Clearness Index and Diffuse Fraction (Erbs Correlations)

Clearness index and the diffuse and beam parts of hourly, daily or monthly average radiation on a horizontal surface by the Erbs, Klein and correlations.

Input parameters

Unit system: SI

Parameter	Value	Unit
Radiation period	One day (daily KT)	
Latitude (north positive, south negative)	50.000	°
Day of the year (1 = 1 January, 365 = 31 December)	344.00	
Hour midpoint, solar time (hourly basis only)	12.000	h
Measured total radiation on a horizontal surface for the period	2.0000	MJ/m²
Declination formula	Cooper (1969), as in the textbook examples	

Calculated results

Parameter	Value	Unit
Extraterrestrial radiation for the period	7.6799	MJ/m²
Sunset hour angle	59.530	°
Clearness index	0.26042	
Diffuse fraction	92.721	%
Diffuse radiation	1.8544	MJ/m²
Beam radiation	0.14559	MJ/m²

Notes for this case

- Erbs et al. (1982) correlations from U.S. pyrheliometer data; individual hours and days scatter widely about them.

Formula and method

$$K_T = \frac{H}{H_o}$$

$$\frac{I_d}{I} = 0.9511 - 0.1604k_T + 4.388k_T^2 - 16.638k_T^3 + 12.336k_T^4 \quad (0.22 < k_T \leq 0.80)$$

$$\frac{\bar{H}_d}{\bar{H}} = 1.391 - 3.560\bar{K}_T + 4.189\bar{K}_T^2 - 2.137\bar{K}_T^3 \quad (\omega_s \leq 81.4°)$$

Variables

basis	Radiation period	-
ϕ	Latitude (north positive, south negative)	rad
n	Day of the year (1 = 1 January, 365 = 31 December)	-
t_s	Hour midpoint, solar time (hourly basis only)	s
H	Measured total radiation on a horizontal surface for the period	J/m²
$\delta\ \mathrm{formula}$	Declination formula	-
H_o	Extraterrestrial radiation for the period	J/m²
ω_s	Sunset hour angle	rad

K_T	Clearness index	-
H_d/H	Diffuse fraction	-
H_d	Diffuse radiation	J/m²
H_b	Beam radiation	J/m²

Method and standards

Erbs, Klein and (1982) diffuse fraction correlations.

Assumptions and limits

- Correlations from mid-latitude U.S. data; tropical and very polluted sites may differ.

Report details

Report reference	FCC-S3F3-CP3X (the same inputs always give the same reference)
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Release checks	4 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/solar-thermal/clearness-index-diffuse-fraction-erbs

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.