



Evaporation pan

Manual



Meet the difference

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1. Description

The evaporation pan of this standard set is made of stainless steel and has the dimensions of a "class A" evaporation pan, namely 254 mm (10 inches) in height and 1206 mm (47.5 inches) in diameter. The evaporation pan is installed on the wooden support, which is set and levelled on the ground in a grassy location, away from bushes, trees and other obstacles which obstruct a natural air flow around the pan, thus representing open water in an open area.

The stilling well is installed in the evaporation pan and levelled with the adjustable levelling foot.

Daily the result of evaporation and precipitation is measured within the still well, by means of a high quality evaporation micrometer with a measuring range of 100 mm and an accuracy of 0.02 mm. This accuracy can be obtained because the still well prevents rippling of the water surface.

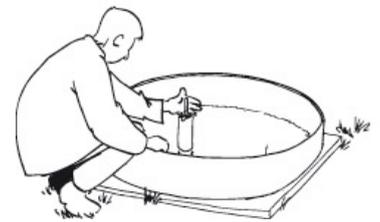
The amount of evaporation is a function of temperature, humidity, wind and other ambient conditions. In order to relate the evaporation to wind current or expected conditions, the maximum and minimum temperature as well as the amount of air passed are recorded with the evaporation. For a more exact use of the evaporation pan it is recommended to use an additional wind path meter.



Level sensor for automatic measurement



Stilling well with micrometer



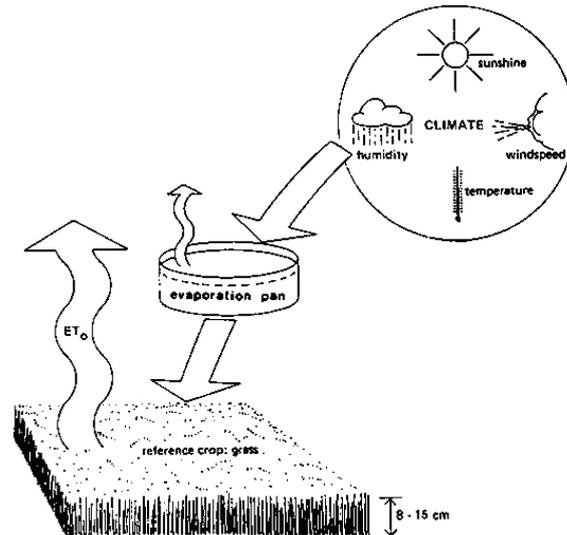
Reading the micrometer

For automatic measurement of the evaporation use can be made of a level sensor. The level sensor consists of a sensitive pressure transducer built in a stainless steel housing. The sensor has a pressure range of 0-20 mbar, accuracy 0,25%. Output signal 0-20 mA, power supply voltage 8-28 V. The sensor is supplied with 5 m cable.

The sensor is read-out with a datalogger. To configure and read-out the datalogger and to process the measuring data, use is made of the evaporation pan software.

2. Measuring principle

An evaporation pan provides a measurement of the combined effect of temperature, humidity, windspeed and sunshine on the reference crop evapotranspiration ET_o .



The principle of the evaporation pan is the following:

- the pan is installed in the field
- the pan is filled with a known quantity of water (the surface area of the pan is known and the water depth is measured)
- the water is allowed to evaporate during a certain period of time (usually 24 hours). For example, each morning at 7 o'clock a measurement is taken. The rainfall, if any, is measured simultaneously
- after 24 hours, the remaining quantity of water (i.e. water depth) is measured
- the amount of evaporation per time unit (the difference between the two measured water depths) is calculated; this is the pan evaporation: E_{pan} (in mm/24 hours)
- the E_{pan} is multiplied by a pan coefficient, K_{pan} , to obtain the ET_o .

Formula: $ET_o = K_{pan} \times E_{pan}$

with:

ET_o : reference crop evapotranspiration

K_{pan} : pan coefficient

E_{pan} : pan evaporation

If the water depth in the pan drops too much (due to lack of rain), water is added and the water depth is measured before and after the water is added. If the water level rises too much (due to rain) water is taken out of the pan and the water depths before and after are measured.

3. Determination of K_{pan}

When using the evaporation pan to estimate the ET_o , in fact, a comparison is made between the evaporation from the water surface in the pan and the evapotranspiration of the standard grass. Of course the water in the pan and the grass do not react in exactly the same way to the climate. Therefore a special coefficient is used (K_{pan}) to relate one to the other.

The pan coefficient, K_{pan} , depends on:

- the type of pan used
- the pan environment: if the pan is placed in a fallow or cropped area
- the climate: the humidity and windspeed

For the Class A evaporation pan, the K_{pan} varies between 0.35 and 0.85. Average $K_{pan} = 0.70$.

The K_{pan} is high if:
 the pan is placed in a fallow area
 the humidity is high (i.e. humid)
 the windspeed is low

The K_{pan} is low if:
 the pan is placed in a cropped area
 the humidity is low (i.e. dry)
 the windspeed is high

If the pan factor is not known the average value could be used. If more accuracy is required, the pan factors can be taken from the table below (for class A pan only).

Table: Pan coefficients (K_p) for Class A pan for different pan siting and environment and different levels of mean relative humidity and wind speed (FAO Irrigation and Drainage Paper No. 24)

Example:

Class A pan	Case A: Pan placed in short green cropped area				Case B: Pan placed in dry fallow area			
		low < 40	medium 40 - 70	high > 70		low < 40	medium 40 - 70	high > 70
RH mean (%) Ⓢ								
Wind speed (m s ⁻¹)	Windward side distance of green crop (m)				Windward side distance of dry fallow (m)			
Light	1	.55	.65	.75	1	.7	.8	.85
< 2	10	.65	.75	.85	10	.6	.7	.8
	100	.7	.8	.85	100	.55	.65	.75
	1000	.75	.85	.85	1000	.5	.6	.7
Moderate	1	.5	.6	.65	1	.65	.75	.8
2-5	10	.6	.7	.75	10	.55	.65	.7
	100	.65	.75	.8	100	.5	.6	.65
	1000	.7	.8	.8	1000	.45	.55	.6
Strong	1	.45	.5	.6	1	.6	.65	.7
5-8	10	.55	.6	.65	10	.5	.55	.65
	100	.6	.65	.7	100	.45	.5	.6
	1000	.65	.7	.75	1000	.4	.45	.55
Very strong	1	.4	.45	.5	1	.5	.6	.65
> 8	10	.45	.55	.6	10	.45	.5	.55
	100	.5	.6	.65	100	.4	.45	.5
	1000	.55	.6	.65	1000	.35	.4	.45

- 1) Type of pan: Class A evaporation pan
 Water depth in pan on day 1 = 150 mm
 Water depth in pan on day 2 = 144 mm (after 24 hours)
 Rainfall (during 24 hours) = 0 mm
 $K_{pan} = 0.75$
 Formula: $ET_o = K_{pan} \times E_{pan}$
 Calculation: $E_{pan} = 150 - 144 = 6 \text{ mm/day}$
 $ET_o = 0.75 \times 6 = 4.5 \text{ mm/day}$

4. For more information:

www.fao.org

Crop evapotranspiration - Guidelines for computing crop water requirements - Irrigation and drainage paper 56