to rightmost Point B:

Formula (1) $\quad D' - D = \Delta D = Ref B * \cos(\alpha+2\delta) - Ref A \cos\alpha$

CONTRACTION OF SMALL ANGULAR DISTANCES DUE TO REFRACTION

LADD OBSERVATORY N41°50.260'/W071°23.988'/+69m 31°F/29.90" 23 OCT 1924 TT-UT=+23.7s

☾ – REGULUS ✱ occultation ✱ → ☾ 10h58m20.2s

NO REFRACTION (01) ✱ 52.64526748° / (02) 134.4488639° (07) ☾ 53.01033081° (04) ☾ 52.75131149° / (05) 134.8389117° (08) ☾ 52.49229217°

WITH REFRACTION (03) ✱ 52.65804802 (06) ☾ 52.76404300°

(09) $SD\alpha = \frac{1}{2}((07)-(08)) = 0.259019320°$ (10) $\varphi_m = \frac{1}{2}((04)+(01)) = 52.69828950°$

(11) $\cos\varphi_m = 0.6060121479$ (12) $\sin\varphi_m = 0.7954553894$ (13) $\Delta h = (04)-(01) = 0.106044010°$

(14) $\Delta Z = (05)-(02) = 0.390047800°$ (15) $\Delta Z \cos\varphi_m = (14)\times(11) = 0.236373705$ (16) $\sqrt{(13),(15)} = D = 0.259071150°$

(17) Position Angle = 65.83763047°

(18) Ref✱ = (03) − (01) = 0.012780540 (19) Ref ☾ = (06) − (04) = 0.012731510°

(20) Meridians convergence = $\Delta Z \sin\varphi_m = (14)\times(12) = 0.310265625° = 2\delta$

UNREFRACTED / REFRACTED ✱ ☾ DISTANCES / CONTRACTION

(1) GREAT CIRCLE 0.259070690° / 65.99285161° 0.258987600° / 65.99651844° −0.299124"

(2) PLANE 0.259071150° / 65.83763047° 0.258988052° / 65.84127139° −0.299154"

(3) FORMULA (1) (19) ✱ cos((17)+(20)) − (18) cos (17) = −0.298974"

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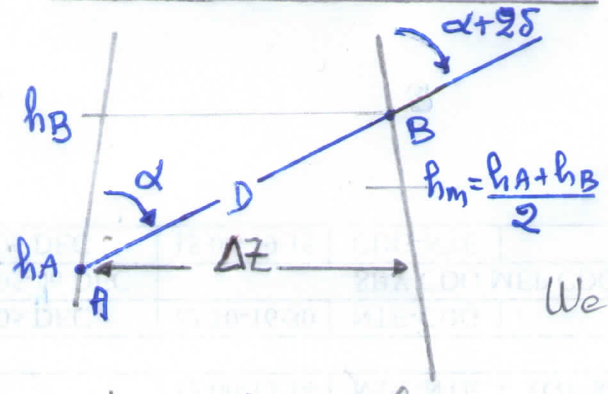
(4) ANOTHER APPROXIMATION



We are given $D°$, $\alpha°$ & $h_A°$ (unrefracted)

then (4.1) $h_B° = h_a° + D° \cos\alpha$

(4.2) $h_m° = \frac{1}{2}(h_a° + h_b°)$

(4.3) $\Delta Z° = D° \sin\alpha / \cos h_m°$

(4.4) $2\delta° = \Delta Z° \sin h_m$

We are also assuming that: ($h > 15°$)

(4.5) Ref(h) in arcminutes = $\frac{1}{\operatorname{tg} h°}$

Numerical example, same as above:

unrefracted : D = 0.259070690°, α = 65.99285161°, E = h_a = 52.64526748°

obtain a contraction of −0.297203"

Other example: Sun, SD = 32', α = 90°

HORIZONTAL CONTRACTION

h = 15° −0".5585

h = 22° −0".5585

h = 30° −0".5585

h = 45° −0".5585

h = 60° −0".5585

h = 75° −0".5584

Kermit P 27 octobre 2023