

Evapotranspiration is estimated at the Celestino meteorological tower (see Figure 1 & 2) using built-in implementation of the ASCE Standardized Reference Evapotranspiration Equation on the Campbell dataloggers.

All parameters are sampled every 10 seconds. Total estimated ET is recorded at the end of every 15 minute interval.

According to the Campbell Sci. webpage <https://www.campbellsci.ca/blog/evapotranspiration-101>

ASCE Standardized Reference Evapotranspiration Equation

$$ET_{sz} = \frac{0.408 \Delta (R_n - G) + \gamma \frac{C_n}{T + 273} u_2 (e_s - e_a)}{\Delta + \gamma (1 + C_d u_2)}$$

where:

ET_{sz}	= standardized reference crop evapotranspiration for short (ET_{os}) or tall (ET_{rs}) surfaces (mm d^{-1} for daily time steps or mm h^{-1} for hourly time steps),
R_n	= calculated net radiation at the crop surface ($\text{MJ m}^{-2} \text{d}^{-1}$ for daily time steps or $\text{MJ m}^{-2} \text{h}^{-1}$ for hourly time steps),
G	= soil heat flux density at the soil surface ($\text{MJ m}^{-2} \text{d}^{-1}$ for daily time steps or $\text{MJ m}^{-2} \text{h}^{-1}$ for hourly time steps),
T	= mean daily or hourly air temperature at 1.5 to 2.5-m height ($^{\circ}\text{C}$),
u_2	= mean daily or hourly wind speed at 2-m height (m s^{-1}),
e_s	= saturation vapor pressure at 1.5 to 2.5-m height (kPa), calculated for daily time steps as the average of saturation vapor pressure at maximum and minimum air temperature,
e_a	= mean actual vapor pressure at 1.5 to 2.5-m height (kPa),
Δ	= slope of the saturation vapor pressure-temperature curve ($\text{kPa } ^{\circ}\text{C}^{-1}$),
γ	= psychrometric constant ($\text{kPa } ^{\circ}\text{C}^{-1}$),
C_n	= numerator constant that changes with reference type and calculation time step ($\text{K mm s}^3 \text{Mg}^{-1} \text{d}^{-1}$ or $\text{K mm s}^3 \text{Mg}^{-1} \text{h}^{-1}$) and
C_d	= denominator constant that changes with reference type and calculation time step (s m^{-1}).

Units for the 0.408 coefficient are $\text{m}^2 \text{ mm MJ}^{-1}$.

The Campbell implementation of this formula occasionally produces small, negative values during the night. These values are set to zero and flagged as calibration adjustments. This adjustment increases the estimated ET by approximately 1.85% (21.8 mm/year)

Sensor elements are replaced according to the manufacture's recommendations.

Records are provided with two Quality Control flags. Flag one indicates the fitness for use of each record. Possible values are: good, bad, doubtful, missing. Records are marked as bad if they fail one or more QC tests. Likewise, records are marked as doubtful if they are potentially bad, but without sufficiently strong evidence to be marked as bad. The second QC variable provides that reason for marking a variable as bad or doubtful. Potential values are: range, step, persistence, drift. At this time only range tests have been applied.

Figure 1



Location of the Agua Salud research plots (red polygons) and the Celestino Meteorology Station

Figure 2



Celestino tower