XtremeGeo

Delay Time Equations

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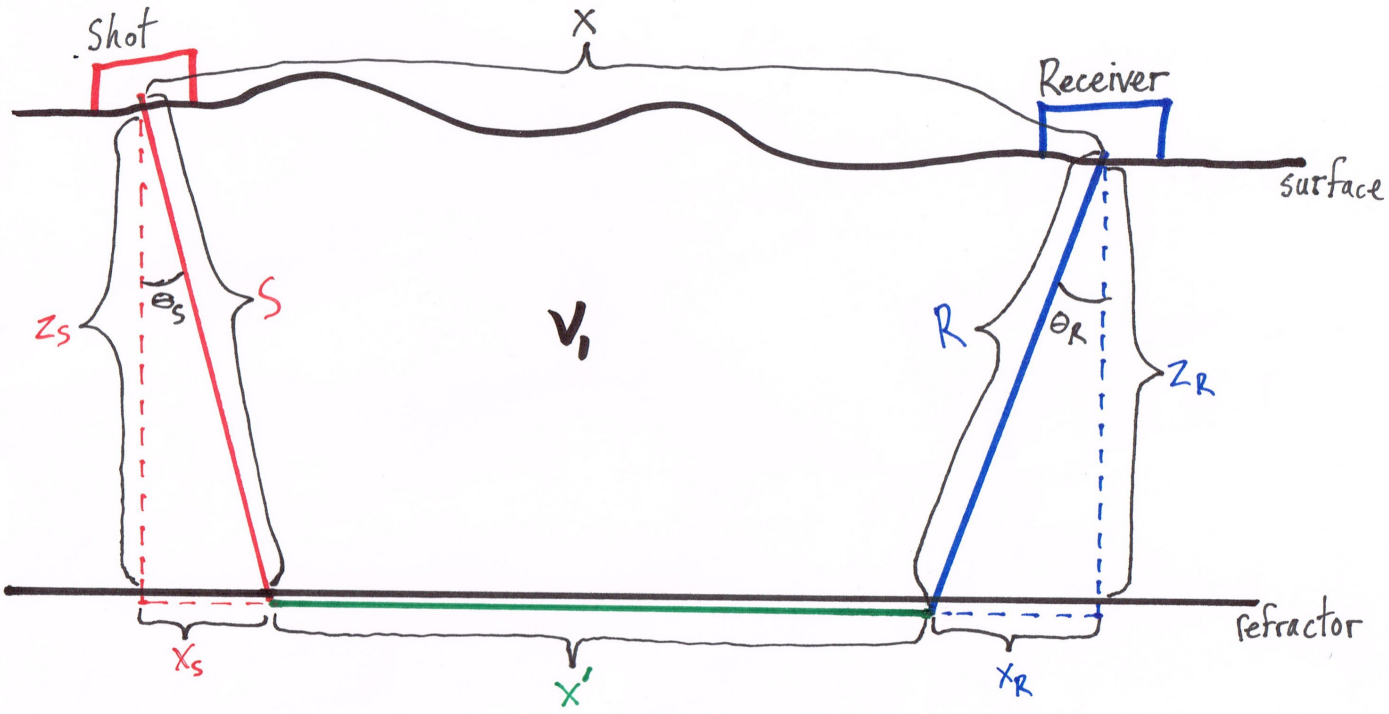

x = trace offset

S = raypath from shot to refractor

Z_S = vertical component of S / weathering thickness at shot

X_S = horizontal component of S

V_{1S} = weathering velocity at shot

V_{2S} = refractor velocity at shot

$\theta_S = \sin^{-1}\left(\frac{V_{1S}}{V_{2S}}\right)$, shot refraction angle

R = raypath from refractor to receiver

Z_R = vertical component of R / weathering thickness at receiver

X_R = horizontal component of R

V_{1R} = weathering velocity at receiver

V_{2R} = refractor velocity at receiver

$\theta_R = \sin^{-1}\left(\frac{V_{1R}}{V_{2R}}\right)$, receiver refraction angle

$X' = x - (X_S + X_R)$, distance actually traveled along refractor

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traveltime equation:

$$t = \frac{x'}{V_{2avg}} + \frac{S}{V_{1S}} + \frac{R}{V_{1R}} \qquad \frac{X}{V_{2avg}} = \frac{x'}{V_{2avg}} + \frac{X_S}{V_{2S}} + \frac{X_R}{V_{2R}}$$

define the Delay Times δ:

$$\delta_S = \frac{S}{V_{1S}} - \frac{X_S}{V_{2S}} \qquad \delta_R = \frac{R}{V_{1R}} - \frac{X_R}{V_{2R}}$$

then:

$$t = \frac{X}{V_{2avg}} + \delta_S + \delta_R$$

$$\delta_S = \frac{X}{V_{2avg}} - t - \delta_R \qquad \delta_R = \frac{X}{V_{2avg}} - t - \delta_S$$

since $\cos\theta = \sqrt{1-\sin^2\theta} = \frac{1}{V_2}\sqrt{V_2^2 - V_1^2}$:

$$\delta_S = \frac{Z_S\sqrt{V_{2S}^2 - V_{1S}^2}}{V_{1S}\,V_{2S}} \qquad \delta_R = \frac{Z_R\sqrt{V_{2R}^2 - V_{1R}^2}}{V_{1R}\,V_{2R}}$$