Water and Nutrient Management

An Integrated System Approach

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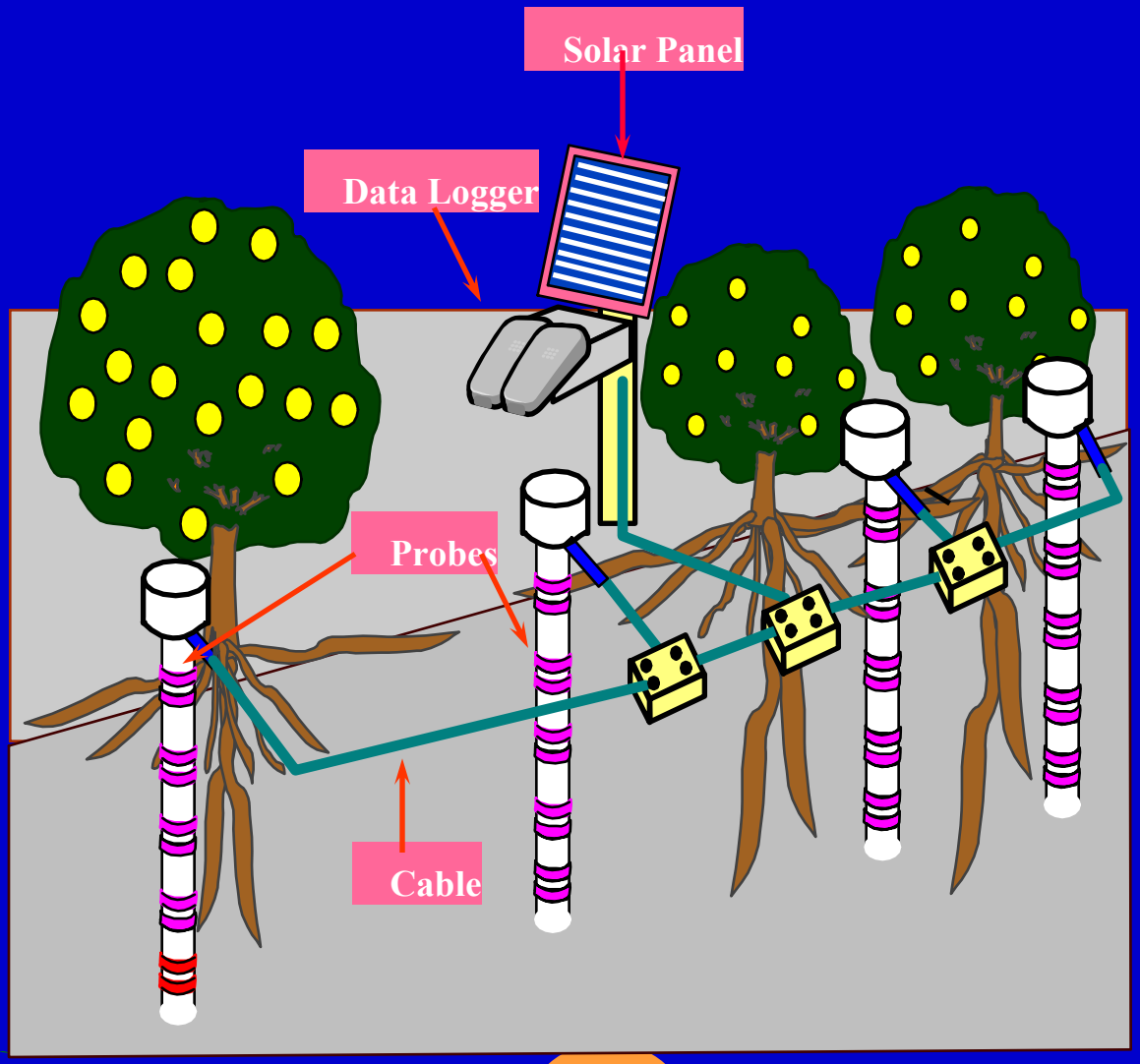

Solar Panel
Data Logger
Probes
Cable

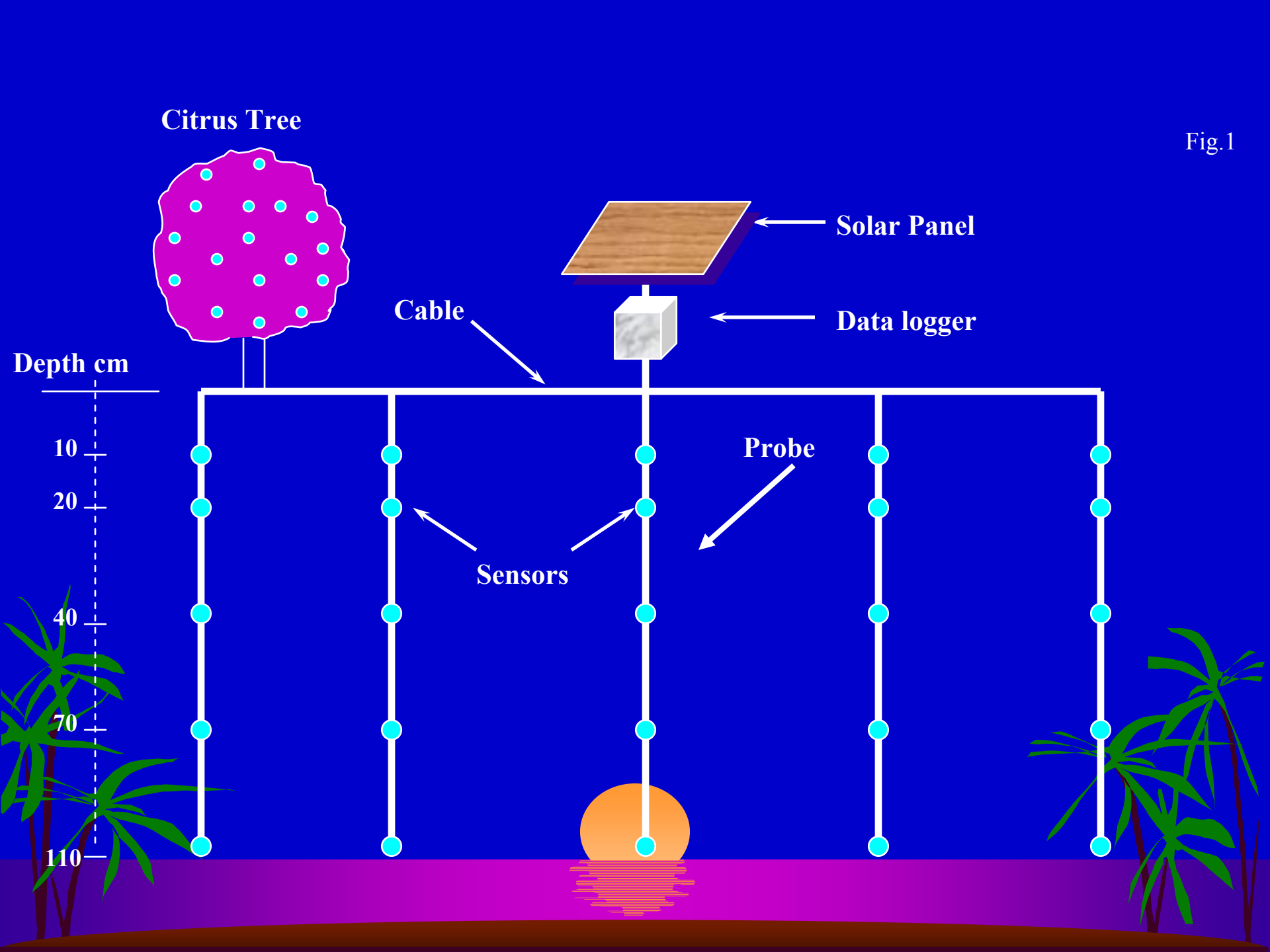

Citrus Tree
Solar Panel
Cable
Data logger
Depth cm
10
20
40
70
110
Probe
Sensors

Fig.1

Probe Installation

- The EnviroSCAN probe is installed using specialized tools to minimize disturbance of the soil profile and insure a tight contact between the access tube and the soil.

EnviroSCAN Probe Design

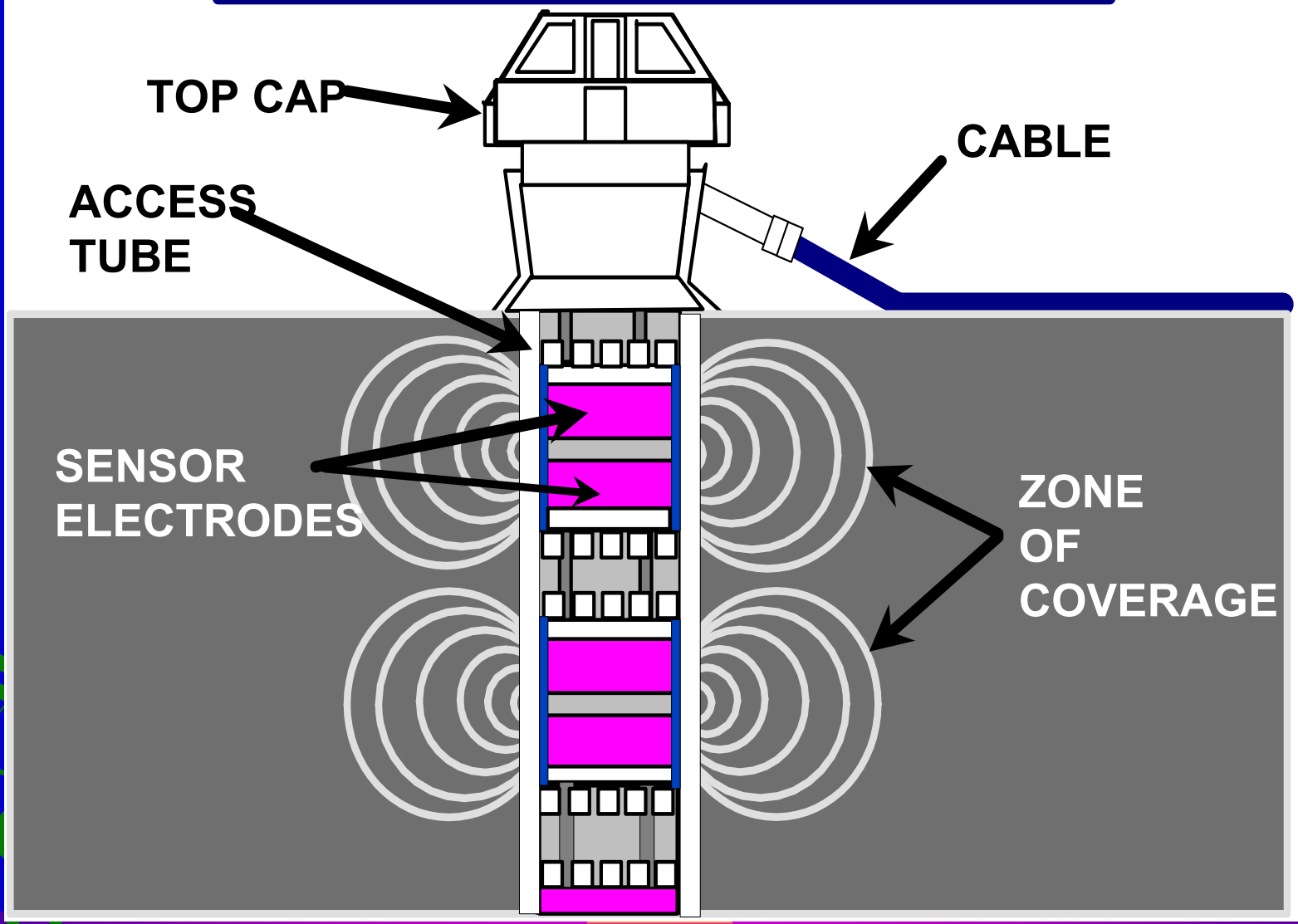


Fig. 1

Dielectric Constant

- The dielectric constant of water depends upon the polarization of its molecules in an electric field.
- The dielectric for :
  - water = 80
  - soil matrix < 10
  - air = 1
- The dielectric contant of the SWA mixture is dominated by water-volume fraction

- Capacitance probe can be inserted in PVC access tube or placed directly in the soil.
- Field results indicated that portable probes were unable to give acceptable soil water content especially for coarse textured and fine sandy loam soils.
- Air gaps, changes in bulk densities and poor field installation of the access tubes are serious problems with portable probes.

EnviroSCAN

Logger Options Exit

B2

Settings 10d

Stacked Separate Graph > Logger: LakeAlfred

S1,P5, 10cm 6.08

S1,P5, 20cm 5.11

S1,P5, 40cm 4.8

S1,P5, 70cm 5.28

S1,P5,110cm 5.87

29/11/98 1/12 3/12 5/12 7/12

B2

Settings 10d

Summed Graph - Interpolated > Logger: LakeAlfred

SOIL WATER CONTENT (%)

80 70 60 50

29/11/98 1/12 3/12 5/12 7/12

LakeAlfred

Defaults

- On
- Off

Interpolation

Depth

10 20 30 40 50 60 70 80 90 100 110 cm

A1 A2 A3 B1 B2

F5 SUMMED

F6 SEPARATE

A3 A3 A2 B1

B1 B1 B2 B2

EnviroSCAN

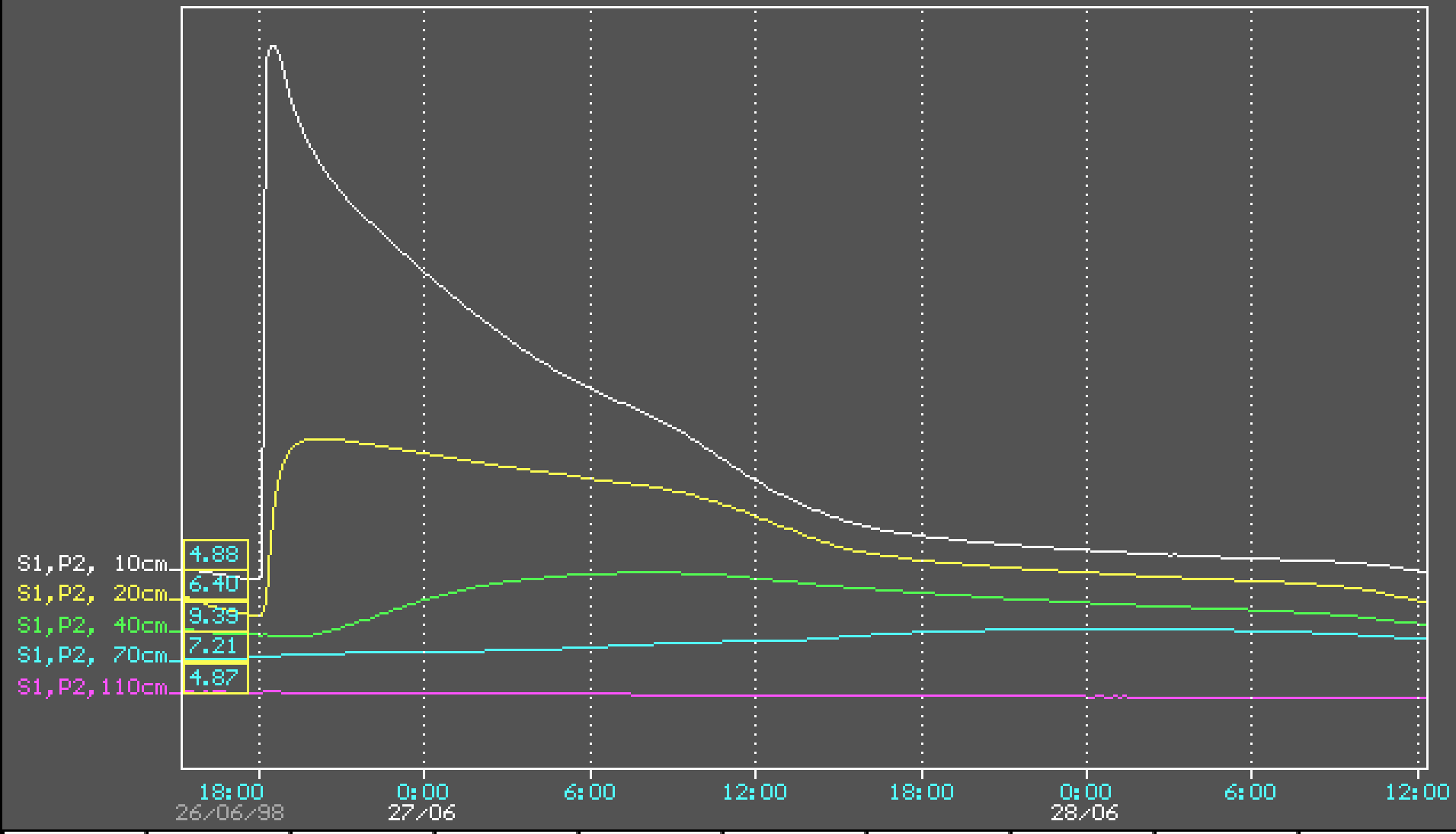
Logger Options Exit

A2

Settings 30d

Stacked Separate Graph > Logger: LakeAlfred

Site ID's: S1=A2



EnviroSCAN

Logger Options Exit

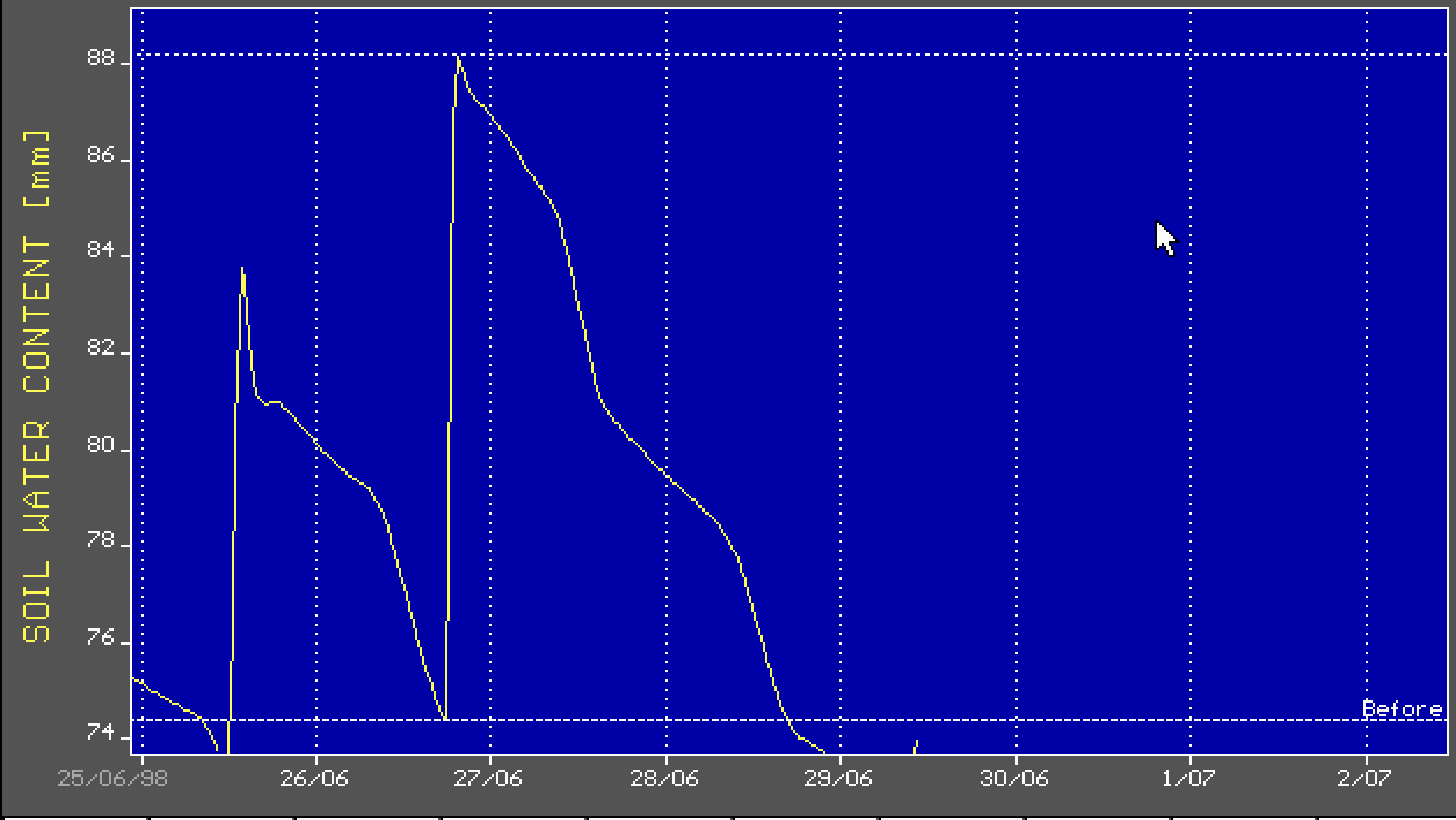
A2

Settings 30d

Summed Graph - Interpolated > Logger: LakeAlfred

Site ID's: A2;

Probe(s): 2 Sensor(s) [cm]: 10+20+40+70+110



EnviroSCAN

Logger Options Exit

A3

Settings 30d

Stacked Separate Graph > Logger: LakeAlfred

S1,P3, 10cm 4.87
S1,P3, 20cm 6.03
S1,P3, 40cm 6.88
S1,P3, 70cm 5.39
S1,P3,110cm 5.82

20/08/97 24/08 28/08 1/09

A3

Settings 30d

Summed Graph - Interpolated > Logger: LakeAlfred

SOIL WATER CONTENT [mm]

110
90
70

20/08/97 24/08 28/08

LakeAlfred

Defaults

- On
- Off

Interpolation

Depth

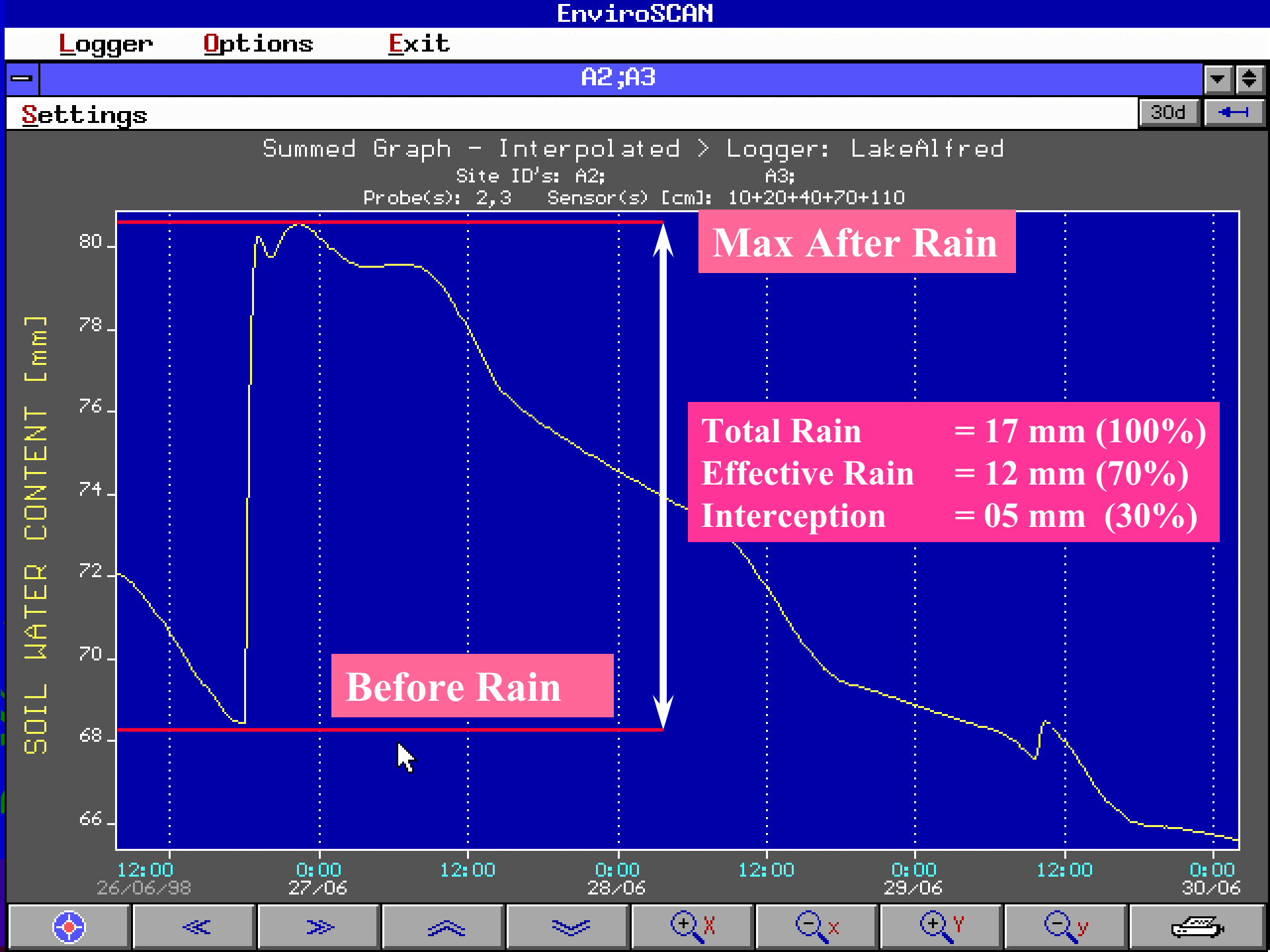
10 20 30 40 50 60 70 80 90 100 110 cm

A1 A2 A3 B1 B2

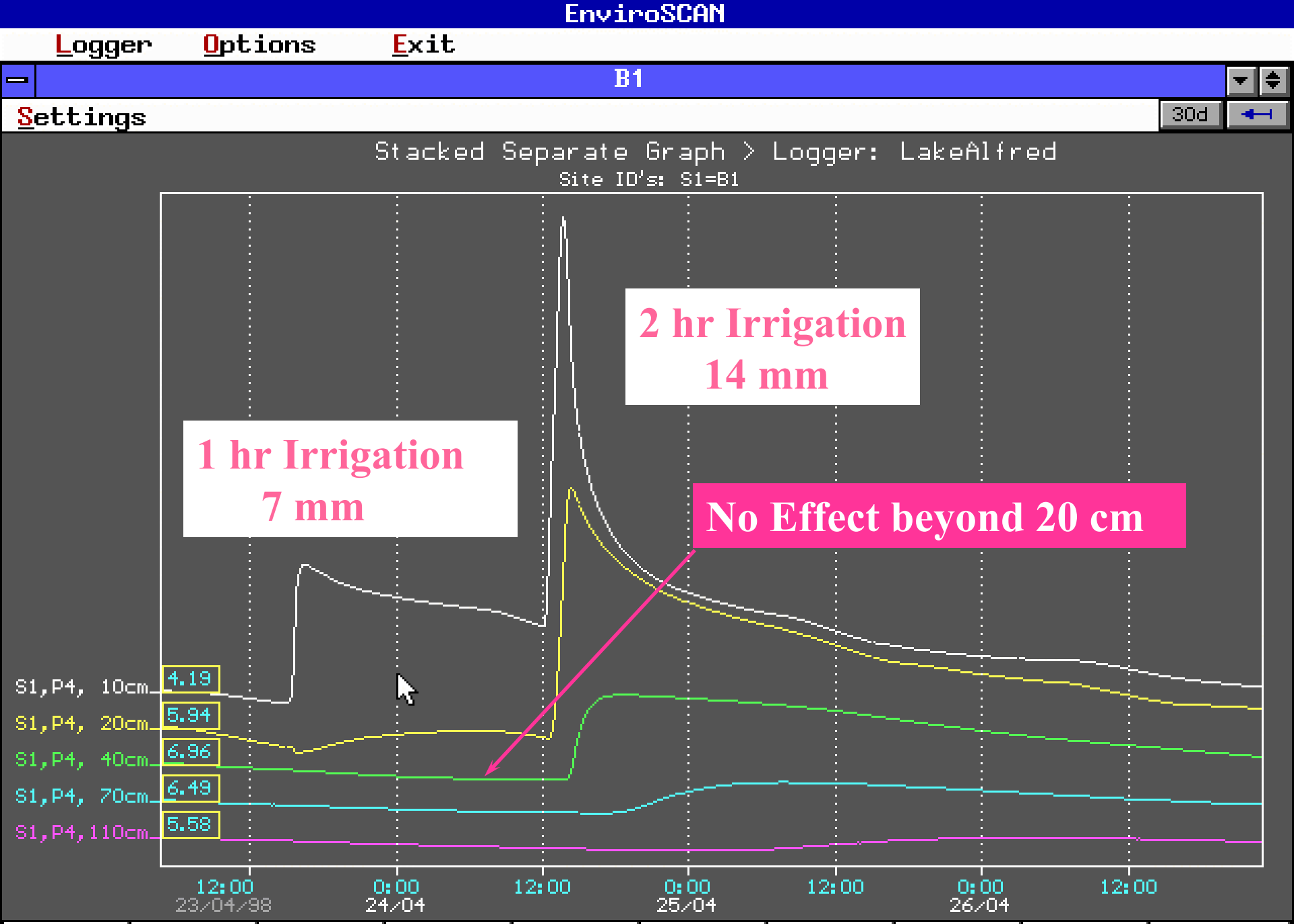
F5 SUMMED

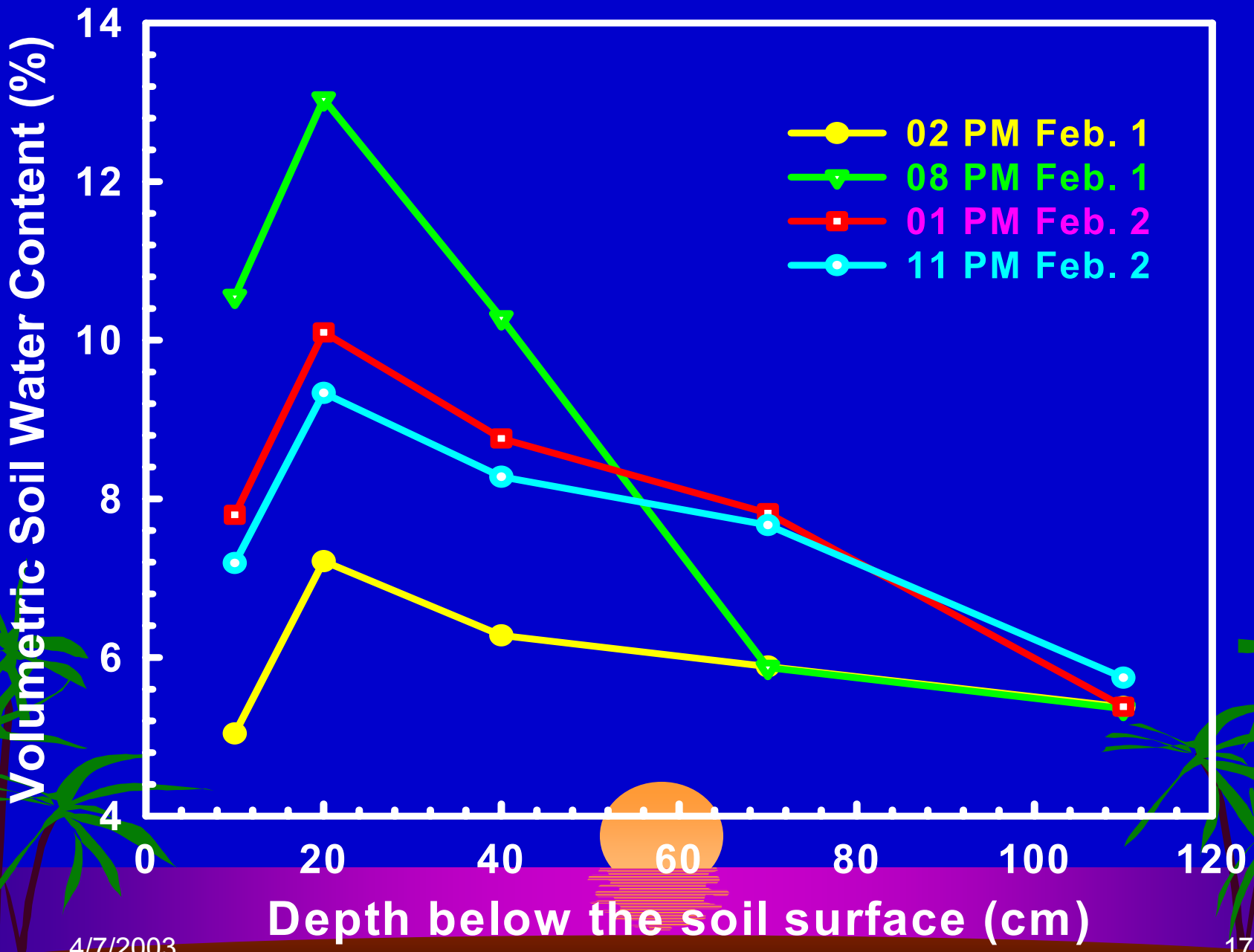
F6 SEPARATE

B1 B1 B2 B2


EnviroSCAN
Logger
Options
Exit
A2;A3
Settings
30d
Summed Graph - Interpolated > Logger: LakeAlfred
Site ID's: A2; A3;
Probe(s): 2,3 Sensor(s) [cm]: 10+20+40+70+110
SOIL WATER CONTENT [mm]
80
78
76
74
72
70
68
66
12:00 26/06/98
0:00 27/06
12:00
0:00 28/06
12:00
0:00 29/06
12:00
0:00 30/06
Max After Rain
Total Rain = 17 mm (100%)
Effective Rain = 12 mm (70%)
Interception = 05 mm (30%)
Before Rain

EnviroSCAN
Logger
Options
Exit
B1
Settings
30d
Summed Graph - Interpolated > Logger: LakeAlfred
Site ID's: B1;
Probe(s): 4 Sensor(s) [cm]: 10+20+40+70+110
Irrig Eff. =77%
Irrig Eff. =82%
Irrig Eff. =75%
SOIL WATER CONTENT [mm]
95
90
85
80
75
70
65
60
10/05/98
11/05
12/05
13/05
14/05
15/05
16/05

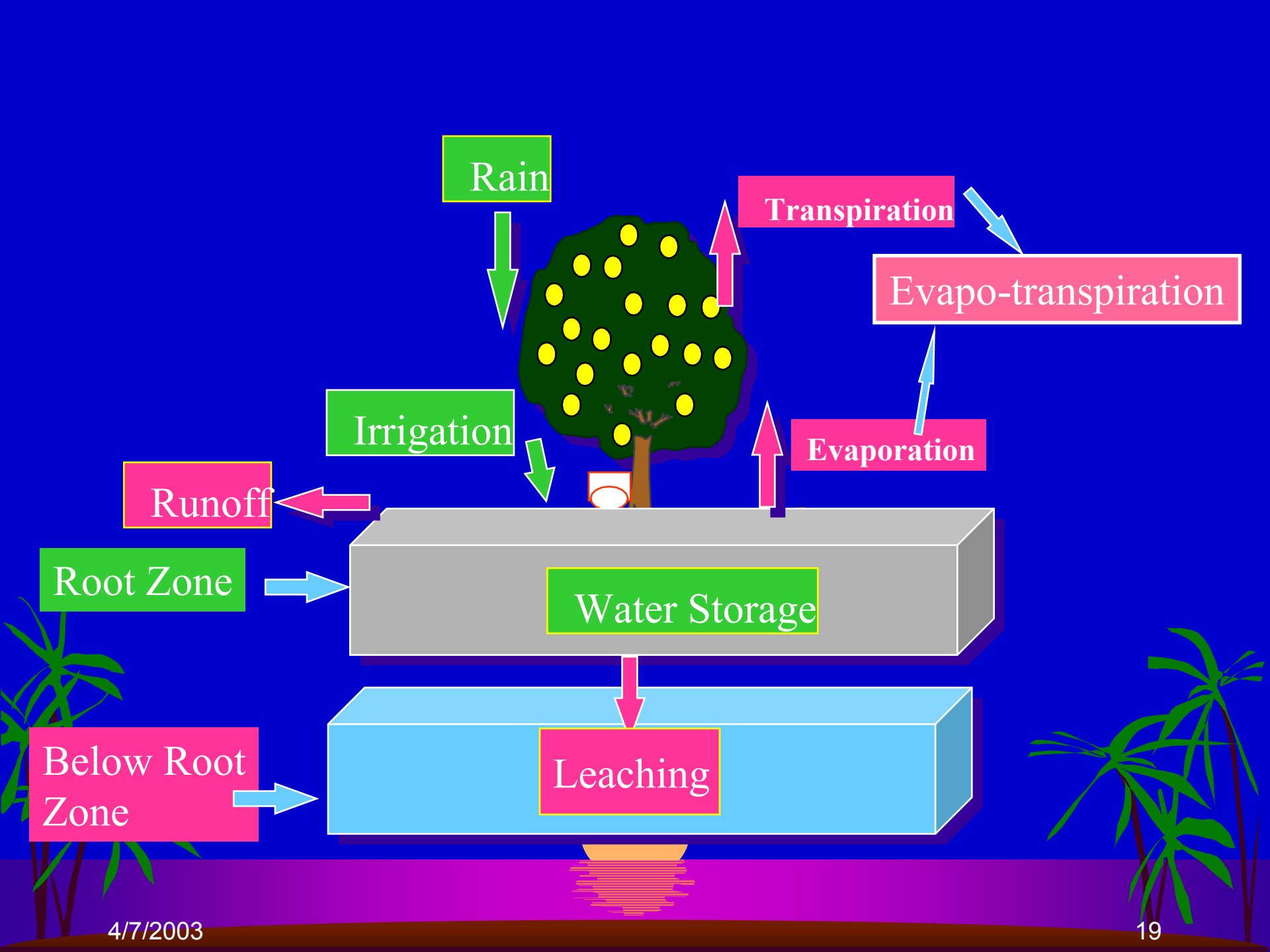

EnviroSCAN
Logger
Options
Exit
B1
Settings
30d
Stacked Separate Graph > Logger: LakeAlfred
Site ID's: S1=B1
1 hr Irrigation
7 mm
2 hr Irrigation
14 mm
No Effect beyond 20 cm
S1,P4, 10cm
S1,P4, 20cm
S1,P4, 40cm
S1,P4, 70cm
S1,P4,110cm
4.19
5.94
6.96
6.49
5.58
12:00
23/04/98
0:00
24/04
12:00
0:00
25/04
12:00
0:00
26/04
12:00


Volumetric Soil Water Content (%)
14
12
10
8
6
4
0
20
40
60
80
100
120
Depth below the soil surface (cm)
02 PM Feb. 1
08 PM Feb. 1
01 PM Feb. 2
11 PM Feb. 2

WABAMO

Model Description

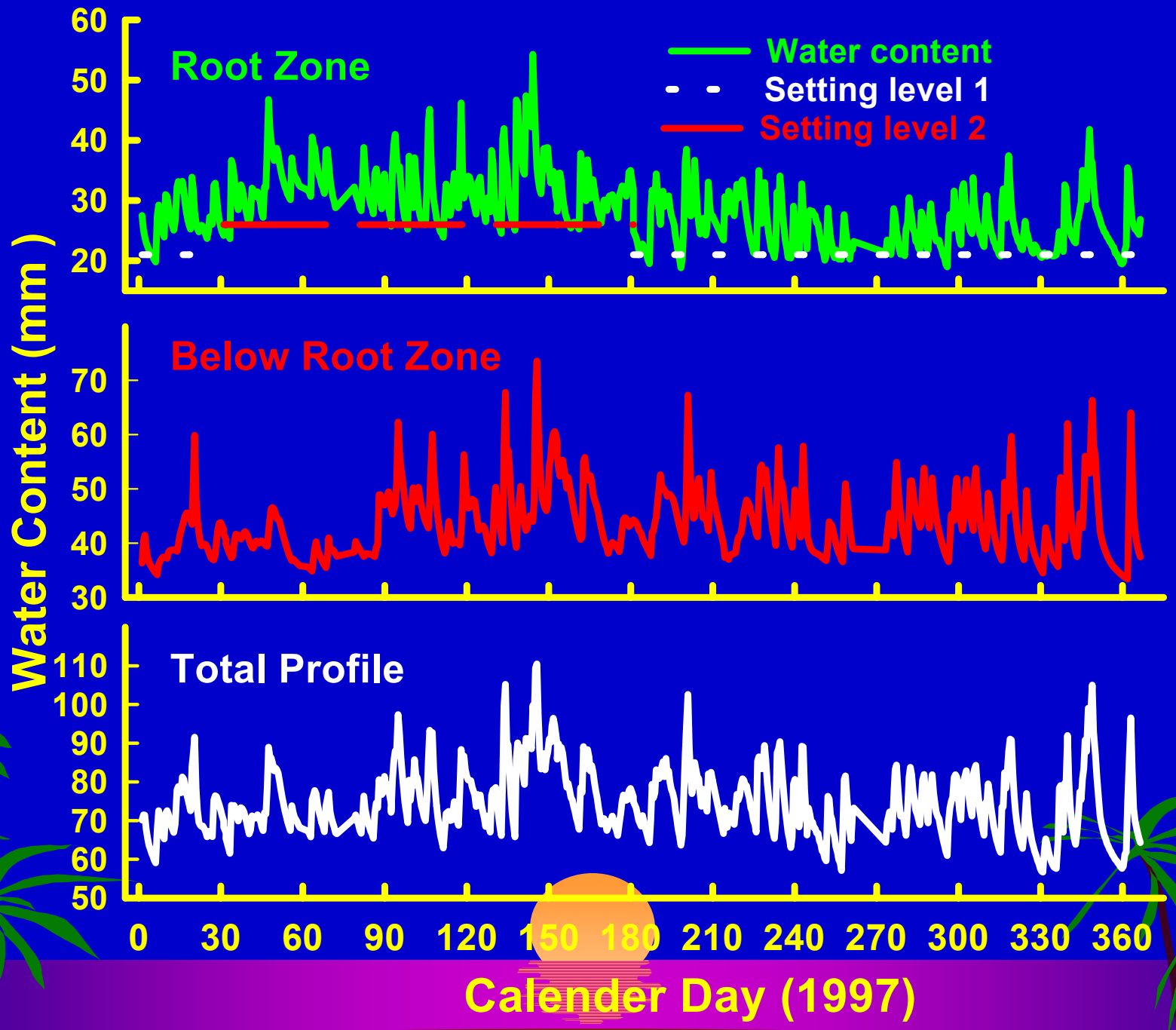
Citrus Evapotranspiration & Water Leaching


Rain
Transpiration
Evapo-transpiration
Irrigation
Evaporation
Runoff
Root Zone
Water Storage
Below Root Zone
Leaching

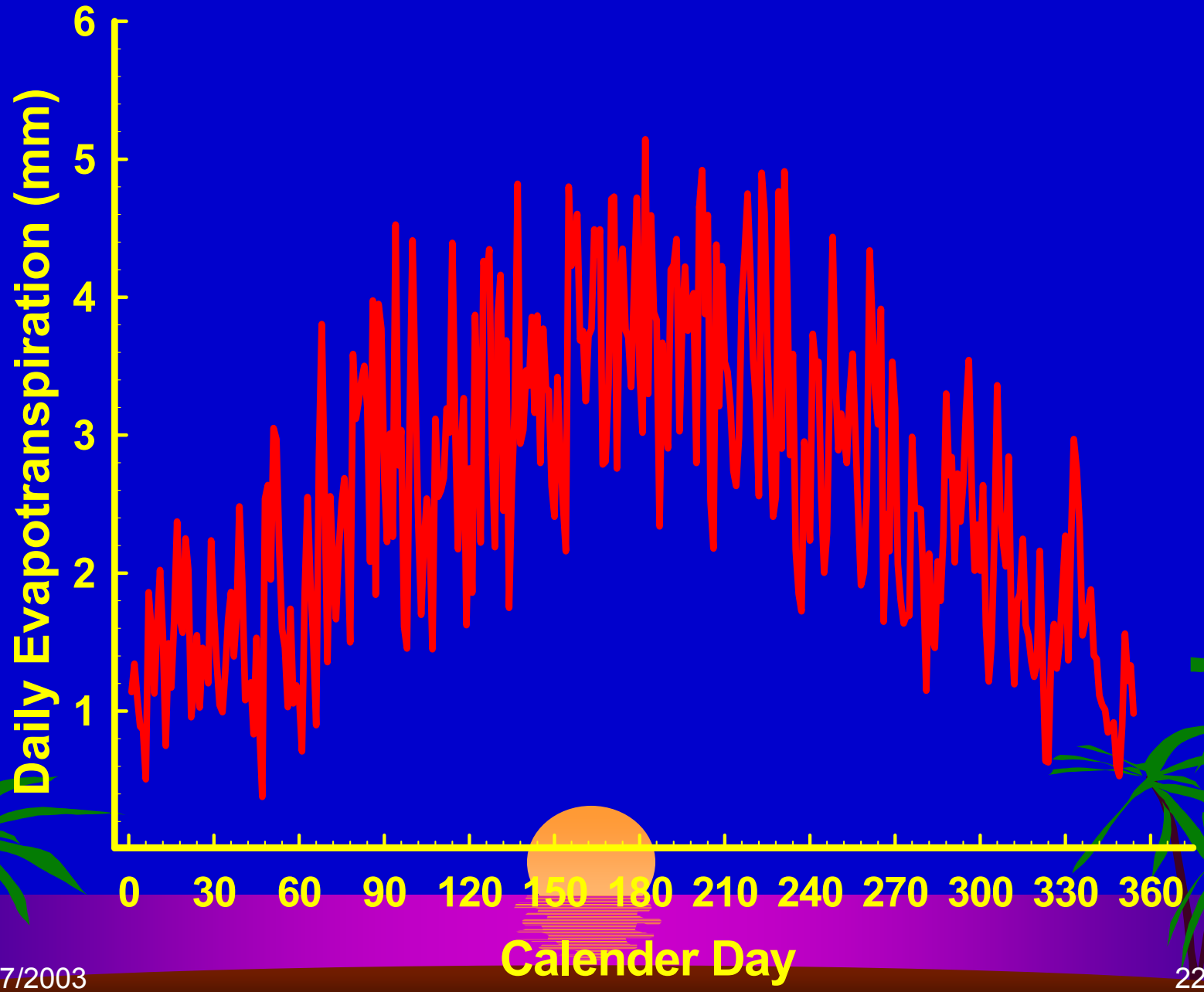
Water Mass balance Equation

$$ET = I + Qv + W$$

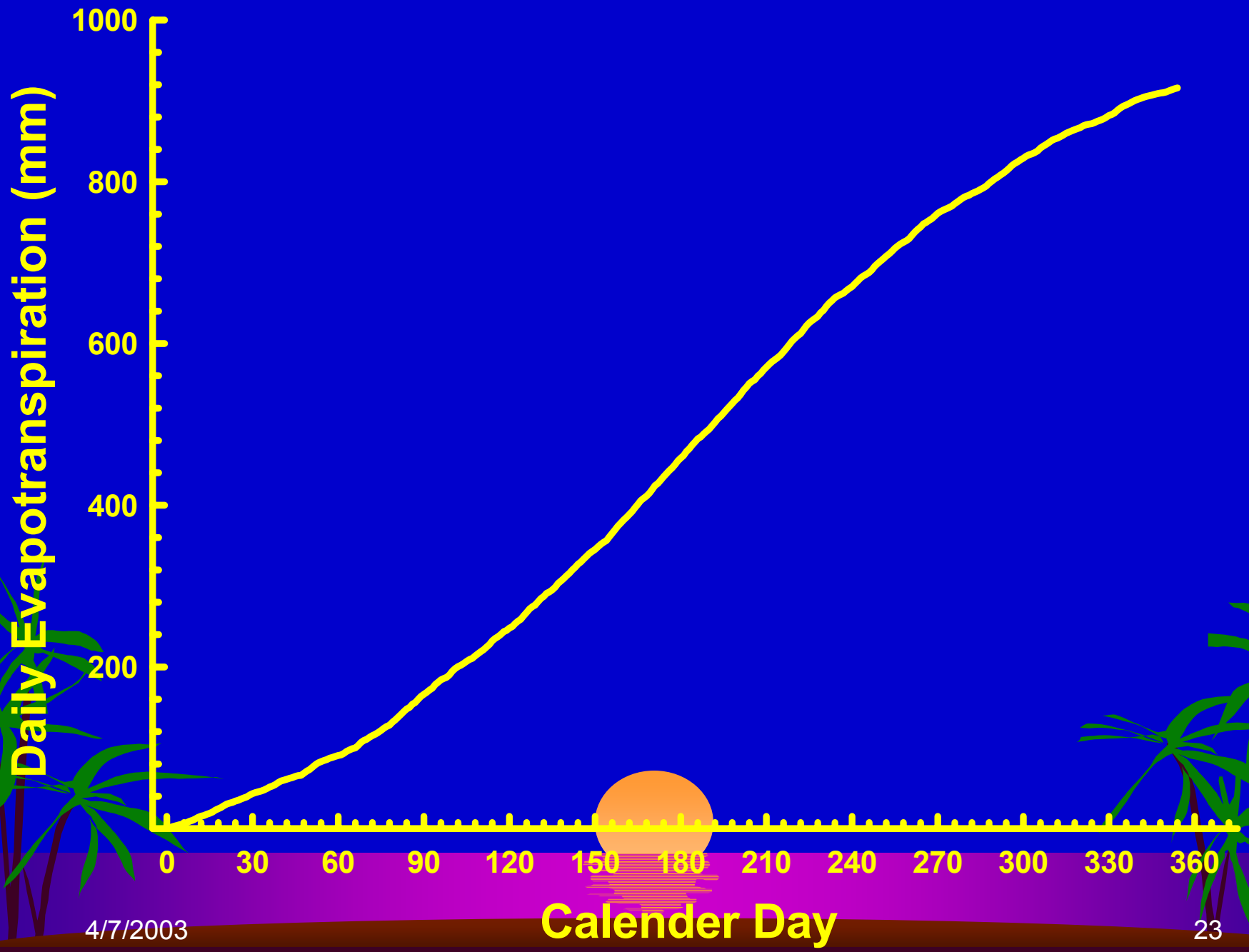
- ET = Evapotranspiration
- I = Rain & Irrigation
- Q_v = Drainage Below Rootzone
-) W = Soil Water Storage variation between two time steps


Root Zone
Water content
Setting level 1
Setting level 2
Below Root Zone
Total Profile
Water Content (mm)
60
50
40
30
20
70
60
50
40
30
110
100
90
80
70
60
50
0
30
60
90
120
150
180
210
240
270
300
330
360
Calender Day (1997)

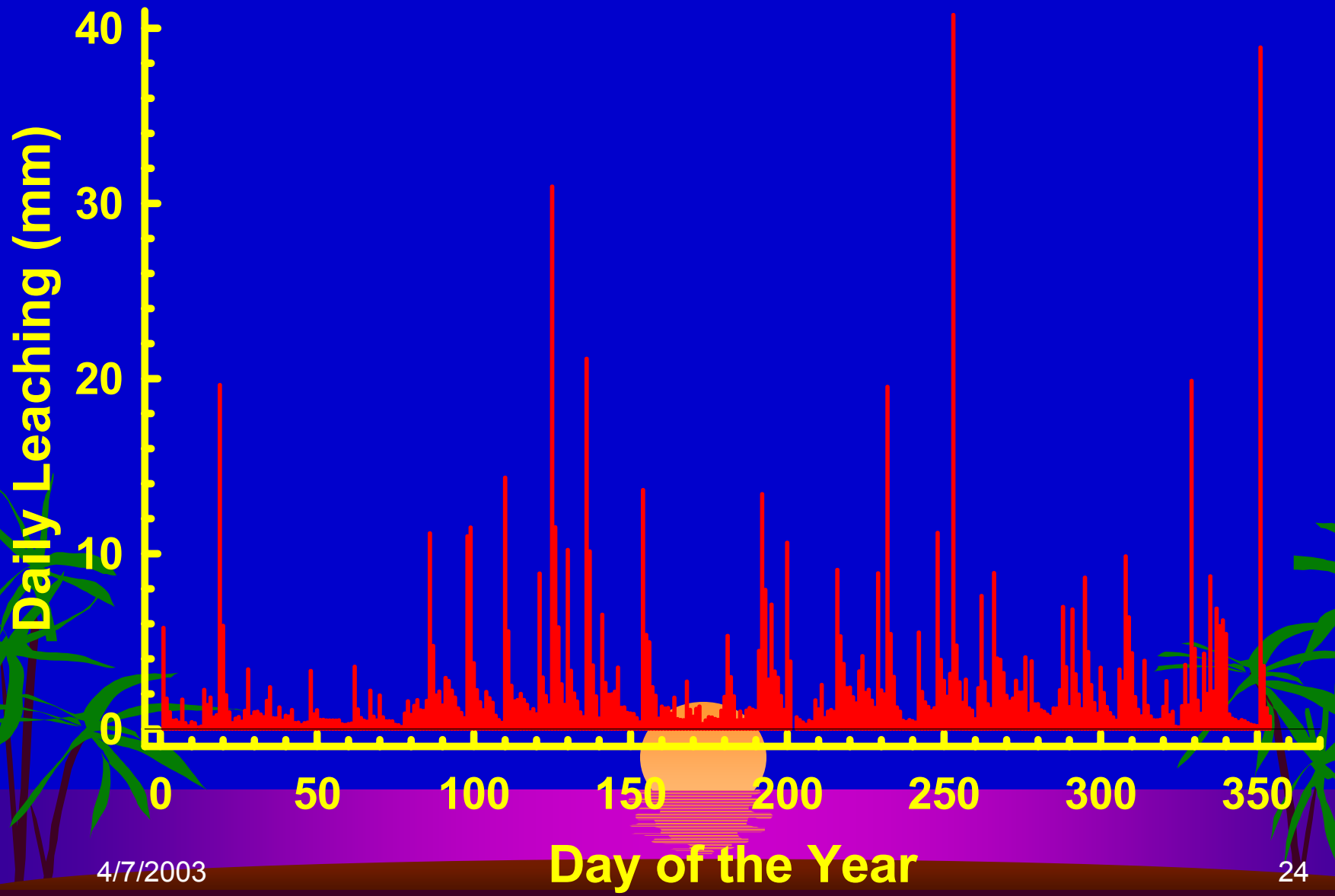
Daily Evapotranspiration for a Young Citrus Grove (1997)

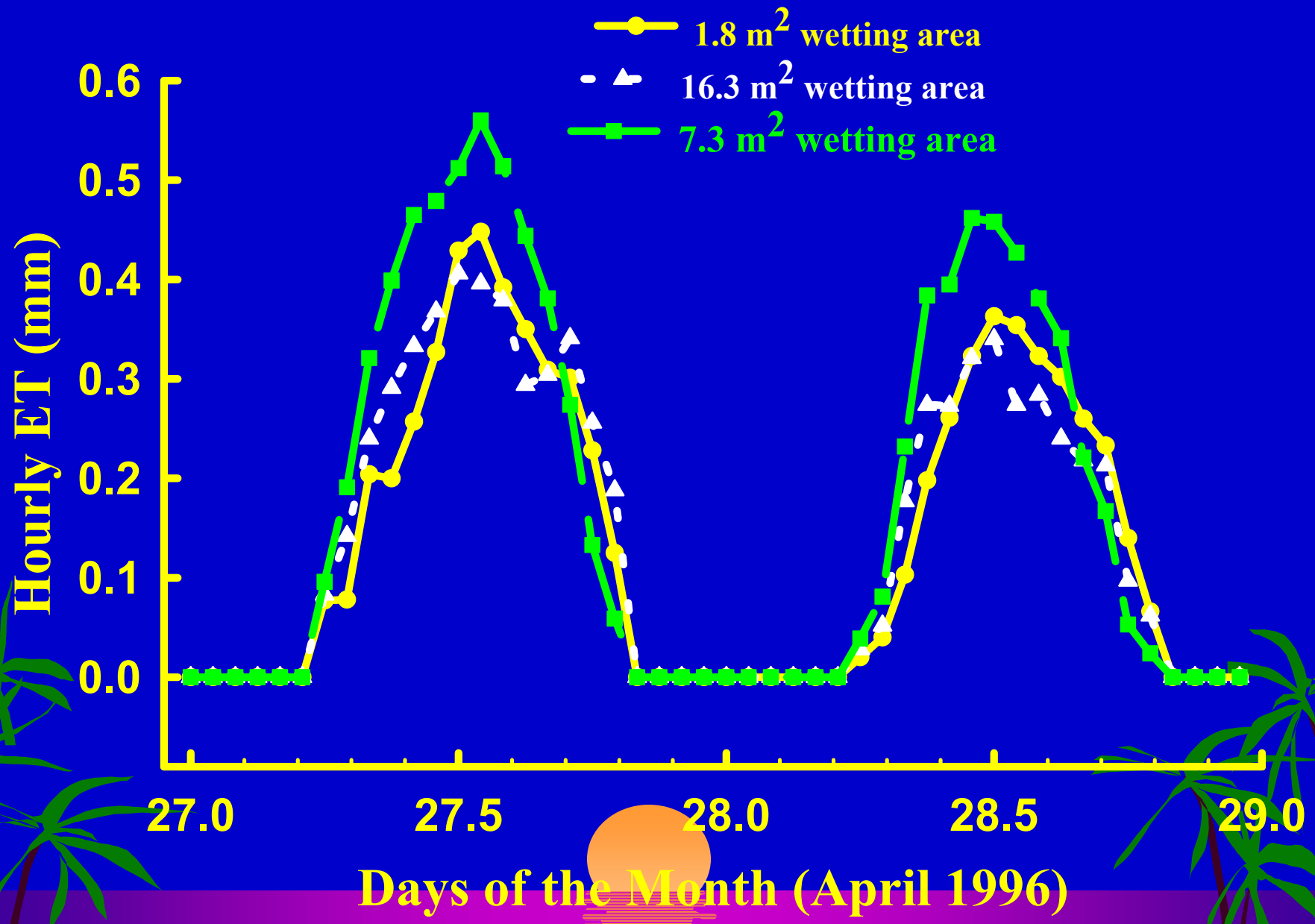


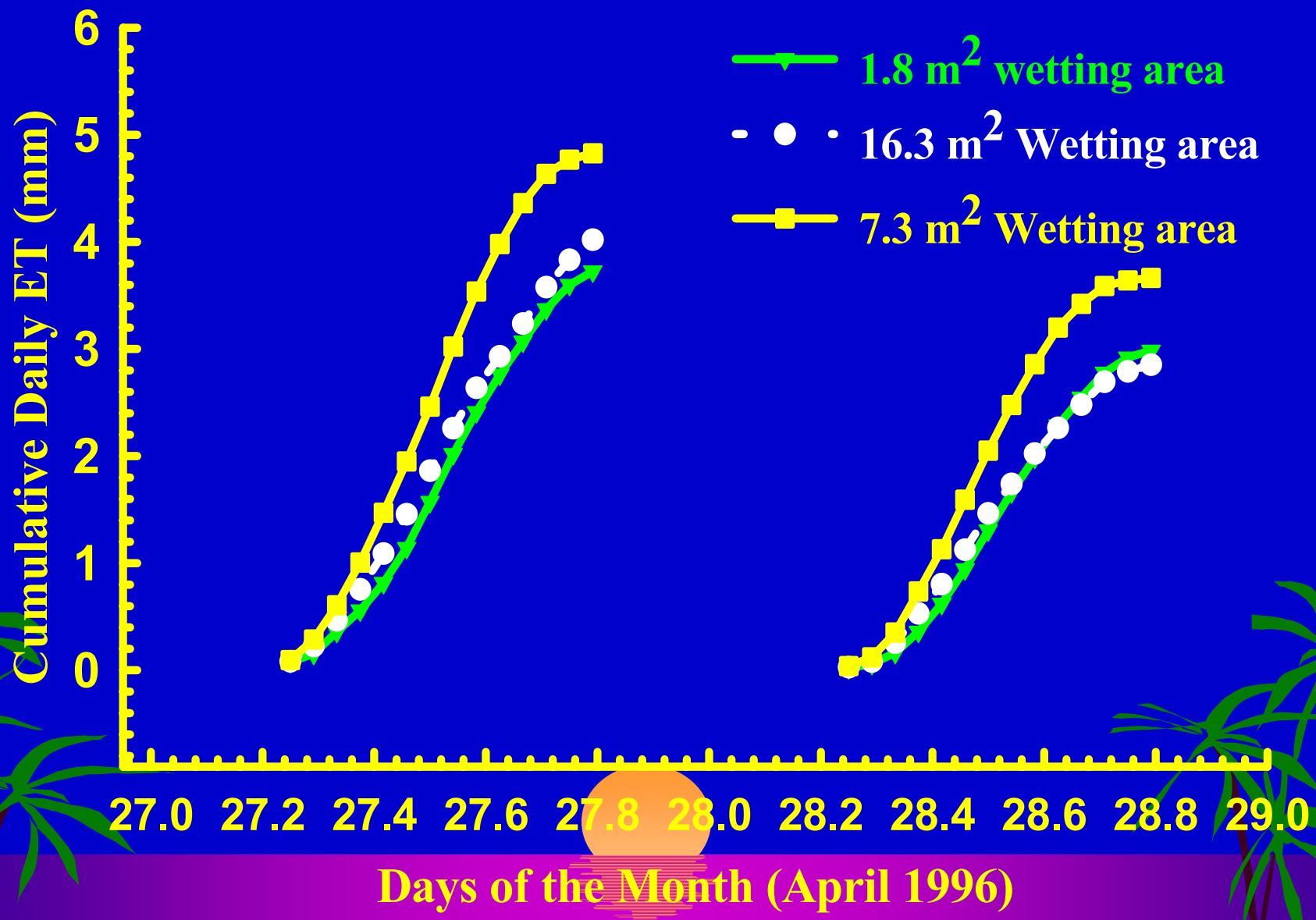
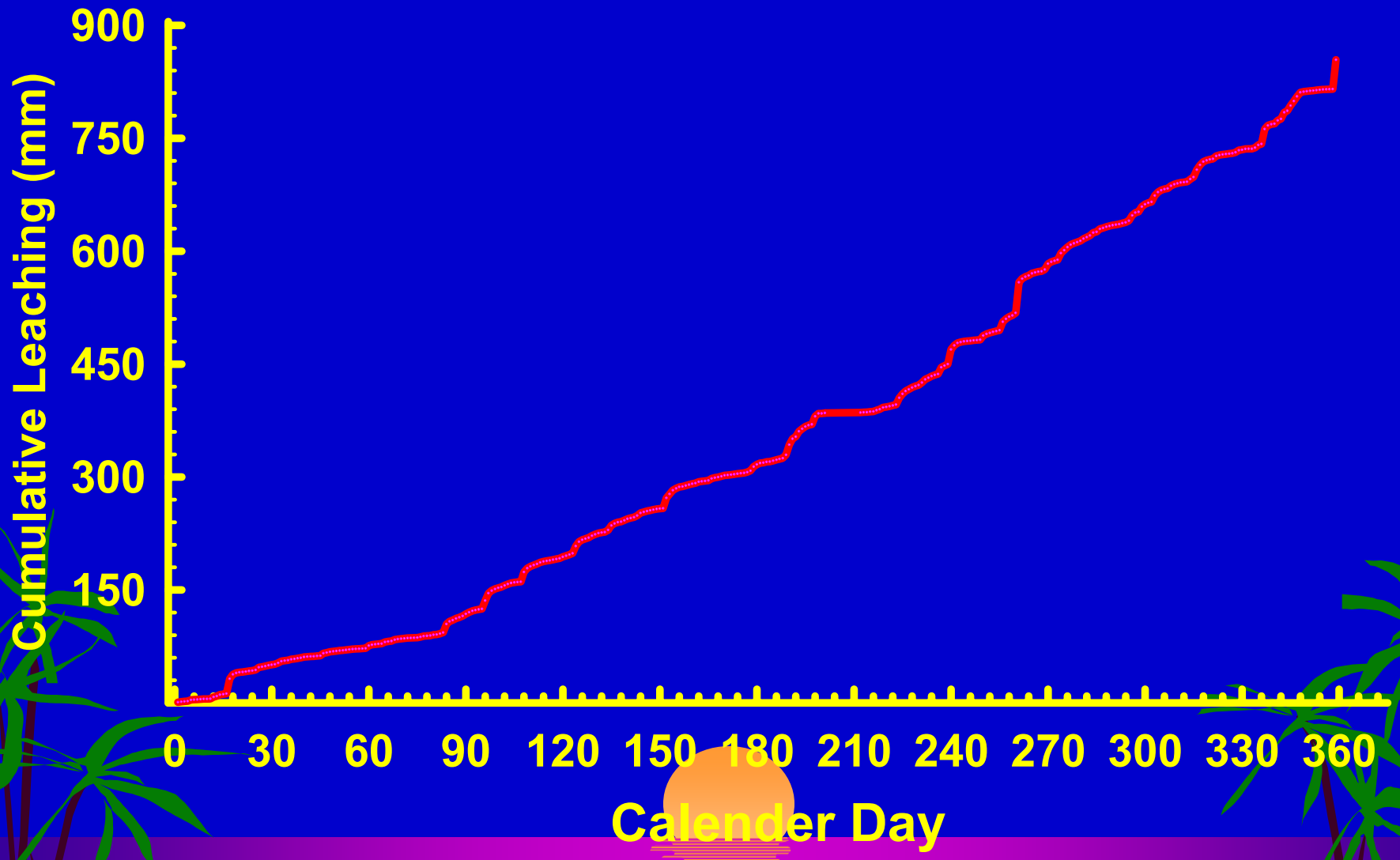
Calculated Cumulative Evapotranspiration for a Young Citrus Grove (1997)



Calculated Water Leaching Below a Young Citrus Grove (1997)




1.8 m2 wetting area
16.3 m2 wetting area
7.3 m2 wetting area
Hourly ET (mm)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
27.0
27.5
28.0
28.5
29.0
Days of the Month (April 1996)


1.8 m2 wetting area
16.3 m2 Wetting area
7.3 m2 Wetting area
Cumulative Daily ET (mm)
0
1
2
3
4
5
6
27.0
27.2
27.4
27.6
27.8
28.0
28.2
28.4
28.6
28.8
29.0
Days of the Month (April 1996)

Cumulative Leaching Below a Citrus Grove (1997)