Maidment (1993): Handbook of Hydrology
Table 4.4.1: Selection and Computation Sequence for Estimating the Energy (Needed?) for Evaporation

1 Are local measurements of net radiation (R_n in MJ m^{-2} day^{-1}) available?
YES: (i) Divide by λ [Eq. (4.2.1)] to give R_n in mm day^{-1}.
(ii) Go to 5(a).
NO: Continue with 2(a).

2(a) Are local records of fractional cloud cover (n/N) available?
YES: Go to 3(a).
NO: Continue with 2(b).

2(b) Local records of sunshine hours (n) available?
YES: (i) Compute (n/N); N from Eq. (4.4.1).
(ii) Go to 3(a).
NO: Continue with 2(c).

2(c) Can n or n/N be estimated from regional records?
YES: (i) Proceed as 2(a) or 2(b).
(ii) Recognize increased uncertainty in (n/N).
(iii) Go to 3(a).
NO: Select pan- or temperature-based evaporation estimate.

3(a) Local measurements of solar radiation (S_t in MJ m^{-2} day^{-1}) available?
YES: (i) Divide by λ [Eq. (4.2.1)] to give water equivalent.
(ii) Go to 3(c).
NO: Continue with 3(b).

3(b) Locally calibrated Angstrom coefficients (a_s, b_s) available?
YES: Select as and bs from available values.
NO: Set $a_s = 0.25$; $b_s = 0.50$.
THEN: (i) Obtain value of extraterrestrial radiation (S_0) from Eq. (4.4.4).
(ii) Compute S_t from Eq. (4.2.6).
(iii) Continue with 3(c).

3(c) Local measurements of land cover albedo (α) available?
YES: Select value of α from available measurements.
NO: Estimate α using Table 4.2.2.
THEN: (i) Compute net solar radiation from Eq. (4.2.5).
(ii) Continue with 4(a).

4(a) Locally calibrated emissivity coefficients [a_e, b_e; Eq. (4.2.8)] available?
YES: Select a_e and b_e from available values.
NO: Set $a_e = 0.34$; $b_e = -0.14$.
THEN: Continue with 4(b).

4(b) Measurements of dew point temperature available?

YES: (i) Obtain vapor pressure e_d at dew point temperature from Eq. (4.2.2) or Table 4.2.1.

(ii) Compute ε' from Eq. (4.2.8).

(iii) Go to 4(d).

NO: Continue with 4(c).

4(c) Measurements of minimum air temperature available?

YES: (i) Set dew point to minimum temperature; obtain e_d from Eq. (4.2.2) or Table 4.2.1.

(ii) Compute ε' from Eq. (4.2.8).

NO: Compute ε' from Eq. (4.2.9).

THEN: Continue with 4(d).

4(d) Locally calibrated cloudiness coefficients [a_c, b_c; Eq. (4.2.10)] available?

YES: Select a_c and b_c from available values.

NO: Set $a_c = 1.35$; $b_c = -0.35$ in arid areas
or $a_c = 1.00$; $b_c = 0.00$ in humid areas.

THEN: (i) Compute clear sky solar radiation S_{t0} as the value given by Eq. (4.2.6) with (n/N) set to zero.

(ii) Compute the cloudiness factor (f) from Eq. (4.2.10).

(iii) Compute net long-wave radiation from Eq. (4.2.7).

(iv) Compute net radiation from Eq. (4.2.13).

(v) Continue with 5(a).

5(a) Estimate of available energy for open water surface required?

YES: Go to 5(b).

NO: Go to 5(c).

5(b) Data to estimate advected energy [A_h; Eq. (4.2.20)] available?

YES: (i) Compute A_h from Eq. (4.2.20).

(ii) Energy available for evaporation $A = R_n + A_h$.

NO: Energy available for evaporation $A = R_n$.

THEN: Energy estimation complete.

5(c) Measurements or data to estimate soil heat flux G available?

YES: (i) Obtain G from measurements, or estimate from Eq. (4.2.18) or (4.2.19).

(ii) Energy available for evaporation $A = R_n - G$.

NO: Energy available for evaporation $A = R_n$.

THEN: Energy estimation complete.

The equations:

(4.2.1)	$\lambda = 2.501 - 0.002361\, T_s$ MJ kg^{-1}	T_s: water surface temperature (°C)
(4.2.2)	$e_s = 0.6108 \exp\left(\frac{17.27\, T}{237.3 + T}\right)$ kPa	T: air temperature (°C)
(4.2.5)	$S_n = S_t (1 - \alpha)$ MJ m^{-2} day^{-1}	S_t: global radiation (MJ day^{-1})
(4.2.6)	$S_t = \left(a_s + b_s \frac{n}{N}\right) S_0$ MJ m^{-2} day^{-1}	a_s, b_s: Angstrom coefficients n: sunshine hours per day (h) N: total day length (h)
(4.2.7)	$L_n = L_i - L_o = - f\, \varepsilon' \sigma (T + 273.2)^4$ MJ m-2 day-1	Lo: outgoing lw radiation Li: incoming lw radiation f: cloudiness correction factor ε': net emissivity between atmosphere & ground
(4.2.8)	$\varepsilon' = a_e + b_e \sqrt{e_d}$	
(4.2.9)	$\varepsilon' - 0.02 + 0.261 \exp(-7.77 \times 10^{-4} T^2)$	
(4.2.10)	$f = a_c \frac{S_t}{S_{t0}} + b_c$	
(4.2.13)	$R_n = S_n + L_n$ MJ m^{-2} day^{-1}	
(4.2.18)	$G = 0.38 (T_{day2} - T_{day1})$ MJ m^{-2} day^{-1}	
(4.2.19)	$G = 0.14 (T_{month\,2} - T_{month\,1})$ MJ m^{-2} month^{-1}	
(4.2.20)	$A_h = \rho_w c_w (q_i T_i - q_0 T_0 + P\, T_p) = 4.19 \times 10 - 3 (q_i T_i - q_0 T_0 + P\, T_p)$ MJ m^{-2}	
(4.4.1)	$N = \frac{24}{\pi} \omega_s$	
(4.4.4)	$S_0 = 15.392\, d_r (\omega_s \sin\phi \sin\delta + \cos\phi \cos\delta \sin\omega_s)$ mm day^{-1}	

The tables:

Tab. 4.2.2: Albedos for different land cover classes

Land cover class	Albedo
Open water	0.08
Tall forest	0.11 – 0.16
Tall farm crops (e.g., sugarcane)	0.15 – 0.20
Cereal crops (e.g., wheat)	0.20 – 0.26
Short farm crops (e.g., sugar beet)	0.20 – 0.26
Grass and pasture	0.20 – 0.26
Bare soil	0.10 (wet) – 0.35 (dry)
Snow and ice	0.20 (old) – 0.80 (new)