

Solar radiation normal to the sun, $Q_n = (5E-06\theta^3 - 0.0002\theta^2 + 0.0029\theta + 1) * Q$,

Where Q is the measured solar radiation value and θ is the solar zenith angle in degrees (as determined above)

Otherwise, if the c is greater than 60%, $Q_n = Q$.

Next, direct incoming solar, Q_d , is determined from Q_n ,

$Q_d = 0.9 * (1 - c^2) * Q_n$, where c is the cloud cover fraction calculated as before,

Finally, $Q1 = 0.56 * F * Q_d$

Where F is the projected area body factor.

If $70^\circ \geq \theta \geq 2^\circ$, $F = 0.386 - 0.0032 * (90 - \theta)$, (θ is in degrees in the formula),

If $\theta < 2^\circ$, $F = 0.110$

If $\theta > 70^\circ$, $F = 0.325$

Indirect Incoming Solar Radiation Term (Q2)

$Q_i = 0.1 * (1 - c^2) * Q_n$, where Q_n is the normal solar radiation & c is the cloud cover fraction (as determined in $Q1$ above)

$Q2 = 0.224 * Q_i$

Terrestrial Radiation (Q3)

$Q3 = 0.028 * Q$, where Q is the directly measured solar radiation and is used in this case.

Sky Radiation (Q4)

$Q4 = 150 [1 - c^2 (0.50 - 0.0043\phi)] * [1 - 0.62 * \exp(-0.108Z) - 0.16 * (vp^{0.5})]$,

Where c is the cloud cover fraction calculated as before, ϕ is the station's latitude in degrees, Z is the station's elevation in **kilometers**, and vp is the vapor pressure (in kPa),

$vp = RH * 0.01 * 0.6112 * \exp[(17.62 * T) / (T + 243.12)]$, where RH is the outdoor relative humidity expressed as a percent & T the air temperature in $^\circ\text{C}$.

From the resulting Q_d , if the wind speed is < 7 mph, then the sun term in THSWI (in $^\circ\text{F}$) is $0.101 * Q_d$,

Otherwise, the sun term is $(1.10Q_d) / (8 + 0.45v)$, where v is the wind speed in mph.

REFERENCES

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