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Wageningen Universiteit & Research centre
Omgevingswetenschappen
Centrum Water & Klimaat
Team Integraal Waterbeheer

Nota 1636 December 1985

Instituut voor Cultuurtechniek en Waterhuishouding
Wageningen

Introduction of the occurrence of high groundwater levels and surface water storage in computer program SWATRE.

Ir. J. G. Wesseling
Dr. T. Brandyk

C O N T E N T S

ALTERRA,
Wageningen Universiteit & Research centr
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Team Integraal Waterbeheer

I N T R O D U C T I O N

In the previous version of the computer program SWATRE (BELMANS, WESSELING and FEDDES, 1983) calculations of the soil moisture distribution and the waterbalance stopped when the water table was rising close to the soil surface. This restriction was caused by the way of computation of the height of the groundwater level (see page 279, point 4 of BELMANS et al., 1983). In practice, situations may occur in which the groundwater table is rising up to or even beyond the soil surface. This paper presents an extension of SWATRE, which is capable to deal with this type of situation, including the ponding phenomenum. In the following the underlying theory, a description of the major changes in the program, the description of input and an example will be presented.

1. H i g h g r o u n d w a t e r l e v e l s.

When the groundwater level comes too close to the soil surface, i.e. within the first two soil compartments, the numerical scheme cannot be solved any more. Thus the effects of relatively high groundwater levels should be considered in a different way. When the groundwater level is close to the surface, the soil water pressure head distribution in the profile above the water table may assumed be considered to be in a condition of equilibrium:

$$h=-\zeta \qquad (1)$$

where

h = pressure head (cm)

ζ = height above the groundwater level (cm)

The water balance of the soil profile for one time step may be written as follows:

$$(P - E - T + q_m)\,\Delta t^j - \Delta W = \varepsilon \qquad (2)$$

where

P = net precipitation rate, i.e. rainfall - interception (cm.d^{-1})

E = soil evaporation rate (cm.d^{-1})

T = transpiration rate (cm.d^{-1})

q_m = flux through the bottom of the soil profile (cm.d^{-1})

Δt^j = time step (d)

ΔW = change in moisture content of the soil profile (cm)

ε = error in the water balance (should be 0) (cm)

Eq. (2) should be satisfied for every time step. Under equilibrium soil moisture condition, the value of ΔW represents the change in moisture content, caused by either lowering or raising the groundwater level. Suppose the groundwater level is kept constant during that timestep, then most of the time the expression on the left hand side of eq. (2) will not be equal to zero. This is due to the fact that the position of the groundwater level usually changes when moisture is flowing into or out of the soil profile.

The error ε is an indication of the change in groundwater level depth. Using this parameter the amount of moisture stored in the soil profile to satisfy the water balance can be computed according to:

$$W^j = W^{j-1} + \varepsilon \qquad (3)$$

where

W^j = soil moisture storage in the profile after the j^{th} timestep (cm)

W^{j-1} = calculated soil moisture storage in the profile after the previous timestep (cm)

The soil moisture storage in the profile is calculated by integration:

$$V = \int_{D}^{0} \theta(\xi)\, d\xi \qquad (4)$$

where

D = position of the bottom of the soil profile (cm).

$\theta(\xi)$ = moisture content at depth ξ (-)

The value of $\theta(\xi)$ is computed from the pressure head in the profile using the soil moisture retention curve. When equilibrium soil moisture condition is assumed in the profile, one may use eq. (4) to calculate the moisture content of the soil profile for several depths of the groundwater level and storing them in a table. The actual soil moisture content of the profile , W_t, is computed using eq. (3). Then the depth of the groundwater table may be found by linear interpolation between the values in the groundwater level - moisture content table.

2. P o n d i n g

With high precipitation rates not all the precipitation will infiltrate into the soil. Depending on the kind and slope of soil, some of the water will stay on top of the profile by surface storage ponding, and some will flow away by runoff. See fig. 1. Now eq. (2) becomes:

$$(q_m - E - T - q_s)\,\Delta t^j - \Delta W = \varepsilon \qquad (5)$$

where

q_s = moisture flux density through the top of the soil profile ($cm.d^{-1}$)

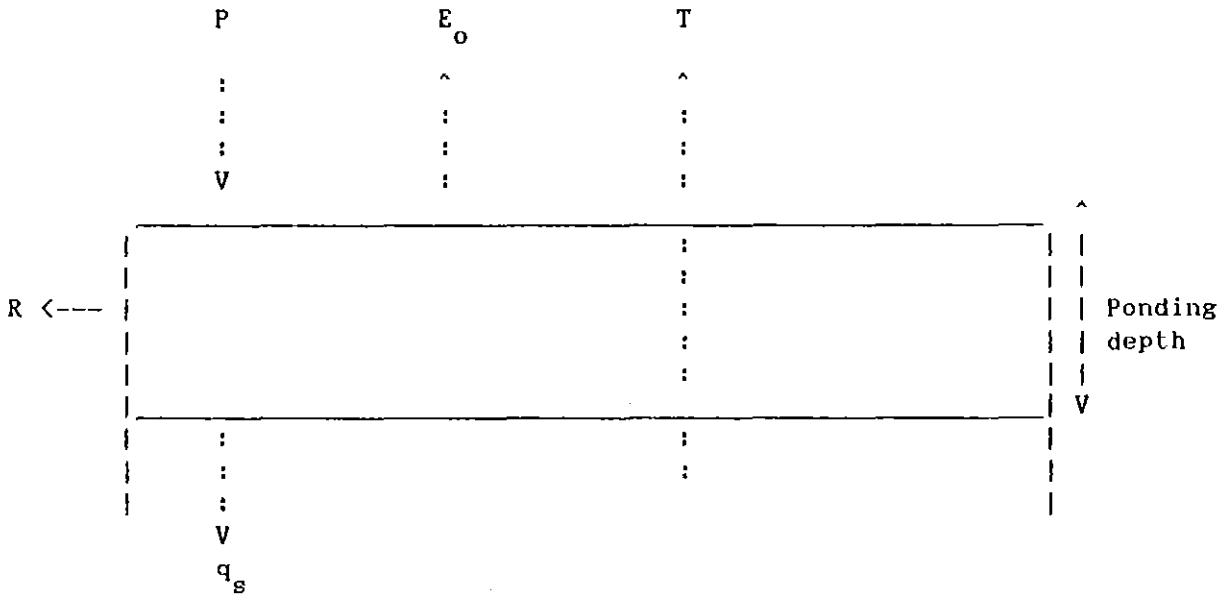

Fig. 1. Schematic view of flux densities in case of surface storage

As the evaporation is now taking place from open water, it is not allowed to calculate it as E any more. Many equations can be found in literature to calculate open water evaporation. It is possible to choose between different equations to compute the potential evapotranspiration flux in the computerprogram SWATRE. This implies different input data. So for the calculation of open water evaporation an equation was required using data available to the program whatever method of soil evaporation was applied. The equation chosen was described by MAKKINK (1960) and states

$$E_o = 0.098 \frac{\delta}{\delta+\gamma} 0.0352 R_s - 0.027 \qquad (6)$$

where

E_o = open water evaporation ($cm.d^{-1}$)

δ = slope of the saturation pressure curve ($mbar.K^{-1}$)

γ = psychometric constant ($mbar.K^{-1}$)

R_s = global radiation ($W.m^{-2}$)

After every time step that has been taken, the thickness of the ponding water layer must be calculated on the basis of the fluxes that are responsible for it. The maximum thickness of the ponding water layer is depending on the slope of the soil and on the kind of soil.

3. Major changes in the program

Some of the main differences between the original program SWATRE as described by BELMANS et al. (1983) and the present version that is capable to handle high groundwater levels and surface water storage, will be discussed in this chapter. Not all the differences in the subroutines will be mentioned, because in some cases it is only a matter of one extra statement.

a. In the main program an extra variable, IERR, has been introduced. When this variable gets a value not equal to zero, the depth of groundwater level (if it has to be calculated) is found using the subroutine RUNOFF, assuming equilibrium conditions.

b. In subroutine RDATA some additional calculations are performed:

   - open water evaporation is computed using eq. (6),

- the variable VOLMAX, which represents the maximum amount of moisture the profile can contain, is computed,
- a new array is introduced: VOLFC, with 40 elements. This array represents the soil moisture storage in the profile when equilibrium is assumed for a depth of groundwater level varying from -1 to -40 cm, with steps of 1 cm.

c. Subroutine BOCO has been changed in such a way that, when there is a layer of water standing on the soil (POND > 0) the pressure head at the soil surface (PHSA) is set equal to 0.

d. Calculation of the thickness of the ponding layer is performed in subroutine INTGRL, according to

POND = POND + (PRECA - FINA + FLXS(1) - EOPENA) * DT

This value is bounded by 0 at the lower side, and by the specified maximum value, PONDMX, at the upper side.

e. When the groundwater level is above nodal point 2, a fixed value of 0.2 days is used as timestep. This has been introduced in subroutine CALCDT.

f. The new subroutine RUNOFF is taking care of finding the depth of the water table when, due to the lack of available nodal points, the original procedure of calculation Starting from the known soil moisture storage of the profile, the depth of the groundwater table is calculated as if equilibrium conditions would occur. As the error in the water balance, DVOL, is known, the actual moisture content of the soil profile at the end of the momentary timestep (TOSTOR) can be found. Using the array VOLFC, now the new groundwater level is known. When the level is then below the third nodal point,

the next calculation of groundwater level will be performed in the original way. Before returning to the main program, a correction is made for the discretization into the original compartments.

4. I n p u t

As compared to the original program, there is one new variable to read: PONDMX, the maximum allowed thickness of the layer of water ponding on the surface (in cm). Its location is just before the soil physical parameters (see Description of Input).

R E F E R E N C E S

BELMANS, C., J.G. WESSELING and R.A. FEDDES, 1983. Simulation model of the water balance of a cropped soil: SWATRE. Journal of Hydrology, 63, 3/4 : 271-286. Technical Bulletin I.C.W. nr. 21.

MAKKINK, G.F., 1960. De verdamping uit vegetaties in verband met de formule van Penman. Comm. Hydrol. Research TNO, The Hague. Proceedings and Informations 4:90-115.

APPENDIX A: Description of input

I. INSTRUCTIONS FOR INPUT

G R O U P A

Columns	Format	Symbol	Description
1-80	20A4	HED	desired heading to be printed
			group A consists of 1 card

G R O U P B

Columns	Format	Symbol	Description
			Choice of type of initial and boundary conditions, of constant/variable rooting depth and of constant/variable output increments
1-5	I5	KOD(1)	= 0 : groundwater level is input (cm) = 1 : flux from the saturated zone is input (positive upwards; cm/d) = 2 : flux towards ditches and deep percolation is calculated (positive upwards; cm/d) = 3 : flux from the saturated zone is calculated as a function of groundwater level (positive upwards; cm/d) = 4 : pressure head of bottom compartment is input (cm) = 5 : zero flux at the bottom of an unsaturated profile = 6 : free drainage at the bottom of an unsaturated profile (negative downwards; cm/d), flux is equal to hydraulic conductivity of bottom compartment
6-10	I5	KOD(2)	= 0 : bottom boundary condition is varying with time = 1 : bottom boundary condition is constant with time If KOD(1)=3, 5 or 6, KOD(2) may be set to 0 KOD(3) describes the upper boundary condition

11-15	I5	KOD(3)	= 0 : absolute values of precipitation (cm/d), soil evaporation (cm/d), transpiration (cm/d) and minimum allowed pressure head at the soil surface (cm) is input = 1 : potential evapotranspiration (cm/d) is calculated with the Priestly and Taylor equation = 2 : potential evapotranspiration (cm/d) is calculated as Eo (Penman) * crop coefficient (for Penman equation see eq. 3.26) (References to equations are to the book of FEDDES et al. 1978) = 3 : potential evapotranspiration (cm/d) is calculated with Monteith-Rijtema equation (eq. 3.33, without the '+Ei' term: ETpot = ETmax - Ei ; for rs a constant value has to be taken) If KOD(3) = 1, 2 or 3, potential soil evaporation is calculated with eq. 36 of Belmans et al. (1983), minimum allowed pressure head at the soil surface with eq. 4.11.
16-20	I5	KOD(4)	= 0 : upper boundary condition is varying with time = 1 : upper boundary condition is constant with time
21-25	I5	KOD(5)	= 0 : moisture content at each nodal point is input (cm**3/cm**3) = 1 : pressure head at each nodal point is input (cm) = 2 : pressure head at each nodal point is calculated as being in equilibrium with the initial groundwater table (cm)
26-30	I5	KOD(6)	= 0 : rooting depth is varying with time (cm) = 1 : rooting depth is constant with time (cm)
31-35	I5	KOD(7)	= 0 : time increment between outputs (water balance terms, moisture content profile, etc.) is variable (d) = 1 : time increment between outputs is constant (d)

Group B consists of 1 card

G R O U P C

Columns	Format	Symbol	Description
			Geometry of soil profile
1-10	F10.1	DSP	depth of soil profile (cm)
11-15	I5	NCS	number of soil compartments of equal size (maximally 40)
16-20	I5	NPL	number of different types of soil layers (maximally 5)
21-25	I5	NC(1)	number of bottom compartment of 1st soil layer
26-30	I5	NC(2)	
31-35	I5	NC(3)	
36-40	I5	NC(4)	as above but for 2nd, 3rd, ..., 5th soil layer
41-45	I5	NC(5)	
46-50	I5	ISD	number of soil compartment at which bottom the Darcian-flux will be integrated over the time. This integral is an approximation only
			Group C consists of 1 card

G R O U P D

Columns	Format	Symbol	Description
			Way of input of soil physical characteristics of each separate soil layer
1-10	F10.2	LV(1)	lowest input value of moisture content theta (cm**3/cm**3) of K(theta) and h(theta) table of 1st soil layer
11-20	F10.2	LV(2)	
21-30	F10.2	LV(3)	
31-40	F10.2	LV(4)	as above, but for 2nd, 3rd,.....5th soil
41-50	F10.2	LV(5)	layer
1-10	F10.2	MV(1)	highest input value of moisture content theta (cm**3/cm**3) of K(theta) and h(theta) table of 1st soil layer
11-20	F10.2	MV(2)	
21-30	F10.2	MV(3)	
31-40	F10.2	MV(4)	as above, but for 2nd, 3rd,.....5th soil
41-50	F10.2	MV(5)	layer

1-10	F10.2	SWC(1)	saturated moisture content (cm**3/cm**3) of 1st soil layer
11-20	F10.2	SWC(2)	
21-30	F10.2	SWC(3)	
31-40	F10.2	SWC(4)	as above, but for 2nd, 3rd,.....5th soil
41-50	F10.2	SWC(5)	layer
1-10	E10.3	CS1	saturated hydraulic conductivity of 1st soil layer (must be given in the same units as chosen for the hydraulic conductivities of the groups V-Z)
11-20	E10.3	FAC	factor to convert units of input hydraulic conductivity to units of cm/d

Group D consists of 4 cards

G R O U P E

Columns	Format	Symbol	Description
			Description of sink term and root extraction pattern (see figs. 1-4)
1- 5	I5	IRER	= 0 : sink term according to Feddes et al (1978) see fig. 1 = 1 : sink term according to Hoogland et al (1981) see fig. 2
5-10	I5	INL	= 0 : linear relationship between the points P2 and P3 of the sink term (see fig. 3) = 1 : hyperbolic relationship between the points P2 and P3 of the sink term (see fig. 4)
11-20	E10.4	ARER	intercept a of eq. Smax=a-b*|z|
21-30	E10.4	BRER	slope b of eq. Smax=a-b*|z|
1-10	F10.3	RNAM	maximum depth (cm, absolute value) at top of profile where roots are non-active during the period t > TE
11-20	F10.3	TB	point of time at which roots become non-active (drought damage or morphological reasons)
21-30	F10.3	TE	point of time at which roots reach their maximum depth of non-activity for t < TB : RNA = 0 for TB < t < TE : RNA = RNAM*(t-TB)/(t-TE) for t > TE : RNA = RNAM where t is time (d) and RNA, the actual depth where roots are non-active
1-10	F10.0	P0	value of pressure head below which roots start to extract water from the soil (starting point)

11-20	F10.0	PU1	value of pressure head below which roots start to extract water optimally from the upper soil layer
21-30	F10.0	PL1	as above, but for the lower soil layers
31-40	F10.0	P2H	value of pressure head below which roots cannot extract water optimally anymore, for potential transpiration rate equal to 0.5 cm/d (limiting point)
41-50	F10.0	P2L	as above, but for potential transpiration rate equal to 0.1 cm/d the values P2H and P2L are used only if IRER = 0 (see fig. 1) P2 is calculated from linear interpolation in between P2H and P2L, according to $P2 = P2H + \frac{(0.5-EPA)}{(0.5-0.1)} * (P2L-P2H)$ for $0.1 <= EPA <= 0.5$ P2 = P2L if EPA < 0.1 cm/d P2 = P2H if EPA > 0.5 cm/d where EPA is potential transpiration rate (cm/d)
51-60	F10.0	P2	value of pressure head below which the roots cannot extract water optimally anymore (limiting point); this value is used only if IRER = 1 (see fig. 2)
61-70	F10.0	P3	value of pressure head below which no water uptake by roots is possible (wilting point)

Group E consists of 3 cards

G R O U P F

Columns	Format	Symbol	Description
			Describes times of input and coefficients of wind function, leaf area index and interception
1- 5	I5	L(1)	first day of input (reckoned from the beginning of the year)
6-10	I5	L(2)	last day of input (the same)
11-15	I5	L(3)	number of days in February (28 or 29)
16-20	I5	L(4)	first day of input in the first month under consideration (e.g. L(4) = 21)
21-25	I5	L(5)	first month of input (e.g. June : L(5) = 6)
26-30	I5	L(6)	last month of input (e.g. October : L(6) = 10)
31-35	I5	L(7)	= 0 : 6 coefficients of the G(CH)-function must be prescribed in group M

			= 1 : 6 coefficients of the G(CH)-function are as Fig. 30 (book FEDDES et al., 1978) for G(CH)-function see eq. (8.3) to (8.5): only used if KOD(3) = 3
36-40	I5	L(8)	= 0 : 6 coefficients of the FIN-function must be prescribed in group M
			= 1 : 6 coefficients of the FIN-function are as in Fig. 32 (book FEDDES et al., 1978), but transformed to units of cm/d for the FIN-function see eq. (8.7) - (8.9)

Group F consists of 1 card

G R O U P G

Columns	Format	Symbol	Description
			Describes the calculation period and size of time step
1-10	F10.0	TINIT	starting time of calculations (TINIT>=L(1)-1); for L-values see group F
11-20	F10.0	TEND	finishing time of calculations (TEND<=L(2)); for L-values see group F
21-30	F10.3	DTMI	maximum value of time step allowed (d); we advise DTMI = 0.5 (approx.)
31-40	E10.3	DTHM	maximum change of moisture content allowed within one time step; we advise DHTM = 0.005 (approx.)
41-50	F10.3	CGWLAM	maximum change of groundwater level (cm) within one time step; we advise CGWLAM = 0.5 (approx.) This applies only for cases for which the groundwater level is calculated

Group G consists of 1 card

G R O U P H

Columns	Format	Symbol	Description
			Describes the number and the increments of output
1-10	I5	NPR	number of outputs (water balance terms, moisture content profile, etc.); standard output at t = TINIT is not included in NPR

1-10	F10.0	TPRINT	only if KOD(7) = 1; TPRINT is a constant time increment (d) for which the output must be printed; output is listed at t = TINIT + i * TPRINT where i = 1 to NPR
1-10	F10.0	TPR(1)	only if KOD(7) = 0; TPR(1) is time increment for 1st output
11-20	F10.0	TPR(2)	
21-30	F10.0	TPR(3)	as above, but for 2nd, 3rd, ..., NPRth output
etc.	F10.0	TPR(NPR)	
			output is listed at time t = TINIT + TPR(1), t = TINIT + TPR(1) + TPR(2), etc.
			Group H consists of maximally 7 cards

G R O U P I

Columns	Format	Symbol	Description
			Group I is only used if KOD(3) = 0. Describes upper boundary condition
1-10	F10.2	PREC(L(1))	precipitation (cm/d) |
11-20	F10.3	ES(L(1))	potential soil evaporation rate (cm/d) |for first |
21-30	F10.3	EP(L(1))	potential transpiration rate (cm/d) |day of in- |
31-40	E10.4	PHS(L(1))	minimum allowed pressure head (cm) at the soil surface |put L(1) |
			if KOD(4) = 0 : 1 card is required for each day of input L(1) to L(2), or [L(2) - L(1) + 1] cards; if KOD(4) = 1 : only one card is required
			Group I consists of maximally 366 cards

G R O U P J

Columns	Format	Symbol	Description
			Group J is used only if KOD(3) = 1. Describes the upper boundary condition. Potential evapotranspiration rate (cm/d) is calculated with the Priestley and Taylor equation
1-10	F10.3	ALPHA	empirical constant in the Priestley and Taylor equation (ALPHA = 1.35 + or - 0.10)

1-10	F10.2	PREC(L(1))	precipitation (cm/d)	for first day of input, L(1)
11-20	F10.1	HSH(L(1))	flux of global radiation (J/cm**2.d)	
21-30	F10.1	TEM(L(1))	mean daily air temperature (degrees Celsius)	
31-40	F10.3	RH(L(1))	mean daily air humidity (fraction)	
41-50	F10.3	SC(L(1))	soil cover (fraction)	

if KOD(4) = 0 : 1 card is required for each day of input, L(1) to L(2), or [L(2) - L(1) + 1] cards;
if KOD(4) = 1 : only 1 card is required

Group J consists of maximally 367 cards (1 card for the ALPHA value and 366 cards for daily inputs)

G R O U P K

Columns	Format	Symbol	Description	
			Group K is used only if KOD(3) = 2. Describes the upper boundary condition. Potential evapotranspiration rate (cm/d) is calculated as Eo (Penman, open water) * crop coefficient	
1-10	F10.2	PREC(L(1))	precipitation (cm/d)	for first day of input, L(1)
11-20	F10.1	HSH(L(1))	short-wave radiation flux (W/m**2)	
21-30	F10.3	DCL(L(1))	degree of cloudiness (fraction)	
31-40	F10.1	TEM(L(1))	mean daily air temperature (degrees Celsius)	
41-50	F10.3	RH(L(1))	mean daily air humidity (fraction)	
51-60	F10.2	U(L(1))	mean daily wind velocity at 2 m height (m/s)	
61-70	F10.3	SC(L(1))	soil cover (fraction)	
71-80	F10.3	CH(L(1))	crop coefficient (fraction)	

if KOD(4) = 0 : 1 card is required for each day of input, L(1) to L(2), or [L(2) - L(1) + 1] cards;
if KOD(4) = 1 : only 1 card is required

Group K consists of maximally 366 cards

G R O U P L

Columns	Format	Symbol	Description	
			Group L is used only if KOD(3) = 3. Describes the upper boundary condition. Potential evapotranspiration rate (cm/d) is calculated with the Monteith-Rijtema equation	
1-10	F10.1	RS	Stomatal resistance (s/m)	
1-10	F10.2	PREC(L(1))	precipitation (cm/d)	for first day of input, L(1)
11-20	F10.1	HNT(L(1))	net radiation flux (W/m**2)	
21-30	F10.1	TEM(L(1))	mean daily air temperature (oC)	
31-40	F10.3	RH(L(1))	mean daily air humidity (fraction)	
41-50	F10.2	U(L(1))	mean daily wind velocity at 2 m height (m/s)	
51-60	F10.3	SC(L(1))	soil cover (fraction)	
61-70	F10.0	CH(L(1))	crop height (cm)	
			if KOD(4) = 0 : 1 card is required for each day of input, (L(1) to L(2), or [L(2) - L(1) + 1] cards; if KOD(4) = 1 : only 1 card is required	
			Group L consists of maximally 367 cards (1 card for RS-value and 366 cards for daily inputs)	

G R O U P M

Columns	Format	Symbol	Description
			Describes the crop height - wind function, the leaf area index relationship with soil cover and the interception function depending on precipitation. For details see pages 73-75 of FEDDES et al. (1978)
1-10	E10.4	FGA	coefficients of G(CH)-function, which is
11-20	E10.4	FGB	used to estimate potential evapo-
21-30	E10.4	FGC	transpiration flux (see eq. 8.3 to 8.5)
31-40	E10.4	FGD	
41-50	E10.4	FGM	use this card only if KOD(3) = 3 and if
51-60	E10.4	FMCH	L(7) = 0 (if L(7) = 1, standard values of the coefficients are used, see Fig. 30 of FEDDES et al, 1978)

1-10	E10.4	FLA	coefficients of the leaf area index -
11-20	E10.4	FLB	soil cover function
21-30	E10.4	FLC	use this card only if KOD(3) >= 1
1-10	E10.4	FIA	
11-20	E10.4	FIB	coefficients of the FIN-function describing
21-30	E10.4	FIC	reduction in precipitation rate as caused
31-40	E10.4	FID	by interception (eq. 8.7 - 8.9)
41-50	E10.4	FMP	use this card only if KOD(3) = 3
51-60	E10.4	FMI	(if L(8) = 1, standard values of the co-efficients are used: FIA = 0.169; FIB = 0.516; FIC = 0.1787; FID = 0.0593; FMP = 2.0; FMI = 0.19; see also Fig. 42 of book FEDDES et al, 1978)

Group M consists of maximally 3 cards

G R O U P N

Columns	Format	Symbol	Description
			Group N is used only if KOD(1) = 0. Describes the daily groundwater level. Absolute values may be given as input (soil surface is used as reference level)
1-10	F10.1	GWL(L(1))	groundwater level (cm) for the first day of input, L(1)
11-20	F10.1	GWL(L(1)+1)	as above, but for the 2nd, 3rd, ...,
etc.	F10.1	GWL(L(2))	L(2)th day of input
			if KOD(2) = 0 : [L(2) - L(1) + 1] values must be given if KOD(2) = 1 : only 1 value, GWL(L(1)), must be given

Group N consists of maximally 46 cards

G R O U P O

Columns	Format	Symbol	Description
			Group O is used only if KOD(1) = 1. Describes the initial groundwater level and the daily values of the flux from the saturated zone (positive upwards, cm/d)
1-10	F10.1	GWLA	initial groundwater level (cm), for t = TINIT

1-10	F10.3	QDEEP(L(1))	flux from the saturated zone for the first day of input, L(1)
11-20	F10.3	QDEEP(L(1)+1)	as above, but for the 2nd, 3rd, ...,
enz.	F10.3	QDEEP(L(2))	L(2)th day of input

If KOD(2) = 0 : [L(2)-L(1) + 1] values must be given
If KOD(2) = 1 : only 1 value, QDEEP(L1)), must be given

Group O consists of maximally 47 cards

G R O U P P

Columns	Format	Symbol	Description
			Group P is used only if KOD(1) = 2. Describes saturated flow to ditches and deep percolation (soil surface is used as the reference level for water tables/levels)
1-10	F10.1	GWLA	initial groundwater level (cm), for t = TINIT
1-10	F10.1	CHND	spacing between channels (m)
11-20	F10.3	CHNR	radial resistance of channel (d/m)
21-30	F10.3	DKD	transmissivity for horizontal flow (m**2/d); kD value
31-40	F10.3	ALPHAR	shape factor of groundwater level
41-50	F10.1	DGRWL	deep groundwater level (cm)
51-60	F10.1	SIMPR	vertical resistance of poorly permeable layer (d)
1-10	F10.1	CHNL(L(1))	open water level in the ditch (cm); may be given as absolute value
11-20	F10.1	CHNL(L(1)+1)	as above, but for 2nd, 3rd, ...,
etc.	F10.1	CHNL(L(2))	L(2)th day of input

if KOD(2) = 0 : [L(2)-L(1)+1] values must be given
if KOD(2) = 1 : only 1 value, CHNL(L(1)), must be given

Group P consists of maximally 48 cards

G R O U P Q

Columns	Format	Symbol	Description
			Group Q is used only if KOD(1) = 3. Describes the flux - groundwater level relationship according to : $q = a * e^{b * fi_m}$ where: q_m is basic discharge, fi is the groundwater level and a and b are parameters to be determined from fig. 5 or to be derived from measurements
1-10	F10.1	GWLA	initial groundwater level (cm), for t = TINIT
1-10	E10.4	AREL	value of a in above equation
11-20	E10.4	BREL	value of b in above equation
			Group Q consists of 2 cards

G R O U P R

Columns	Format	Symbol	Description
			Group R is used only if KOD(1) = 4. Describes daily values of pressure head of bottom compartment
1-10	E10.4	GPRH(L(1))	pressure head of bottom compartment for 1st day of input, L(1); absolute value may be given
11-20	E10.4	GPRH(L(1)+1)	as above, but for 2nd, 3rd, ..., L(2)th
etc.	E10.4	GPRH(L(2))	day of input
			if KOD(2) = 0 : [L(2)-L(1)+1) values must be given if KOD(2) = 1 : only 1 value, GPRH(L(1)), must be given
			Group R consists of maximally 46 cards

G R O U P S

Columns	Format	Symbol	Description
			Describes the rooting depth
1-10	F10.1	DRZ(L(1))	rooting depth (cm) for the first day of input, L(1)
11-20	F10.1	DRZ(L(1)+1)	as above, but for 2nd, 3rd, ..., L(2)th
etc.	F10.1	DRZ(L(2))	day of input
			if KOD(6)=0 : [L(2)-L(1)+1] values must be given if KOD(6)=1 : only 1 value, DRZ(L(1)), must be given
			Group S consists of maximally 46 cards

G R O U P T

Columns	Format	Symbol	Description
			Group T is used only if KOD(5)=0. Describes the initial moisture content profile (t = TINIT)
1-10	F10.3	WC(1)	initial water content (cm**3/cm**3) of 1st nodal point (surface compartment)
11-20	F10.3	WC(2)	as above, but for 2nd, 3rd, ..., NCSth
etc.	F10.3	WC(NCS)	nodal point; numbering is from top to bottom of soil profile
			Group T consists of maximally 5 cards

G R O U P U

Columns	Format	Symbol	Description
			Group U is used only if KOD(5)=1. Describes the initial pressure head profile (t = TINIT)
1-10	E10.4	PH(1)	initial pressure head (cm) of 1st nodal point (surface compartment); absolute value may be given
11-20	E10.4	PH(2)	as above, but for 2nd, 3rd, ..., NCSth
etc.	E10.4	PH(NCS)	nodal point; numbering is from top to bottom of soil profile
			Group U consists of maximally 5 cards

G R O U P V

Columns	Format	Symbol	Description
1-10	F10.2	PONDMX	Maximum thickness of the layer of ponding water on the soil surface [cm].
			Group V consists of one card.

G R O U P W

Columns	Format	Symbol	Description
			Describes the physical characteristics of soil layer 1 (numbering of layers is from top to bottom). Units of hydraulic conductivity can be chosen arbitrarily; see also factor FAC , group D
1-10	E10.4	PRH(1,x)	pressure head (cm) for 1st soil layer at water content theta=LV(1) (cm**3/cm**3); absolute values may be given
11-20	E10.4	PRH(1,x)	as above, but for pressure heads at theta=
etc.	E10.4	PRH(1,x)	LV(1)+0.01, theta=LV(1)+0.02, ..., theta= MV(1)
1-10	E10.4	CON(1,x)	hydraulic conductivity for 1st soil layer at water content theta=LV(1) (cm**3/cm**3)
11-20	E10.4	CON(1,x)	as above, but for hydraulic conductivities
etc.	E10.4	CON(1,x)	at theta=LV(1)+0.01, theta=LV(1)+0.02, ... , theta=MV(1)
			the x-values do not have to be defined
			Group W consists of maximally 20 cards (10 for h-values, 10 for K-values)

G R O U P X

Columns	Format	Symbol	Description
			Group X may be omitted if NPL=1. Describes the physical characteristics of soil layer 2. Units of hydraulic conductivity as in group W

as group W, but LV(1), MV(1), PRH(1,x), CON(1,x) become LV(2), MV(2), PRH(2,x), CON(2,x) respectively

Group X consists of maximally 20 cards

G R O U P Y

Columns	Format	Symbol	Description
			Group Y may be omitted if NPL<=2. Describes the physical characteristics of soil layer 3. Units of hydraulic conductivity as in group W
			as group W, but LV(1), MV(1), PRH(1,x), CON(1,x) become LV(3), MV(3), PRH(3,x), CON(3,x) respectively
			Group Y consists of maximally 20 cards

G R O U P Z

Columns	Format	Symbol	Description
			Group Z may be omitted if NPL<=3. Describes the physical characteristics of soil layer 4. Units of hydraulic conductivity as in group W
			as group W, but LV(1), MV(1), PRH(1,x), CON(1,x) become LV(4), MV(4), PRH(4,x), CON(4,x) respectively
			Group Z consists of maximally 20 cards

G R O U P ZA

Columns	Format	Symbol	Description
			Group ZA may be omitted if NPL<=4. Describes the physical characteristics of soil layer 5. Units of hydraulic conductivity as in group W

as group W, but LV(1), MV(1), PRH(1,x), CON(1,x) become LV(5), MV(5), PRH(5,x), CON(5,x) respectively

Group ZA consists of maximally 20 cards

APPENDIX B: Summary of main sequential output data

In the first part of the output some of the input data are printed:

- boundary condition at the top;
  if evapotranspiration is calculated, daily values of potential soil evaporation and potential transpiration are printed
- boundary condition at the bottom;
- rooting depth;
- initial condition;
- soil physical parameters of each layer.

In the second part variables are printed for initial time (t = TINIT), for selected times (t = TPR(I)) and for the end of the last day (t = TEND). In the list given below all cumulative values are initiated at t = TINIT.

CPREC	: cumulative precipitation
CINTCEP	: cumulative interception
CPINFILT	: cumulative potential infiltration (CPINFILT=CPREC-CINTCEP)
CINFILT	: actual cumulative infiltration
CRUNOFF	: cumulative runoff (CRUNOFF=CPINFILT-CINFILT)
CPETR	: cumulative potential evapotranspiration
CPTRANSP	: cumulative potential transpiration
CPSEVAP	: cumulative potential soil evaporation
CETR	: cumulative actual evapotranspiration
CTRANSP	: cumulative actual transpiration
CSEVAP	: cumulative actual soil evaporation
FLUXI	: water flux through soil surface
CFLXSD	: integrated Darcian flux at bottom of compartment ISD; when the groundwater level rises above the bottom of that compartment this flux has no meaning and 'stars' will appear in the output
CFLXSDP	: integrated positive (=upward) Darcian flux at bottom of compartment ISD
CFLXSDN	: integrated negative (=downward) Darcian flux at bottom of compartment ISD
FLXSD	: actual Darcian flux at bottom of compartment ISD
ISD	: number of compartment at which the Darcian flux is integrated
CFLXBU	: integrated Darcian flux at the bottom of the unsaturated

profile (only in case of free drainage, otherwise 'stars' will appear)

FLXBU : actual flux of free drainage

CQDEEP : integrated flux through the bottom of the soil profile for those cases where the groundwater level is calculated, for all other boundary conditions at the bottom 'stars' will appear

CQDEEPP : positive part of CQDEEP

CQDEEPN : negative part of CQDEEP

QDEEPA : actual flux through the bottom of the soil profile for those cases where the groundwater level is calculated

CDELTA : cumulative net amount of water that passed through the bottom of the soil profile; calculated as the rest term of the soil water balance, if the groundwater level is calculated, 'stars' will appear

CDELTAP : positive part of CDELTA

CDELTAN : negative part of CDELTA

DELTA : actual amount of water that passed during the last time step through the bottom of the soil profile; calculated as the rest term of the soil water balance; in the program this is implemented as: DEL=VOL-VOL1+CTRA-CTRA1+FLXS(1)*DT)

VOLINIT : water storage in the entire soil profile at initial time t=TINIT

VOL : actual water storage in the entire soil profile

GWLA : actual groundwater level

DRZA : actual rooting depth

N : number of first unsaturated nodal point above the groundwater level

Below the values mentioned, a table is printed containing:

COMP.NR. : number of soil compartment with numbering starting from top to bottom

LEVEL : position of the nodal point with respect to the soil surface

THETA : volumetric moisture content (cm**3/cm**3)

PR.HEAD : soil water pressure head

CONDUC : hydraulic conductivity

ROOT EXT : root extraction rate (cm**3/cm**3.d), i.e. the actual sink

C.ROOT EXT : cumulative amount of water extracted by the roots

CUM.WATER : water storage in the soil profile summed up from soil surface to bottom of compartment

FLUXES : Darcian flux through the bottom of each compartment

Below the table a print plot is made of soil moisture content (dotted lines), fraction of air (blank) and fraction of solid material (slashes), all as a function of depth.

The third part of the output concerns various terms of the water balance expressed at the end of each day in the period considered

TIME : day number
C.INFILT : actual cumulative infiltration
TRANSP : actual transpiration rate
CTRANSP : cumulative actual transpiration
SEVAP : actual soil evaporation rate
CSEVAP : cumulative soil evaporation
CFLXBOTP : cumulative amount of water that flowed through the bottom of the soil profile that flows i n t o the system
if no groundwater level is calculated, the value CDELTAP will be printed
if the groundwater level is calculated, the value of CQDEEPP will be printed
CFLXBOTN : as above, but for flows o u t of the system and with CDELTAN and CQDEEPN being printed
VOL-VOLI : change in water storage over the entire soil profile with respect to VOL at t=TINIT
GROUNDW.LEV: groundwater level with respect to the soil surface

NOTE : The names of the variables listed above and in the output may be
----- different from the variable names used in the program !!

APPENDIX C: Example of input

```
 TEST : SELLINGEN  POTATOES 1979  VELDPODZOL, PONDMX=0.5
    2    1    1    0    1    1    1
      200.   20    2    3   20   20   20   20    3
      0.01      0.01
      0.46      0.34
      0.46      0.34
     0.495        1.   0.0
    0    0      0.02       0.0
       0.0      365.      366.
      -10.      -25.      -25.     -320.     -600.     -500.   -16000.
  139  258   28   19    5    9    1    1
      138.      258.        1.      0.02        2.
    3
       60.
     1.500
      0.00    2464.0      11.5      0.70     0.000
      0.20     638.4      14.3      0.76     0.000
      0.26    1176.0      12.9      0.74     0.000
      0.59    1918.4      13.3      0.76     0.020
      2.45    1001.6      11.9      0.81     0.052
      2.25    1286.4      10.0      0.80     0.085
      2.18    1259.2       9.3      0.82     0.117
      3.52    1476.8      12.8      0.81     0.149
      1.07    1419.2      11.5      0.79     0.182
      0.00    2219.2      14.6      0.69     0.214
      0.50     883.2      17.7      0.83     0.246
      3.54    1918.4      19.7      0.81     0.279
      1.43    2323.2      18.7      0.84     0.311
      0.21     796.8      14.3      0.87     0.343
      0.00    1572.8      17.2      0.86     0.376
      1.74    2116.8      22.2      0.72     0.408
      0.00    1852.8      20.5      0.80     0.440
      0.00     768.0      16.1      0.84     0.473
      0.00    1904.0      14.7      0.72     0.505
      1.00    1772.8      12.9      0.77     0.537
      0.17    1502.4      12.8      0.80     0.569
      0.00    1990.4      14.9      0.77     0.602
      0.05    2340.8      13.9      0.73     0.634
      0.55     683.2      13.5      0.88     0.666
      0.01    1024.0      13.3      0.78     0.699
      1.05     657.6      12.9      0.90     0.731
      1.77     339.2      12.2      0.90     0.763
      0.24    1500.8      10.1      0.83     0.796
      0.00    2505.6      12.4      0.75     0.828
      0.00    1283.2      12.6      0.80     0.860
      0.00    2464.0      14.8      0.76     0.893
      0.00    2329.6      15.6      0.86     0.925
      0.00    2580.8      17.6      0.82     0.957
      0.06    2280.0      19.8      0.79     0.990
      0.00    1808.0      14.8      0.82     1.000
      0.00    2124.8      16.4      0.76     1.000
      1.02     952.0      14.8      0.82     1.000
      0.00    1435.2      13.3      0.80     1.000
```

1.04	1083.2	14.2	0.83	1.000
0.00	1792.0	15.9	0.72	1.000
1.00	2264.0	15.8	0.72	1.000
0.15	1371.2	15.2	0.76	1.000
0.06	1403.2	13.0	0.70	1.000
0.00	1768.0	12.0	0.69	1.000
0.00	1729.6	13.4	0.72	1.000
0.00	2334.4	15.7	0.75	1.000
0.00	1523.2	14.0	0.74	1.000
0.00	1836.8	15.6	0.76	1.000
0.00	1932.8	16.7	0.77	1.000
0.30	1612.8	16.2	0.82	1.000
0.00	2123.2	16.2	0.73	1.000
0.40	1715.2	16.0	0.77	1.000
0.00	1904.0	15.7	0.72	1.000
0.00	1568.0	16.5	0.68	1.000
0.00	2760.0	18.4	0.58	1.000
0.03	1372.8	16.1	0.75	1.000
0.00	1940.8	15.6	0.78	1.000
0.00	643.2	13.4	0.82	1.000
0.14	795.2	14.0	0.86	1.000
0.05	1120.0	17.8	0.84	1.000
0.74	507.2	16.4	0.90	1.000
0.01	601.6	13.8	0.79	1.000
0.00	1425.6	15.0	0.70	1.000
0.92	1080.0	13.7	0.79	1.000
0.01	1412.8	13.7	0.75	1.000
0.06	486.4	12.8	0.88	1.000
0.01	2080.0	15.9	0.74	1.000
0.00	1616.0	17.3	0.79	1.000
0.00	2315.2	18.4	0.75	1.000
0.00	1939.2	19.1	0.74	1.000
0.00	2118.4	20.9	0.70	1.000
0.60	872.0	18.5	0.87	1.000
0.05	1452.8	17.9	0.78	1.000
0.05	1064.0	16.8	0.77	1.000
0.56	910.4	16.1	0.83	1.000
0.00	1467.2	16.8	0.76	1.000
0.10	1396.8	16.0	0.82	1.000
0.00	1571.2	15.4	0.80	1.000
0.00	2246.4	16.2	0.73	1.000
0.00	1776.0	19.2	0.70	1.000
0.00	1299.2	19.6	0.74	1.000
0.75	782.4	15.5	0.84	1.000
1.16	435.2	13.1	0.93	1.000
0.00	1723.2	14.9	0.80	1.000
0.06	1256.0	14.6	0.85	0.982
0.06	459.2	14.6	0.95	0.957
0.00	654.4	17.8	0.93	0.932
0.00	1660.8	20.5	0.70	0.907
0.00	1947.2	16.3	0.69	0.882
0.00	1104.0	15.8	0.77	0.856
0.50	712.0	14.7	0.86	0.831
0.01	1472.0	16.1	0.85	0.806
0.00	923.2	16.7	0.86	0.781

```
     0.00      939.2       15.8       0.82      0.755
     0.22      806.4       13.9       0.85      0.730
     0.01     1528.0       13.2       0.79      0.705
     0.39     1376.0       13.0       0.78      0.680
     0.47     1342.4       12.7       0.82      0.655
     0.37     1187.2       12.7       0.87      0.629
     0.83     1387.2       13.5       0.86      0.604
     0.21     1435.2       13.1       0.79      0.579
     0.00      995.2       13.1       0.75      0.554
     0.00     1798.4       14.8       0.81      0.529
     0.00     1948.8       18.0       0.70      0.503
     0.00     1696.0       18.4       0.77      0.478
     0.00     1491.2       20.6       0.79      0.453
     0.06      641.6       17.9       0.84      0.428
     1.16      460.8       14.1       0.89      0.403
     0.00     1384.0       13.9       0.84      0.377
     0.00     1729.6       14.9       0.82      0.352
     0.00     1811.2       17.5       0.74      0.327
     0.00     1404.8       17.3       0.83      0.302
     0.00     1236.8       18.4       0.83      0.276
     0.00     1116.8       17.9       0.77      0.251
     0.00     1291.2       16.9       0.83      0.226
     0.00     1150.4       16.3       0.84      0.201
     0.00      358.4       14.3       0.92      0.176
     0.00      771.2       13.0       0.80      0.150
     0.18     1188.8       11.0       0.76      0.125
     0.04     1452.8       10.3       0.76      0.100
      2.5        1.6        0.9
     94.8
    250.0        3.0      3.125       0.79       -70.  1000000.
    130.0
     40.0
.1141E+03 .9810E+02 .8060E+02 .6420E+02 .5120E+02 .4060E+02 .3020E+02 .2000E+02

.4800E+01 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00
.50
.4170E+07 .1700E+07 .8910E+06 .4900E+06 .3090E+06 .2040E+06 .1410E+06 .1050E+06
.7590E+05 .5620E+05 .4070E+05 .3090E+05 .2290E+05 .1740E+05 .1310E+05 .1020E+05
.7760E+04 .6030E+04 .4680E+04 .3720E+04 .2950E+04 .2400E+04 .1950E+04 .1590E+04
.1290E+04 .1050E+04 .8510E+03 .7080E+03 .5750E+03 .4790E+03 .3980E+03 .3240E+03
.2630E+03 .2190E+03 .1820E+03 .1510E+03 .1290E+03 .1070E+03 .8700E+02 .6800E+02
.5000E+02 .3600E+02 .2700E+02 .1700E+02 .9000E+01 .0000E+00
.6200E-07 .1800E-06 .3900E-06 .7900E-06 .1400E-05 .2200E-05 .3500E-05 .4900E-05
.7300E-05 .1000E-04 .1500E-04 .2100E-04 .3000E-04 .4200E-04 .5800E-04 .7900E-04
.1100E-03 .1500E-03 .2000E-03 .2600E-03 .3500E-03 .4400E-03 .5600E-03 .7300E-03
.9300E-03 .1200E-02 .1500E-02 .1900E-02 .2400E-02 .3000E-02 .7000E-02 .1550E-01
.2970E-01 .4760E-01 .7060E-01 .9800E-01 .1250E+00 .1570E+00 .1950E+00 .2400E+00
.2900E+00 .3360E+00 .3710E+00 .4150E+00 .4500E+00 .4950E+00
.2510E+06 .8910E+04 .1950E+04 .9120E+03 .5130E+03 .3160E+03 .2240E+03 .1900E+03
.1820E+03 .1660E+03 .1580E+03 .1510E+03 .1450E+03 .1350E+03 .1290E+03 .1200E+03
.1150E+03 .1070E+03 .1020E+03 .9800E+02 .9100E+02 .8700E+02 .8100E+02 .7700E+02
.7400E+02 .6900E+02 .6600E+02 .6300E+02 .5400E+02 .4200E+02 .2600E+02 .9000E+01
.3000E+01 .0000E+00
.4300E-08 .2980E-05 .5880E-04 .2610E-03 .8050E-03 .2080E-02 .5720E-02 .1740E-01
```

.2270E-01 .3840E-01 .4990E-01 .6270E-01 .7640E-01 .1060E+00 .1290E+00 .1730E+00
.2040E+00 .2660E+00 .3120E+00 .3560E+00 .4480E+00 .5110E+00 .6230E+00 .7100E+00
.7830E+00 .9230E+00 .1010E+01 .1120E+01 .1510E+01 .2240E+01 .3780E+01 .6610E+01
.8050E+01 .1000E+02

Appendix D: Example of output

```
 TEST : SELLINGEN  POTATOES 1979  VELDPODZOL, PONDMX=0.5
I N P U T   V A R I A B L E S :
- - - - -  - - - - - - - - - -

KOD(1)=2  KOD(2)=1  KOD(3)=1   KOD(4)=0  KOD(5)=1  KOD(6)=1  KOD(7)=1

DEPTH OF SOIL PROFILE  :   200.0 CM
NUMBER OF COMPARTMENTS : 20
NUMBER OF SOIL LAYERS  :  2
NC - ARRAY :    3   20    0    0    0
DARCIAN FLUX INTEGRATED AT BOTTOM OF COMPARTMENT NR : 20


LY - ARRAY  :  0.01  0.01  0.00  0.00  0.00
HY - ARRAY  :  0.46  0.34  0.00  0.00  0.00
SNC - ARRAY :  0.46  0.34  0.00  0.00  0.00


SATURATED HYDRAULIC CONDUCTIVITY OF FIRST SOIL LAYER 0.495E+00
FAC    : 0.100E+01



S I N K  T E R M  V A R I A B L E S

    IRER  IKL      ARER      BRER
      0    0    0.200E-01 0.000E+00

    RNAM       TB        TE
     0.0      365.      366.

      P0       PU1       PL1       P2H       P2L        P2        P3
    -10.      -25.      -25.     -320.     -600.     -500.  -16000.



L - ARRAY :  139  258   28   19    5    9    1    1


START OF CALCULATIONS : 138. DAYS
END OF  CALCULATIONS   : 258. DAYS
MAXIMUM TIME STEP     : 0.100E+01 DAYS
MAXIMUM CHANGE OF MOISTURE CONTENT   : 0.200E-01 CM**3/CM**3
MAXIMUM CHANGE OF GROUNDWATER LEVEL  : 0.200E+01 CM


NUMBER OF PRINTPLOTS :   3
PRINTING INTERVAL    : 60. DAYS
```

BOUNDARY CONDITIONS AT THE TOP :

DAY	PRECIPITATION	SH.RAD(J.CM0-2)	TEMPERATURE	REL. HUMIDITY	SOIL COVER
139	0.00	2464.0	284.6	0.700	0.000
140	0.20	638.4	287.4	0.760	0.000
141	0.26	1176.0	286.0	0.740	0.000
142	0.59	1918.4	286.4	0.760	0.020
143	2.45	1001.6	285.0	0.810	0.052
144	2.25	1286.4	283.1	0.800	0.085
145	2.18	1259.2	282.4	0.820	0.117
146	3.52	1476.8	285.9	0.810	0.149
147	1.07	1419.2	284.6	0.790	0.182
148	0.00	2219.2	287.8	0.690	0.214
149	0.50	883.2	290.9	0.830	0.246
150	3.54	1918.4	292.9	0.810	0.279
151	1.43	2323.2	291.9	0.840	0.311
152	0.21	796.8	287.4	0.870	0.343
153	0.00	1572.8	290.4	0.860	0.376
154	1.74	2116.8	295.4	0.720	0.408
155	0.00	1852.8	293.6	0.800	0.440
156	0.00	768.0	289.3	0.840	0.473
157	0.00	1904.0	287.9	0.720	0.505
158	1.00	1772.8	286.0	0.770	0.537
159	0.17	1502.4	285.9	0.800	0.569
160	0.00	1990.4	288.0	0.770	0.602
161	0.05	2340.8	287.0	0.730	0.634
162	0.55	683.2	286.6	0.880	0.666
163	0.01	1024.0	286.4	0.780	0.699
164	1.05	657.6	286.0	0.900	0.731
165	1.77	339.2	285.4	0.900	0.763
166	0.24	1500.8	283.3	0.830	0.796
167	0.00	2505.6	285.5	0.750	0.828
168	0.00	1283.2	285.8	0.800	0.860
169	0.00	2464.0	287.9	0.760	0.893
170	0.00	2329.6	288.8	0.860	0.925
171	0.00	2580.8	290.8	0.820	0.957
172	0.06	2280.0	292.9	0.790	0.990
173	0.00	1808.0	287.9	0.820	1.000
174	0.00	2124.8	289.5	0.760	1.000
175	1.02	952.0	287.9	0.820	1.000
176	0.00	1435.2	286.4	0.800	1.000
177	1.04	1083.2	287.4	0.830	1.000
178	0.00	1792.0	289.0	0.720	1.000
179	1.00	2264.0	288.9	0.720	1.000
180	0.15	1371.2	288.4	0.760	1.000
181	0.06	1403.2	286.1	0.700	1.000
182	0.00	1768.0	285.1	0.690	1.000
183	0.00	1729.6	286.5	0.720	1.000
184	0.00	2334.4	288.9	0.750	1.000
185	0.00	1523.2	287.1	0.740	1.000

186	0.00	1836.8	288.8	0.760	1.000
187	0.00	1932.8	289.9	0.770	1.000
188	0.30	1612.8	289.4	0.820	1.000
189	0.00	2123.2	289.4	0.730	1.000
190	0.40	1715.2	289.1	0.770	1.000
191	0.00	1904.0	288.9	0.720	1.000
192	0.00	1568.0	289.6	0.680	1.000
193	0.00	2760.0	291.5	0.580	1.000
194	0.03	1372.8	289.3	0.750	1.000
195	0.00	1940.8	288.8	0.780	1.000
196	0.00	643.2	286.5	0.820	1.000
197	0.14	795.2	287.1	0.860	1.000
198	0.05	1120.0	290.9	0.840	1.000
199	0.74	507.2	289.5	0.900	1.000
200	0.01	601.6	286.9	0.790	1.000
201	0.00	1425.6	288.1	0.700	1.000
202	0.92	1080.0	286.9	0.790	1.000
203	0.01	1412.8	286.9	0.750	1.000
204	0.06	486.4	285.9	0.880	1.000
205	0.01	2080.0	289.0	0.740	1.000
206	0.00	1616.0	290.4	0.790	1.000
207	0.00	2315.2	291.5	0.750	1.000
208	0.00	1939.2	292.3	0.740	1.000
209	0.00	2118.4	294.0	0.700	1.000
210	0.60	872.0	291.6	0.870	1.000
211	0.05	1452.8	291.0	0.780	1.000
212	0.05	1064.0	289.9	0.770	1.000
213	0.56	910.4	289.3	0.830	1.000
214	0.00	1467.2	289.9	0.760	1.000
215	0.10	1396.8	289.1	0.820	1.000
216	0.00	1571.2	288.5	0.800	1.000
217	0.00	2246.4	289.4	0.730	1.000
218	0.00	1776.0	292.4	0.700	1.000
219	0.00	1299.2	292.8	0.740	1.000
220	0.75	782.4	288.6	0.840	1.000
221	1.16	435.2	286.3	0.930	1.000
222	0.00	1723.2	288.0	0.800	1.000
223	0.06	1256.0	287.8	0.850	0.982
224	0.06	459.2	287.8	0.950	0.957
225	0.00	654.4	290.9	0.930	0.932
226	0.00	1660.8	293.6	0.700	0.907
227	0.00	1947.2	289.4	0.690	0.882
228	0.00	1104.0	288.9	0.770	0.856
229	0.50	712.0	287.9	0.860	0.831
230	0.01	1472.0	289.3	0.850	0.806
231	0.00	923.2	289.9	0.860	0.781
232	0.00	939.2	288.9	0.820	0.755
233	0.22	806.4	287.0	0.850	0.730
234	0.01	1528.0	286.4	0.790	0.705
235	0.39	1376.0	286.1	0.780	0.680
236	0.47	1342.4	285.9	0.820	0.655
237	0.37	1187.2	285.9	0.870	0.629
238	0.83	1387.2	286.6	0.860	0.604
239	0.21	1435.2	286.3	0.790	0.579
240	0.00	995.2	286.3	0.750	0.554

241	0.00	1798.4	287.9	0.810	0.529
242	0.00	1948.8	291.1	0.700	0.503
243	0.00	1696.0	291.5	0.770	0.478
244	0.00	1491.2	293.8	0.790	0.453
245	0.06	641.6	291.0	0.840	0.428
246	1.16	460.8	287.3	0.890	0.403
247	0.00	1384.0	287.0	0.840	0.377
248	0.00	1729.6	288.0	0.820	0.352
249	0.00	1811.2	290.6	0.740	0.327
250	0.00	1404.8	290.4	0.830	0.302
251	0.00	1236.8	291.5	0.830	0.276
252	0.00	1116.8	291.0	0.770	0.251
253	0.00	1291.2	290.0	0.830	0.226
254	0.00	1150.4	289.4	0.840	0.201
255	0.00	358.4	287.4	0.920	0.176
256	0.00	771.2	286.1	0.800	0.150
257	0.18	1188.8	284.1	0.760	0.125
258	0.04	1452.8	283.4	0.760	0.100

THE FUNCTIONS OF G(CH), LAI(SC) AND FIN(PREC)

LAI= 2.500 * SC + 1.600 * SC**2 + 0.900 * SC**3

FIN(PREC)= SC * 0.169 * PREC**(0.52-0.1787 * (PREC- 0.06)) FOR.PREC.LT. 2.00 CM/DAY
FIN(PREC)= SC * 0.19 FOR.PREC.GE. 2.00 CM/DAY

CALCULATION OF POTENTIAL EVAPOTRANSPIRATION

POTENTIAL TRANSPIRATION RATE (CM/DAY)

DATE	DAY	EPOT	ESOIL	EPLANT	0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4	SEP	SES	PHS	VPD
19	5 139	0.46	0.42	0.00		0.00	0.42	-.478E+06	4.1
20	5 140	0.13	0.11	0.00		0.00	0.53	-.371E+06	3.9
21	5 141	0.23	0.21	0.00		0.00	0.74	-.406E+06	3.9
22	5 142	0.38	0.33	0.05	+	0.05	1.07	-.370E+06	3.7
23	5 143	0.19	0.16	0.03	+	0.08	1.22	-.283E+06	2.6
24	5 144	0.23	0.18	0.05	+	0.13	1.41	-.297E+06	2.5
25	5 145	0.22	0.17	0.06	+	0.19	1.57	-.264E+06	2.1
26	5 146	0.29	0.20	0.08	+	0.27	1.77	-.284E+06	2.8
27	5 147	0.27	0.18	0.09	+	0.36	1.95	-.316E+06	2.8
28	5 148	0.45	0.28	0.17	+	0.53	2.23	-.503E+06	5.2
29	5 149	0.19	0.11	0.08	+	0.61	2.34	-.255E+06	3.4
30	5 150	0.43	0.23	0.20	+	0.81	2.57	-.291E+06	4.4
31	5 151	0.51	0.26	0.25	+	1.06	2.83	-.240E+06	3.5
1	6 152	0.16	0.07	0.08	+	1.14	2.90	-.188E+06	2.1
2	6 153	0.33	0.15	0.19	+	1.33	3.05	-.206E+06	2.7
3	6 154	0.49	0.20	0.29	+	1.63	3.25	-.457E+06	7.5
4	6 155	0.42	0.15	0.26	+	1.89	3.40	-.308E+06	4.8
5	6 156	0.16	0.05	0.11	+	2.00	3.45	-.237E+06	2.9
6	6 157	0.39	0.12	0.27	+	2.26	3.57	-.445E+06	4.7
7	6 158	0.34	0.10	0.25	+	2.51	3.67	-.352E+06	3.4
8	6 159	0.29	0.07	0.22	+	2.73	3.74	-.300E+06	3.0
9	6 160	0.41	0.09	0.31	+	3.04	3.84	-.354E+06	3.9
10	6 161	0.47	0.10	0.37	+	3.41	3.93	-.425E+06	4.3
11	6 162	0.13	0.02	0.11	+	3.52	3.96	-.173E+06	1.9
12	6 163	0.20	0.03	0.17	+	3.69	3.99	-.335E+06	3.4
13	6 164	0.13	0.02	0.11	+	3.79	4.01	-.142E+06	1.5
14	6 165	0.06	0.01	0.05	+	3.85	4.02	-.142E+06	1.4
15	6 166	0.27	0.03	0.24	+	4.09	4.05	-.248E+06	2.1
16	6 167	0.48	0.05	0.43	+	4.52	4.09	-.387E+06	3.6
17	6 168	0.25	0.02	0.23	+	4.75	4.12	-.300E+06	2.9
18	6 169	0.50	0.04	0.46	+	5.21	4.15	-.372E+06	4.0
19	6 170	0.48	0.03	0.45	+	5.66	4.18	-.205E+06	2.5
20	6 171	0.56	0.03	0.52	+	6.19	4.22	-.272E+06	3.6
21	6 172	0.51	0.02	0.49	+	6.68	4.24	-.325E+06	4.8
22	6 173	0.37	0.02	0.35	+	7.03	4.26	-.269E+06	3.0
23	6 174	0.45	0.02	0.43	+	7.45	4.28	-.374E+06	4.5
24	6 175	0.19	0.01	0.18	+	7.64	4.28	-.269E+06	3.0
25	6 176	0.28	0.01	0.27	+	7.90	4.30	-.301E+06	3.1
26	6 177	0.22	0.01	0.21	+	8.11	4.31	-.252E+06	2.8
27	6 178	0.37	0.02	0.36	+	8.47	4.32	-.447E+06	5.1
28	6 179	0.47	0.02	0.45	+	8.91	4.34	-.447E+06	5.0
29	6 180	0.28	0.01	0.27	+	9.18	4.36	-.375E+06	4.1
30	6 181	0.27	0.01	0.26	+	9.44	4.37	-.481E+06	4.5
1	7 182	0.34	0.02	0.32	+	9.76	4.38	-.498E+06	4.3
2	7 183	0.34	0.02	0.32	+	10.09	4.40	-.443E+06	4.3
3	7 184	0.48	0.02	0.46	+	10.55	4.42	-.391E+06	4.5

4	7	185	0.30	0.01	0.29	+	10.84	4.43	-.407E+06	4.2
5	7	186	0.38	0.02	0.36	+	11.20	4.45	-.373E+06	4.3
6	7	187	0.41	0.02	0.39	+	11.59	4.47	-.357E+06	4.4
7	7	188	0.34	0.02	0.32	+	11.91	4.48	-.270E+06	3.3
8	7	189	0.44	0.02	0.42	+	12.34	4.50	-.429E+06	5.0
9	7	190	0.36	0.02	0.34	+	12.68	4.52	-.356E+06	4.2
10	7	191	0.39	0.02	0.38	+	13.06	4.54	-.447E+06	5.0
11	7	192	0.33	0.01	0.31	+	13.37	4.55	-.526E+06	6.0
12	7	193	0.60	0.03	0.58	+	13.95	4.58	-.748E+06	8.9
13	7	194	0.29	0.01	0.27	+	14.22	4.59	-.392E+06	4.6
14	7	195	0.40	0.02	0.38	+	14.60	4.61	-.338E+06	3.9
15	7	196	0.12	0.01	0.12	+	14.72	4.62	-.268E+06	2.8
16	7	197	0.16	0.01	0.15	+	14.87	4.62	-.204E+06	2.2
17	7	198	0.24	0.01	0.23	+	15.10	4.63	-.239E+06	3.3
18	7	199	0.10	0.00	0.10	+	15.20	4.64	-.144E+06	1.9
19	7	200	0.12	0.01	0.11	+	15.31	4.64	-.318E+06	3.3
20	7	201	0.29	0.01	0.28	+	15.59	4.66	-.484E+06	5.1
21	7	202	0.21	0.01	0.20	+	15.79	4.67	-.318E+06	3.5
22	7	203	0.28	0.01	0.27	+	16.06	4.68	-.389E+06	3.9
23	7	204	0.09	0.00	0.09	+	16.15	4.68	-.172E+06	1.8
24	7	205	0.43	0.02	0.41	+	16.56	4.70	-.410E+06	4.7
25	7	206	0.34	0.02	0.33	+	16.89	4.72	-.322E+06	4.1
26	7	207	0.51	0.02	0.48	+	17.37	4.74	-.395E+06	5.3
27	7	208	0.43	0.02	0.41	+	17.78	4.76	-.414E+06	5.7
28	7	209	0.48	0.02	0.46	+	18.24	4.78	-.494E+06	7.4
29	7	210	0.19	0.01	0.18	+	18.42	4.79	-.191E+06	2.8
30	7	211	0.31	0.01	0.30	+	18.72	4.80	-.340E+06	4.5
31	7	212	0.22	0.01	0.21	+	18.94	4.81	-.357E+06	4.4
1	8	213	0.19	0.01	0.18	+	19.12	4.82	-.254E+06	3.1
2	8	214	0.31	0.01	0.30	+	19.41	4.84	-.375E+06	4.6
3	8	215	0.29	0.01	0.28	+	19.69	4.85	-.270E+06	3.3
4	8	216	0.32	0.01	0.31	+	20.00	4.86	-.303E+06	3.5
5	8	217	0.47	0.02	0.45	+	20.45	4.89	-.429E+06	5.0
6	8	218	0.39	0.02	0.38	+	20.82	4.90	-.491E+06	6.7
7	8	219	0.29	0.01	0.28	+	21.10	4.92	-.415E+06	5.9
8	8	220	0.16	0.01	0.15	+	21.25	4.92	-.237E+06	2.8
9	8	221	0.08	0.00	0.08	+	21.33	4.93	-.978E+05	1.1
10	8	222	0.35	0.02	0.33	+	21.67	4.94	-.303E+06	3.4
11	8	223	0.25	0.01	0.24	+	21.91	4.95	-.220E+06	2.5
12	8	224	0.09	0.01	0.09	+	21.99	4.96	-.695E+05	0.8
13	8	225	0.14	0.01	0.13	+	22.12	4.97	-.994E+05	1.4
14	8	226	0.38	0.03	0.35	+	22.47	4.99	-.493E+06	7.2
15	8	227	0.41	0.03	0.38	+	22.85	5.03	-.506E+06	5.7
16	8	228	0.23	0.02	0.21	+	23.05	5.05	-.356E+06	4.1
17	8	229	0.14	0.01	0.13	+	23.18	5.06	-.204E+06	2.3
18	8	230	0.31	0.03	0.27	+	23.46	5.09	-.221E+06	2.7
19	8	231	0.19	0.02	0.17	+	23.63	5.12	-.206E+06	2.7
20	8	232	0.19	0.03	0.17	+	23.79	5.14	-.270E+06	3.2
21	8	233	0.16	0.02	0.14	+	23.93	5.17	-.220E+06	2.4
22	8	234	0.30	0.05	0.25	+	24.18	5.21	-.318E+06	3.2
23	8	235	0.27	0.05	0.22	+	24.40	5.26	-.335E+06	3.3
24	8	236	0.26	0.05	0.21	+	24.61	5.31	-.267E+06	2.6
25	8	237	0.23	0.05	0.18	+	24.79	5.36	-.187E+06	1.9
26	8	238	0.27	0.06	0.21	+	25.00	5.42	-.204E+06	2.2
27	8	239	0.28	0.07	0.21	+	25.21	5.49	-.318E+06	3.2

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28  8 240  0.19  0.05  0.14  +------+                                                    +  25.36   5.54 -.388E+06   3.8
29  8 241  0.36  0.10  0.26  +----------+                                                +  25.62   5.65 -.286E+06   3.2
30  8 242  0.42  0.13  0.29  +--------------+                                            +  25.91   5.78 -.489E+06   6.2
31  8 243  0.37  0.12  0.25  +----------+                                                +  26.15   5.90 -.359E+06   4.9
 1  9 244  0.34  0.12  0.22  +---------+                                                 +  26.37   6.02 -.326E+06   5.1
 2  9 245  0.14  0.05  0.08  +---+                                                       +  26.46   6.07 -.239E+06   3.3
 3  9 246  0.09  0.04  0.05  +--+                                                        +  26.51   6.11 -.158E+06   1.8
 4  9 247  0.27  0.12  0.16  +-------+                                                   +  26.67   6.23 -.236E+06   2.5
 5  9 248  0.35  0.16  0.19  +--------+                                                  +  26.85   6.39 -.269E+06   3.1
 6  9 249  0.39  0.19  0.20  +---------+                                                 +  27.05   6.58 -.412E+06   5.2
 7  9 250  0.30  0.15  0.14  +------+                                                    +  27.20   6.73 -.255E+06   3.4
 8  9 251  0.27  0.15  0.12  +-----+                                                     +  27.32   6.88 -.256E+06   3.6
 9  9 252  0.24  0.14  0.10  +----+                                                      +  27.42   7.02 -.358E+06   4.7
10  9 253  0.27  0.17  0.11  +----+                                                      +  27.53   7.18 -.254E+06   3.3
11  9 254  0.24  0.15  0.09  +---+                                                       +  27.62   7.34 -.238E+06   3.0
12  9 255  0.07  0.05  0.02  ++                                                          +  27.64   7.38 -.113E+06   1.3
13  9 256  0.15  0.10  0.04  +-+                                                         +  27.68   7.49 -.301E+06   3.0
14  9 257  0.22  0.16  0.06  +--+                                                        +  27.74   7.65 -.367E+06   3.2
15  9 258  0.26  0.20  0.06  +--+                                                        +  27.80   7.85 -.366E+06   3.0
                             ¦****¦****¦****¦****¦****¦****¦****¦****¦****¦****  ****¦****¦****¦****¦
DATE  DAY  EPOT ESOIL EPLANT 0.0       0.2       0.4       0.6       0.8       1.0       1.2       1.4   SEP    SES     PHS     VPD
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BOUNDARY CONDITION AT BOTTOM OF SOIL PROFILE :
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FLUX TOWARDS DITCHES AND DEEP PERCOLATION

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DISTANCE BETWEEN THE CHANNELS     :        250.  M
RADIAL RESISTANCE OF THE CHANNEL     :  0.300E+01  DAY/M
TRANSMISSIVITY (SATURATED FLOW) :  0.3125E+01  M**2/DAY
REDUCTION COEFFICIENT (ALPHAR)   :       0.790
DEEP GROUNDWATER LEVEL           :        -70.  CM
RESISTANCE OF SEMI-IMPERMEABLE LAYER :    1000000.  DAY
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THE WATER LEVEL IN THE CHANNELS IS CONSTANT :   -130.0CM

THE ROOTING DEPTH IS CONSTANT = -40.0 CM
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INITIAL CONDITION :
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***** PRESSURE HEAD PROFILE IS GIVEN *****

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 -0.1141E+03   -0.9810E+02   -0.8060E+02   -0.6420E+02   -0.5120E+02
 -0.4060E+02   -0.3020E+02   -0.2000E+02   -0.4800E+01    0.0000E+00
  0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00
  0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00
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WHEN PONDING OCCURS, MAX. 0.5 CM. WATER IS ALLOWED ON TOP OF THE SOIL SURFACE.

SOIL PHYSICAL PARAMETERS OF SOIL LAYER NR : 1

THETA	PR.HEAD CM	CONDUC CM/DAY	THETA	PR.HEAD CM	CONDUC CM/DAY	THETA	PR.HEAD CM	CONDUC CM/DAY	THETA	PR.HEAD CM	CONDUC CM/DAY
0.01	-0.417E+07	0.620E-07	0.02	-0.170E+07	0.180E-06	0.03	-0.891E+06	0.390E-06	0.04	-0.490E+06	0.790E-06
0.05	-0.309E+06	0.140E-05	0.06	-0.204E+06	0.220E-05	0.07	-0.141E+06	0.350E-05	0.08	-0.105E+06	0.490E-05
0.09	-0.759E+05	0.730E-05	0.10	-0.562E+05	0.100E-04	0.11	-0.407E+05	0.150E-04	0.12	-0.309E+05	0.210E-04
0.13	-0.229E+05	0.300E-04	0.14	-0.174E+05	0.420E-04	0.15	-0.131E+05	0.580E-04	0.16	-0.102E+05	0.790E-04
0.17	-0.776E+04	0.110E-03	0.18	-0.603E+04	0.150E-03	0.19	-0.468E+04	0.200E-03	0.20	-0.372E+04	0.260E-03
0.21	-0.295E+04	0.350E-03	0.22	-0.240E+04	0.440E-03	0.23	-0.195E+04	0.560E-03	0.24	-0.159E+04	0.730E-03
0.25	-0.129E+04	0.930E-03	0.26	-0.105E+04	0.120E-02	0.27	-0.851E+03	0.150E-02	0.28	-0.708E+03	0.190E-02
0.29	-0.575E+03	0.740E-02	0.30	-0.479E+03	0.300E-02	0.31	-0.398E+03	0.700E-02	0.32	-0.324E+03	0.155E-01
0.33	-0.263E+03	0.297E-01	0.34	-0.219E+03	0.476E-01	0.35	-0.182E+03	0.706E-01	0.36	-0.151E+03	0.980E-01
0.37	-0.129E+03	0.125E+00	0.38	-0.107E+03	0.157E+00	0.39	-0.870E+02	0.195E+00	0.40	-0.680E+02	0.240E+00
0.41	-0.500E+02	0.290E+09	0.42	-0.360E+02	0.336E+00	0.43	-0.270E+02	0.371E+00	0.44	-0.170E+02	0.415E+00
0.45	-0.900E+01	0.450E+00	0.46	0.000E+00	0.495E+00	0.47	0.000E+00	0.000E+00	0.48	0.000E+00	0.000E+00

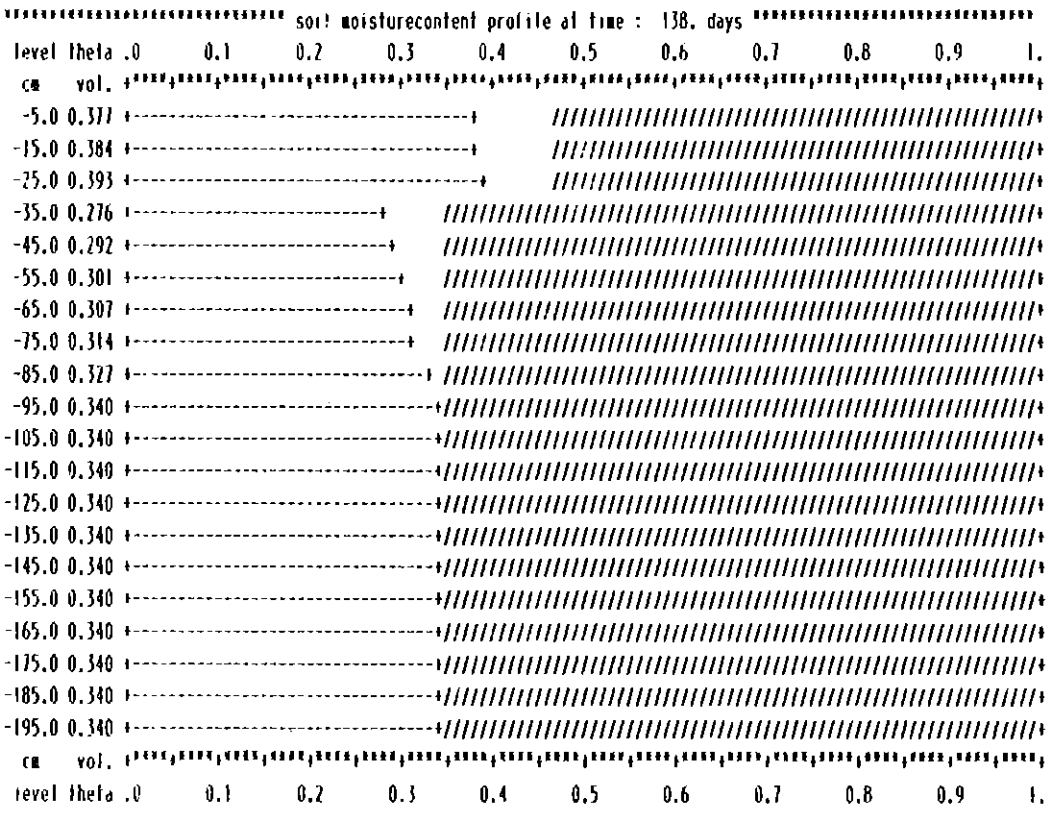
SOIL PHYSICAL PARAMETERS OF SOIL LAYER NR : 2

THETA	PR.HEAD CM	CONDUC CM/DAY	THETA	PR.HEAD CM	CONDUC CM/DAY	THETA	PR.HEAD CM	CONDUC CM/DAY	THETA	PR.HEAD CM	CONDUC CM/DAY
0.01	-0.251E+06	0.430E-08	0.02	-0.891E+04	0.298E-05	0.03	-0.195E+04	0.588E-04	0.04	-0.912E+03	0.261E-03
0.05	-0.513E+03	0.805E-03	0.06	-0.316E+03	0.208E-02	0.07	-0.224E+03	0.572E-02	0.08	-0.190E+03	0.174E-01
0.09	-0.182E+03	0.227E-01	0.10	-0.166E+03	0.384E-01	0.11	-0.158E+03	0.499E-01	0.12	-0.151E+03	0.627E-01
0.13	-0.145E+03	0.764E-01	0.14	-0.135E+03	0.106E+00	0.15	-0.129E+03	0.129E+00	0.16	-0.120E+03	0.173E+00
0.17	-0.115E+03	0.204E+00	0.18	-0.107E+03	0.266E+00	0.19	-0.102E+03	0.312E+00	0.20	-0.980E+02	0.356E+00
0.21	-0.910E+02	0.448E+00	0.22	-0.870E+02	0.511E+00	0.23	-0.810E+02	0.623E+00	0.24	-0.770E+02	0.710E+00
0.25	-0.740E+02	0.783E+00	0.26	-0.690E+02	0.923E+00	0.27	-0.660E+02	0.101E+01	0.28	-0.630E+02	0.112E+01
0.29	-0.540E+02	0.151E+01	0.30	-0.420E+02	0.224E+01	0.31	-0.260E+02	0.378E+01	0.32	-0.900E+01	0.661E+01
0.33	-0.300E+01	0.805E+01	0.34	0.000E+00	0.100E+02	0.35	0.000E+00	0.000E+00	0.36	0.000E+00	0.000E+00

time : 138. days time step= 0.100E 09 day number of time step= 1

cprec = 0.000 cm cintcep = 0.000 cm cpinfilt= 0.000 cm cinfilt = 0.000 cm
cpetr = 0.000 cm cptransp= 0.000 cm cpsevap = 0.000 cm crunoff = 0.000 cm
cetr = 0.000 cm 'ctransp = 0.000 cm' 'csevap = 0.000 cm' fluxl = 0.094427 cm/day
cflxsd = 0.000 cm cflxsdp = 0.000 cm cflxsdn = 0.000 cm flxsd = 0.000000 cm/day isd= 20
cflxbu = 0.000 cm flxbu = 0.000000 cm/day
cqdeep = 0.000 cm cqdeepp = 0.000 cm cqdeepn = 0.000 cm qdeepa = -0.010799 cm/day
cdelta = -0.034 cm cdeltap= 0.000 cm cdeltan= -0.034 cm delta =-0.337E-01 cm
volinit= 67.113 cm vol = 67.079 cm gwla = -94.8 cm drza = -40.0 cm n = 9

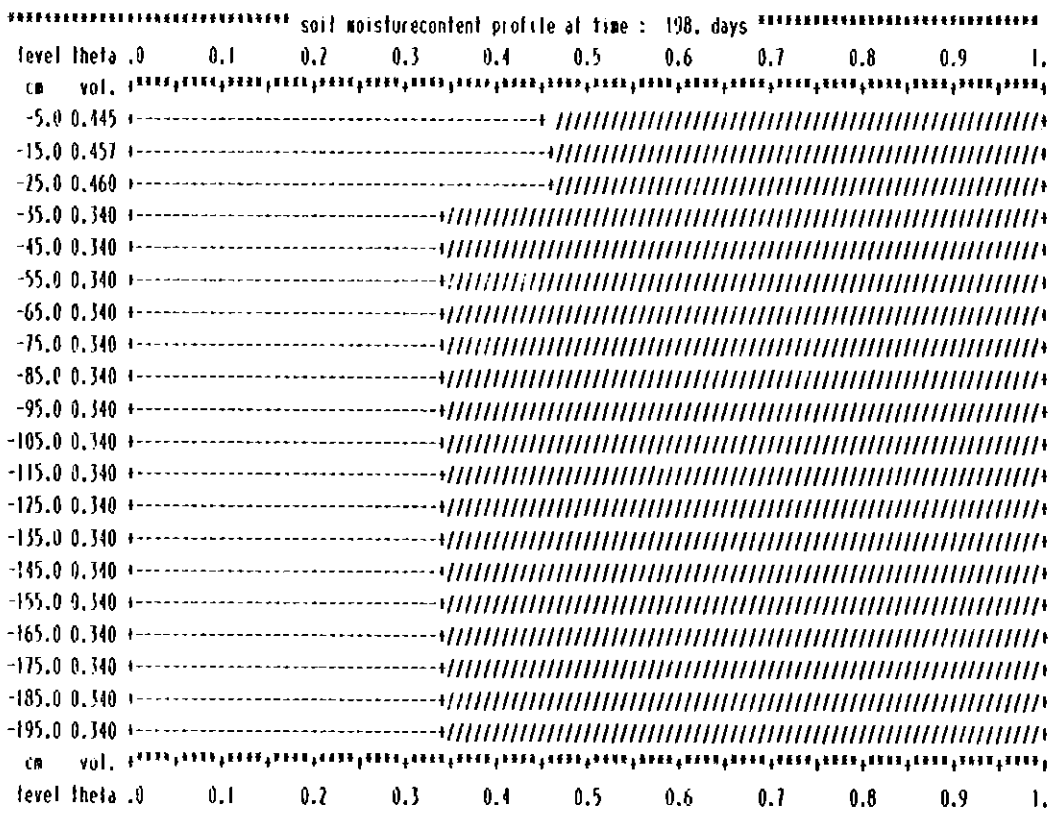
comp. nr	level (cm)	theta (vol)	pr.head (cm)	conduc (cm/day)	root ext (1/day)	c.root ext (cm)	cum.water (cm)	fluxes (cm/day)	comp. nr
1	-5.0	0.377	-0.114E+03	0.147E+00	0.000E+00	0.000E+00	3.768	0.958E-01	1
2	-15.0	0.384	-0.981E+02	0.174E+00	0.000E+00	0.000E+00	7.612	0.143E+00	2
3	-25.0	0.393	-0.806E+02	0.210E+00	0.000E+00	0.000E+00	11.546	0.304E+00	3
4	-35.0	0.276	-0.642E+02	0.108E+01	0.000E+00	0.000E+00	14.306	0.403E+00	4
5	-45.0	0.292	-0.512E+02	0.168E+01	0.000E+00	0.000E+00	17.229	0.120E+00	5
6	-55.0	0.301	-0.406E+02	0.237E+01	0.000E+00	0.000E+00	20.238	0.113E+00	6
7	-65.0	0.307	-0.302E+02	0.338E+01	0.000E+00	0.000E+00	23.312	0.803E-01	7
8	-75.0	0.314	-0.200E+02	0.478E+01	0.000E+00	0.000E+00	26.447	0.136E+01	8
9	-85.0	0.327	-0.480E+01	0.762E+01	0.000E+00	0.000E+00	29.717	0.136E+01	9
10	-95.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	33.117	-0.108E-01	10
11	-105.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	36.517	-0.108E-01	11
12	-115.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	39.917	-0.108E-01	12
13	-125.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	43.317	-0.108E-01	13
14	-135.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	46.717	-0.108E-01	14
15	-145.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	50.117	-0.108E-01	15
16	-155.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	53.517	-0.108E-01	16
17	-165.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	56.917	-0.108E-01	17
18	-175.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	60.317	-0.108E-01	18
19	-185.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	63.717	-0.108E-01	19
20	-195.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	67.117	-0.108E-01	20



time : 198. days time step= 0.200E+00 day number of time step= 337

cprec	= 79.930 cm	cintcep	= 1.934 cm	cpinfilt	= 27.096 cm	cinfilt	= 10.269 cm
cpeti	= 19.736 cm	cptransp	= 15.101 cm	cpsevap	= 4.634 cm	crunoff	= 16.827 cm
cetr	= 4.038 cm	*ctransp	= 0.441 cm*	*csevap	= 3.597 cm*	fluxt	= -0.585241 cm/day
cflxsd	= -2.220 cm	cflxsdp	= 3.416 cm	cflxsdn	= -5.636 cm	flxsd	= 0.000000 cm/day isd= 20
cflxbu	= 0.000 cm					flxbu	= 0.000000 cm/day
cqdeep	= -2.083 cm	cqdeepp	= 0.000 cm	cqdeepn	= -2.083 cm	qdeepa	= -0.034490 cm/day
cdelta	= -3.531 cm	cdeltap	= 1.183 cm	cdeltan	= -4.714 cm	delta	= 0.127E-06 cm
volinit	= 67.113 cm	vol	= 71.255 cm	gwla	= -18.0 cm	drza	= -40.0 cm n = 2

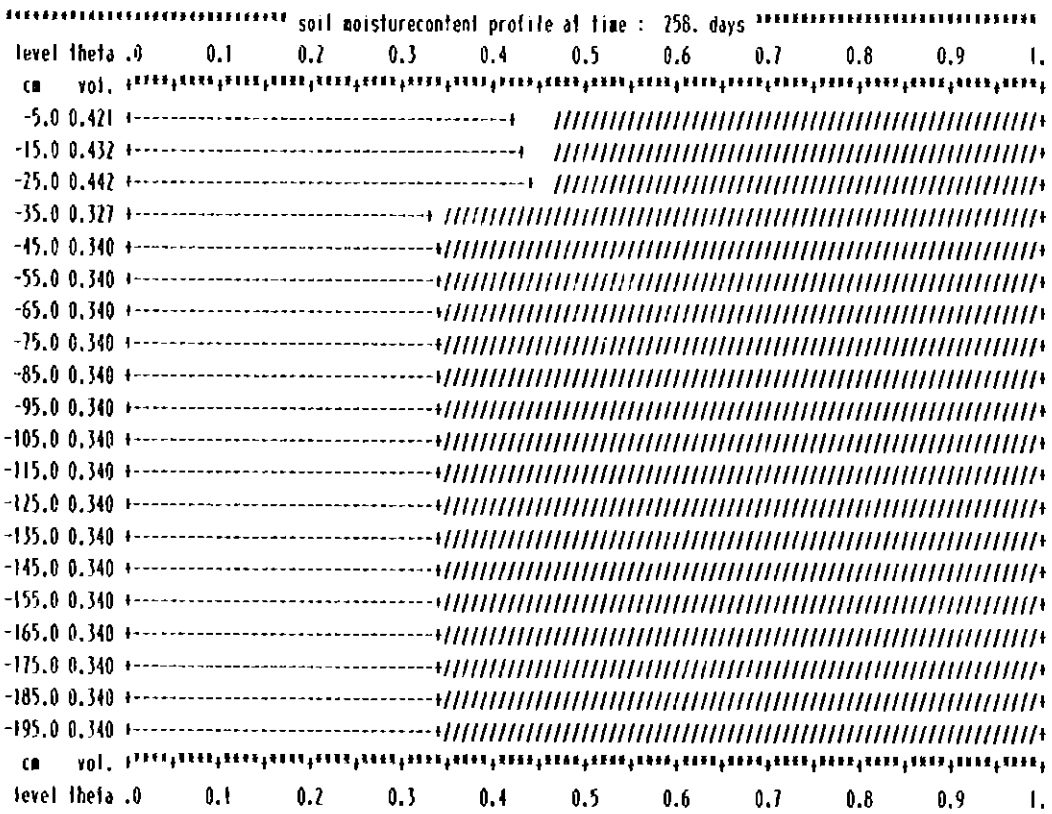
comp. nr	level (cm)	theta (vol)	pr.head (cm)	conduc (cm/day)	root ext (1/day)	c.root ext (cm)	cum.water (cm)	fluxes (cm/day)	comp. nr
1	-5.0	0.445	-0.130E+02	0.432E+00	0.499E-03	0.188E+00	4.450	0.868E-01	1
2	-15.0	0.457	-0.300E+01	0.480E+00	0.000E+00	0.164E+00	9.017	0.868E-01	2
3	-25.0	0.460	-0.100E-08	0.495E+00	0.000E+00	0.468E-01	13.617	-0.345E-01	3
4	-35.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.414E-01	17.017	-0.345E-01	4
5	-45.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	20.417	-0.345E-01	5
6	-55.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	23.817	-0.345E-01	6
7	-65.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	27.217	-0.345E-01	7
8	-75.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	30.617	-0.345E-01	8
9	-85.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	34.017	-0.345E-01	9
10	-95.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	37.417	-0.345E-01	10
11	-105.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	40.817	-0.345E-01	11
12	-115.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	44.217	-0.345E-01	12
13	-125.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	47.617	-0.345E-01	13
14	-135.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	51.017	-0.345E-01	14
15	145.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	54.417	-0.345E-01	15
16	-155.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	57.817	-0.345E-01	16
17	-165.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	61.217	-0.345E-01	17
18	-175.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	64.617	-0.345E-01	18
19	-185.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	68.017	-0.345E-01	19
20	-195.0	0.340	-0.100E-08	0.100E+02	0.000E+00	0.000E+00	71.417	-0.345E-01	20



time : 758. days time step= 0.100E+01 day number of time step= 669

cprec = 38.621 cm	cintcep = 3.779 cm	cpinfilt= 34.842 cm	cinfilt = 13.996 cm		
cpetr = 35.658 cm	cptransp= 27.804 cm	cpsevap = 7.853 cm	crunoff = 20.846 cm		
cetr = 6.174 cm	^{a}ctransp = 0.644 cm^{a}	^{a}csevap = 5.530 cm^{a}	fluxl = 0.012682 cm/day		
cflxsd = -4.971 cm	cflxsdp = 4.672 cm	cflxsdn = -9.643 cm	flxsd = 0.000000 cm/day	isd= 20	
cflxbu = 0.000 cm			flxbu = 0.000000 cm/day		
cqdeep = -4.341 cm	cqdeepp = 0.000 cm	cqdeepn = -4.341 cm	qdeepa = -0.027703 cm/day		
cdelta = -5.600 cm	cdeltap= 2.376 cm	cdeltan= -7.976 cm	delta = 0.114E-01 cm		
volinit= 67.313 cm	vol = 70.614 cm	gwla = -40.0 cm	dtza = -40.0 cm	n = 4	

comp. nr	level (cm)	theta (-)	pr.head (cm)	conduc (cm/day)	sink ext (1/day)	c.root ext (cm)	pot.water (cm)	fluxes (cm/day)	comp. nr
1	-5.0	0.421	-0.355E+02	0.338E+00	0.154E-02	0.309E+00	4.206	0.657E-02	1
2	-15.0	0.432	-0.253E+02	0.379E+00	0.154E-02	0.231E+00	8.523	0.875E-02	2
3	-25.0	0.442	-0.151E+02	0.423E+00	0.521E-03	0.617E-01	12.947	0.114E-01	3
4	-35.0	0.327	-0.500E+01	0.757E+01	0.000E+00	0.414E-01	16.214	0.114E-01	4
5	-45.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	19.614	-0.277E-01	5
6	-55.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	23.014	-0.277E-01	6
7	-65.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	26.414	-0.277E-01	7
8	-75.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	29.814	-0.277E-01	8
9	-85.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	33.214	-0.277E-01	9
10	-95.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	36.614	-0.277E-01	10
11	-105.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	40.014	-0.277E-01	11
12	-115.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	43.414	-0.277E-01	12
13	-125.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	46.814	-0.277E-01	13
14	-135.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	50.214	-0.277E-01	14
15	-145.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	53.614	-0.277E-01	15
16	-155.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	57.014	-0.277E-01	16
17	-165.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	60.414	-0.277E-01	17
18	-175.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	63.814	-0.277E-01	18
19	-185.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	67.214	-0.277E-01	19
20	-195.0	0.340	0.000E+00	0.100E+02	0.000E+00	0.000E+00	70.614	-0.277E-01	20



******** terms of the water balance ********

time	cinfilt	transp	ctransp	sevap	csevap	cflxbotp	cflxbotn	vol-volt	groundw.lev	time
	cm	cm/day	cm	cm/day	cm	cm	cm	cm	cm	
139	0.00	0.00	0.00	0.09	0.09	0.00	-0.01	-0.15	-100.8	139
140	0.20	0.00	0.00	0.07	0.17	0.00	-0.02	-0.01	-96.8	140
141	0.46	0.00	0.00	0.07	0.24	0.00	-0.03	0.24	-96.8	141
142	1.05	0.05	0.05	0.06	0.30	0.00	-0.04	0.57	-96.8	142
143	2.83	0.03	0.07	0.16	0.46	0.00	-0.05	2.19	-84.8	143
144	3.98	0.03	0.11	0.18	0.64	0.00	-0.06	3.15	-58.8	144
145	5.10	0.03	0.14	0.17	0.81	0.00	-0.09	3.99	-40.8	145
146	5.68	0.01	0.15	0.20	1.01	0.00	-0.12	4.37	-9.0	146
147	5.89	0.00	0.15	0.18	1.18	0.00	-0.16	4.37	-9.0	147
148	6.08	0.01	0.16	0.14	1.33	0.00	-0.19	4.37	-9.0	148
149	6.36	0.00	0.16	0.11	1.44	0.00	-0.23	4.49	0.0	149
150	6.63	0.01	0.17	0.23	1.67	0.00	-0.27	4.49	0.0	150
151	6.93	0.01	0.19	0.26	1.93	0.00	-0.31	4.49	0.0	151
152	7.04	0.00	0.19	0.07	2.00	0.00	-0.35	4.49	0.0	152
153	7.20	0.01	0.20	0.11	2.12	0.00	-0.39	4.49	0.0	153
154	7.43	0.02	0.22	0.20	2.31	0.00	-0.43	4.49	0.0	154
155	7.62	0.01	0.23	0.14	2.46	0.00	-0.47	4.49	0.0	155
156	7.62	0.01	0.24	0.05	2.51	0.00	-0.51	4.37	-9.0	156
157	7.62	0.01	0.25	0.09	2.61	0.00	-0.55	4.25	-14.0	157
158	8.05	0.01	0.26	0.08	2.69	0.00	-0.58	4.49	0.0	158
159	8.17	0.00	0.26	0.07	2.76	0.00	-0.62	4.49	0.0	159
160	8.19	0.00	0.26	0.07	2.83	0.00	-0.66	4.49	0.0	160
161	8.22	0.00	0.26	0.06	2.90	0.00	-0.70	4.37	-9.0	161
162	8.44	0.00	0.26	0.02	2.92	0.00	-0.74	4.49	0.0	162
163	8.47	0.00	0.26	0.03	2.95	0.00	-0.78	4.49	0.0	163
164	8.53	0.00	0.26	0.02	2.97	0.00	-0.82	4.49	0.0	164
165	8.58	0.00	0.26	0.01	2.98	0.00	-0.86	4.49	0.0	165
166	8.65	0.00	0.26	0.03	3.01	0.00	-0.90	4.49	0.0	166
167	8.70	0.00	0.26	0.05	3.06	0.00	-0.94	4.49	0.0	167
168	8.70	0.00	0.26	0.02	3.08	0.00	-0.98	4.37	-9.0	168
169	8.70	0.00	0.26	0.04	3.12	0.00	-1.02	4.37	-9.0	169
170	8.70	0.00	0.26	0.03	3.15	0.00	-1.05	4.25	-14.0	170
171	8.70	0.01	0.26	0.03	3.18	0.00	-1.09	4.14	-18.0	171
172	8.72	0.02	0.29	0.02	3.20	0.00	-1.12	4.14	-18.0	172
173	8.72	0.03	0.31	0.02	3.22	0.00	-1.16	4.01	-22.0	173
174	8.72	0.05	0.36	0.02	3.24	0.00	-1.19	3.90	-26.0	174
175	9.39	0.03	0.39	0.01	3.25	0.00	-1.22	4.49	0.0	175
176	9.41	0.00	0.39	0.01	3.26	0.00	-1.26	4.49	0.0	176
177	9.46	0.00	0.39	0.01	3.27	0.00	-1.30	4.49	0.0	177
178	9.52	0.00	0.39	0.02	3.29	0.00	-1.34	4.49	0.0	178
179	9.58	0.00	0.39	0.02	3.31	0.00	-1.38	4.49	0.0	179
180	9.63	0.00	0.39	0.01	3.32	0.00	-1.42	4.49	0.0	180
181	9.68	0.00	0.39	0.01	3.33	0.00	-1.46	4.49	0.0	181
182	9.68	0.00	0.39	0.02	3.35	0.00	-1.50	4.49	0.0	182
183	9.68	0.00	0.39	0.02	3.36	0.00	-1.54	4.37	-9.0	183
184	9.68	0.00	0.39	0.02	3.38	0.00	-1.58	4.37	-9.0	184
185	9.68	0.00	0.39	0.01	3.40	0.00	-1.62	4.25	-14.0	185
186	9.68	0.00	0.39	0.02	3.41	0.00	-1.65	4.25	-14.0	186
187	9.68	0.01	0.40	0.02	3.43	0.00	-1.69	4.14	-18.0	187

188	9.89	0.02	0.42	0.02	3.45	0.00	-1.72	4.25	-14.0	188
189	9.89	0.00	0.42	0.02	3.47	0.00	-1.76	4.25	-14.0	189
190	10.18	0.00	0.42	0.02	3.48	0.00	-1.79	4.39	-8.0	190
191	10.18	0.00	0.42	0.02	3.50	0.00	-1.83	4.39	-8.0	191
192	10.18	0.00	0.42	0.01	3.52	0.00	-1.87	4.39	-8.0	192
193	10.18	0.00	0.42	0.03	3.54	0.00	-1.91	4.28	-13.0	193
194	10.18	0.00	0.42	0.01	3.56	0.00	-1.94	4.28	-13.0	194
195	10.18	0.00	0.42	0.02	3.57	0.00	-1.98	4.14	-18.0	195
196	10.18	0.01	0.42	0.01	3.58	0.00	-2.01	4.14	-18.0	196
197	10.25	0.01	0.43	0.01	3.59	0.00	-2.05	4.14	-18.0	197
198	10.27	0.01	0.44	0.01	3.60	0.00	-2.08	4.14	-18.0	198
199	10.69	0.00	0.44	0.00	3.60	0.00	-2.12	4.49	0.0	199
200	10.71	0.00	0.44	0.01	3.61	0.00	-2.16	4.49	0.0	200
201	10.71	0.00	0.44	0.01	3.62	0.00	-2.20	4.49	0.0	201
202	10.76	0.00	0.44	0.01	3.63	0.00	-2.24	4.49	0.0	202
203	10.82	0.00	0.44	0.01	3.64	0.00	-2.28	4.49	0.0	203
204	10.86	0.00	0.44	0.00	3.65	0.00	-2.32	4.49	0.0	204
205	10.87	0.00	0.44	0.02	3.67	0.00	-2.36	4.37	-9.0	205
206	10.87	0.00	0.44	0.02	3.68	0.00	-2.40	4.37	-9.0	206
207	10.87	0.00	0.44	0.02	3.70	0.00	-2.43	4.25	-14.0	207
208	10.87	0.00	0.44	0.02	3.72	0.00	-2.47	4.25	-14.0	208
209	10.87	0.00	0.45	0.02	3.74	0.00	-2.50	4.14	-18.0	209
210	11.27	0.00	0.45	0.01	3.75	0.00	-2.54	4.49	0.0	210
211	11.32	0.00	0.45	0.01	3.77	0.00	-2.58	4.49	0.0	211
212	11.37	0.00	0.45	0.01	3.78	0.00	-2.62	4.49	0.0	212
213	11.42	0.00	0.45	0.01	3.79	0.00	-2.66	4.49	0.0	213
214	11.45	0.00	0.45	0.01	3.80	0.00	-2.70	4.49	0.0	214
215	11.51	0.00	0.45	0.01	3.81	0.00	-2.74	4.49	0.0	215
216	11.51	0.00	0.45	0.01	3.83	0.00	-2.78	4.49	0.0	216
217	11.51	0.00	0.45	0.02	3.85	0.00	-2.82	4.39	-8.0	217
218	11.51	0.00	0.45	0.02	3.87	0.00	-2.86	4.39	-8.0	218
219	11.51	0.00	0.45	0.01	3.88	0.00	-2.89	4.25	-14.0	219
220	11.79	0.00	0.45	0.01	3.89	0.00	-2.93	4.49	0.0	220
221	11.84	0.00	0.45	0.00	3.89	0.00	-2.97	4.49	0.0	221
222	11.89	0.00	0.45	0.02	3.91	0.00	-3.01	4.49	0.0	222
223	11.95	0.00	0.45	0.01	3.92	0.00	-3.05	4.49	0.0	223
224	11.99	0.00	0.45	0.01	3.92	0.00	-3.09	4.49	0.0	224
225	11.99	0.00	0.45	0.01	3.93	0.00	-3.13	4.49	0.0	225
226	11.99	0.00	0.45	0.03	3.96	0.00	-3.17	4.37	-9.0	226
227	11.99	0.00	0.45	0.03	3.99	0.00	-3.21	4.37	-9.0	227
228	11.99	0.00	0.45	0.02	4.01	0.00	-3.25	4.25	-14.0	228
229	12.28	0.00	0.45	0.01	4.02	0.00	-3.28	4.49	0.0	229
230	12.30	0.00	0.45	0.03	4.06	0.00	-3.32	4.49	0.0	230
231	12.30	0.00	0.45	0.02	4.08	0.00	-3.36	4.37	-9.0	231
232	12.30	0.00	0.45	0.03	4.11	0.00	-3.40	4.37	-9.0	232
233	12.46	0.00	0.45	0.02	4.13	0.00	-3.44	4.37	-9.0	233
234	12.46	0.00	0.45	0.05	4.18	0.00	-3.47	4.37	-9.0	234
235	12.71	0.00	0.45	0.05	4.22	0.00	-3.51	4.49	0.0	235
236	12.79	0.00	0.45	0.04	4.27	0.00	-3.55	4.49	0.0	236
237	12.88	0.00	0.45	0.04	4.31	0.00	-3.59	4.49	0.0	237
238	12.96	0.00	0.45	0.04	4.35	0.00	-3.63	4.49	0.0	238
239	13.04	0.00	0.45	0.04	4.39	0.00	-3.67	4.49	0.0	239
240	13.12	0.00	0.45	0.04	4.43	0.00	-3.71	4.49	0.0	240
241	13.14	0.00	0.45	0.04	4.47	0.00	-3.75	4.49	0.0	241
242	13.14	0.00	0.45	0.04	4.51	0.00	-3.79	4.37	-9.0	242

243	13.14	0.00	0.45	0.04	4.55	0.00	-3.83	4.37	-9.0	243
244	13.14	0.00	0.45	0.04	4.58	0.00	-3.87	4.25	-14.0	244
245	13.18	0.00	0.45	0.04	4.62	0.00	-3.90	4.25	-14.0	245
246	13.57	0.00	0.45	0.04	4.65	0.00	-3.94	4.49	0.0	246
247	13.73	0.00	0.45	0.12	4.77	0.00	-3.98	4.49	0.0	247
248	13.79	0.00	0.45	0.11	4.88	0.00	-4.02	4.49	0.0	248
249	13.79	0.00	0.45	0.09	4.98	0.00	-4.06	4.25	-14.0	249
250	13.79	0.00	0.45	0.08	5.06	0.00	-4.09	4.14	-18.0	250
251	13.79	0.01	0.46	0.07	5.14	0.00	-4.13	4.01	-22.0	251
252	13.79	0.01	0.47	0.07	5.20	0.00	-4.16	4.01	-22.0	252
253	13.79	0.04	0.50	0.06	5.27	0.00	-4.19	3.88	-26.0	253
254	13.79	0.03	0.54	0.06	5.33	0.00	-4.23	3.63	-40.0	254
255	13.79	0.01	0.55	0.05	5.37	0.00	-4.26	3.52	-40.0	255
256	13.79	0.03	0.57	0.05	5.43	0.00	-4.29	3.48	-40.0	256
257	13.96	0.03	0.61	0.05	5.48	0.00	-4.31	3.54	-40.0	257
258	14.00	0.03	0.64	0.05	5.53	0.00	-4.34	3.50	-40.0	258