1974

A Simplified Version of the Desert Biome General-Purpose Model to Simulate the Production of Dry Matter in Plants

F. Romane

1973/74 PROGRESS REPORT

A SIMPLIFIED VERSION OF THE DESERT BIOME GENERAL-PURPOSE MODEL TO SIMULATE THE PRODUCTION OF DRY MATTER IN PLANTS

F. Romane
Centre d' Etudes Phytosociologiques et Ecologiques
(C.N.R.S.)
Montpellier, France

US/IBP DESERT BIOME
RESEARCH MEMORANDUM 74-55

in

REPORTS OF 1973 PROGRESS
Volume 1: Central Office, Modelling
Auxiliary Submodels Section, pp. 1-29

MAY, 1974

Citation format: Author(s). 1974. Title.
US/IBP Desert Biome Res. Memo. 74-55.
Utah State Univ., Logan. 29 pp.

Ecology Center, Utah State University, Logan, Utah 84322

INTRODUCTION

The model explained here is in a preliminary stage and is subject to improvement. Ameliorations will surely result from dialogue with the field scientists for whom the model was built (scientists of the FAO/CNRS project "Parcours Sud de la Tunisie" in Gabès). Because of the distance between Gabès and Logan, good communication between personnel was difficult during the author's stay in Logan.

Because of close association with the Desert Biome modelling team and the availability of data, this first version model based on dry matter (and not on the chemical constituents of dry matter) was able to be built in a relatively short time (Fig. 1).

We hope that this attempt at a simplified model will be useful to others working with simple data (dry matter) from the field.

OBJECTIVES

The most important objective of this model was the prediction of primary production for one or two years in one given type of production.

It was proposed at first to use the general existing model used in the Desert Biome. Two reasons militated against this proposal: (1) the lack of detailed Tunisian data for the chemical composition of plants; and (2) the goal of having an easily modified simple program which could be used with the available data.

In fact, the first attempt at simplification of the existing model, in order to simulate primary production for total dry matter only, was abandoned because of the inability to adopt several features of the model (e.g., ratio of protein carbon to total carbon, etc.). It was necessary to add "parallel" subroutines to the existing model. Once accomplished, it was easier to build a new model which fits more closely to the objectives and data.

GENERAL CHARACTERISTICS

This model was patterned after the "Multi-purpose Desert Biome Model" and shares its principal characteristics, the three most notable being: (1) modular structure; (2) submodels differing in degree of sophistication; and (3) ability to specify state variables at execution time, etc.

Whenever possible the general structural design and processes used in the Desert Biome models were preserved, and for this reason detailed descriptions of items explained in the 1973 modelling report (Goodall, 1973) and other Desert Biome reports are limited. In fact, processes come from the different existing version levels, including Version IV of the plant submodel (Valentine, 1974).

Submodels related to the plants and soil are given here as examples. Due to the lack of time and the lack of data for animals and other processes, we prefer to add this at a later time.

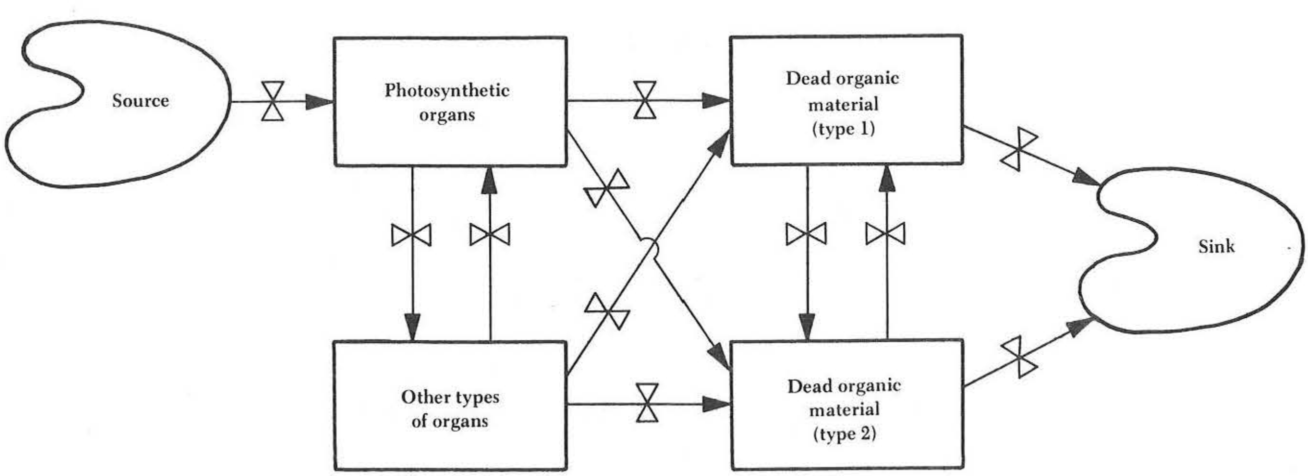


Figure 1. Simplified diagram for the dry matter model. Each valve is controlled by one or more parameters, including exogenous data, soil conditions, etc.

SHORT DESCRIPTION OF THE PROGRAM

MAIN PROGRAM

At this stage of development, the state variables are the dry weight of each organ of each plant species and of each type of dead organic material.

The time step is one day, although the subroutine SOWAT and one part of the main program can run for lesser time increments.

The most important role of the main program is the calling of the subroutines, which can be modified if necessary (Fig. 2).

Steps in the Operation of the Program

1. Read parameters and initial data with the help of the subroutines.
2. The subroutines will determine the conditions for vegetation in the current day (date, season, rain, soil condition, etc.)
3. For each species, the subroutines will determine the phenological stage, the net daily increment of dry matter, allocation of this increment among the photosynthetic organs, transfers between organs, and the death of each organ.
4. Subroutines will be called to determine the transfer of dead organic material. A sink can simulate the loss to the ecosystem or the decomposition which is not included in this version.
5. Increments (whether negative or positive) are "tested to ensure that none of them would cause state variables to become negative where this constraint is appropriate (which is true of most state variables in ecological systems). If some of the negative increments are 'too large' in this sense, all increments are scaled down in such proportion as the most limiting constraint requires, the increments are applied to all state variables, and the subroutines are called again for recalculation of increments. These increments are then multiplied by the complement of the proportion already applied to the state variables, and the test of their magnitude is repeated. The process continues until a set of increments can be applied *in toto*. Briefly, this is equivalent to dividing the time unit over which the difference equations approximate the underlying differentials into arbitrary portions such that the constraints can be met." (Goodall, 1973, pp. 2.1.3.1.-17 and 18.)
6. The main program fills a storage array with all state variables.
7. Subroutines are called to plot specified variables and the program terminates. A listing of the program appears in Appendix 1.

SUBROUTINES
(in alphabetical order)

DATE -- Computes the date (day, month, year) from the date of the initial day, and the number of days after the initial day.

DEGREE -- Deals with the soil temperatures. The processes proposed by Griffin et al. (1974) are used in this model. The differential equation describes soil temperature, T, as a function of depth, z, and time t:

$$\frac{\partial T}{\partial t} = \frac{\partial}{\partial z}\left[\sigma \frac{\partial T}{\partial z}\right]$$

where T is the thermal diffusivity (generally a function of time and depth), which is equal to thermal conductivity at the specific heat.

DLIGHT -- Computes the number of daylight hours in the current day and the fraction of the total number of daylight hours in one year in the current day. This fraction is used in subroutine EVAPO.

If

$$A = 730 + 274 \cdot 10^{-3} \cdot RLAT + 793 \cdot 10^{-5} (RLAT)^2$$
$$B = 342 \cdot 10^{-1} + 78 \cdot 10^{-2} \cdot RLAT + 10^{-1} \cdot (RLAT)^2$$

$$Z = 2 \cdot \pi \cdot \left(\frac{I + 285}{365}\right)$$

DAPHOT = Number of daylight hours the first day of the calendar year (January 1, I = 1; December 31, I = 365 or 366).

$$= \frac{A + B + \sin(Z)}{60}$$

where

RLAT is latitude in degrees.
DALITE is for the first day of the calendar year the portion of illumination relative to the illumination occurring in an entire year.

DMDM (provisional version) -- Computes, with given rates, the translocations between the different types of dead organic material. To simulate the losses, it is possible to create an "artificial" compartment of dead material which is a "sink." For each season (IS) a rate of daily transfer, RTLI (IS, LD, LR), is given between the different compartments of dead material. The amount transferred to the receptor compartment (LR) is proportional to the amount of dry matter in the donor compartment (LD).

Under these conditions the daily variation (DCLIT) in dry matter for compartment p is equal to

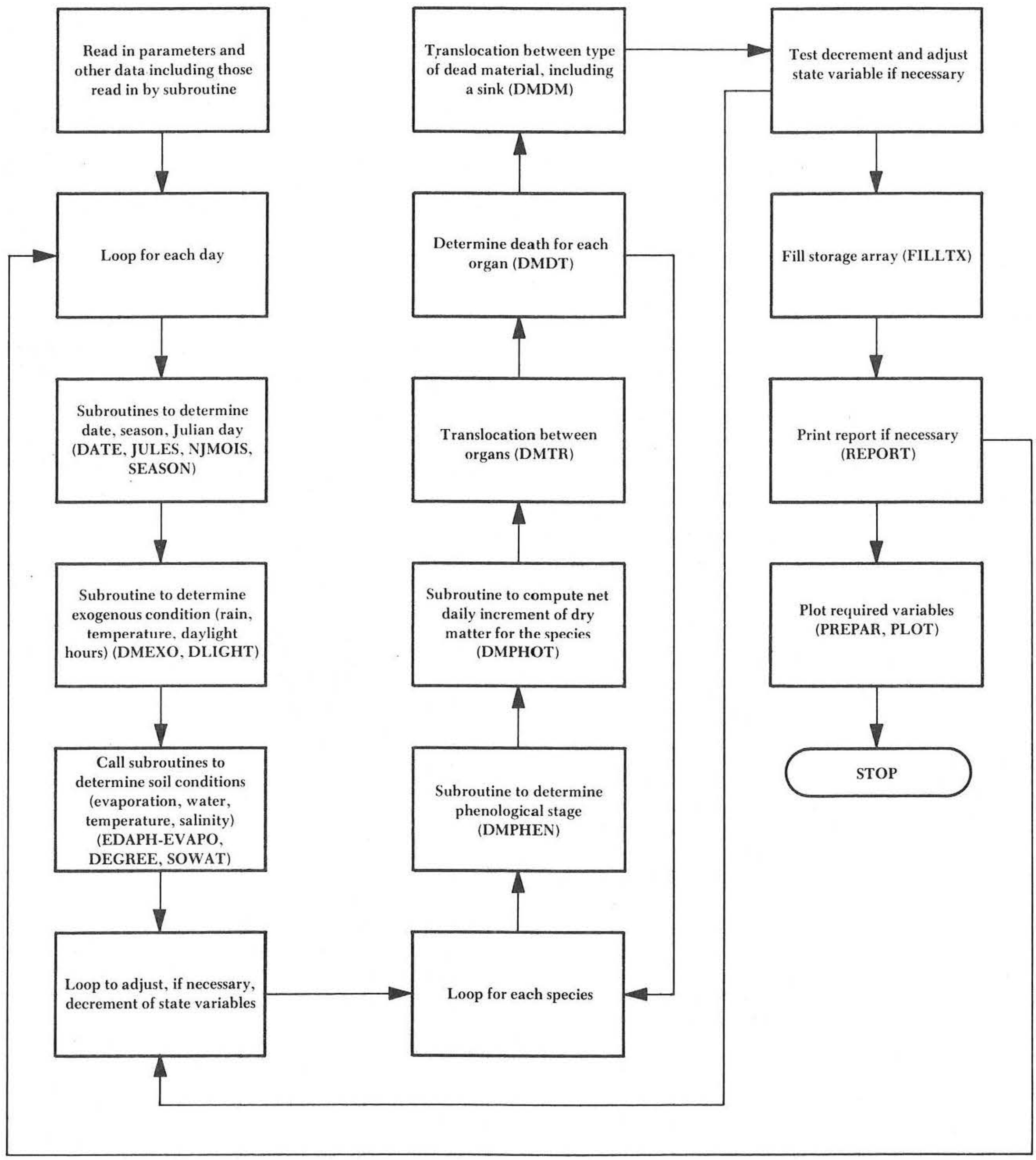


Figure 2. Simplified flow chart of FORTRAN IV program for the plant and soil model.

DCLIT (p) =

$$\underbrace{\sum_{\substack{i=1\\ i\neq p}}^{NLIT} \text{CLIT}(i)\cdot\text{RTLI}(IS,i,p)}_{\text{received}} \quad \underbrace{\sum_{\substack{i=1\\ i\neq p}}^{NLIT} \text{CLIT}(P)-\text{RTLI}(IS,p,i)}_{\text{lost}}$$

by compartment p

where

CLIT (p) = quantity of organic matter in compartment p at the beginning of the daily time step.

NLIT = total number of compartments containing dead organic matter.

DMDT -- Deals with the death of the living material and lists the class of dead organic material to which the new dead organic material will be transferred. For each organ (J) of each species (I) a mortality rate (DRATE) is calculated depending on phenological status. The subroutine contains two parts:

1. Dormancy stage: where the rate of death is an exponential function of the time since the beginning of the dormancy (cf. provisional version IV of the Desert Biome model). It is possible to give different parameters for each organ of each species.

$$\text{DRATE} = a + b\cdot e^{ct}$$

where

a, b, c = parameters provided for each organ of each species.

t = time in days since the onset of dormancy.

The amount of material passing into a dead status for organ J of species I, for one day, is now equal to

$$\text{DDMSP (I,J)} = \text{DMSP (I,J)} \cdot \text{DRATE}$$

where

DMSP (I, J) = the quantity of dry matter in organ I of species J at the beginning of the daily time step.

This function has been made exponential in form in order to eventually cause a total disappearance of biomass of the organ concerned.

2. Phenological states other than dormancy: the rates of death are read in, for each organ of each species in each phenological stage.

DMEXO -- Reads in the exogenous data (rain, temperature and total daily irradiation) and provides this data each day. For the rain, the dates (and the amount of water in millimeters) are used, for the days where rain occurs. For the temperature, the dates of change of temperature are read in, and the temperature is assumed to be the same between successive changes.

DMPHEN -- Determines the phenological stage for each species. This version is based on the provisional Version IV of the Desert Biome model. The possibilities are:

1. A jump from germination (or leafing-out) to vegetative stage is possible if X is greater than a coefficient which is an exponential function of the moisture in the soil. For the annual species, X is the ratio of the total dry matter in this species to the dry matter in seeds of this species; for other species, X is the ratio of the dry matter in new shoots of this species to the total dry matter in this species. The duration of germination is not allowed to exceed a specified value.

   A threshold value (CRATLO) is calculated in the following manner:

$$\text{CRATLO} = a + b\cdot e^{cw}$$

where

w is the water potential (WATER [LSOIL]) of a given horizon LSOIL with

$$\text{LSOIL} = \text{LCOUCH (ISP)}$$

a, b, c are parameters provided for each species (respectively, PARPH1 [ISP], PARPH2 [ISP], PARPH3 [ISP]).

The species will change its phenological state if

$$X > \text{CRATLO}$$

$$X = \frac{\text{total dry matter contained in a species}}{\text{dry matter in grains of same species}} \text{ for annuals}$$

$$X = \frac{\text{dry matter contained in the shoots}}{\text{total dry matter for the species}} \text{ for perennials}$$

Moreover, the germination period cannot be more than a given time (NDGERM).

2. A jump from vegetative to fruiting stage occurs if the soil moisture and temperature are above the given thresholds, and if the value of daylight hours is between two thresholds; i.e.,

Soil temperature by horizon (LCOUCH [ISP]) above a threshold (THTPVG [ISP]),

Water potential of a given horizon (LCOUCH [ISP]) above a threshold (THWTVG [ISP]),

Daily illumination between two values (PHOVMN [ISP] and PHOVMX[ISP]).

3. A jump from vegetative to dormant stage occurs when either the soil moisture or soil temperature falls below a specified threshold.

Water potential of a given horizon (LCOUCH [ISP]) below a threshold (THTPVD [ISP]).

Temperature of a given horizon (LCOUCH [ISP]) below a threshold (THTPVD[ISP]).

4. Test for return from fruiting stage to vegetative stage: the fruiting stage is finished if X is greater than a one-parameter function of the soil moisture, where X is the ratio of the dry matter accumulated in fruits to the total dry matter in the species. The duration of the fruiting stage is not allowed to exceed a specified value.

A threshold value CRATFT (ISP) is calculated for each species in the following manner:

$$\text{CRATFT (ISP)} = a + b \cdot e^{cw}$$

where

w is the water potential (WATER[LSOIL]) of a given horizon LSOIL with:

$$\text{LSOIL} = \text{LCOUCH (ISP)}$$

a, b, c are parameters provided for each species (respectively, PARPH4 [ISP], PARPH5 [ISP], PARPH6 [ISP]).

There will be transfer from fruiting to a vegetative stage if a quantity X is above CRATFT (ISP).

where

$$X = \frac{\text{DMNEW (ISP)}}{\text{DMT (ISP)}} = \frac{\text{year's addition to dry matter; organs}}{\text{total dry matter of the species}}$$

The fruiting period (IPFRUT [ISP]) cannot be above a given threshold (NDFRUT [ISP]).

5. Jump from dormant to germination (or leafing-out) stage begins if temperature and soil moisture are above given thresholds and if the number of daylight hours is between two given thresholds; i.e.,

Temperature (SOILTE [LSOIL]) in a given horizon of LSOIL (with LSOIL = LCOUCH) above a threshold (THTPLO [ISP]),

Water potential (WATER [LSOIL]) in a given horizon (LSOIL), above a threshold (THWTLO [ISP]),

Daily illumination between two values (PHOTMN[ISP]) and (PHOTMX [ISP]).

DMPHOT -- This subroutine computes for each species (each day) a total daily increment for the dry matter. This increment is proportional to the biomass of photosynthetic organs. The rate is determined from a maximum rate which is depressed when air temperature, the soil moisture, or the radiation is not optimum.

The actual rate, LIGHTF, of radiation is given thus:

$$\text{LIGHTF} = \frac{\text{DAYRAD}}{\text{KMLITE (ISP)} + \text{DAYARAD}}$$

where

DAYRAD is total daily radiation in cal/m^2 of leaf area.

The actual rate, TEMPF of the temperature (here is equal to ambient), is calculated in two different ways depending on whether the temperature is above or below a given threshold TEMPUM (ISP).

If the temperature (TLEAF) > TEMPUM (ISP), the function is linear:

$$\text{TEMPF} = \frac{\text{TEMPUT (ISP)} - \text{TLEAF}}{\text{TEMPUT (ISP)} - \text{TEMPUM (ISP)}}$$

where

TEMPUT and TEMPUM are parameters.

If TLEAF $\leqslant$ TEMPUM (ISP) one has a sigmoid function.

$$\text{TEMPF} = \frac{1}{1 + \text{CCPS (ISP)} \cdot e^{(-\text{RRPS} \times \text{TLEAF})}}$$

where

CCPS and RRPS are the parameters.

The actual rate, PMSF, of soil moisture is obtained as follows:

If soil moisture in a given layer for each species LAYCH (ISP) is above a given threshold WMAC (ISP) PMSF = 1.

If this soil moisture is below a given threshold WMIN (ISP), PMSF = 0.

If the soil moisture, WBID, is between these two thresholds, PMSF is a linear function of soil moisture.

$$PMSF = \frac{WBID - WMIN(ISP)}{WMAX(ISP) - W(ISP)}$$

The daily increment of dry matter per g of dry photosynthetic material is then given by:

$$PSRATE = DDMMAX(ISP).\ LIGHTF.\ TEMPF.\ PMSF$$

where

DDMMAX (ISP) is the maximum possible (ideal conditions) daily increment per g of photosynthetic dry matter.

DMTR -- There are two parts in this subroutine:

1. One to allocate the total net daily increment of dry matter to the photosynthetic organs.

2. One to simulate the translocation of dry matter between organs. This translocation is assumed to be proportional to the amount of dry material present in the donor compartment at the beginning of the day. This subroutine provides also the amount of new dry matter accumulated during the germination, leafing-out, or fruiting stage.

EDAPH -- In this version only those subroutines dealing with soil processes are called:

DEGREE for the soil temperature
EVAPO for the evapotranspiration and evaporation
SOWAT for the water movements in the soil

EVAPO -- To compute evaporation and evapotranspiration with the model proposed by Griffin et al. (1974).

FILLTX -- This subroutine deals with the storage of the state variables for the plotting of results at the need of the simulation.

INVDAT -- Computes the number of days (+ 1) after the initial day from the current date (day, month, year).

JULES -- Computes the number of days after the first of January of the current year (in Julian days) from the current date (day, month, year).

NJMOIS -- For a given year computes the number of days in one month.

PLOT -- Plots the results at the end of the simulation.

PREPAR -- Prepares the data for the subroutine PLOT from the storage array which is in the subroutine FILLTX.

REPORT -- To write a report of the principal variables, if this report is required.

SEASON -- To determine the season on the basis of the Julian day.

SOWAT -- This subroutine predicts soil water content and potential as a function of time and depth, and also the salt content (Griffin et al., 1974; Hanks et al., 1969; Jurinak and Griffin, 1972; Nimah and Hanks, 1973). The differences between this model and the model proposed by Griffin et al. (1974) involve only the input/output statements.

The theoretical aspects of the model can be described by the following relations.

The model performs the solution of the general equation in one-dimensional flows with an extraction term for roots, A (z):

$$\frac{\partial \theta}{\partial t} = \frac{\partial}{\partial Z}\left[K(\theta)\frac{\partial H}{\partial z}\right] + A(z)$$

with

$$A(z) = \frac{[Hroot + (PRES \times z) - h(z)s(z)] \times RDF(z) \times K(\theta)}{\Delta z}$$

where

θ = water content by volume
t = time
z = depth
K = hydraulic conductivity
H = hydraulic head at the surface (z = o)
PRES = $R_c + 1$
R_c = flow coefficient
$h_{(z)}$ = pressure at depth z
$S_{(z)}$ = osmotic pressure at depth z
$RDF_{(z)}$ = fraction of roots active in the layer of soil ∂ z.

This subroutine permits equally the description of a process for salt:

$$\frac{\partial}{\partial t}[Q + Oc] = \frac{\partial}{\partial z}\left[D(V,O)\frac{\partial c}{\partial z}\right] - \frac{\partial(qc)}{\partial z} + S$$

where

Q = local concentration (positive or negative) of solute in the absorbent phase (meq/cm^3).

C = concentration in the solution phase (meq/cm^3 of soil solution).

S = a "well" or a "source" for the efflux or influx of salt in the soil.

z = depth (positive down below).

D = coefficient (cm^2 sec^{-1} combining diffusion and dispersion.

q = flux in volume of solution (cm^3 cm^{-2} sec^{-1}) and V is the average speed of capillary flow.

We note, however, that the use of this model poses some problems since it presumes the soil has certain characteristics identical throughout the profile.

INPUT ORGANIZATION

Remark: Columns 61 to 80 are for explanations and are not read, except in some specified cases. An example of input/output is given in Appendix 2.

CARDS READ BY MAIN PROGRAM

Comments and Table Headings

Any comments which are to be associated with the output may be printed out before the rest of the output by inserting cards bearing the comment information at the beginning of the input deck. These cards should finish with a blank card, or be replaced by a blank card if no comments are needed. The blank ending the comments is followed by a single card providing a heading (STATE(20)) for tabular output. (The 80 columns are read in for this card.)

Instruction Cards

One card with the starting date (IND, INM, INY) of the run and the date of the last day of the run (ILD, ILM, ILY) are read in (6I5) format. The components of the dates are given in the following order: day, month, year.

One card with the number of species (NSP), the number of types of dead organic material (NLIT), the number of horizons (NHOR) in (12I5) format.

One card (or two) with the number of organs (NORG(I)) for each species in (1215) format.

One card (or two) for each species, containing the function (IFUN(I,J)) of each organ J of species I, in (12I5) format. Provisional classification: 1=seed, 2=fruit, 3=photosynthetic organs, 4=root, 5=stem.

One card (or two) with the life forms (LIF(I)) of each species I, in (12I5) format. Provisional classification: 1=annual, 2=shrub, 3=perennial herbaceous.

One card (or two) with the name (NAMSP(I)) of each species, in (10A8) format. (Explanations in columns 61 to 80 are not possible.)

One card (or more) for each species, containing the name (NAMORG(I,J)) of each organ J of species I, in (10A8) format. (Explanations in columns 61 to 80 are not possible.)

One card with the name (NAMLIT(I)) of each type of dead material in (10A8) format. (Explanations in columns 61 to 80 are not possible.)

One card (or more) for each species, containing the dry weight (DMSP(I,J)) in g/ha of each organ J of species I, in (6F10.0) format.

One card (or two) with the dry weight (CLIT(I)) of each type of dead organic material, in (6F10.0) format.

CARDS READ IN THE SUBROUTINES

Subroutine REPORT (ENTRY INDMRP)

One card, serving as a check on the proper order of the cards, which reads in a character string, in (20A4) format. Hereafter this will be called a read-check card.

One card with the number (NREP) of tabulated reports required, including the report for the initial day in (12I5) format.

One card for each report, containing the date (ID=(day), IM=(month), IY=(year)) of the required report, in (3I5) format.

Subroutine DMEXO (ENTRY INDMEX)

One read-check card.

One card with the number of days (NDR) with rain, and the number of days (NDT) where the temperature changes (including the initial day) in (12I5) format.

One card for each day of rain containing the date (day, month, year) when the rain occurs and the amount of rain (in mm), in (3I5, F10.0) format.

One card for each day of temperature change, containing the date of the change and the new temperature (in degrees centigrade), in (3I5, F10.0) format.

Subroutine DMPHEN (ENTRY INDMPN)

One read-check card.

One card (or two) with the phenological stage (IPHENO(I)) of each species, in (12I5) format. 1=germination, 2=leafing-out, 3=vegetative stage, 4=fruiting stage, 5=dormancy.

One card for each species, in (12I5) format, containing the following:

The maximum number of days (NDGERM(I)) for the germination.
The maximum number of days (NDFRUT(I)) for the fruiting stage.
If the species is in germination, the number of days (IPGERM(I)) since the beginning of this stage (0 if not).
If the species is in the fruiting stage the number of days (IPFRUT(I)) since the beginning of this stage (0 if not).

One card (or two) for each species specifying the horizon (LCOUCH(I)) whose water content and temperature are used as an environmental trigger, in (12I5) format.

A group of three cards for each species containing parameters used in this subroutine, in (6F10.0) format:

First card: PARPH1(I), PARPH2(I), PARPH3(I). PARPH4(I), PARPH5(I), PARPH6(I).

Second card: THTPVG(I), THWTVG(I), PHOVMX(I), PHOVMN(I), THRTVG(I), THTPVD(I).

Third card: THWTVD(I), THRTVD(I), THTPLO(I), THWTLO(I), PHOTMN(I), PHOTMX(I).

The meaning of these parameters is given in the comments of the program.

Subroutine DMPHOT (ENTRY INDMFO)

One read-check card.

Two cards for each species containing parameters used in this subroutine, in (6F10.0) format:

First card: KMLITE(I), CCPS(I), RRPS(I), TEMPUT(I), TEMPUM(I), DDMMAX(I).

Second card: WMIN(I), WMAX(I).

The meaning of these parameters is given in the comments of the program.

One card (or two) for each species, specifying the horizon whose water content (LAYCH(I)) is used as an environmental trigger, in (12I5) format.

Subroutine DMTR (ENTRY INDMTR)

One read-check card.

One card (or two) for each species I, containing the rate of transfer of the daily increment of dry matter for each organ J, (RTPH(I,J)), in (6F10.0) format.

One card (or two) for each species I, and each donor organ JD, specifying the rate of transfer from the donor organ JD to the receptor organs JR (including the donor organ itself) during the germination (RTGR(I,JD,JR)), in (6F10.0) format.

A similar group of cards for the leafing-out stage (RTLO(I,JD,JR)): for the vegetative stage (RTVG(I,JD, JR)); for the fruiting stage (RTFR(I,JD,JR)).

Subroutine DMDT (ENTRY INDMDT)

One read-check card.

One card (or more) for each species I, specifying the number of days (WTIME(I)) since the beginning of dormancy if species I is in the dormant stage at the start of the simulation (0 if not), in (6F10.0) format.

One card for each species I, containing pointers (LREP(I,J)), which indicates the type of dead organic material to which the dead organic material of the organ "J" will be transferred, in (6F10.0) format.

One card for each organ J of each species I (organs nested inside species), containing the three parameters (PDDT1(I,J) PDDT2(I,J), PDDT3(I,J)) in the exponential function which computes the rate of death during dormancy.

One card (or more) for each species J, giving the rate of death (PDT(I,J,K)) of each organ K during germination (I = 1).

A similar group of cards for: the leafing-out stage (I = 2); the vegetative stage (I = 3); the fruiting stage (I = 4).

Subroutine DMDM (ENTRY INDMDM)

One read-check card

One card (or two) for each season I and each donor type JD of dead organic material (donor type nested in season) giving the rates of transfer RTLI(I,JD,JR) for the season I from the donor compartment JD to the receptor compartment JR (including the donor compartment itself) in (6F10.0) format.

Subroutine DLIGHT (ENTRY INDMDL)

One read-check card.

One card to read in the latitude (RLAT, in degrees) of the site, in (6F10.0) format.

SUBROUTINE EDAPH (ENTRY INDMED)

One read-check card.

One card with the depth in centimeters, of the bottom of each soil horizon in (6F10.0) format.

SUBROUTINE EVAPO (ENTRY INDMEV)

One read-check card.

One card to read in the number of temperature thresholds plus one (NT), used to compute evaporation in (12I5) format.

One card to read the (NT-1) temperature threshold values (TARTUF(I)), in °C, in (6F10.0) format.

One card to read NT values for FACTOR (I), the parameter used to compute the evaporation, in (6F10.0) format.

SUBROUTINE SOWAT (ENTRY INDMWT)

One read-check card.

One card with the parameters MM, NB, ND, in (12I5) format.

One card with the parameters ALAMBA, CB, CONQ, CUMT, DETT, DELW, in (6F10.0) format.

One card with the parameters DELX, DIFA, DIFB, DIFO, SYSTD, in (6F10.0) format.

One card with the parameters HDRY, HWET, HLOW HHI, RRES, SOCON, in (6F10.0) format.

One card with the parameters SOURCE, TAA, TIME, TT, in (6F10.0) format.

One group of cards with the value of $D(\dot{I})$ in (6E10.0) format.

One group of cards with the value of $P(\dot{I})$ in (6E10.0) format.

One card (or two) with the value of $W(\dot{I})$ in (6F10.0) format.

One card (or two) with the value of $WATL(\dot{I})$ in (6F10.0) format.

One card (or two) with the value of $WATH(\dot{I})$ in (6F10.0) format.

One card (or two) with the value of $RDF(\dot{I})$ in (6F10.0) format.

One card (or two) with the value of $SE(\dot{I})$ in (6F10.0) format.

One card assigning a value to the logical variable IWRITE, in (L5) format.

SUBROUTINE FILLTX (ENTRY INFILL)

One read-check card.

SUBROUTINE PREPAR

One read-check card.

One card with KSUP=1, if the tables of the superposed symbols in diagrams are required (=0 if not) in (12I5) format.

For one required diagram:

One card for each variable containing the following, in (3I5, 11A4) format: (see comments in PREPAR) IGEN, IND1, IND2, LEG(11).

One card with nothing in columns 1 to 5.

To terminate:

One card with 100 (or more) in columns 1 to 5.

LITERATURE CITED

GOODALL, D. W. 1973. Modelling. US/IBP Desert Biome Res. Memo. 73-52. 822 pp.

GRIFFIN, R. A., R. J. HANKS, and S. CHILDS. 1974. Model for estimating water, salt, and temperature distribution in the soil profile. US/IBP Desert Biome Res. Memo 74-61. 13 pp.

HANKS, R. J., A. KLUTE, and E. BRESSLER. 1969. A numeric method for estimating infiltration, redistribution, drainage and evaporation of water from soil. Soil Resources Res. 5:1064.

JURINAK, J. J., and R. A. GRIFFIN. 1972. Factors affecting the movement and distribution of anions in desert soils. US/IBP Desert Biome Res. Memo. 72-38. 19 pp.

NIMAH, M.N., and R. J. HANKS. 1973. Model for estimating soil water, plant, and atmospheric interrelations. I. Description and sensitivity. Soil Sci. Soc. Amer. Proc. 37(4):522-527.

VALENTINE, W. 1974. Plant submodel Version IV, General-purpose model. US/IBP Desert Biome Res. Memo. 74-58. 42 pp.

APPENDIX 1

Program Listing

Storage and time requirements (after compilation and storage of the program) on a Burroughs 6700 for a simulation of 36 days: process time, 0.38 min; virtual memory, 5.78 kwords-mins.

Explanations for Variables

```
C          PROGRAMME   MODELE MATIERE SECHE
C1                   ...................................
C2                   .           EXPLANATIONS          .
C3                   .   FOR THE VARIABLES IN COMMONS  .
C4                   ...................................
C5             ..............................................................
C1 A      (I)      NEGATIVES VALUES SHOW THE SOIL HORIZON ROOTS ARE
C2 A      (I)      EXTRACTING WATER FROM.
C1 ALAMHA          CONSTANT USED IN SALT CALCULATION.
C1 ARAIN  (I)      STORAGE ARRAY FOR THE AMOUNT OF RAIN.
C1 ARTE   (I)      STORAGE ARRAY FOR THE TEMPERATURES.
C1 B      (I)      VARIABLE USED IN 'SOWAT' .
C1 BEGTEM(I)       INITIAL SOIL TEMPERATURE(DEGREE C.) IN HORIZON 'I'.
C1 C      (I)      WATER CAPACITY OF THE SOIL INCREMENTS IN CM FOR THE
C2 C      (I)      HORIZON 'I' .
C1 CB              CONSTANT TO MULTIPLY  D ARRAY BY,USUALLY 1.0 .
C1 CCPS   (I)      CONSTANT FOR THE SPECIES 'I' IN THE INTEGRATED FORM OF
C2 CCPS   (I)      THE LOGISTIC EQUATION RELATING NET DAILY INCREMENT OF
C3 CCPS   (I)      DRY MATTER TO TEMPERATURE.
C1 CHECK  (I)      TEMPORARY STORAGE VARIABLE FOR READ CHECK CARD.
C1 CLIGHT          NAME OF A COMMON FOR THE SUBROUTINE DLIGHT.
C1 CLIT   (I)      AMOUNT OF DRY MATTER OF THE TYP 'I' OF DEAD ORGANIC
C2 CLIT   (I)      MATERIAL.
C1 CONDUC(I)       SOIL THERMAL CONDUCTIVITY (CAL/CM*HR*DEG) IN HORIZON I.
C1 CONW            LARGEST WATER CONTENT CHANGE ALLOWED EACH COMPUTATION,
C2 CONW            THE SMALLER THE NUMBER THE MORE ACCURATE THE COMPUTA-
C3 CONW            TION BUT THE LONGER THE RUN TIME,USUALLY 0.03 TO 0.05 .
C1 CRATFT(I)       RATIO OF DRY MATTER I. NEW FRUITS  TO CARBON IN PLANT
C2 CRATFT(I)       THAT MUST BE ATTAINED FOR THE PLANT TO PROGRESS FROM
C3 CRATFT(I)       CURRENT PHENOLOGICAL STAGE (FRUITING) TO THE NEXT(VEG.)
C1 CRATLO(I)       RATIO OF DRY MATTER IN NEW GROWTH TO DRY MATTER IN PLANT
C2 CRATLO(I)       THAT MUST BE ATTAINED FOR THE PLANT TO PROGRESS FROM
C3 CRATLO(I)       CURRENT PHENOLOGICAL STAGE (LEAFING-OUT OR GERMINATION)
C4 CRATLO(I)       TO THE NEXT (VEGETATIVE).
C1 CURT
C1 CV     (I)      SOIL HEAT CAPACITY(CAL/G) IN HORIZON 'I'.
C1 CWFLX           VARIABLE USED IN 'SOWAT' .
C1 D      (I)      CM/HR HYDRAULIC CONDUCTIVITY-WATER CONTENT ARRAY IN
C2 D      (I)      'DELW' INCREMENTS AT THE BEGINNING. AFTER  CONTAINS
C3 D      (I)      THE DIFFUSIVITY.
C1 DALITE          FRACTION OF  THE TOTAL DAYLIGHT HOURS IN ONE YEAR FOR
C2 DALITE          THE CURRENT DAY.
C1 DAPHOT          NB. OF DAYLIGHT HOURS FOR THE CURRENT DAY.
C1 DARAIN          RAIN (MM) OF THE CURRENT  DAY.
C1 DATE            NAME OF A SUBROUTINE
C1 DATUM           NAME OF THE COMMON FOR THE DATE.
C1 DAYMIN(I)       STORAGE VARIABLE USED FOR THE COMPUTATION OF DAPHOT AND
C2 DAYMIN(I)       DALITE.
C1 DAYRAD          TOTAL IRRADIATION IN CAL/M*M/DAY
C1 DCLIT  (I)      VARIATION OF DRY MATTER FOR THE CURRENT DAY IN THE TYP
C2 DCLIT  (I)      'I' OF DEAD ORGANIC MATERIAL.
C1 DDMSP  (I,J)    VARIATION OF DRY MATTER FOR THE CURRENT DAY IN ORGAN
C2 DDMSP  (I,J)    'J' OF SPECIES 'I'.
C1 DD     (I)      DEPTH OF LAYERS USED IN THE SUBROUTINE 'SOWAT'.
C2 DD     (I)      THEY ARE DIFFERENT OF THE DEPTH  (DEPTH(I)) OF THE
C3 DD     (I)      BOTTOM  OF EACH HORIZON(CF. EXPLANATIONS  IN 'EDAPH',
C4 DD     (I)      IN CENTIMETERS.
C1 DDMMAX(I)       MAXIMUM, FOR THE SPECIES 'I', NET DAYLY INCREMENT FOR
C2 DDMMAX(I)       DRY MATTER UNDER OPTIMAL CONDITIONS OF SOIL WATER POT-
C3 DDMMAX(I)       ENTIAL, AIR TEMPERATURE AND SUNLIGHT.(G D.M./G OF
C4 DDMMAX(I)       PHOTOSYNTHETIC ORGANS/DAY)
C1 DEGREE          NAME OF A SUBROUTINE
C1 DELT            VARIABLE USED IN 'SOWAT' .
C1 DELW            WATER CONTENT DIFFERENCE OF THE P(I),D(I) ARRAYS ,
C2 DELW            USUALLY  0.01   .
C1 DELX            CONSTANT EQUAL TO 7.6   .
C1 DETI            SMALLEST TIME INCREMENT ALLOWED, USUALLY  0.0024 HR 9
C1 DIAGR           NAME OF A COMMON
C1 DIFA            CONSTANT USED IN SALT CALCULATIONS.
C1 DIFB            CONSTANT USED IN SALT CALCULATIONS.
C1 DIFO            CONSTANT USED IN SALT CALCULATIONS.
C1 DLIGHT          NAME OF A SUBROUTINE
C1 DMDM            NAME OF A SUBROUTINE
C1 DMDT            NAME OF A SUBROUTINE
C1 DMEXO           NAME OF A SUBROUTINE
C1 DMNEW  (I)      DRY MATTER ACUMULATED IN  SPECIES 'I' DURING THE
C2 DMNEW  (I)      GERMINATION (OR LEAFING-OUT)  OR FRUITING STAGE.
C1 DMPHEN          NAME OF A SUBROUTINE
C1 DMPHOT          NAME OF A SUBROUTINE
C1 DMSP   (I,J)    AMOUNT OF DRY MATTER IN THE ORGAN 'J' OF THE SPECIES I.
C1 DMT    (I)      AMOUNT OF DRY MATTER IN SPECIES 'I'.
C1 DMTR            NAME OF A SUBROUTINE
C1 DTIME           SIZE OF THE TIME INTERVAL FOR SOIL TEMPERATURE CALCULA-
C2 DTIME           TIONS IN HOURS.
C1 E      (I)      VARIABLE USED IN 'SOWAT' .
C1 EDAFON          NAME OF A COMMON
C1 EDAPH           NAME OF A SUBROUTINE
C1 EOR             EVAPORATION(CM) OR RAIN(CM) FOR 1 HOUR.
C1 ERAIN           NAME  OF A COMMON
C1 ET              POTENTIAL EVAPO TRANSPIRATION (CM/HR)
C1 ETIME           VARIABLE TO CONTROL THE NUMBER OF RUNS FOR THE SUBROU-
C2 ETIME           TINE 'SOWAT' .
C1 ETOUT           TRANSPIRED WATER.
C1 EVAP            CF. EOR.
C1 EVTP            NAME OF A COMMON
C1 EVAPO           NAME OF A SUBROUTINE
C1 EXO             NAME OF A COMMON
C1 F      (I)      VARIABLE USED IN 'SOWAT' .
C1 FACTOR(I)       DIFFERENT VALUES (ACCORDING WITH THE VALUES OF TAMTUF)
C2 FACTOR(I)       OF A PARAMETER USED  TO COMPUTE ET AND EVAP IN 'EVAPO'.
C1 FILL            NAME OF A COMMON
C1 FILLIX          NAME OF A SUBROUTINE
C1 FORCE           RAINFALL INTENSITY (MM/HOUR).
C1 G      (I)      VARIABLE USED IN 'SOWAT' .
C1 GRADE           NAME OF A COMMON
C1 H      (I)      WATER POTENTIAL IN SOIL HORIZON 'I' IN CM .
C1 HDRY            CM PRESSURE OF AIR DRY SOIL WATER CONTENT.
C1 HEAD            NAME OF THE COMMON FOR THE TITLE.
C1 HHT             MAXIMUM ROOT POTENTIAL ALLOWED,USUALLY 0.0  .
C1 HLOW            MINIMUM ROOT POTENTIAL ALLOWED,USUALLY -15000. TO
C2 HLOW            -40000. CM  .
C1 HROOT           ROOT WATER POTENTIAL IN CM.
C1 HWET            CM PRESSURE OF SATURATION SOIL  WATER CONTENT.
C1 IANUAL          (=1)  NUMBER FOR THE ANNUAL LIFE FORM.
C1 IBIS             NOT USED.
C1 ICD             THE DAY FOR THE CURRENT DATE.
C1 ICM             THE MONTH FOR THE CURRENT DATE.
C1 ICY             THE YEAR FOR THE CURRENT DATE.
C1 IDATR (I)       DATE OF THE I-TH REPORT.
C1 IDAY            CURRENT DAY (INITIAL DAY=1).
C1 IERAIN          TEST IF RAIN IS FINISHED FOR A DAY WITH RAIN/IN 'EVAPO.
C1 IFON   (I,J)    FUNCTION OF THE ORGAN J IN THE SPECIES I.
C2 IFON   (I,J)    SEE ALSO  NOSEED,NOFRUT,NOPHOT,NOROOT,NOSTEM.
C1 IMP             PRINTING MACHINE.
C1 IND             DAY OF THE INITIL DATE. (EXCEPT IN 'PLOT')
C1 INM             MONTH OF THE INITIAL DATE.
C1 INOU            NAME OF THE COMMON FOR THE INPUT-OUTPUT.
C1 INVDAT          NAME OF A SUBROUTINE
C1 INY             YEAR OF THE INITIAL DATE.
C1 IPDAY           CURRENT DAY(IDAY) -1.
C1 IPFRUT(I)       IF THE SPECIES I IS IN FRUITING STAE
C2 IPFRUT(I)       NUMBER OF DAYS OF FRUITING STAGE
C3 IPFRUT(I)       THE BEGINNING OF THIS STAGE.
C1 IPGERM(I)       IF THE SPECIES I IS IN GERMINATION, OR LEAFING-OUT.
C2 IPGERM(I)       NUMBER OF DAYS OF GERMINATION,OR LEAFING-OUT, SINCE
C3 IPGERM(I)       THE BEGINNING OF THIS STAGE.
C1 IPHENN(I)       PHENOLOGICAL STAGE OF THE SPECIES 'I' DURING THE PRE-
C2 IPHENN(I)       VIOUS DAY.
C1 IPHENO(I)       PHENOLOGICAL STAGE OF THE SPECIES 'I'.
C1 IPU             PUNCH CARD.
C1 IREP            NUMBER OF THE CURRENT REPORT.
C1 IS              THE SEASON.
C2 IS                   =1 FOR WINTER
C3 IS                   =2 FOR SPRING
C4 IS                   =3 FOR SUMMER
C5 IS                   =4 FOR AUTUMN
C1 ISHRB           (=2)  NUMBER FOR THE SHRUB  LIFE FORM.
C1 ISP             NUMBER OF THE CURRENT SPECIES.
C1 IWRITE          LOGICAL VARIABLE .IF TRUE WRITE INFORMATIONS FOR THE
C2 IWRITE          SOIL THE DAYS WITH A REPORT.
C1 JOR    (I)      STORAGE ARRAY FOR THE DATES OF DAYS WITH RAIN.
C1 JOTC   (I)      STORAGE ARRAY FOR THE DATES OF DAYS WHOSE THE TEMPERA-
C2 JOTC   (I)      TURE CHANGES.
C1 JOURS           NUMBER OF DAYS IN THE CALLED MONTH (SUBROUTINE NJMOIS).
C1 JULDAY          THE CURRENT JULIAN DAY.
C1 JULES           NAME OF A SUBROUTINE
C1 K               = NHOR .
C1 K1     (TO K15)PARAMETERS USED BETWEEN 'FILLIX' AND 'PREPAR'.
C1 KAS             NAME OF A COMMON
C1 KCK             VARIABLE USED IN 'SOWAT' .
C1 KK              =K+1    .
C1 KMLITE(I)       THE IRRADIATION WHICH CAUSES THE CARBON FIXATION RATE
C2 KMLITE(I)       TO BE HALF ITS MAXIMUM WHEN OTHER FACTORS ARE OPTIMAL
C3 KMLITE(I)       FOR THE SPECIES 'I'.
C1 LAYCH (I)       THE  SOIL HORIZON WHOSE TEMPERATURE AND/OR SOIL WATER
C2 LAYCH (I)       POTENTIAL IS USED A TRIGGER  IN THE  DETERMINATION OF
C3 LAYCH (I)       DAYLY  RATE INCREMENT FOR DRY MATTER.
C1 LEC             CARD READER.
C1 LCOUCH(I)       THE  SOIL HORIZON WHOSE TEMPERATURE AND/OR SOIL WATER
C2 LCOUCH(I)       POTENTIAL IS USED A TRIGGER FOR GERMINATION  AND LEAFING
C3 LCOUCH(I)       -OUT FOR THE SPECIES 'I'.
C1 LEG    (I,J)    IDEM IV
C1 LIF    (I)      LIFE FORM OF THE SPECIES I.
C2 LIF    (I)      1= ANNUAL
C3 LIF    (I)      2= SHRUB
C4 LIF    (I)      3= PERENNIAL HERBACEOUS
C1 LITPAR          NAME OF A COMMON
C1 LITTER          NAME OF A COMMON
C1 LL              VARIABLE USED IN 'SOWAT' .
C1 LREP   (I,J)    POINTERS TO INDICATE IN WHICH COMPARTMENT OF DEAD
C2 LREP   (I,J)    MATERIAL WILL BE TRANSFERRED THE DEAD MATTER OF
C3 LREP   (I,J)    ORGAN 'J' IN THE SPECIES 'I'.
C1 MM              NOT USED IN THIS VERSION .
C1 N               VARIABLE USED IN 'SOWAT' .
C1 NAME            NAME OF THE COMMON FOR THE ALPHABETICAL NAMES.
C1 NAMLIT(I)       ALPHABETICAL NAME OF THE DEAD MATERIAL CATEGORY I.
C1 NAMORG(I,J)     ALPHABETICAL NAME OF THE ORGAN J IN THE SPECIES I.
C1 NAMSP (I)       ALPHABETICAL NAME OF THE SPECIES I.
C1 NB              EQUAL TO K OR LESS, USED WHEN COMPUTATION OVER ONLY A
C2 NB              PORTION  OF THE PROFILE IS DESIRED .
C1 ND              SIZE OF THE POTENTIAL-WATER CONTENT TABLE .
C1 NDAY            NUMBER OF DAYS TO SIMULATE +1.
C1 NDFRUT(I)       MAXIMUM NUMBER OF DAYS FOR THE FRUITING STAGE OF THE
C2 NDFRUT(I)       SPECIES I.
C1 NDGERM(I)       MAXIMUM NUMBER OF DAYS FOR THE GERMINATION, OR LEAFING-
C2 NDGERM          OUT, OF THE SPECIES I.
C1 NDR             NUMBER OF DAYS WITH RAIN.
C1 NDTC            NUMBER OF DAYS WHOSE THE TEMPERATURE CHANGES(INCLUDING
C2 NDTC            THE INITIAL DAY).
C1 NHOR            NUMBER OF SOIL HORIZONS.
C1 NLIT            NB. OF TYPS OF DEAD ORGANIC MATERIAL.
C1 NODOR           (=5) NUMBER FOR DORMANCY.
C1 NOFR            (=4) NUMBER FOR FRUITING STAGE.
C1 NOFRUT          (=2) NUMBER OF THE FRUT FUNCTION.
C1 NOGER           (=1) NUMBER FOR GERMINATION.
C1 NOLO            (=2) NUMBER FOR LEAFING-OUT.
C1 NOPHOT          (=3)  NUMBER OF THE PHOTOSYNTHETIC FUNCTION.
C1 NORG   (I)      NUMBER OF ORGANS OF THE SPECIES I.
C1 NOROOT          (=4) NUMBER OF THE ROOT FUNCTION.
C1 NOSEED          ( =1) NUMBER OF THE SEED FUNCTION.
C1 NOSTEM          (=5) NUMBER OF THE   STEM FUNCTION.
C1 NOVEG           (=3) NUMBER FOR VEGETATIVE STAGE.
C1 NREP            NUMBER OF REPORTS (INCLUDED FOR THE INITIAL DAY IF
C2 NREP            DESIRED)  ,MAXIMUM=20.
C1 NSP             NUMBER OF SPECIES.
C1 NT              NUMBER OF THRESHOLDS (+1) USED  IN 'EVAPO' FOR THE
C2 NT              TEMPERATURE.
C1 P      (I)      CM OF PRESSURE HEAD-WATER CONTENT ARRAY IN 'DELW'
C2 P      (I)      INCREMENTS.
C1 PARPH1(I)       PARAMETER USED IN THE SUBROUTINE 'DMPHEN' IN EXPONEN-
C2 PARPH1(I)       TIAL FUNCTION RELATING  THE MAXIMUM VALUE OF THE RATIO
C3 PARPH1(I)       (DRY MATTER IN NEW TISSUE TO TOTAL DRY MATTER IN PLANT
C4 PARPH1(I)       OR IN SEED POOL),AT END OF LEAFING-OUT OR GERMINATION
C5 PARPH1(I)       TO THE SOIL WATER POTENTIAL.
C1 PARPH2(I)       CF. PARPH1(I).
C1 PARPH3(I)       CF. PARPH1(I).
C1 PARPH4(I)       PARAMETER USED IN THE SUBROUTINE 'DMPHEN' IN EXPONEN-
C2 PARPH4(I)       TIAL FUNCTION RELATING THE MAXIMUM VALUE OF THE RATIO
C3 PARPH4(I)       (DRY  MATTER IN FRUTS TO DRY MATTER IN PLANT) AT END
C4 PARPH4(I)       OF FRUITING STAGE TO THE SOIL WATER POTENTIAL.
C1 PARPH5(I)       CF   PARPH4(I).
C1 PARPH6(I)       CF   PARPH4(I).
C1 PDDT1 (I,J)     PARAMETER FOR THE ORGAN 'J' OF THE SPECIES 'I' ,USED TO
C2 PDDT1 (I,J)     COMPUTE THE RATE OF DEATH DURING THE DORMANCY.
C1 PDDT2 (I,J)     CF. PDDT1(I,J)
C1 PDDT3 (I,J)     CF. PDDT1(I,J)
```

```
      C1 POT    (I,J,K) RATE OF DEATH DURING THE SEASON 'I' FOR THE ORGAN 'K'
      C2 POT            OF THE SPECIES 'J'.
      C1 PHENO          NAME OF A COMMON
      C1 PHOTMN(I)      MINIMUM PHOTOPERIOD TO GO FROM LEAFING-OUT OR GERMINA-
      C2 PHOTMN(I)      TION  TO VEGETATIVE STAGE FOR THE SPECIES 'I'.
      C1 PHOTMX(I)      MAXIMUM PHOTOPERIOD TO GO FROM LEAFING-OUT OR GERMINA-
      C2 PHOTMX(I)      TION  TO VEGETATIVE STAGE FOR THE SPECIES 'I'.
      C1 PHOTO          NAME OF A COMMON
      C1 PHOVMN(I)      MINIMUM PHOTOPERIOD FOR THE SPECIES 'I' TO JUMP FROM
      C2 PHOVMN(I)      VEGETATIVE TO REPRODUCTIVE STAGE.
      C1 PHOVMX(I)      MAXIMUM PHOTOPERIOD FOR THE SPECIES 'I' TO JUMP FROM
      C2 PHOVMX(I)      VEGETATIVE TO REPRODUCTIVE STAGE.
      C1 PHSATE         NET DAYLY DRY MATTER FOR THE CURRENT SPECIES.
      C1 PIT            VARIABLE USED IN 'SOWAT' .
      C1 PLOT           NAME OF A SUBROUTINE
      C1 PREPAR         NAME OF A SUBROUTINE
      C1 PRFACT(I)      STORAGE ARRAY FOR THE REPORT OF THE VALUE 'PSRATE' IN
      C2 PRFACT(I)      SUBROUTINE 'DMPHOT'.
      C1 PRLITE(I)      STORAGE ARRAY FOR THE REPORT OF THE VALUE 'LIGHTF' IN
      C2 PRLITE(I)      SUBROUTINE 'DMPHOT'.
      C1 PRMOIS(I)      STORAGE ARRAY FOR THE REPORT OF THE VALUE 'PMSF  ' IN
      C2 PRMOIS(I)      SUBROUTINE 'DMPHOT'.
      C1 PROVIS         NAME OF A COMMON
      C1 PRSATE(I)      STORAGE ARRAY FOR THE REPORT OF THE VALUE 'PHSATE' IN
      C2 PRSATE(I)      SUBROUTINE 'DMPHOT'.
      C1 PRTEMP(I)      STORAGE ARRAY FOR THE REPORT OF THE VALUE 'TEMPF ' IN
      C2 PRTEMP(I)      SUBROUTINE 'DMPHOT'.
      C1 RCHECK         NAME OF A COMMON
      C1 ROF    (I)     FRACTION OF ROOTS IN EACH DEPTH INCREMENT(HORIZON 'I')
      C1 REP            NAME OF A COMMON
      C1 REPORT         NAME OF A SUBROUTINE
      C1 RRES           ROOT RESISTANCE, 1.05    .
      C1 RRPS   (I)     CONSTANT FOR THE SPECIES 'I' IN THE INTEGRATED FORM OF
      C2 RRPS   (I)     THE LOGISTIC EQUATION RELATING NET DAILY INCREMENT OF
      C3 RRPS   (I)     DRY MATTER TO TEMPERATURE.
      C1 RT             NAME OF A COMMON
      C1 RTFR   (I,J,K) THE SAME AS RTGR(I,J,K) BUT FOR FRUITING STAGE.
      C1 RTGR   (I,J,K) RATE OF TRANSFER DURING THE GERMINATION FOR THE SPECIES
      C2 RTGR   (I,J,K) 'I' BETWEEN THE DONOR ORGAN 'J' AND THE RECEPTOR ORGAN
      C3 RTGR   (I,J,K) 'K'.
      C1 RTLT   (I,J,K) RATE OF TRANSFER FOR THE SEASON 'I' BETWEEN THE TYP 'J'
      C2 RTLT   (I,J,K) (DONOR) AND THE TYP 'K' (RECEPTOR) OF DEAD ORGANIC MATERIAL.
      C1 RTLO   (I,J,K) THE SAME AS RTGR(I,J,K) BUT FOR LEAFING-OUT.
      C1 RTPH   (I,J)   RATE TO ALLOCATE THE  NET DAYLY INCREMENT  FOR THE
      C2 RTPH   (I,J)   SPECIES 'I' TO THE  ORGAN 'J'.
      C1 RTVG   (I,J,K) THE SAME AS RTGR(I,J,K) BUT FOR VEGETATIVE STAGE.
      C1 RUNOF          CUMULATIVE CM OF RUNOFF WATER (FOR THE CURRENT DAY).
      C1 SALNTY(I)      AMOUNT OF SALT IN HORIZON 'I' IN M(=SD(I))
      C1 SD     (I)     AMOUNT OF SALT IN HORIZON 'I' IN MEQ.
      C1 SE     (I)     CONCENTRATION OF SALT IN HORIZON 'I' ,E.C. READINGS IN
      C2 SE     (I)     MMHOS/CM.
      C1 SEASON         NAME OF A SUBROUTINE
      C1 SMAX           VARIABLE USED IN 'SOWAT' .
      C1 SUCON          CONSTANT USED IN SALT CALCULATIONS.
      C1 SOIL           NAME OF A COMMON
      C1 SOILTE(I)      SOIL TEMPERATURE IN HORIZON 'I'(IN DEGREE C.)/=STEMP(I)
      C1 SOURCE         CONSTANT USED IN SALT CALCULATIONS.
      C1 SOWAT          NAME OF A SUBROUTINE
      C1 SS     (I)     VARIABLE USED IN 'SOWAT' .
      C1 STATE  (I)     VARIABLE WITH THE TITLE
      C1 STEMP  (I)     SOIL TEMPERATURE IN HORIZON 'I', (=SOILTE(I)).
      C1 SYSTO          TEMPORARY PARAMETER TO SHIFT THE HYDRAULIC CONDUCTIVITY
      C1 T      (I)     WATER CONTENT TABLE, HAS EVEEN INCREMENTS 'DELW' IN
      C2 T      (I)     SIZE .
      C1 TAA            ZERO IF THE BOTTOM BOUNDARY IS A WATER TABLE, OTHERWISE
      C2 TAA            EQUAL TO 1.0   .
      C1 TARTOF(I)      DIFFERENT  THRESHOLDS TEMPERATURE (IN DEGREE C.) USED
      C2 TARTOF(I)      IN 'EVAPO'
      C1 TBB            VARIABLE USED IN 'SOWAT' .
      C1 TCOVER         FRACTION OF THE GROUND SURFACE COVERED BY VEGETATION.
      C1 TDAY           AIR TEMPERATURE  (DEGREE C.) OF THE CURRENT DAY.
      C1 TEMPUM(I)      THE 'UPPER OPTIMUM TEMPERATURE' FOR MAIMUM DAYLY INCRE-
      C2 TEMPUM(I)      MENT.
      C1 TEMPUT(I)      THE UPPER TEMPERATURE THRESHOLD ABOVE WHICH THERE IS NO
      C2 TEMPUT(I)      DAYLY INCREMENT FOR DRY MATTER.
      C1 TIME           TIME THE COMPUTATION STARTS , USUALLY 0. - AND THE
      C2 TIME           CUMULATIVE HOURS OF THE SIMULATION RUN FOR EACH DAY.
      C1 THRTVG(I)      NOT USED IN THIS VERSION.
      C1 THRTVD(I)      NOT USED IN THIS VERSION.
      C1 THTPLO(I)      MINIMUM TEMPERATURE            TO GO FROM LEAFING-OUT
      C2 THTPLO(I)      OR GERMINATION TO VEGETATIVE STAGE FOR THE SPECIES 'I'.
      C1 THTPVD(I)      THRESHOLD TEMPERATURE            TO GO FROM VEGETATIVE
      C2 THTPVD(I)      TO DORMANT STAGE FOR THE SPECIES 'I'.
      C1 THTPVG(I)      MINIMUM TEMPERATURE FOR THE SPECIES 'I' TO JUMP FROM
      C2 THTPVG(I)      VEGETATIVE TO REPRODUCTIVE STAGE.
      C1 THWTLO(I)      MINIMUM SOIL  WATER POTENTIAL TO GO FROM LEAFING-OUT
      C2 THWTLO(I)      OR GERMINATION TO VEGETATIVE STAGE FOR THE SPECIES 'I'.
      C1 THWTVD(I)      THRESHOLD SOIL WATER POTENTIAL TO GO FROM VEGETATIVE
      C2 THWTVD(I)      TO DORMANT STAGE FOR THE SPECIES'I'.
      C1 THWTVG(I)      MINIMUM SOIL WAT.POT.  FOR THE SPECIES 'I' TO JUMP FROM
      C2 THWTVG(I)      VEGETATIVE TO REPRODUCTIVE STAGE.
      C1 TIME   (I)     NB. OF DORMANT DAYS SINCE THE BEGINNING OF THIS STAGE,
      C2 TIME   (I)     IF THE SPECIES 'I' IS IN DORMANCY(IN OTHER CASES=0.)
      C1 TM             VARIABLE USED IN 'SOWAT' .
      C1 TOTMIN         STORAGE VARIABLE USED IN THE COMPUTATION  OF DAPHOT AND
      C2 TOTMIN         DALITE
      C1 TRAIN          LENGTH OF THE  RAIN FOR ONE DAY(IN HOURS).
      C1 TRANS          NAME OF A COMMON
      C1 TRMAT (I,J)    STORAGE ARRAY USED IN THE SUBROUTINE 'DMTR'.
      C1 TT             IS 1.0 FOR BAASONEN OR 0.5 FOR CRANK-NICHOLSON COMPUTA-
      C2 TT             TIONAL PROCEDURE .
      C1 TV     (I,J)   STORAGE ARRAY USED BETWEEN THE SUBROUTINES 'PREPAR'
      C2 TV     (I,J)   AND 'PLOT'.
      C1 TX     (I,J)   STORAGE ARRAY FOR THE VARIABLES WHICH WILL BE PLOTTED.
      C1 VEG            NAME OF A COMMON
      C1 W      (I)     INITIAL VOLUMETRIC FRACTIONAL WATER CONTENT IN HORIZON
      C2 W      (I)     'I' .
      C1 WAT            NAME OF A COMMON
      C1 WATABS(I)      TOTAL AMOUNT OF WATER (MM) IN THE HORIZON 'I'.
      C1 WATER  (I)     SOIL WATER POTENTIAL OF THE HORIZON 'I' (IN BARS).
      C1 WATH   (I)     SATURATION SOIL WATER CONTENT OF HORIZON 'I'.
      C1 WATL   (I)     VOLUMETRIC FRACTIONAL AIR DRY SOIL WATER CONTENT
      C2 WATL   (I)     (HORIZON 'I') .
      C1 WFOD           VARIABLE USED IN 'SOWAT' .
      C1 WMAX   (I)     SOIL WATER POTENTIAL THRESHOLD ABOVE WICH  THIS PARAME-
      C2 WMAX   (I)     TER  HAS NO INHIBITING EFFECT.
      C1 WMIN   (I)     SOIL WATER POTENTIAL THRESHOLD BELOW WHICH PHOTOSYN-
      C2 WMIN   (I)     THESIS CANNOT OCCUR
      C1 WTIME  (I)     THE NUMBER OF DAYS SINCE THE BEGINNING OF  DORMANCY
      C2 WTIME  (I)     FOR THE SPECIES  'I' IN DORMANT STAGE (0. FOR OTHERS)
      C1 Y      (I)     VARIABLE USED IN 'SOWAT' .
      C1 YORO           NAME OF A COMMON
```

Main Program

```
C*************************************************************************
C                          M A I N   P R O G R A M                      *
C                          ***********************                      *
C.........................................................................
      COMMON /CLIGHT/ DAYMIN(366),TOTMIN
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1               NDAY,IPDAY
      COMMON /DEATH/WTIME(20),LREP(20,10),PODT1(20,10),PDDT2(20,10),
     1               PDDT3(20,10),PDT(4,20,10)
      COMMON /DIAGR/ TV(10,100),LEG(10,11)
      COMMON /EDAFON/  DD(11),DTIME
      COMMON /ERAIN/ IERAIN,FORCE
      COMMON /EVTP/ ET,EVAP,FACTOR(4),TARTOF(4),NT
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /FILL/ TX(50,100)
      COMMON /GRADE/ STEMP(11),CV(11),CONDUC(11),REGTEM(11)
      COMMON /HEAD/ STATE(20)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /KAS/ K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15
      COMMON /LITPAR/ RTLT(5,10,10)
      COMMON /LITTER/ CLIT(10),DCLIT(10),NLIT
      COMMON /NAME/ NAMSP(20),NAMORG(20,10),NAMLIT(10)
      COMMON /PHENO/ PARPH1(20),PARPH2(20),PARPH3(20),PARPH4(20),
     1               PARPH5(20),PARPH6(20),CRATLO(20),CRATFT(20),
     2               THTPVG(20),THWTVG(20),PHOVMN(20),PHOVMX(20),
     3               THRTVG(20),THTPVD(20),
     4               THWTVD(20),THRTVD(20),THTPLO(20),THWTLO(20),
     5               PHOTMN(20),PHOTMX(20),
     6               IPGERM(20),IPFRUT(20),NDGERM(20),NDFRUT(20),
     7               LCOUCH(10)
      COMMON /PHOTO/ KMLITE(20),CCPS(20),RRPS(20),TEMPUT(20),TEMPUM(20),
     1               DUMMAX(20),WMIN(20),WMAX(20),LAYCH(20)
      COMMON /PROVIS/ PRLITE(20), PRTEMP(20),PRMOIS(20),PRFACT(20),
     1                PRSATE(20)
      COMMON /RCHECK/ CHECK(20)
      COMMON /REP/ IDATR(20),NREP ,IPEP
      COMMON /RT/ NDR,JDR(100),ARAIN(100),NDTC,JDTC(100),ARTE(100)
      COMMON /SOIL/  WATER(10),SOILTE(10),        NHOR
      COMMON /TRANS/ RTPH(20,10),RTGR(20,10,10),RTLO(20,10,10),
     1               RTVG(20,10,10),RTFR(20,10,10),TRMAT(10,10)
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRB,NOSEED,NOPHOT,
     1            NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2            DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3             NOGER,NOLO,NOVEG,NOFR,NODOR,ICOVER
      COMMON /WAT/ WATABS(10),RUNOF,     SALNTY(10),EOR,ETIME,ETOUT,
     1             WROOT
      COMMON /YORO/ ALAMBA,CB    ,CUNQ  ,CUMT  ,DETT  ,DELW  ,
     1              DELX  ,DIFA  ,DIFB  ,DIFO  ,
     2              HDRY  ,HWET  ,HLOW  ,HMI   ,RRES  ,SUCON ,
     3              SOURCE,TAA   ,TIME  ,TT,ND ,WFOD  ,LL,MM ,DELT  ,NH,
     4              TM    ,TBB   ,PIT   ,SMAX  ,CWFLX ,N,K,KK,KCK   ,
     5              D(60),P(60),T(60),
     6              C(11),G(11),H(11),ROF(11),SD(11),SE(11),SS(11),
     7          W(11),WATH(11),WATL(11),Y(11),A(11),B(11),E(11),F(11),
     8              IWRITE
      LOGICAL IWRITE
      DOUBLE PRECISION NAMSP,NAMORG,NAMLIT
      DATA IMP/6/,LEC/5/
      DATA TCOVER/0.2/,DAYRAD/275./
      DATA BLANK/' '/
C........ALL DATA ARE READ IN COLUMNS 1 TO 60,EXCEPT THE NAMES.(C. 1 TO
C         40).
C.........................................................................
C         COMMENTS ARE READ IN AND PRINTED OUT UNTIL A BLANK CARD IS     .
C         ENCOUNTERED.                                                   .
C.........................................................................
   19 READ(LEC,1) (STATE(I),I=1,20)
      WRITE(IMP,2)(STATE(I),I=1,20)
      DO 20 I=1,20
      IF (STATE(I).NE. BLANK) GO TO 19
   20 CONTINUE
C.........A HEADING IS READ IN FOR TABULAR OUTPUT.
      READ(LEC,1)(STATE(I),I=1,20)
C.....READ THE DATE OF THE INITIAL DAY. THE SIMULATION BEGIN THE SECOND
C         DAY.
      READ(LEC,3) IND,INM,INY,ILD,ILM,ILY
      CALL INVDAT(IND,INM,INY,NDAY,ILD,ILM,ILY)
      READ(LEC,3) NSP,NLIT,NHOR
C........POSSIBLE FUNCTIONS FOR ONE ORGAN.
      NOSEED=1
      NOFRUT=2
      NOPHOT=3
      NOROOT=4
      NOSTEM=5
      READ(LEC,3)(NORG(I),I=1,NSP )
      DO 23 I=1,NSP
      IBID=NORG(I)
   23 READ(LEC,3)(IFUN(I,J),J=1,IBID)
C.........POSSIBLE LIFE FORMS.
      IANUAL=1
      ISHRB=2
      IMPER=3
      READ(LEC,3) (LIF(I),I=1,NSP)
C........READ THE ALPHABETICAL NAMES.
      READ(LEC,5)(NAMSP(I),I=1,NSP)
      DO 25 I=1,NSP
      IBID=NORG(I)
   25 READ(LEC,5)(NAMORG(I,J),J=1,IBID)
      READ(LEC,5)(NAMLIT(I),I=1,NLIT)
C.........READ INITIAL DATA FOR DRY MATTER IN THE SPECIES.
      DO 26 I=1,NSP
      IBID=NORG(I)
   26 READ(LEC,4)(DMSP(I,J),J=1,IBID)
C.........READ INITIAL DATA FOR DRY MATTER IN THE DEAD MATERIAL.
      READ(LEC,4)( CLIT(I),I=1,NLIT)
C........READ IN PARAMETERS FOR EACH SUBROUTINE.
      CALL INDMRP
      CALL INDMEX
      CALL INDMPN
      CALL INDMFO
      CALL INDMTR
      CALL INDMDT
      CALL INDMOM
      CALL INDMDL
      CALL INDMED
      CALL INDMEV
      CALL INDMDG
      CALL INDMWT
      CALL INFILL
      IDAY=0
      IREP=1
C........BEGIN THE LOOP FOR EACH DAY.
 1001 IDAY=IDAY+1
      CALL DATE
      CALL JULES
      CALL NJMOIS(ICM,ICY,JOURS,THIS )
      CALL SEASON
      CALL DMEXO
      CALL DLIGHT
      CALL EDAPH
      IF(IDAY.EQ.1) GOTO 1100
      LOOP=0
C........BEGINNING OF THE LOOP IN ONE DAY.
 1002 LOOP=LOOP+1
      IF (LOOP.LE.10) GO TO 1003
      WRITE(IMP,1004)      ICD,ICM,ICY
      GO TO1102
 1003 CONTINUE
      DO 1005 ISP=1,NSP
      CALL DMPHEN
      CALLDMPHOT
      CALLDMTR
      CALLDMDT
 1005 CONTINUE
      CALL DMOM
      IF(LOOP.EQ.1) COEF=1.
      FGOOD=1.
C........TEST FOR THE DRY MATTER
```

```
      DO 1010  I=1,NSP
      IBID=NORG(I)
      DO 1009 J=1,IBID
      BGOOD=DDMSP(I,J)*COEF
      AGOOD=DMSP(I,J)+BGOOD
      IF(AGOOD.GE.0.) GO TO 1009
      FT=-DMSP(I,J)/BGOOD
      IF(FT.LT.FGOOD) FGOOD=FT
 1009 CONTINUE
 1010 CONTINUE
C........TEST FOR THE DEAD MATERIAL.
      DO 1011 I=1,NLIT
      BGOOD=DCLIT(I)*COEF
      AGOOD=CLIT(I)+BGOOD
      IF(AGOOD.GE.0.) GO TO 1011
      FT=-CLIT(I)/BGOOD
      IF(FT.LT.FGOOD) FGOOD=FT
 1011 CONTINUE
C........ADJUST THE STATE VARIABLES
      DO 1021 I=1,NSP
      IBID=NORG(I)
      DO 1020 J=4
      DO 1020 J=1,IBID
      DMSP(I,J)=DMSP(I,J)+DDMSP(I,J)*FGOOD
 1020 CONTINUE
 1021 CONTINUE
      DO 1022 I=1,NLIT
      CLIT(I)=CLIT(I)+DCLIT(I)*FGOOD
 1022 CONTINUE
      IF(FGOOD.EQ.1.) GO TO 1100
      COEF=COEF*(1.-FGOOD)
      GO TO 1002
 1100 CONTINUE
      DO 1101 I=1,NSP
      DMT(I   )=0.
      IBID=NORG(I)
      DO 1101 J=1,IBID
 1101 DMT(I)= DMT(I)+DMSP(I,J)
      CALL REPORT
      CALL FILLIX
      IF(IDAY.GE.NDAY) GO TO 1102
      IPDAY=IDAY
      GO TO 1001
 1102 CALL PREPAR
      STOP
    1 FORMAT(20A4)
    2 FORMAT(1X,20A4)
    3 FORMAT(12I5)
    4 FORMAT(6F10.0)
    5 FORMAT(10A8)
 1034 FORMAT(' TROP DE BOUCLES LE '3I5)
      END
```

Subroutine DATE

```
C**********************************************************************
      SUBROUTINE DATE
C----------------------------------------------------------------------
C   COMPUTE THE DATE(ICD,ICM ,ICY) WITH THE CURRENT DAY(IDAY)          I
C----------------------------------------------------------------------
C........IBIS=DUMMY VARIABLE
C........IND =INITIAL DAY    (INPUT)
C........INM =    *    MONTH  (INPUT)
C........INY =    *    YEAR   (INPUT)
C........IDAY=CURRENT DAY, COUNTING FROM THE INITIAL DAY(INCLUDED)
C               (INPUT)
C........ICD=THE DATE WITHIN THE CURRENT DAY      (OUTPUT)
C........ICM = THE MONTH WITHIN THE CURRENT YEAR (OUTPUT)
C........ICY=THE CURRENT YEAR                    (OUTPUT)
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS ,
     1               NDAY,IPDAY
      ICD=IND
      ICM=INM
      ICY=INY
      IF(IDAY.LE.1) RETURN
      DO 10 K=2,IDAY
      ICD=ICD+1
      CALL NJMOIS(ICM ,ICY,NJ,IBIS)
      IF(ICD.LE.NJ) GO TO 10
      ICM=ICM+1
      ICD=1
      IF(ICM .LE.12) GO TO 10
      ICY=ICY+1
      ICM=1
      ICD=1
   10 CONTINUE
      RETURN
      END
```

Subroutine DEGREE

```
C**********************************************************************
      SUBROUTINE DEGREE
C           *******************************************
C           *           COMPUTE SOIL TEMPERATURES       *
C           *******************************************
      COMMON /EDAFON/  DD(11),DTIME
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /GRADE/ STEMP(11),CV(11),CONDUC(11),BEGTEM(11)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /HCHECK/ CHECK(20)
      COMMON /SOIL/  WATER(10),SOILTE(10),        NHOR
      DIMENSION F(11),E(11)
      K=NHOR-1
      KK=K+1
      STEMP(1)=TDAY
      STEMP(KK)=BEGTEM(KK)
C-********************************************************************
C-          SOLUTION TO TRI-DIAGONAL MATRIX
C-********************************************************************
      DO 46 I=2,K
      POT=(DD(I+1)-DD(I-1))/(2.*DTIME)
      DLXA=(DD(I)-DD(I-1))
      DLXB=(DD(I+1)-DD(I))
      BB=CV(I)*POT+CONDUC(I)/DLXB+CONDUC(I-1)/DLXA
      DA=CV(I)*POT*BEGTEM(I)
      IF (I .GT. 2) GO TO 44
      DA=DA+CONDUC(I-1)*STEMP(I-1)/DLXA
      F(I)=DA/BB
      E(I)=(CONDUC(I)/DLXB)/BB
      GO TO 46
   44 IF (I .GE. K) GO TO 47
   45 E(I)=(CONDUC(I)/DLXB)/(BB-(CONDUC(I-1)/DLXA)*E(I-1))
      F(I)=(DA+(CONDUC(I-1)/DLXA)*F(I-1))/(BB-(CONDUC(I-1)/DLXA)*E(I-1))
   46 CONTINUE
   47 BB=BB-CONDUC(I)/DLXB
      STEMP(I)=(DA+(CONDUC(I-1)/DLXA)*F(I-1))/(BB-(CONDUC(I-1)/DLXA)*
     1E(I-1))
   48 I=I-1
      STEMP(I)=E(I)*STEMP(I+1)+F(I)
      IF (I .GT. 2) GO TO 48
      STEMP(KK)=(BEGTEM(KK)+STEMP(K))*0.5
      DO 50 I=1,KK
      BEGTEM(I)=STEMP(I)
   50 CONTINUE
      DO 60 I=1,KK
   60 SOILTE(I)= STEMP(I)
      RETURN
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INOMDG
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      KK=NHOR
C........READ,(NHOR  )*SOIL TEMPERATURES (DEGREE C.)
      READ(LEC,1)(BEGTEM(I),I=1,KK)
C........READ,(NHOR  )*SOIL HEAT CAPACITY(CAL/G)
      READ(LEC,1)(CV(I),I=1,KK)
C........READ,(NHOR+1)*SOIL THERMAL CONDUCTIVITY(CAL/CM-HR-DEG)
      READ(LEC,1)(CONDUC(I),I=1,KK)
      READ(LEC,1) DTIME
    1 FORMAT(6F10.0)
      RETURN
      END
```

Subroutine DLIGHT

```
C**********************************************************************
      SUBROUTINE DLIGHT
C**********************************************************************
COMPUTE DAYLIGHT HOURS                                                 *
C**********************************************************************
      COMMON /DLIGHT/ DAYMIN(366),TOTMIN
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1               NDAY,IPDAY
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
        COMMON /INOU/ LEC,IMP,IPU
      COMMON /HCHECK/ CHECK(20)
      DALITE=DAYMIN(JULDAY)/TOTMIN
      DAPHOT=DAYMIN(JULDAY)/60.
      RETURN
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INOMDL
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      READ(LEC,1) RLAT
      TOTMIN=0.
      DO 10 I=1,365
      C=I
      A=730.-5.274*RLAT+0.00793*(RLAT**2)
      B=34.2-0.78*RLAT+0.1*(RLAT**2)
      Z=2.0*3.1416*((C+285.0)/365.)
      DAYMIN(I)=A+B*SIN(Z)
   10 TOTMIN=TOTMIN+DAYMIN(I)
      DAYMIN(366)=DAYMIN(365)
      RETURN
    1 FORMAT(6F10.0)
      END
```

Subroutine DMOM

```
C**********************************************************************
      SUBROUTINE DMOM
      COMMON /HCHECK/ CHECK(20)
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS ,
     1               NDAY,IPDAY
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /LITTER/ CLIT(10),DCLIT(10),NLIT
      COMMON /LITPAR/ RTLI(5,10,10)
C.......PROVISIONAL VERSION TO COMPUTE THE VARIATIONS IN DEAD MATERIAL.
      DO 20 LD=1,NLIT
      DO 10 LR=1,NLIT
      IF(LD.EQ.LR) GO TO 10
      DELTA=CLIT(LD)*RTLI(IS,LD,LR)
      DCLIT(LD)=DCLIT(LD)-DELTA
      DCLIT(LR)=DCLIT(LR)+DELTA
   10 CONTINUE
   20 CONTINUE
      RETURN
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INOMOM
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
C.......READ IN PARAMETERS FOR EACH SEASON.
      DO 30 K=1,4
      DO 30 LD=1,NLIT
   30 READ(LEC,1)(RTLI(K,LD,LR),LR=1,NLIT)
    1 FORMAT(6F10.0)
      RETURN
      END
```

Subroutine DMDT

```
C**********************************************************************
      SUBROUTINE DMDT
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1               NDAY,IPDAY
      COMMON /DEATH/WTIME(20),LREP(20,10),PODT1(20,10),PODT2(20,10),
     1              PODT3(20,10),PDT(4,20,10)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /LITTER/ CLIT(10),DCLIT(10),NLIT
      COMMON /HCHECK/ CHECK(20)
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRB,NOSEED,NOPHOT,
     1             NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2             DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3             NOGEN,NOLO,NOVEG,NOFR,NODOR,TCOVER
      FUNEX(AE,BE,CE,XE)=AE+BE*EXP(CE*XE)
      IBID=NORG(ISP)
      IF(IPHENO(ISP).NE.NODOR) GO TO 100
C.......THIS SECTION DEALS WITH THE DEATH OCCURING DURING THE
C         DORMANCY.
      IF(IPHENO(ISP).NE.IPHENN(ISP)) GO TO 10
      IF(IDAY.EQ.IPDAY) GO TO 11
      WTIME(ISP)=WTIME(ISP)+1.
      GO TO 11
   10 WTIME(ISP)=0.
   11 DO 15 J=1,IBID
      DRATE=FUNEX(PODT1(ISP,J),PODT2(ISP,J),PODT3(ISP,J),WTIME(ISP))
      D=DRATE*DMSP(ISP,J)
      DDMSP(ISP,J)=DDMSP(ISP,J)-D
```

```
      N=LREP(ISP,J)
      DCLIT(N)=DCLIT(N)+D
   15 CONTINUE
      RETURN
  100 CONTINUE
C........THIS SECTION DEALS WITH THE DEATH DURING ALL PHENOLOGICAL
C           STAGES,EXCEPT THE DORMANCY.
      K=IPHENO(ISP)
      DO 115 J=1,IBID
      D= POT(K,ISP,J)*DMSP(ISP,J)
      DDMSP(ISP,J)=DDMSP(ISP,J)-D
      N=LREP(ISP,J)
      DCLIT(N)=DCLIT(N)+D
  115 CONTINUE
      RETURN
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INDMOT
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      READ(LEC,1)(NTIME(I),I=1,NSP)
      DO 500 I=1,NSP
      IBID=NORG(I)
  500 READ(LEC,2)(LREP(I,J),J=1,IBID)
      DO 501 I=1,NSP
      IBID=NORG(I)
      DO 501 J=1,IBID
  501 READ(LEC,1) (PODT1(I,J),PODT2(I,J),PODT3(I,J)
      DO 503 K=1,4
      DO 502 I=1,NSP
      IBID=NORG(I)
  502 READ(LEC,1)(POT(K,I,J),J=1,IBID)
  503 CONTINUE
    1 FORMAT(6F10.0)
    2 FORMAT(12I5)
      RETURN
      END
```

Subroutine DMEXO

```
C***********************************************************************
      SUBROUTINE DMEXO
C***********************************************************************
C COMPUTE THE RAINFALL (DARAIN) & TEMPERATURE (TDAY) OF THE DAY 'IDAY'  *
C***********************************************************************
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS ,
     1                  NDAY,IPDAY
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD ,DALITE,TRAIN
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /RCHECK/ CHECK(20)
      COMMON /RT/ NDR,JDR(100),ARAIN(100),NDTC,JDTC(100),ARTE(100)
C........RAINFALL
      DARAIN=0.
      DO 30 I=1,NDR
      IF(IDAY.NE.JDR(I)) GO TO 30
      DARAIN=ARAIN(I)
      GO TO 31
   30 CONTINUE
C........TEMPERATURE
   31 DO 32 I=1,NDTC
      TDAY=ARTE(I)
      IF(I.EQ.NDTC) GO TO 33
      I1=I+1
      IF(IDAY.LT.JDTC(I1)) GO TO 33
   32 CONTINUE
   33 RETURN
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INDMEX
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
C.......................................................................
C NDR            NUMBER OF DAYS WITH RAINFALL                           .
C NDTC           NUMBER OF DAYS WHOSE THE TEMPERATURE CHANGES.(INCLUDED  .
C                THE INITIAL DAY)                                       .
C.......................................................................
      READ(LEC,1)NDR,NDTC
      DO 20 I=1,NDR
      READ(LEC,1)ID,IM,IY,P
      CALL INVDAT(IND,INM,INY,IDAT,ID,IM,IY)
      JDR(I)=IDAT
      ARAIN(I)=P
   20 CONTINUE
      DO 21 I=1,NDTC
      READ(LEC,1)ID,IM,IY,T
      CALL INVDAT(IND,INM,INY,IDAT,ID,IM,IY)
      JDTC(I)=IDAT
      ARTE(I)=T
   21 CONTINUE
      RETURN
    1 FORMAT( 3I5,F10.0)
      END
```

Subroutine DMPHEN

```
C***********************************************************************
      SUBROUTINE DMPHEN
C         .....................................
C         .  DETERMINE THE PHENOLOGICAL STAGE  .
C         .....................................
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1                  NDAY,IPDAY
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /PHENO/ PARPH1(20),PARPH2(20),PARPH3(20),PARPH4(20),
     1               PARPH5(20),PARPH6(20),CRATLO(20),CRATFT(20),
     2               THTPVG(20),THWTVG(20),PHOVMN(20),PHOVMX(20),
     3               THRTVG(20),THTPVD(20),
     4               THWTVD(20),THRTVD(20),THTPLO(20),THWTLO(20),
     5               PHOTMN(20),PHOTMX(20),
     6               IPGERM(20),IPFRUT(20),NDGERM(20),NDFRUT(20),
     7               LCOUCH(10)
      COMMON /RCHECK/ CHECK(20)
      COMMON /SOIL/  WATER(10),SOILTE(10),        NHOR
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRB,NOSEED,NOPHOT,
     1            NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2            DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3             NOGER,NOLO,NOVEG,NOFR,NODOR,TCOVER
      FUNX(AE,BE,CE,XE)=AE+BE*EXP(CE*XE)
      LSOIL=LCOUCH(ISP)
      IF(IDAY.EQ.IPDAY) GO TO 299
      IRAIN1=IRAIN2
      IRAIN2=IRAIN3
      IRAIN3=0
      IF(DARAIN.GT.0.0) IRAIN3=1
  299 ISTAGE=IPHENO(ISP)
      GO TO(300,300,500,700,900),ISTAGE
C.......................................................................
C........TEST FOR JUMP FROM GERMINATION (OR LEAFING-OUT) TO VEGETATIVE .
C            STAGE.                                                    .
C.......................................................................
  300 IF(IPHENO(ISP).NE.IPHENN(ISP)) GO TO 310
      IF(IDAY.LE.2) GO TO 310
      IF(IDAY.EQ.IPDAY) GO TO 315
      IPGERM(ISP)=IPGERM(ISP)+1
      IF(IRAIN1.EQ.1.OR.IRAIN2.EQ.1) GO TO 310
      GO TO 315
  310 CRATLO(ISP)=FUNX(PARPH1(ISP),PARPH2(ISP),PARPH3(ISP),WATER(LSOIL))
  315 IBID=NORG(ISP)
      DO 350 JORG=1,IBID
      IF(IFUN(ISP,JORG).EQ.NOSEED) GO TO 316
  350 CONTINUE
C........IF COMPARTMENT OF SEEDS NOT GIVEN  GO TO VEGETATIVE STAGE
      GO TO 330
C........IF  COMPARTMENT WITH SEEDS EMPTY, JUMP TO VEGETATIVE STAGE.
  316 IF(DMSP(ISP,JORG).EQ.0.0) GO TO 330
      IF(LIF(ISP).NE. IANUAL) GO TO 320
      X=DMT(ISP)/DMSP(ISP,JORG)
      GO TO 325
  320 X=DMNEW(ISP)/DMT(ISP)
  325 IF(X.GE.CRATLO(ISP)) GO TO 330
C........TEST FOR LIMITING  THE PERIODE OF GERMINATION.
      IF(IPGERM(ISP).LT.NDGERM(ISP)) GO TO 999
  330  IPHENO(ISP)=NOVEG
      DMNEW(ISP)=0.
      IPGERM(ISP)=0
      GO TO 999
C.......................................................................
C........TEST FOR JUMP FROM VEGETATIVE TO FRUITING STAGE.              .
C.......................................................................
  500 IF(SOILTE(LSOIL).LT.THTPVG(ISP)) GO TO 559
      IF(WATER(LSOIL).LT.THWTVG(ISP)) GO TO 559
      IF(DAPHOT.LT.PHOVMN(ISP).OR.DAPHOT.GT.PHOVMX(ISP)) GO TO 559
      IPHENO(ISP)=NOFR
      GO TO 700
C.......................................................................
C........TEST FOR JUMP FROM VEGETATIVE TO DORMANT STAGE.               .
C.......................................................................
  559 IF(WATER(LSOIL).GT.THWTVD(ISP)) GO TO 999
      IF(SOILTE(LSOIL).GT.THTPVD(ISP)) GO TO 999
      IPHENO(ISP)= NODOR
      DMNEW(ISP)=0.
      GO TO 999
C.......................................................................
C........TEST FOR RETURN FROM FRUITING TO VEGETATIVE  STAGE.           .
C.......................................................................
  700 IF(IPHENO(ISP).NE.IPHENN(ISP)) GO TO 710
      IPFRUT(ISP)=IPFRUT(ISP)+1
      IF(IRAIN1.EQ.1.OR.IRAIN2.EQ.1) GOTO 710
      GO TO 715
  710 CRATFT(ISP)=FUNX(PARPH4(ISP),PARPH5(ISP),PARPH6(ISP),WATER(LSOIL))
  715 X=DMNEW(ISP)/DMT(ISP)
      IF(X.GE.CRATFT(ISP)) GO TO 798
      IF(IPFRUT(ISP).LT.NDFRUT(ISP)) GO TO 999
C........TEST FOR LIMITING THE FRUITING STAGE.
  798 IPHENO(ISP)=NOVEG
      DMNEW(ISP)=0.0
      IPFRUT(ISP)=0
      GO TO 999
C.......................................................................
C........TEST FOR JUMP FROM DORMANT TO GERMINATION(  OR  LEAFING-OUT).  .
C.......................................................................
  900 IF(SOILTE(LSOIL).LT.THTPLO(ISP)) GO TO 999
      IF (WATER(LSOIL).LT.THWTLO(ISP)) GO TO 999
      IF(DAPHOT.LT.PHOTMN(ISP).OR.DAPHOT.GT.PHOTMX(ISP)) GO TO 999
      IF(LIF(ISP).EQ.IANUAL) GO TO 920
      IPHENO(ISP)=NOLO
      GO TO 950
  920 IPHENO(ISP)=NOGER
  950 DMNEW(ISP)=0.0
      GO TO 300
  999 IPHENN(ISP)=ISTAGE
      RETURN
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INDMPN
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      NOGER=1
      NOLO=2
      NOVEG=3
      NOFR=4
      NODOR=5
      IRAIN1=0
      IRAIN2=0
      IRAIN3=0
      READ(LEC,1) (IPHENO(I),I=1,NSP)
      DO 1002 I=1,NSP
 1002 IPHENN(I)=IPHENO(I)
      DO 1000 I=1,NSP
 1000 READ(LEC,1) NDGERM(I),NDFRUT(I),IPGERM(I),IPFRUT(I)
      READ(LEC,1)(LCOUCH(I),I=1,NSP)
      DO 1001 I=1,NSP
 1001 READ(LEC,2)    PARPH1(I),PARPH2(I),PARPH3(I),PARPH4(I),PARPH5(I),
     1               PARPH6(I),
     2    THTPVG(I),THWTVG(I),PHOVMN(I),PHOVMX(I),THRTVG(I),THTPVD(I),
     3    THWTVD(I),THRTVD(I),THTPLO(I),THWTLO(I),PHOTMN(I),PHOTMX(I)
      RETURN
    1 FORMAT(12I5)
    2 FORMAT(6F10.0)
      END
```

Subroutine DMPHOT

```
C***********************************************************************
      SUBROUTINE DMPHOT
C               .......................................
C               .  COMPUTE A TOTAL DAYLY INCREMENT  .
C               .......................................
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /PHOTO/ KMLITE(20),CCPS(20),RRPS(20),TEMPOT(20),TEMPUM(20),
     1                 DUMMAX(20),WMIN(20),WMAX(20),LAYCH(20)
      COMMON /PROVIS/ PRLITE(20), PRTEMP(20),PRMOIS(20),PRFACT(20),
     1                  PRSATE(20)
      COMMON /RCHECK/ CHECK(20)
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRB,NOSEED,NOPHOT,
     1               NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2               DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3                NOGER,NOLO,NOVEG,NOFR,NODOR,TCOVER
      COMMON /SOIL/  WATER(10),SOILTE(10),        NHOR
      REAL KMLITE,LIGHTF
C1 FUNSIG          SIGMOID ARITHMETIC STATEMENT FUNCTION.
      FUNSIG(ASY,CC,RR,VAL)=ASY/(1.+ASY*CC*EXP(-RR*VAL))
C1 FUNLIN          LINEAR  ARITHMETIC STATEMENT FUNCTION.
```

```
      FUNLIN(BIGMAG,SMAMAG,VALUE)=(BIGMAG-VALUE)/(BIGMAG-SMAMAG)
C1 TLEAF          TEMPERATURE OF THE LEAVES.
      TLEAF=TDAY
C.......................................................................
C........EFFECT OF SUNLIGHT.                                              .
C.......................................................................
      LIGHTF=DAYRAD/(KMLITE(ISP)+DAYRAD)
C.......................................................................
C........EFFECT OF TEMPERATURE.                                           .
C.......................................................................
      IF(TLEAF.GT.TEMPUM(ISP)) GO TO 30
      TEMPF=FUNSIG(1.0,CCPS(ISP),RRPS(ISP),TLEAF)
      GO TO 50
   30 TEMPF=FUNLIN(TEMPUT(ISP),TEMPUM(ISP),TLEAF)
   50 CONTINUE
C.......................................................................
C........EFFECT OF SOIL MOISTURE                                          .
C.......................................................................
      K=LAYCH(ISP)
      WAID= WATER(K)
      IF(WAID    .GT.WMAX(K)) GO TO 90
      IF(WAID    .LT.WMIN(K)) GO TO 91
      PHSF=(WAID     -WMIN(K))/(WMAX(K)-WMIN(K))
      GO TO 92
   90 PHSF=1.
      GO TO 92
   91 PHSF=0.
   92 CONTINUE
C........CALCULATE NET RATE.
      PSRATE=DDMMAX(ISP)*LIGHTF*TEMPF*PHSF
      PHSATE=0.
      IBID=NORG(ISP)
      DO 101 JORG=1,IBID
      IF(IFUN(ISP,JORG).NE.NOPHOT) GO TO 101
      PHSATE=PHSATE+    DMSP(ISP,JORG)*PSRATE
  101 CONTINUE
      PRLITE(ISP)=LIGHTF
      PRTEMP(ISP)=TEMPF
      PRMOIS(ISP)=PHSF
      PRFACT(ISP)= PSRATE
      IF(IPHENO(ISP).NE.NODOR) GO TO 998
      PHSATE(ISP)=0.0
      PHSATE=0.
      GO TO 999
  998 PRSATE(ISP)=PHSATE
  999 RETURN
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INPHFO
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      DO 1000 I=1,NSP
 1000 READ(LEC,1)KMLITE(I),CCPS(I),RRPS(I),TEMPUT(I),TEMPUM(I),DDMMAX(I)
     1              ,WMIN(I),WMAX(I)
      READ(LEC,2)(LAYCH(I),I=1,NSP)
    1 FORMAT(6F10.0)
    2 FORMAT(12I5)
      RETURN
      END
```

Subroutine DMTR

```
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      SUBROUTINE DMTR
C         ..................................
C         .  TRANSLOCATION BETWEEN ORGANS  .
C         ..................................
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /RCHECK/ CHECK(20)
      COMMON /TRANS/ RTPH(20,10),RTGR(20,10,10),RTLO(20,10,10),
     1               RTVG(20,10,10),RTFR(20,10,10),TRMAT(10,10)
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRB,NOSEED,NOPHOT,
     1             NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2             DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3              NOGER,NOLO,NOVEG,NOFR,NODOR,ICOVER
      IBID=NORG(ISP)
      DO 100 J=1,IBID
  100 DDMSP(ISP,J)=0.
C.......................................................................
C........ALLOCATES THE DAILY INCREMENT OF DRY MATTER, IF GREATER THAN  .
C         0.0,  TO PHOTOSYNTHETICS ORGANS.                              .
C.......................................................................
      IF (PHSATE.EQ.0.0) GO TO 120
      IF(IPHENO(ISP).EQ.NOGER) GO TO 60
      IF(IPHENO(ISP).EQ.NOLO) GO TO 60
      GO TO 61
   60 IF(IPHENO(ISP).NE.IPHENN(ISP)) DMNEW(ISP) =0.
      DMNEW(ISP)=DMNEW(ISP)+PHSATE
   61 DO 110 JORG=1,IBID
      IF(IFUN(ISP,JORG).NE.NOPHOT) GO TO 110
      DDMSP(ISP,JORG)=PHSATE*    RTPH(ISP,JORG)
  110 CONTINUE
  120 ISTAGE=IPHENO(ISP)
      GO TO(10,20,30,40,1000),ISTAGE
C.......................................................................
C........THE TRANSLOCATION IS ASSUMED TO BE PROPORTIONAL TO THE AMOUNT .
C         OF MATERIAL PRESENT IN THE DONOR COMPARTMENT AT THE BEGINNING .
C         OF THE DAY (OR  TIME-LOOP).                                   .
C.......................................................................
C........GERMINATION
   10 DO 11 JR=1,IBID
      DO 11 JD=1,IBID
   11 TRMAT(JD,JR)=RTGR(ISP,JD,JR)
      GO TO 50
C........LEAFING-OUT
   20 DO 21 JR=1,IBID
      DO 21 JD=1,IBID
   21 TRMAT(JD,JR)=RTLO(ISP,JD,JR)
      GO TO 50
C........VEGETATIVE STAGE
   30 DO 31 JR=1,IBID
      DO 31 JD=1,IBID
   31 TRMAT(JD,JR)=RTVG(ISP,JD,JR)
      GO TO 50
C........FRUITING STAGE
   40 DO 41 JR=1,IBID
      DO 41 JD=1,IBID
   41 TRMAT(JD,JR)=RTFR(ISP,JD,JR)
      GO TO 50
C.......................................................................
C........CALCULE THE AMOUNT OF TRANSFERRED MATTER BETWEEN THE DONOR     .
C         COMPARTMENT (JDORG) AND THE RECEPTOR COMPARTMENT (JRORG).     .
C.......................................................................
   50 DO 52 JRORG=1,IBID
      DO 51 JDORG=1,IBID
      IF(JRORG.EQ.JDORG) GO TO 51
      TRLC=DMSP(ISP,JDORG)*TRMAT(JDORG,JRORG)
      DDMSP(ISP,JDORG)=DDMSP(ISP,JDORG)-TRLC
      DDMSP(ISP,JRORG)=DDMSP(ISP,JRORG)+TRLC
      IF(IPHENO(ISP).NE.NOFR) GO TO 51
      IF(IPHENO(ISP).NE.IPHENN(ISP)) DMNEW(ISP)=0.
      DMNEW(ISP)= DMNEW(ISP)+TRLC
   51 CONTINUE
   52 CONTINUE
 1000 RETURN
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INDMTR
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      DO 1003 I=1,NSP
      IBID=NORG(I)
      READ(LEC,9) (RTPH(I,J      ),J =1,IBID)
 1003 CONTINUE
      DO 1010 K=1,4
      DO 1009 I=1,NSP
      IBID=NORG(I)
      DO 1008 JD=1,IBID
      GO TO (1,2,3,4),K
    1 READ(LEC,9) (RTGR(I,JD,JR),JR=1,IBID)
      GO TO 1008
    2 READ(LEC,9) (RTLO(I,JD,JR),JR=1,IBID)
      GO TO 1008
    3 READ(LEC,9) (RTVG(I,JD,JR),JR=1,IBID)
      GO TO 1008
    4 READ(LEC,9) (RTFR(I,JD,JR),JR=1,IBID)
 1008 CONTINUE
 1009 CONTINUE
 1010 CONTINUE
      RETURN
    9 FORMAT(6F10.0)
      END
```

Subroutine EDAPH

```
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      SUBROUTINE EDAPH
C         ..................................................
C         .  THIS SUBROUTINE DEALS  WITH THE SOIL PROCESSES  .
C         ..................................................
      COMMON /CLIGHT/ DAYMIN(366),TOTMIN
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1              NDAY,IPDAT
      COMMON /EDAFUN/  DD(11),DTIME
      COMMON /ERAIN/  IERAIN,FORCE
      COMMON /EVTP/ ET,EVAP,FACTOR(4),TARTUF(4),NT
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /GRADE/ STEMP(11),CV(11),CONDUC(11),REGTEM(11)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /RCHECK/ CHECK(20)
      COMMON /SOIL/  WATER(10),SOILTE(10),        NHOR
      COMMON /VEG/ FANTOM(32),ICOVER
      COMMON /WAT/ WATABS(10),RUNOF,        SALNTY(10),EOR,ETIME,ETOUT,
     1             HROUT
      COMMON /TORO/ ALAMBA,CB     ,COND   ,CUNT   ,DETT   ,DELW   ,
     1              DELX  ,DIFA   ,DIFB   ,DIFD   ,
     2              HDRY  ,HWET   ,HLOW   ,HMI    ,RRES   ,SOCON  ,
     3              SOURCE,TAA    ,TIME   ,TT,ND  ,WFOD   ,LL,MM  ,DELT   ,NB,
     4              TH    ,TOB    ,PIT    ,SMAX   ,CWFLX  ,N,K,KK,KCK   ,
     5              D(60),P(60),T(60),
     6              C(11),G(11),H(11),ROF(11),SD(11),SE(11),SS(11),
     7          W(11),WATH(11),WATL(11),Y(11),A(11),B(11),E(11),F(11),
     8              IWRITE
      LOGICAL IWRITE
      DIMENSION DEPTH(10)
C........COMPUTE THE NUMBER OF HOURS 'TRAIN' WITH RAIN FOR THE CURRENT
C         DAY.
      TRAIN=DARAIN/FORCE
      IF(TRAIN.GT.24.) TRAIN=24.
      RUNOF=0.
      CALL DEGREE
      IERAIN=0
      CALL EVAPO
      EOR=EVAP
      HRAIN=TRAIN
      REPET=0.
      IF(TRAIN.LE.0.0) GO TO 60
   20 IF (HRAIN.LE.0.0) GO TO 50
      ETIME=AMIN1(1.,HRAIN)
      REPET=REPET+ETIME
      HRAIN=AMAX1(0.,HRAIN-1.)
      CALL SOWAT
      ETOUT=0.
      GO TO 20
   50 ETIME=24.-REPET
      IF(ETIME.LE.0.0) GO TO 62
      CALL EVAPO
      EOR=EVAP
      GO TO 61
   60 ETIME=24.
   61 CALL SOWAT
   62 CONTINUE
 1000 CONTINUE
      RETURN
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INOMED
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
C1 FORCE           RAINFALL INTENSITY (MM/HOUR).
      READ(LEC,1) FORCE
C........READ THE DEPTH OF THE BOTTOM OF EACH HORIZON.
      READ(LEC,1)(DEPTH(I),I=1,NHOR)
C........THE FIRST HORIZON (VERY SMALL) IS A THEORETICAL  LAYER FOR
C         THE INTERFACE SOIL-ATMOSPHERE. THE 'DEPTH' OF THE BOTTOM OF
C         EACH HORIZON IS CONVERTED IN DEPTH, DD(I),COMPATIBLE WITH THE
C         'SOWAT' SUBROUTINE WHICH ASSUMES THAT THE BOTTOM OF AN HORIZON
C         I IS HALF-WAY  BETWEEN DD(I) AND DD(I+1). (IF  IT IS NECESSARY
C         ADD AN EXTRA HORIZON BELOW THE TRUE HORIZONS TO FIT WITH SOWAT.
      NHOR1 =NHOR-1
      DD(1)=0.
      DO 500 I=2,NHOR1
  500 DD(I)=(DEPTH(I-1)-DD(I-1))*2.+DD(I-1)
      DD(NHOR)=DEPTH(NHOR)
      RETURN
    1 FORMAT(6F10.0)
      END
```

Subroutine EVAPO

```
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      SUBROUTINE EVAPO
      COMMON /ERAIN/ IERAIN,FORCE
      COMMON /EVTP/ ET,EVAP,FACTOR(4),TARTUF(4),NT
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /RCHECK/ CHECK(20)
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRB,NOSEED,NOPHOT,
     1             NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2             DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3              NOGER,NOLO,NOVEG,NOFR,NODOR,ICOVER
C........DARAIC=RAIN IN CM
      DARAIC=DARAIN/10.
```

```
      IF(DARAIC.LE.0.0) GO TO 21
C........TEST IF THE RAIN IS FINISHED FOR THE CURRENT DAY.
      IF(IERAIN.EQ.1) GO TO 21
      GO TO 20
   21 IERAIN=0
      DO 10 I=1,NT
      J=I
      IF(TDAY.LT.TARTUF(I)) GO TO 15
   10 CONTINUE
   15 TEMP=(1.8*TDAY)+32.
      ET=-(DALITE*TEMP*FACTOR(J))*2.54/24.
      EVAP= ET*(1.-TCOVER)
      RETURN
C........IF RAIN OCCURS
   20 ET=0.
C........'EVAP' FOR 1 HOUR= INTENSITY OF THE RAIN.(CM)
      EVAP=DARAIC/TRAIN
      IERAIN=1
      RETURN
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INDMEV
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
C1 TARTUF(I)     IN DEGREE C.-(NT-1) THRESHOLDS USED TO CALCULATE EVAP
C2 TARTUF        AND ET.
      READ(LEC,1) NT
      NT1=NT-1
      READ(LEC,2)(TARTUF(I),I=1,NT1)
      TARTUF(NT)=TARTUF(NT1)
      READ(LEC,2)(FACTOR(I),I=1,NT)
      RETURN
    1 FORMAT(12I5)
    2 FORMAT(8F10.0)
      END
```

Subroutine FILLTX

```
C**********************************************************************
      SUBROUTINE FILLTX
C......................................................................
C        THIS SUBROUTINE DEALS WITH THE STORAGE OF THE STATE VARIABLES.
C......................................................................
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1                NDAY,IPDAY
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /FILL/ TX(50,100)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /KAS/ K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15
      COMMON /LITTER/ CLIT(10),DCLIT(10),NLIT
      COMMON /RCHECK/ CHECK(20)
      COMMON /SOIL/  WATER(10),SOILTE(10),      NHOR
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRB,NOSEED,NOPHOT,
     1              NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2              DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3               NOGER,NOLD,NOVEG,NOFR,NODOR,TCOVER
      COMMON /WAT/ WATABS(10),RUNOF,     SALNTY(10),COR,ETIME,ETOUT,
     1               WROUT
C........TEST IF THE FIRST DAY
      IF (IDAY.EQ.1) GO TO 20
      IF(NDAY.LE.100) GO TO 22
      FIDAY=IDAY
      FNDAY=NDAY
      FIABS=FIDAY/(FNDAY/100.)
      IABS=FIABS
      IF(IABS.GT.100) IABS=100
      GO TO 19
   22 IABS=IDAY
   19 IF(IABS.LT.2) RETURN
      GO TO 21
   20 IABS=1
   21 K=0
C........DRY MATTER FOR EACH SPECIES
      DO 23 I=1,NSP
      K=K+1
   23 TX(K,IABS)=DMT(I)
      K1=K
C........DRY MATTER  FOR EACH ORGAN OF EACH SPECIES
      DO 26 I=1,NSP
      IBID=NORG(I)
      DO 26 J=1,IBID
      K=K+1
   26 TX(K,IABS)=DMSP(I,J)
      K2=K
C........DEAD MATERIAL
      DO 24 I=1,NLIT
      K=K+1
   24 TX(K,IABS)=CLIT(I)
      K3=K
C........WATER
      DO 25 I=1,NHOR
      K=K+1
   25 TX(K,IABS)=WATER(I)
      K4=K
C........SOIL TEMPERATURE
      DO 27 I=1,NHOR
      K=K+1
   27 TX(K,IABS)=SOILTE(I)
      K5=K
C........RAIN
      K=K+1
      TX(K,IABS)=DARAIN
      K6=K
C........TEMPERATURE(AIR)
      K=K+1
      TX(K,IABS)=      TDAY
      K7=K
C........PHENOLOGY
      DO 28 I=1,NSP
      K=K+1
   28 TX(K,IABS)=IPHENO(I)
      K8=K
C........WATABS
      DO 29 I=1,NHOR
      K=K+1
   29 TX(K,IABS)=WATABS(I)
      RETURN
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INFILL
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
C........TO CLEAR THE STORAGE ARRAY.
      DO 100 I=1,50
      DO 100 J=1,100
  100 TX(I,J)=0.
      RETURN
      END
```

Subroutine INVDAT

```
C**********************************************************************
      SUBROUTINE INVDAT (IND,INM ,INY,IDAY,ICD,ICM,ICY)
C----------------------------------------------------------------------
C   COMPUTE THE CURRENT DAY(IDAY) WITH THE DATE(ICD,ICM,ICY)          I
C----------------------------------------------------------------------
C........IBIS=DUMMY VARIABLE
C........IND =INITIAL DAY     (INPUT)
C........INM =   "    MONTH   (INPUT)
C........INY =   "    YEAR    (INPUT)
C........IDAY=CURRENT DAY, COUNTING FROM THE INITIAL DAY(INCLUDED)OUTPUT
C........ICD=THE DATE  WITHIN THE CURRENT MONTH(INPUT)
C........ICM=THE MONTH WITHIN THE CURRENT YEAR(INPUT)
C........ICY= THE      CURRENT YEAR(INPUT)
      IF(INY.LT.1900) INY=INY+1900
      ID=IND
      IM=INM
      IY=INY
      IDAY=1
   11 IF(ID.NE.ICD) GO TO 10
      IF(IM.NE.ICM) GO TO 10
      IF(IY.NE.ICY) GO TO 10
      RETURN
   10 IDAY=IDAY+1
      ID=ID+1
      CALL NJMOIS(IM,IY,NJ,IBIS)
      IF(ID.LE.NJ) GO TO 11
      IM=IM+1
      ID=1
      IF(IM.LE.12) GO TO 11
      IY=IY+1
      IM=1
      ID=1
      GO TO 11
      END
```

Subroutine JULES

```
C**********************************************************************
      SUBROUTINE JULES
C**********************************************************************
COMPUTE THE 'JULIAN DAY'  FOR THE CURRENT DAY 'IDAY'.                 *
C**********************************************************************
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS ,
     1               NDAY
      JULDAY=0
      M=ICM-1
      DO 10  I=1,M
      CALL NJMOIS(I,ICY,JOURS,IBIS)
   10 JULDAY=JULDAY+JOURS
      JULDAY=JULDAY+ICD
      RETURN
      END
```

Subroutine NJMOIS

```
C**********************************************************************
      SUBROUTINE NJMOIS(MOIS,IAN,JOURS,IBIS)
C........ CALCULE LE NOMBRE DE JOURS DU MOIS-IEME MOIS DE L' ANNEE IAN.
      DIMENSION NJOUR(12)
      DATA NJOUR/31,0,31,30,31,30,31,31,30,31,30,31/
      IBIS=0
      JOURS=NJOUR(MOIS)
      IF(JOURS)101,101,102
  101 AN=IAN
      X=AMOD(AN,4.)
      IF(X)104,104,103
  104 JOURS=29
      IBIS=1
      GO TO 102
  103 JOURS=28
  102 RETURN
C........IBIS=1,FEBRUARY IS 29 DAYS.   IBIS=0 IN OTHER CASE.
      END
```

Subroutine PLOT

```
C**********************************************************************
      SUBROUTINE  PLOT(XMAX,XMIN,NV,IND,XPAS,KUPT,KCHUIM,KSUP)
C XXXXXX WARNING... IN 'PLOT', 'IND' IS NOT THE DAY OF THE INITIAL DATE.
      COMMON /INOU/ LEC,IMP,IPU
    * COMMON /DIAGR/ TVEC(10,100),LEG(10,11)
      COMMON /HEAD/ TITRE(20)
      DIMENSION     GRAPH(53,103),Y(30),SYMBOL(30),XVAL(6)
      DIMENSION TABEL(4,10)
C........ KUPT= 1,PAS DE GRAPHIQUE,
C........    " = 2, UN GRAPHIQUE GENERAL,DANS CE CAS KCHUIM=2.
C........    " = 3, UN GRAPHIQUE PAR VARIABLE,
C........    " = 4, UN GRAPHIQUE PAR VARIABLE & UN GENERAL.
C........ KCHUIM= 1, MAX. ET MIN. POUR CHAQUE GRAPHIQUE.
C........  "    = 2, MEME MAX. ET MIN. POUR TOUS LES GRAPHIQUES.
C1 KSUP           WRITE THE SUPERPOSED SYMBOLS IN DIAGRAMS(=0 NOT)
      DATA YAXIS/'I'/
      DATA SYMBOL/'A','B','C','D','E','F','G','H','I','J','K','L','M',
     1'N','O','P','Q','R','S','T','U','V','W','X','Y','Z','+','-','*',
     2'.'/
      YMAX=TVEC(1,1)
      YMIN=TVEC(1,1)
      DO 120 K=1,IND
      DO 120 I=1,NV
      YMAX=AMAX1(TVEC(I,K),YMAX)
  120 YMIN=AMIN1(TVEC(I,K),YMIN)
      IV=0
C     BLANK THE GRAPH
  209 BLANC=' '
      DO 30 I=1,53
      DO 30 J=1,103
   30 GRAPH(I,J)=' '
C     SET UP Y-AXIS
      DO 50 I=2,52
      IF (MOD(I-2,5) .EQ. 0) GO TO 40
      GRAPH(I,1)=YAXIS
      GRAPH(I,103)=YAXIS
      GO TO 50
   40 GRAPH(I,1)='+'
      GRAPH(I,103)='+'
   50 CONTINUE
C     SET UP X-AXIS
```

```
      DO 70 J=2,102
      IF (MOD(J-2,10) .EQ. 0) GO TO 60
      GRAPH(1,J)='-'
      GRAPH(53,J)='-'
      GO TO 70
   60 GRAPH(1,J)='+'
      GRAPH(53,J)='+'
   70 CONTINUE
      XDIV=(XMAX-XMIN)/100.0
      YDIV=(YMAX-YMIN)/50.0
      GO TO (208,221,220,220),KOPT
  220 IV=IV+1
      GO TO(41,42),KCHOIM
   41 YMINS=TVEC(IV,1)
      YMAXS=TVEC(IV,1)
      DO 43 KYM=1,IND
      YMAXS=AMAX1(TVEC(IV,KYM),YMAXS)
   43 YMINS=AMIN1(TVEC(IV,KYM),YMINS)
      YDIVS=(YMAXS-YMINS)/50.
      YMIP=YMINS
      YDIVP=YDIVS
      GO TO 47
   42 YDIVP=YDIV
      YMIP=YMIN
   47 DO 205 K=1,IND
      Y(1)=TVEC(IV,K)
      X=K
      X=X*XPAS
      J=2.5+(X-XMIN)/XDIV
      I=52-(Y(1)-YMIP)/YDIVP
      IF(GRAPH(I,J)-BLANC)210,211,210
  210 WRITE(IMP,2)K2    ,X,GRAPH(I,J),SYMBOL(IV)
    2 FORMAT(1X,I4,F8.0,10X,A1,'=',A1)
  211 CONTINUE
  205 GRAPH(I,J)=SYMBOL(IV)
      GO TO 207
  221 IF(KSUP.EQ.0) GO TO 225
      WRITE(IMP,3)
    3 FORMAT('1','SYMBOLES SUPERPOSES DANS LE GRAPHIQUE SUIVANT(A=ANCIEN
     1,N=NOUVEAU)'/1X,10('PAS JOUR A=N*'))
      ICOUNT=0
      DO 236 KLM=1,10
      DO 236 MLK=1,4
  236 TABEL(MLK,KLM) =' '
  225 DO 202 K=1,IND
      X=K
      X=X*XPAS
      DO 203 I=1,NV
  203 Y(I)=TVEC(I,K)
      J=2.5+(X-XMIN)/XDIV
      DO 204 L=1,NV
      I=52-(Y(L)-YMIN)/YDIV
      IF(KSUP.EQ.0) GO TO 213
      IF(GRAPH(I,J)-BLANC)212,213,212
  212 ICOUNT=ICOUNT+1
      TABEL(1,ICOUNT)=K
      TABEL(2,ICOUNT)=X
      TABEL(3,ICOUNT)=GRAPH(I,J)
      TABEL(4,ICOUNT)=SYMBOL(L)
      IF(ICOUNT-10) 213,231,231
  231 WRITE(IMP,233)((TABEL(1,KLM),TABEL(2,KLM),TABEL(3,KLM),TABEL(4,KLM
     1)),KLM=1,ICOUNT)
  233 FORMAT(1X,10(I3,F5.0,1X,A1,'='A1'*'))
      ICOUNT=0
      DO 235 KLM=1,10
      DO 235 MLK=1,4
  235 TABEL(MLK,KLM) =' '
  213 CONTINUE
  204 GRAPH(I,J)=SYMBOL(L)
  202 CONTINUE
      IF(ICOUNT)237,238,237
  237 WRITE(IMP,233)((TABEL(1,KLM),TABEL(2,KLM),TABEL(3,KLM),TABEL(4,KLM
     1)),KLM=1,ICOUNT)
  238 CONTINUE
C     PRINT THE GRAPH
  207 WRITE(IMP,90) (TITRE(ITI),ITI=1,20)
   90 FORMAT('1',20A4)
      GO TO(44,45),KCHOIM
   44 YMIM=YMINS
      YDIM=YDIVS
      GO TO 46
   45 YMIM=YMIN
      YDIM=YDIV
   46 CONTINUE
  140 DO 150 K=1,6
  150 XVAL(K) = XMIN+(K-1)*20.0*XDIV
      WRITE(6,160)XVAL
  160 FORMAT(7X,6(E10.3,10X))
      DO 190 I=1,53
      WRITE(6,170)(GRAPH(I,J),J=1,103)
  170 FORMAT(12X,103A1)
      IF (MOD(I-2,10) .NE. 0) GO TO 190
      R=YMIM+YDIM*(52-I)
      WRITE(6,180)R,R
  180 FORMAT('+',1X,E9.3,104X,E10.3)
  190 CONTINUE
      WRITE(6,160)XVAL
      DO 175 IRS=1,NV
  175 WRITE(IMP,176) SYMBOL(IRS),(LEG(IRS,ITS),ITS=1,11)
  176 FORMAT(1X,A1,2X,11A4)
      WRITE(IMP,177) XDIV,YDIM
  177 FORMAT(' 1 COLONNE EN ABSCISSE='E10.3,'  1 LIGNE EN ORD.=' E10.3)
      GO TO(208,208,222,222),KOPT
  222 IF(IV-NV)209,219,208
  219 IV=IV+1
      GO TO(208,208,208,221),KOPT
  208 RETURN
      END
```

Subroutine PREPAR

```
C*******************************************************************
      SUBROUTINE PREPAR
C...................................................................
C          PREPARE THE DATA FOR PLOT                               .
C...................................................................
C........MAXIMUM...30 VARIABLES FOR 1 DIAGRAMM.                     .
C........IGEN=0, TO INDICATE THE END OF THE LIST OF THE VARIABLES FOR .
C                 THE CURRENT DIAGRAM. (=1 EMPTY CARD AFTER THE GROUP .
C                OF VARIABLES FOR 1 DIAGRAMM. )                     .
C........IGEN=1, THE STATE VARIABLE REQUIRED IS THE TOTAL DRY MATTER  .
C                 FOR THE SPECIES 'IND1'.                           .
C........IGEN=2, THE STATE VARIABLE REQUIRED IS THE DRY MATTER FOR THE .
C                 SPECIES 'IND1' AND THE ORGAN 'IND2'.              .
C........IGEN=3, THE STATE VARIABLE REQUIRED IS THE DRY MATTER FOR THE .
C                 'IND1' CATEGORY OF DEAD MATERIAL.                 .
C........IGEN=4, THE       VARIABLE REQUIRED IS THE WATER IN HORIZON  .
C                 'IND1'.                                           .
C........IGEN=5, THE       VARIABLE REQUIRED IS THE SOIL TEMPERATURE IN.
C                HORIZON 'IND1'.                                    .
C........IGEN=6, THE       VARIABLE REQUIRED IS THE RAIN FOR THE DAY.  .
C........IGEN=7, THE       VARIABLE REQUIRED IS THE DAILY TEMPERATURE. .
C........IGEN=8, THE       VARIABLE REQUIRED IS THE PHENOLOGICAL STAGE .
C              OF THE SPECIES 'IND1'.                               .
C........IGEN=9, THE       VARIABLE REQUIRED IS THE AMOUNT(MM) OF     .
C                TOTAL WATER IN THE HORIZON 'IND1'.                 .
C........IGEN GREATER THAN 99, NO OTHER DIAGRAM REQUIRED.            .
C........LEG(NV,I) NAME OF THE VARIABLES (COL. 16 TO 59).            .
C...................................................................
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1               NDAY,IPDAY
      COMMON /DIAGR/ TV(10,100),LEG(10,11)
      COMMON /FILL/ TX(50,100)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /KAS/ K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15
      COMMON /LITTER/ CLIT(10),DCLIT(10),NLIT
      COMMON /RCHECK/ CHECK(20)
      COMMON /SOIL/  WATER(10),SOILTE(10),       NHOR
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRH,NOSEED,NOPHOT,
     1              NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2              DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3               NOGER,NOLO,NOVEG,NOFR,NODOR,TCOVER
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      READ(LEC,1) KSUP
    9 NV=0
   10 NV=NV+1
      IF(NV.LE.30) GO TO 12
      NV=30
      READ(LEC,1) IGEN
      IF(IGEN.EQ.0) GO TO 500
      GO TO 10
   12 READ(LEC,1)IGEN,IND1,IND2,( LEG(NV,I),I=1,11)
      IF(IGEN.GT.99) GO TO 1000
      IF(IGEN.EQ.0) GO TO 500
      GO TO(21,22,23,24,25,26,27,28,29),IGEN
C........TOTAL DRY MATTER FOR EACH SPECIES
   21 KT=IND1
      GO TO 400
C........DRY MATTER FOR ORGANS
   22 KT=K1
      IF(IND1.LE.1)GO TO 102
      IND1=IND1-1
      DO 101 I=1,IND1
      IBID=NORG(I)
  101 KT=NORG(I)+KT
  102 KT=KT+IND2
      GO TO 400
C........DEAD MATERIAL
   23 KT=K2+IND1
      GO TO 400
C........WATER IN SOIL.
   24 KT=K3+IND1
      GO TO 400
C........SOIL TEMPERATURE.
   25 KT=K4+IND1
      GO TO 400
C........RAIN
   26 KT=K5+1
      GO TO 400
C........DAILY TEMPERATURE.
   27 KT=K6+1
      GO TO 400
C........PHENOLOGY.
   28 KT=K7+IND1
      GO TO 400
C........WATABS
   29 KT =K8+IND1
C........FILL THE ARRAY 'TV' WHICH IS CALLED BY 'PLOT', FOR EACH
C            DIAGRAMM.
  400 LATV=MIN0(100,NDAY)
      DO 401 K=1,LATV
  401 TV(NV,K)= TX(KT,K)
      GO TO 10
  500 NV=NV-1
      KOPT=2
      KCHOIM=2
      FNDAY=NDAY
      XPAS=1.
      IF(NDAY.GT.100) XPAS=FNDAY/100.
      XMIN=1.
      XMAX=NDAY
      CALL        PLOT(XMAX,XMIN,NV,LATV,XPAS,KOPT,KCHOIM,KSUP)
      GO TO 9
 1000 RETURN
    1 FORMAT(3I5,11A4)
      END
```

Subroutine REPORT

```
C*******************************************************************
      SUBROUTINE REPORT
C                 ......................................
C                 .       WRITE REPORT IF NECESSARY     .
C                 ......................................
      COMMON /DATUM/ IND,INM,INY,IDAY,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1               NDAY,IPDAY
      COMMON /EDAFON/  DD(11),DTIME
      COMMON /EVTP/ ET,EVAP,FACTOR(4),FARTOF(4),NT
      COMMON /EXO/ DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      COMMON /HEAD/ STATE(20)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /LITTER/ CLIT(10),DCLIT(10),NLIT
      COMMON /NAME/ NAMSP(20),NAMORG(20,10),NAMLIT(10)
      COMMON /PROVIS/ PRLITE(20), PRTEMP(20),PRMOIS(20),PRFACT(20),
     1                PRSATE(20)
      COMMON /RCHECK/ CHECK(20)
      COMMON /REP/ IDATR(20),NREP ,IREP
      COMMON /SOIL/  WATER(10),SOILTE(10),       NHOR
      COMMON /VEG/ ISP,NSP,IANUAL,ISHRH,NOSEED,NOPHOT,
     1              NORG(20),LIF(20),IPHENO(20),IPHENN(20),IFUN(20,10),
     2              DMSP(20,10),DDMSP(20,10),DMT(20),DMNEW(20),PHSATE,
     3               NOGER,NOLO,NOVEG,NOFR,NODOR,TCOVER
      COMMON /WAT/ WATABS(10),RUNOF,     SALNTY(10),EOR,ETIME,ETOUT,
     1              RROUT
      DOUBLE PRECISION NAMSP,NAMORG,NAMLIT
      IF(IREP.GT.NREP) RETURN
      IF (IDAY.NE.IDATR(IREP)) RETURN
      IREP=IREP+1
      WRITE(IMP,6) (STATE(I),I=1,20)
      IDAY1=IDAY-1
      WRITE(IMP,2) ICD,ICM,ICY,IDAY1
      WRITE(IMP,12)DARAIN,TDAY,DAPHOT,DAYRAD,DALITE,TRAIN
      WRITE(IMP,9)
      DO 20 I=1,NSP
      WRITE(IMP,3) NAMSP(I),DMT(I),IPHENO(I),PRLITE(I),PRTEMP(I),
     1              PRMOIS(I),PRFACT(I),PRSATE(I)
      IBID=NORG(I)
      DO 20 J=1,IBID
```

```
   20 WRITE(IMP,4) NAMORG(I,J),OMSP(I,J)
      WRITE(IMP,7)
      DO 21 I=1,NLIT
   21 WRITE(IMP,3) NAMLIT(I),CLIT(I)
C........SOILWATER POTENTIAL.
      WRITE(IMP,8)
      DO 22 I=1,NHOR
      PF=-WATER(I)*1000.
      IF(PF.GE.1.) GO TO 23
      PF=0.
      GO TO 22
   23 PF=ALOG10(PF)
   22 WRITE(IMP,10)I,WATER(I),WATABS(I),PF
      WRITE(IMP,11) ET,EVAP
      RETURN
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INDMRP
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
      READ(LEC,1)NREP
      DO 50 I=1,NREP
      READ(LEC,1)ID,IM,IY
      CALL INVDAT(IND,INM,INY,IDAT,ID,IM,IY)
   50 IDATR(I)=IDAT
      RETURN
    1 FORMAT(12I5)
    2 FORMAT(1X,'JOUR=',I3,' MOIS=',I3,' ANNEE',I5,' JOURS SIMULES=',
     1I5/ )
    3 FORMAT(  2X,A8,12X,F10.0,10X,I5,6X,5(E10.3))
    4 FORMAT(4X,A8,F10.0)
    6 FORMAT('J',20A4/  )
    7 FORMAT( //1X,' MATERIEL MORT' )
    8 FORMAT(//' ETAT HYDRIQUE DU SOL'/'  HORIZON  POTENTIEL(BARS)  EAU
     1TOTALE     PF')
    9 FORMAT(10X,'M.S./ORG.       M.S./SP.',10X,'PHENOLOGIE  LIGHTF
     1TEMPF      PHSF      PSRATE     PHSATE')
   10 FORMAT(1X,I5,5X,F10.2,2X,F10.2,2X,2F10.2)
   11 FORMAT          (' ET='E10.4,'  EVAP='E10.4,'CM/HEURE')
   12 FORMAT(1X,'PLUIE(MM) TEMP.(AIR)  DAPHOT   DAYRAD   DALITE    TRAI
     1N'/1X,6(E10.3)/)
      END
```

Subroutine SEASON

```
C*******************************************************************
      SUBROUTINE SEASON
      COMMON /DATUM/ IND,INM,INY,IDAT,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS ,
     1                   NDAY,IPDAY
C........COMPUTE THE SEASON 'IS'.
C        IS=1=WINTER,IS=2=SPRING,IS=3=SUMMER,IS=4=FALL.
      A=80
      B=172
      C=264
      D=355
      IF(JULDAY.LT.A) GO TO 11
      IF(JULDAY.LT.B) GO TO 12
      IF(JULDAY.LT.C) GO TO 13
      IF(JULDAY.LT.D) GO TO 14
   11 IS=1
      RETURN
   12 IS=2
      RETURN
   13 IS=3
      RETURN
   14 IS=4
      RETURN
      END
```

Subroutine SOWAT

```
C*******************************************************************
      SUBROUTINE SOWAT
      COMMON /DATUM/ IND,INM,INY,IDAT,JULDAY,ICD,ICM,ICY,IS,IBIS,JOURS,
     1                   NDAY,IPDAY
      COMMON /EDAFON/  DD(11),DTIME
      COMMON /EVTP/ ET,EVAP,FACTOR(4),IARTOF(4),NT
      COMMON /HEAD/ STATE(20)
      COMMON /INOU/ LEC,IMP,IPU
      COMMON /KCHECK/ CHECK(20)
      COMMON /REP/ IDATR(20),NREP ,IREP
      COMMON /SOIL/  WATER(10),SOILTE(10),        NHOR
      COMMON /WAT/ WATABS(10),RUNOF,     SALNTY(10),EOR,ETIME,EFOUT,
     1                HROOT
      COMMON /YORO/ ALAMBA,CB     ,COND  ,CUNT  ,DETT  ,DELW  ,
     1                  DELX   ,DIFA  ,DIFB  ,DIFD  ,
     2                  HDRY   ,HWET  ,HLOW  ,HHI   ,RRES  ,SUCUN ,
     3                  SOURCE,TAA    ,TIME  ,TTWO  ,WFDD  ,LL,MM ,DELT  ,NB,
     4                  TH     ,TBB   ,PIT   ,SMAX  ,CWFLX ,N,K,KK,KCK   ,
     5                  D(60),P(60),T(60),
     6                  C(11),G(11),H(11),RDF(11),SD(11),SE(11),SS(11),
     7           W(11),WATH(11),WATL(11),Y(11),A(11),B(11),E(11),F(11),
     8                  IWRITE
      LOGICAL IWRITE
      TIME=0.0
      RUNOF=0.0
      CUMS=0.0
      CUMW=0.0
      SUMA=0.0
C*******************************************************************
C-----COMPUTATION OF CONDUCTIVITY (W) AND WATER CAPACITY (C)
   16 Y(1)=(W(1)+Y(1))*.5
      J=(Y(1)-T(1))/DELW+1.0
      BB=(Y(1)-T(J))/DELW
      IF (EOR-0.0) 155,156,155
  155 G(1)=(P(J+1)-P(J))*BB+P(J)
  156 DO 161 I=2,KK
      J=(W(I)-T(1))/DELW+1.0
      BB=(W(I)-T(J))/DELW
      G(I)=(P(J+1)-P(J))*BB+P(J)
      TW=(W(I)-Y(I))+W(I)
      IF (TW-WATH(I)) 157,157,159
  157 IF (TW-WATL(I)) 158,160,160
  158 TW=WATL(I)
      GO TO 160
  159 TW=WATH(I)
  160 Y(I)=W(I)
      W(I)=TW
      SS(I)=SE(I)
  161 CONTINUE
      SS(1)=SE(1)
      TOP=WATH(1)
      BOT=WATL(1)
      HKP=H(1)
      WKP=W(1)
      IF (EOR-0.0) 17,19,18
   17 W(1)=WATL(1)
      H(1)=HDRY
      GO TO 19
   18 W(1)=WATH(1)
      H(1)=HWET
   19 TWW=(W(1)+Y(1))*0.5
      J=(TWW-T(1))/DELW+1.0
      BB=(TWW-T(J))/DELW
      DIFFA=(D(J+1)-D(J))*BB+D(J)
      HI=(P(J+1)-P(J))*BB+P(J)
      DO 37 I=1,K
      TW=(W(I+1)+Y(I+1))*0.5
      J=(TW -T(1))/DELW+1.0
      BB=(TW-T(J))/DELW
      DIFFB=(D(J+1)-D(J))*BB+D(J)
      GI=(P(J+1)-P(J))*BB+P(J)
  219 IF(HI-GI)20,32,20
   20 H(I)=(DIFFA-DIFFB)/(HI-GI)
      IF (I-1) 21,21,33
   21 IF (EOR-0.0) 22,33,22
   22 ER=(B(1)*(H(1)*TI-H(2)*TT-G(2)*TH+G(1)*TH+DD(2)))/DD(2)
      IF (ABS(1.1*EOR-ER)-ABS(0.1*EOR)) 236,236,23
   23 IF(KCK.EQ.1) GO TO 220
C*******************************************************************
C-----THE SURFACE PRESSURE HEAD
C*******************************************************************
      IF (KCK-20)305,236,236
  236 H(1)=(1.1*EOR*DD(2)/B(1)+H(2)*TT-G(1)*TH+G(2)*TH-DD(2))/TT
      IF(H(1).LT.HDRY) H(1)=HDRY
      IF (H(1).GT.HWET) H(1)=HWET
      GO TO 33
  220 H(1)=HKP
      W(1)=WKP
      KCK=KCK+1
      GO TO 19
  305 KCK=KCK+1
      IF (ER-EOR) 24,33,26
   24 IF (W(1)-WATH(1)) 25,33,33
   25 BOT=W(1)
      W(1)=(W(1)+TOP)*0.5
      GO TO 28
   26 IF (W(1)-WATL(1)) 33,33,27
   27 TOP=W(1)
      W(1)=(W(1)+BOT)*0.5
   28 J=(W(1)-T(1))/DELW+1.0
      BB=(W(1)-T(J))/DELW
      IF(EOR-0.0)30,33,30
   30 H(1)=(P(J+1)-P(J))*BB+P(J)
  218 TWW=(W(1)+Y(1))*0.5
      J=(TWW-T(1))/DELW+1.0
      BB=(TWW-T(J))/DELW
      DIFFA=(D(J+1)-D(J))*BB+D(J)
      HI=(P(J+1)-P(J))*BB+P(J)
      GO TO 219
   32 H(I)=(D(J+1)-D(J))/(P(J+1)-P(J))
      IF (I-1) 33,21,33
   33 TWW=TW
      HI=GI
      DIFFA=DIFFB
      TW=(W(I+1)+Y(I+1))*0.5
      J=(TW -T(1))/DELW+1.0
   35 C(I+1)=DELW/(P(J+1)-P(J))
   37 CONTINUE
      KCK=1
      IF(EOR.GT.0.0.AND.ET.GE.0.0) GO TO 6666
      IF(EOR.GT.0.0.AND.ET.LT.0.0) GO TO 5555
 6666 ETPL=ET-EOR
      IF(ET.GE.0.0) GO TO 39
      IF(ETPL-0.0) 365,39,39
 5555 ETPL=ET
C*******************************************************************
C-     SEARCHING FOR THE PROPER HROOT VALUE
C*******************************************************************
  365 HHOLD=HROOT
      HROOT=HLOW
      SINK=0.0
      DO 250 I=2,K
  250 E(I)=G(I)-36.00 *SE(I)-DD(I)*RRES
      DO 420 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 420
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
  420 CONTINUE
      IF ((SINK-ETPL).GT.0.0) GO TO 402
      HROOT=HHOLD
  410 HROOT=1.2*HROOT
      SINK=0.0
      DO 421 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 421
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
  421 CONTINUE
      IF(SINK-ETPL)411,402,410
  411 HRLO=HROOT
      HROOT=HHOLD
      LCOUNT=0
  412 HROOT=0.8*HROOT
      LCOUNT=LCOUNT+1
      IF(LCOUNT.EQ.5) GO TO 490
      SINK=0.0
      DO 422 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 422
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
  422 CONTINUE
      IF(SINK-ETPL)412,402,413
  413 HRHI=HROOT
      GO TO 491
  490 HRHI=HHI
  491 LCOUNT=0
      HROOT=HHOLD
  405 SINK=0.0
      DO 400 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 400
      SINK=B(I)*RDF(I)*(HROOT-E(I))+SINK
  400 CONTINUE
      LCOUNT=LCOUNT+1
      IF(LCOUNT.EQ.20) GO TO 402
      IF(ABS(SINK-ETPL)-0.002)402,402,401
  401 IF(SINK-ETPL)403,402,404
  403 HRLO=HROOT
      HROOT=0.5*(HROOT+HRHI)
      GO TO 405
  404 HRHI=HROOT
      HROOT=0.5*(HROOT+HRLO)
      GO TO 405
   39 DO 251 I=2,K
      SINK=0.0
  251 A(I)=0.0
      GO TO 38
C*******************************************************************
C-     A IS THE DEL WATER/DELT CAUSED BY PLANT EXTRACTION
C*******************************************************************
  402 DO 406 I=2,K
      IF((HROOT-E(I)).GT.0.0) GO TO 407
      A(I)=B(I)*(HROOT-E(I))*2.0*RDF(I)/(DD(I+1)-DD(I-1))
      GO TO 406
```

```
  407 A(I)=0.0
  406 CONTINUE
C-*********************************************************************
C-----COMPUTATION OF TRIDIAGONAL MATRIX MAIN BODY
C-*********************************************************************
38    DO 42 I=2,K
      POT=(DD(I+1)-DD(I-1))/(2.0*DELT)
      DLXA=(DD(I)-DD(I-1))
      DLXB=(DD(I+1)-DD(I))
      BB=C(I)*POT/TT+B(I)/DLXB+B(I-1)/DLXA
      DA=(C(I)*POT*G(I)+(B(I)/DLXB)*(TW*(G(I+1)-G(I))-DLXB)+(B(I-1)/DLXA
     1)*(TW*(G(I-1)-G(I))+DLXA)+A(I)*(DD(I+1)-DD(I-1))*0.5)/TT
      IF(I-2)390,390,40
  390 IF(H(1).GE.HWET.OR.H(1).LE.HORY) GO TO 394
      DA=DA-((B(I-1)/DLXA)*(TW*(G(I-1)-G(I))+DLXA))/TT+EOR/TT
      BB=BB-B(I-1)/DLXA
      GO TO 393
  394 DA=DA+H(I-1)*B(I-1)/DLXA
  393 F(I)=DA/BB
      E(I)=(B(I)/DLXB)/BB
      GO TO 42
40    IF (I-K) 41,43,43
41    E(I)=(B(I)/DLXB)/(BB-(B(I-1)/DLXA)*E(I-1))
      F(I)=(DA+(B(I-1)/DLXA)*F(I-1))/(BB-(B(I-1)/DLXA)*E(I-1))
   42 CONTINUE
43    BB=BB-TAA*B(I)/DLXB
      DA=DA+TAA*(B(I)/DLXB)*((G(I)-G(I+1))*TW+DLXB)/TT+TBB*B(I)/DLXB*H(
     1KK)
      H(I)=(DA+(B(I-1)/DLXA)*F(I-1))/(BB-(B(I-1)/DLXA)*E(I-1))
44    I=I-1
      H(I)=E(I)*H(I+1)+F(I)
      IF (I-2) 45,45,44
45    IF(TAA-1.0)47,46,46
46    H(KK)=H(K)+DD(KK)-DD(K)
47    DO 60 I=2,KK
300   IF (H(I)-HWET-DD(I)) 60,60,55
55    H(I)=HWET+DD(I)
60    CONTINUE
C-*********************************************************************
C-----COMPUTATION OF WATER CONTENTS AS A FUNCTION OF PRESSURES JUST COMP
C-*********************************************************************
      IF(H(1).GE.HWET.OR.H(1).LE.HORY) GO TO 1005
      WFDD=EOR
      H(1)=(EOR*DD(2)/B(1)+H(2)*TT-G(1)*TW+G(2)*TW-DD(2))/TT
      IF(H(1).LT.HORY) H(1)=HORY
      IF (H(1).GT.HWET) H(1)=HWET
      GO TO 134
 1005 WFDD=B(1)*((H(1)-H(2))*TT+(G(1)-G(2))*TW+DD(2))/DD(2)
  134 I=1
   62 IF (H(I)-P(1)) 65,116,65
   65 NHI=ND
      NLO=1
      J=25
66    IF (H(I)-P(J)) 67,72,68
67    NHI=J
      GO TO 69
68    NLO=J
69    JT=J
      J=(NHI-NLO)/2+NLO
      IF (J-JT) 66,70,66
70    IF (H(I)-P(J)) 71,72,72
71    J=J-1
   72 CONTINUE
      WAT=(H(I)-P(J))*DELW/(P(J+1)-P(J))+T(J)
      W(I)=WAT
      GO TO 117
116   W(I)=T(I)
  117 DO 268 I=2,KK
      W(I)=C(I)*(H(I)-G(I))+Y(I)
      IF (W(I).GT.WATH(I)) W(I)=WATH(I)
  268 IF (W(I).LT.WATL(I)) W(I)=WATL(I)
269   SUM3=0.0
      SUM2=0.0
      SUM1=0.0
      DO 131 I=2,K
      SUM1=W(I)+SUM1
      SUM2=Y(I)+SUM2
      IF (ABS(SUM1-SUM2)-ABS(SUM3)) 131,131,130
130   SUM3=SUM1-SUM2
131   CONTINUE
      IF(ABS(SUM3)-ABS(CUNQ))63,63,132
  132 IF(DELT-DETT*0.1)63,63,133
  133 DELT=0.5*DELT
      GO TO 38
   63 SUM1=0.0
      SUM2=0.0
      DO 800 I=2,K
      SUM1=W(I)*(DD(I+1)-DD(I-1))/2.+SUM1
  800 SUM2=Y(I)*(DD(I+1)-DD(I-1))/2.+SUM2
      CWF=SUM1-PIT
      CUMS=WFDD*DELT+CUMS
      SUMA=SUMA+SINK*DELT
      CWFLX=(SUM1-SUM2)
C-*********************************************************************
C-----SALT LOOP
C-*********************************************************************
      KB=K-1
      WFRU=B(1)*((H(1)-H(2))*TT+(G(1)-G(2))*TW+DD(2))/DD(2)
      DO 214 I=2,K
      DLXA=(DD(I)-DD(I-1))
      DLXB=(DD(I+1)-DD(I))
      DLXC=(DD(I+1)-DD(I-1))*0.5
      WFRD=B(I)*((H(I)-H(I+1))*TT+(G(I)-G(I+1))*TW+DLXB)/DLXB
  176 WATD=(Y(I)*TW+W(I)*TT+Y(I+1)*TW+W(I+1)*TT)/2.0
      DISD=DLXC*0.5*WFRD-(W(I)-Y(I))*(WFRD*WFRD)*WFRD*DELT/(8.0*WATD*
     1(W(I)+Y(I)))
      BETA=DIFO+DIFA*EXP(DIFB*WATD)+ALAMBA*ABS(WFRD/WATD)-DISD
      IF (I .GT. 2) GO TO 680
      ALFA=0.0
      IF (WFRU .GT. 0.0) GO TO 182
      WFRU=0.0
      GO TO 182
  680 WATU =(Y(I)*TW+W(I)*TT+Y(I-1)*TW+W(I-1)*TT)/2.0
      DISU=DLXC*0.5*WFRU-(W(I)-Y(I))*(WFRD*WFRU)*WFRU*DELT/(8.0*WATU*
     1(W(I)+Y(I)))
      ALFA=DIFO+DIFA*EXP(DIFB*WATU)+ALAMBA*ABS(WFRU/WATU)-DISU
      IF (WFRU .GE. 0.0) GO TO 182
      UP=0.0
      GO TO 183
  182 UP=1.0
  183 DN=1.0-UP
      IF (WFRD .GE. 0.0) GO TO 185
      DPP=0.0
      GO TO 186
  185 DPP=1.0
  186 DNN=1.0-DPP
      SE(I)=(DLXC*Y(I)*SS(I)/DELT+ALFA*(SS(I-1)-SS(I))/DLXA-BETA*(SS(I)-
     1SS(I+1))/DLXB-WFRD*(SS(I)*DPP+SS(I+1)*DNN)+WFRU*(SS(I-1)*UP+SS(I)
     2*DN)+SOURCE*DLXC)*DELT/(W(I)*DLXC)
      SE(I)=SS(I)+(SE(I)-SS(I))*SOCON
  214 WFRU=WFRD
      SE(KK)=SS(KK)
      SD(1)=SE(1)*W(1)
      DO 217 I=2,KK
  217 SD(I)=SE(I)*W(I)
706   IF(EOR-0.0)136,136,135
  135 RUNOF=RUNOF+(EOR-WFDD)*DELT*10.
136   TIME=TIME+DELT
      IF (SUM3-0.0) 139,301,139
  301 DELT=2.0*DELT
      GO TO 145
139   TW=ABS(CUNQ*DELT/SUM3)
140   IF (TW-0.1*DETT) 141,142,142
  141 TW=0.1*DETT
      GO TO 144
  142 IF(TW-1000.0*DETT)144,144,143
 143  TW=1000.0*DETT
  144 IF(TW.GT.2.0*DELT) GO TO 301
      DELT=TW
C-*********************************************************************
C-----TEST TO SEE IF EVAP OR RAIN INTENSITY (EOR) HAS CHANGED
C-*********************************************************************
  145 IF (TIME-ETIME)148,147,148
  147 IF (IREP.GT.NREP) GO TO 1480
      IF(IDAY.NE.IDAIR(IREP))GO TO 1480
      WRITE(IMP,508) (STATE(I),I=1,20)
  508 FORMAT('1'20A4)
      WRITE(IMP,666)
      WRITE(IMP,168)(DD(I),W(I),H(I),A(I),SE(I),SD(I),SOILTE(I),I=1,K)
      WRITE(IMP,168)(DD(KK),W(KK),H(KK),A(KK),SE(KK),SD(KK))
      WRITE(IMP,184)
      WRITE(IMP,167)IDAY,TIME,ET,EOR,SUMA,RUNOF,HROOT,CWF,CUMS
 1480 DELT=DETT
      GO TO 162
  148 IF (TIME+DELT-ETIME) 16,16,149
  149 DELT=ETIME-TIME
      GO TO 16
  162 CONTINUE
      WATER(1)=H(1)/1017.
      WATABS( 1)=W(1)*(DD(2)/2.)*10.
      SALNTY(1)=SD(1)
      DO 1000 I=2,K
      WATER(I)=H(I)/1017.
      WATABS(I)=W(I)*((DD(I+1)-DD(I-1))/2.)*10.
      SALNTY(I   )=SD(I)
 1000 CONTINUE
      WATER(KK)=H(KK)/1017.
      WATABS(KK)=W(KK)*((DD(KK)-DD(K))/2.)*10.
      SALNTY(KK)=SD(KK)
      ETOUT=SUMA*10.
C-*********************************************************************
166   FORMAT (11E11.4)
  167 FORMAT (4X,I3,8(E12.4),//)
  666 FORMAT(1X,'PROFONDEUR EAU(FRACT.) POTENTIEL  EXT. RAC.  CONC. SEL
     1 QUANT. SEL TEMP. MIL. HOR.')
  168 FORMAT(1X,7E11.4)
170   FORMAT (119H   WATER     POTENTIAL   CONDUCTIVITY DIFFUSIVITY
     1C(1)      DEPTH         W-DEPTH       H-DEPTH        RDF-DEPTH   SE-DEPTH)
  172 FORMAT (53H   HORY          HWET          CB            SYSTD          )
180   FORMAT (66H  DELX          DETT          GRAVY         CONQ          DELW
     1        TIME)
181   FORMAT (66H    TT           CUMT          TAA           HLOW          HHI
     1        RRES)
  184 FORMAT (4X,'DAY',3X,'CUM. HOURS',2X,'ET         ',4X,'EOR         ',
     *'CUM.TRANS.   RUNOFF        HROOT         CWF           CUMS')
  274 FORMAT (11E12.4)
  284 FORMAT(60H     ALAMBA        SOURCE        DIFO          DIFA          DIFB
     1        SOCON)
      RETURN
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      ENTRY INOHWT
      READ(LEC,2222) (CHECK(I),I=1,20)
      WRITE(IMP,2223) (CHECK(I),I=1,20)
 2222 FORMAT(20A4)
 2223 FORMAT(1X,20A4)
C........ 1 BAR=0.987 ATMOSPHERE= 1017 CM OF WATER.
C........ PF= LOG(BASE 10) OF(- WATER POTENTIAL IN MILLIBARS)
      READ(LEC,502) MH,NB,ND
      READ(LEC,501) ALAMBA,CB,CONQ,CUMT,DETT,DELW,
     1              DELX,DIFA,DIFB,DIFO,SYSTD
      READ(LEC,501) HORY,HWET,HLOW,HHI,RRES,SOCON,
     1              SOURCE,TAA,TIME,TT
C........D(I) IS THE WATER CONDUCTIVITY.
      READ(LEC,503) (D(I),I=1,ND)
C........P(I) IS READ IN IN BARS.
      READ(LEC,503) (P(I),I=1,ND)
      K=NHOR -1
      KK=NHOR
      READ(LEC,501)(W     (I),I=1,KK)
      READ(LEC,501)(WATL  (I),I=1,KK)
      READ(LEC,501)(WATH  (I),I=1,KK)
      READ(LEC,501)(RDF   (I),I=1,KK)
      READ(LEC,501)(SE    (I),I=1,KK)
      READ(LEC,504) IWRITE
  501 FORMAT(6F10.0)
  502 FORMAT(12I5)
  503 FORMAT(6E10.0)
  504 FORMAT( L5)
C--------------------------------------------------------------------------
      DO 510 I=1,ND
  510 D(I)=D(I)*SYSTD
      GRAVY=DELX
      WFDD=-.009
      LL=MH
      DO 4 I=1,KK
    4 SE(I)=(SE(I)*10.)/(W(I)/WATH(I))
      P(1)=P(1)*1.0E+03
      T(1)=0.0
      DO 900 I=2,ND
      T(I)=DELW+T(I-1)
 900  P(I)=P(I)*1017.
      SMAX=350.
      CWFLX=0.0
      DELT=DETT
      TW=1.0-TT
      TBB=1.0-TAA
      DO 14 I=1,KK
      SS(I)=SE(I)
      SD(I)=SE(I)*W(I)
14    Y(I)=W(I)
      PIT=0.0
      DO 15 I=2,K
   15 PIT=W(I)*(DD(I+1)-DD(I-1))/2.+PIT
      IF (IWRITE) WRITE(IMP,170)
      TW=D(1)
C........BEYOND THIS POINT D(I) IS THE DIFFUSIVITY
      D(1)=(D(1)*(P(2)-P(1)))*CB
      J=(W(1)-T(1))/DELW+1.0
      H(1)=(P(J+1)-P(J))*(W(1)-T(J))/DELW+P(J)
      G(1)=H(1)
      C(1)=DELW/(P(J+1)-P(J))
      IF (IWRITE) WRITE(IMP,274)T(1),P(1),TW,D(1),C(1),DD(1),W(1),H(1),
     *  RDF(1),SE(1)
      DO 3 I=2,KK
      TW=D(I)
      D(I)=D(I)*(P(I)-P(I-1))*CB+D(I-1)
      J=(W(I)-T(1))/DELW+1.0
      H(I)=(P(J+1)-P(J))*(W(I)-T(J))/DELW+P(J)
      C(I)=DELW/(P(J+1)-P(J))
```

```
      G(I)=H(I)
      IF (IWRITE) WRITE(IMP,274)T(I),P(I),TW,D(I),C(I),DD(I),W(I),H(I),
     *  RUF(I),SE(I)
 3    CONTINUE
      N=KK+1
      DO 2 I=N,ND
      TW=D(I)
      D(I)=D(I)*(P(I)-P(I-1))*CB+D(I-1)
    2 IF (IWRITE)WRITE(IMP,274)T(I),P(I),TW,D(I)
C-*********************************************************************
      IF (.NOT.IWRITE) GO TO 11
      WRITE(IMP,180)
      WRITE(IMP,166)DELX,DETT,GRAVY,CONQ,DELW,TIMF
      WRITE(IMP,181)
      WRITE(IMP,166)TT,CUMI,TAA,HLOW,HHI,RRES
      WRITE(IMP,172)
      WRITE(IMP,166)HDRY,HWET,CB,SYSTD
      WRITE(IMP,505)(I,I=1,KK)
  505    FORMAT(1X,11(' WATL(',I2')  '))
      WRITE(IMP,506) (WATL(I),I=1,KK)
  506 FORMAT(1X,11E11.3)
      WRITE(IMP,507)(I,I=1,KK)
  507    FORMAT(1X,11(' WATH(',I2')  '))
      WRITE(IMP,506) (WATH(I),I=1,KK)
      WRITE(IMP,284)
      WRITE(IMP,274)ALAMBA,SOURCE,DIFO,DIFA,DIFB,SUCON
   11 KCK=1
      HROOT=G(2)
      RETURN
      END
```

APPENDIX 2

Input/Output Example

An example of each form of output is given: (1) parameters for the soil; (2) report for the initial day (November 11, 1971 -- day 1); (3) report for a day with rain (November 18, 1971 -- day 9); (4) report for a day without rain (December 1, 1971 -- day 22); (5) two examples of diagrams.

Input Example

```
                                  ......................
                                  .   G  A  B  E  S    .
                                  .   *************    .
                                  .       KM=52        .
                                  ......................
            (FRANCOIS RUMANE  - LOGAN, AVRIL 1974)
  CECI EST UN  ESSAI .POUR AJUSTER LES PARAMETRES.

  GARES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
     10    11 1971    15    12 1971                                  DATES DEP./ARR.    MN
      4     4     4                                                  NB/SP,LIT,HOR.     MN
      3     2     3     2                                            NB. ORG. /SP.      MN
      3     5     4                                                  RANTH./FONCT. ORG.MN
      3     4                                                        PLANT./FONCT. ORG.MN
      3     5     4                                                  LIGNE./FONCT. ORG.MN
      3     4                                                        ANNUE./FONCT. ORG.MN
      2     2     2     1                                            LIF(I)             MN
 RANTH.S.PLANT.A.A. LIGNEANNUELLE                                    NAMSP(I)           MN
 POUSSES TIGES   RACINES                                             NAHORG(1,*)        MN
 POUSSES RACINES                                                     NAMORG(2,*)        MN
 POUSSES TIGES   RACINES                                             NAMORG(3,*)        MN
 FEUILLESRACINES                                                     NAMORG(4,*)        MN
 P.A.S.  LITIERE RAC.MORTPUITS                                       NAMLIT(I)          MN
      31000.  1173000.    904337.                                    RANTH.     MS=G/HA MN
      23000.   122262.                                               PLANT.     MS=G/HA MN
      39000.    88000.     83681.                                    LIG. DIV.  MS=G/HA MN
      17000.    13940.                                               ANNUELLES  MS=G/HA MN
      27080.    84000.    112422.       0.                           CLIT (I)   MS=G/HA MN
    FNTREE INDMRP
     4                                                               SORTIES RESUL.INDMRP
    10    11 1971                                                    DATE         INDMRP
    18    11 1971                                                    DATE         INDMRP
     1    12 1971                                                    DATE         INDMRP
    15    12 1971                                                    DATE         INDMRP
    FNTREE INDMEX
    33    21                                                         NDR,NDTC     INDMEX
    18    11 1971       30.0                                         PLUIE        INDMEX
    29    11 1971        9.0                                         PLUIE        INDMEX
    13    12 1971        8.0                                         PLUIE        INDMEX
    24     1 1972        7.0                                         PLUIE        INDMEX
     2     2 1972        2.0                                         PLUIE        INDMEX
    29     2 1972        4.0                                         PLUIE        INDMEX
     2     3 1972        2.0                                         PLUIE        INDMEX
    16     3 1972        9.0                                         PLUIE        INDMEX
    21     3 1972        9.0                                         PLUIE        INDMEX
    29     3 1972        2.0                                         PLUIE        INDMEX
     4     4 1972        5.0                                         PLUIE        INDMEX
    11     4 1972       40.0                                         PLUIE        INDMEX
    19     4 1972       19.0                                         PLUIE        INDMEX
    21     4 1972        5.0                                         PLUIE        INDMEX
     8     5 1972       16.0                                         PLUIE        INDMEX
     8     7 1972        7.0                                         PLUIE        INDMEX
     5     9 1972        7.0                                         PLUIE        INDMEX
     5    10 1972       65.1                                         PLUIE/DATE AP.INDMEX
    15    10 1972        4.5                                         PLUIE/DATE AP.INDMEX
    25    10 1972        1.1                                         PLUIE/DATE AP.INDMEX
    25    11 1972        4.6                                         PLUIE/DATE AP.INDMEX
     5    12 1972       23.4                                         PLUIE/DATE AP.INDMEX
    25    12 1972       15.8                                         PLUIE/DATE AP.INDMEX
    15     1 1973        5.1                                         PLUIE/DATE AP.INDMEX
    25     1 1973        7.6                                         PLUIE/DATE AP.INDMEX
     5     2 1973        3.7                                         PLUIE/DATE AP.INDMEX
    15     2 1973        7.6                                         PLUIE/DATE AP.INDMEX
    25     2 1973        1.3                                         PLUIE/DATE AP.INDMEX
     5     3 1973        3.7                                         PLUIE/DATE AP.INDMEX
    15     3 1973        6.4                                         PLUIE/DATE AP.INDMEX
    25     3 1973       31.5                                         PLUIE/DATE AP.INDMEX
    15     4 1973        2.5                                         PLUIE/DATE AP.INDMEX
    25     4 1973        2.5                                         PLUIE/DATE AP.INDMEX
    10    11 1971       11.1                                         TEMPERATURE   INDMEX
    15    12 1971       10.2                                         TEMPERATURE   INDMEX
    15     1 1972        8.1                                         TEMPERATURE   INDMEX
    15     2 1972       11.9                                         TEMPERATURE   INDMEX
    15     3 1972       14.4                                         TEMPERATURE   INDMEX
    15     4 1972       15.6                                         TEMPERATURE   INDMEX
    15     5 1972       18.8                                         TEMPERATURE   INDMEX
    15     6 1972       24.6                                         TEMPERATURE   INDMEX
    15     7 1972       26.3                                         TEMPERATURE   INDMEX
    15     8 1972       26.1                                         TEMPERATURE   INDMEX
    15     9 1972       24.6                                         TEMPERATURE   INDMEX
    15    10 1972       20.1                                         TEMPERATURE   INDMEX
    15    11 1972       13.1                                         TEMPERATURE   INDMEX
```

```
15   12 1972        10.0                                                      TEMPERATURE    INDMEX
15    1 1973         8.7                                                      TEMPERATURE    INDMEX
15    2 1973         9.1                                                      TEMPERATURE    INDMEX
15    3 1973        10.5                                                      TEMPERATURE    INDMEX
15    4 1973        14.0                                                      TEMPERATURF    INDMEX
15    5 1973        20.7                                                      TEMPERATURE    INDMEX
15    6 1973        24.6                                                      TEMPERATURE    INDMEX
15    7 1973        28.8                                                      TEMPERATURE    INDMEX
FNTREE INDMPN
 3    3    3    5                                                             PHENOL./SP.    INDMPN
15   15    0    0                                                             NDGERM,...SP1  INDMPN
15   15    0    0                                                             NDGERM,...SP2  INDMPN
15   15    0    0                                                             NDGERM,...SP3  INDMPN
10   10    0    0                                                             NDGERM,...SP4  INDMPN
 3    3    3    2                                                             LCOUCH(*)      INDMPN
      0.0        1.0        0.1        0.0        0.15       0.08                       SP1  INDMPN
      7.0      -11.0       13.2       18.0        0.17       5.0                        SP1  INDMPN
    -11.0       0.05        4.0      -12.0       11.0       13.0                        SP1  INDMPN
      0.0        1.0        0.1        0.0        0.15       0.08                       SP2  INDMPN
      7.0      -11.0       13.2       18.0        0.17       5.0                        SP2  INDMPN
    -11.0       0.05        4.0      -12.0       11.0       13.0                        SP2  INDMPN
      0.0        1.0        0.1        0.0        0.15       0.08                       SP3  INDMPN
      7.0      -11.0       13.2       18.0        0.17       5.0                        SP3  INDMPN
    -11.0       0.05        4.0      -12.0       11.0       13.0                        SP3  INDMPN
      0.0        1.0        0.1        0.0        0.15       0.08                       SP4  INDMPN
      7.0      -11.0       13.2       18.0        0.17       5.0                        SP4  INDMPN
    -11.0       0.05        4.0      -12.0       11.0       13.0                        SP4  INDMPN
ENTREE INDMFO
      75.       125.       0.65        35.        10.        0.05 SP1                      INDMFO
     -30.        -5.                                                SP1                      INDMFO
      75.       125.       0.65        35.        10.        0.05 SP2                      INDMFO
     -30.        -5.                                                SP2                      INDMFO
      75.       125.       0.65        35.        10.        0.05 SP3                      INDMFO
     -30.        -5.                                                SP3                      INDMFO
      75.       125.       0.65        35.        10.        0.05 SP4                      INDMFO
     -30.        -5.                                                SP4                      INDMFO
 3    3    3    2                                                   LAYCH (*)                INDMFO
FNTREE INDMTR
      1.0        0.0        0.0                                                  RTPH/SP 1      INDMTR
      1.0        0.0                                                             RTPH/SP 2      INDMTR
      1.0        0.0        0.0                                                  RTPH/SP 3      INDMTR
      1.0        0.0                                                             RTPH/SP 4      INDMTR
     1.00       0.00       0.00                                                  RTGR-SP1/POU.  INDMTR
     0.02       0.94       0.02                                                  RTGR-SP1/TIGE  INDMTR
     0.01       0.01       0.98                                                  RTGR-SP1/RAC.  INDMTR
     0.95       0.05                                                             RTGR-SP2/POU.  INDMTR
     0.01       0.99                                                             RTGR-SP2/RAC.  INDMTR
     1.00       0.00       0.00                                                  RTGR-SP3/POU.  INDMTR
     0.02       0.94       0.02                                                  RTGR-SP3/TIGE  INDMTR
     0.01       0.01       0.98                                                  RTGR-SP3/RAC.  INDMTR
     1.00       0.00                                                             RTGR-SP4/FEUI  INDMTR
     0.00       1.00                                                             RTGR-SP4/RAC.  INDMTR
     1.00       0.00       0.00                                                  RTLO-SP1/POU.  INDMTR
     0.02       0.94       0.02                                                  RTLO-SP1/TIGE  INDMTR
     0.01       0.01       0.98                                                  RTLO-SP1/RAC.  INDMTR
     1.00       0.00                                                             RTLO-SP2/POU.  INDMTR
     0.01       0.99                                                             RTLO-SP2/RAC.  INDMTR
     1.00       0.00       0.00                                                  RTLO-SP3/POU.  INDMTR
     0.02       0.94       0.02                                                  RTLO-SP3/TIGE  INDMTR
     0.01       0.01       0.98                                                  RTLO-SP3/RAC.  INDMTR
     1.00       0.00                                                             RTLO-SP4/FEUI  INDMTR
     0.00       1.00                                                             RTLO-SP4/RAC.  INDMTR
     0.98       0.01       0.01                                                  RTVG-SP1/POU.  INDMTR
     0.00       1.00       0.00                                                  RTVG-SP1/TIGE  INDMTR
     0.00       0.00       1.00                                                  RTVG-SP1/RAC.  INDMTR
     0.99       0.01                                                             RTVG-SP2/POU.  INDMTR
     0.00       1.00                                                             RTVG-SP2/RAC.  INDMTR
     0.98       0.01       0.01                                                  RTVG-SP3/POU.  INDMTR
     0.00       1.00       0.00                                                  RTVG-SP3/TIGE  INDMTR
     0.00       0.00       1.00                                                  RTVG-SP3/RAC.  INDMTR
     0.99       0.01                                                             RTVG-SP4/FEU.  INDMTR
     0.00       1.00                                                             RTVG-SP4/TIGE  INDMTR
     0.90       0.05       0.05                                                  RTFR-SP1/POU.  INDMTR
     0.00       1.00       0.00                                                  RTFR-SP1/TIGE  INDMTR
     0.00       0.00       1.00                                                  RTFR-SP1/RAC.  INDMTR
     0.95       0.05                                                             RTFR-SP2/POU.  INDMTR
     0.00       1.00                                                             RTFR-SP2/RAC.  INDMTR
     0.90       0.05       0.05                                                  RTFR-SP3/POU.  INDMTR
     0.00       1.00       0.00                                                  RTFR-SP3/TIGE  INDMTR
     0.00       0.00       1.00                                                  RTFR-SP3/RAC.  INDMTR
     0.99       0.01                                                             RTFR-SP4/FEU.  INDMTR
     0.00       1.00                                                             RTFR-SP4/RAC.  INDMTR
FNTREE INDMDT
      0.0        0.0        0.0       15.0                                       WTIME(I)       INDMDT
 2    1    3                                                                     LREP/SP1       INDMDT
 2    3                                                                          LREP/SP2       INDMDT
 2    1    3                                                                     LREP/SP3       INDMDT
 2    3                                                                          LREP/SP4       INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3/(1,1)  INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3/(1,2)  INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3/(1,3)  INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3/(2,1)  INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3 (2,2)  INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3 (3,1)  INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3 (3,2)  INDMDT
      0.0     0.0111      0.001                                                  PDDT1-3 (3,3)  INDMDT
      0.0     0.0111       0.01                                                  PDDT1-3 (4,1)  INDMDT
      0.0     0.0111       0.01                                                  PDDT1-3 (4,2)  INDMDT
    0.000      0.000      0.000                                                  PDT(1,1,*) GR  INDMDT
    0.000      0.000                                                             PDT(1,2,*) GR  INDMDT
    0.000      0.000      0.000                                                  PDT(1,3,*) GR  INDMDT
```

```
    0.000       0.000                                                            PDT(1,4,*) GR INDMDT
    0.000       0.000       0.000                                                PDT(2,1,*) LN INDMDT
    0.000       0.000                                                            PDT(2,2,*) LN INDMDT
    0.000       0.000       0.000                                                PDT(2,3,*) LN INDMDT
    0.000       0.000                                                            PDT(2,4,*) LN INDMDT
   0.0001      0.0001      0.0001                                                PDT(3,1,*) VG INDMDT
   0.0001      0.0001                                                            PDT(3,2,*) VG INDMDT
   0.0001      0.0001      0.0001                                                PDT(3,3,*) VG INDMDT
   0.0001      0.0001                                                            PDT(3,4,*) VG INDMDT
    0.001       0.002       0.001                                                PDT(4,1,*) FR INDMDT
    0.001       0.001                                                            PDT(4,2,*) FR INDMDT
    0.001       0.002       0.001                                                PDT(4,3,*) FR INDMDT
    0.002       0.002                                                            PDT(4,4,*) FR INDMDT
  ENTREE INDMDM
    0.999       0.001       0.000       0.000                                    RTLI(1,1,*)PASINDMDM
    0.000       0.995       0.000       0.005                                    RTLI(1,2,*)LITINDMDM
   0.0000      0.0000       0.999       0.001                                    RTLI(1,3,*)RM INDMDM
      0.0         0.0         0.0         1.0                                    RTLI(1,4,*)PUIINDMDM
    0.999       0.001       0.000       0.000                                    RTLI(2,1,*)PASINDMDM
   0.0000      0.9999      0.0000      0.0001                                    RTLI(2,2,*)LITINDMDM
   0.0000      0.0000      0.9999      0.0001                                    RTLI(2,3,*)RM INDMDM
      0.0         0.0         0.0         1.0                                    RTLI(2,4,*)PUIINDMDM
    0.999       0.001       0.000       0.000                                    RTLI(3,1,*)PASINDMDM
   0.0000      0.9999      0.0000      0.0001                                    RTLI(3,2,*)LITINDMDM
   0.0000      0.0000      0.9999      0.0001                                    RTLI(3,3,*)RM INDMDM
      0.0         0.0         0.0         1.0                                    RTLI(3,4,*)PUIINDMDM
    0.999       0.001       0.000       0.000                                    RTLI(4,1,*)PASINDMDM
    0.000       0.995       0.000       0.005                                    RTLI(4,2,*)LITINDMDM
   0.0000      0.0000       0.999       0.001                                    RTLI(4,3,*)RM INDMDM
      0.0         0.0         0.0         1.0                                    RTLI(4,4,*)PUIINDMDM
  ENTREE INDMDL
   42.000                                                                        RLAT (DEGRE)  INDMDL
  ENTREE INDMED
       5.                                                                        FORCE         INDMED
     0.05        40.0       100.0       120.0                                    DEPTH(*)      INDMED
  ENTREE INDMEV
    4                                                                            NT            INDMEV
      0.0         4.5        10.0                                                TARTUF(I)     INDMEV
      0.0        0.05         0.1         0.5                                    FACTOR(I)     INDMEV
  ENTREE INDMDG
      12.         10.          9.          8.                                    BEGTEM(*)     INDMDG
      0.3         0.3         0.3         0.3                                    CV    (*)     INDMDG
      3.6         3.6         3.6         3.6                                    CONDUC(*)     INDMDG
      24.                                                                        DTIME         INDMDG
  ENTREE INDMWT
  99     2    54                                                                 MM,NB,ND      INDMWT
      1.0         1.0        0.05        24.0      0.0024      0.01ALAMBA....    INDMWT
      7.6       0.001         1.0        0.01         0.1          DELX....      INDMWT
  -30000.         0.0     -16000.         0.0        1.05       0.1HDRY....      INDMWT
      0.0         1.0         0.0         1.0                      SOURCE....    INDMWT
 .800E-08   .100E-07   .150E-07   .200E-07   .280E-07   .380E-07D( 1) A D( 6) INDMWT
 .520E-07   .700E-07   .960E-07   .130E-06   .170E-06   .230E-06D( 7) A D(12) INDMWT
 .320E-06   .440E-06   .600E-06   .810E-06   .110E-05   .150E-05D(13) A D(18) INDMWT
 .210E-05   .290E-05   .380E-05   .540E-05   .720E-05   .990E-05D(19) A D(24) INDMWT
 .140E-04   .190E-04   .250E-04   .350E-04   .480E-04   .650E-04D(25) A D(30) INDMWT
 .900E-04   .120E-03   .170E-03   .230E-03   .320E-03   .440E-03D(31) A D(36) INDMWT
 .580E-03   .700E-03   .860E-03   .100E-02   .120E-02   .150E-02D(37) A D(42) INDMWT
 .180E-02   .220E-02   .260E-02   .320E-02   .380E-02   .460E-02D(43) A D(48) INDMWT
 .560E-02   .660E-02   .800E-02   .980E-02   .120E-01   .120E-01D(49) A D(54) INDMWT
-.820E+03  -.500E+03  -.200E+03  -.100E+03  -.800E+02  -.400E+02P( 1) A P( 6) INDMWT
-.250E+02  -.160E+02  -.100E+02  -.900E+01  -.750E+01  -.650E+01P( 7) A P(12) INDMWT
-.550E+01  -.450E+01  -.350E+01  -.280E+01  -.220E+01  -.180E+01P(13) A P(18) INDMWT
-.140E+01  -.100E+01  -.800E+00  -.775E+00  -.750E+00  -.725E+00P(19) A P(24) INDMWT
-.700E+00  -.675E+00  -.650E+00  -.625E+00  -.600E+00  -.575E+00P(25) A P(30) INDMWT
-.550E+00  -.525E+00  -.500E+00  -.475E+00  -.450E+00  -.425E+00P(31) A P(36) INDMWT
-.400E+00  -.375E+00  -.350E+00  -.325E+00  -.300E+00  -.275E+00P(37) A P(42) INDMWT
-.250E+00  -.225E+00  -.200E+00  -.175E+00  -.150E+00  -.125E+00P(43) A P(48) INDMWT
-.100E+00  -.750E-01  -.500E-01  -.250E-01  -.000E+00  +.100E+07P(49) A P(54) INDMWT
    0.065       0.065       0.063       0.063                      W             INDMWT
    0.030       0.030       0.050       0.050                      WATL(ESTIME)  INDMWT
    0.520       0.520       0.520       0.520                      WATH(ESTIME)  INDMWT
      0.0         0.5         0.5         0.0                      RUF (ESTIME)  INDMWT
     0.00        0.65        0.50        0.50                      SE(M=MMHO/CM) INDMWT
TRUE                                                               IWRITE        INDMWT
   ENTREE INFILL
   ENTREE PREPAR
    1                                                              KSUP          PREPAR
    2     1     2 M.S. TIGES    (G/HA)     RANTHERIUM                            PREPAR
    2     1     3 M.S. RACINES  (G/HA)     RANTHERIUM                            PREPAR
    1     1       M.S. TOTALE   (G/HA)     RANTHERIUM                            PREPAR
                                                                                 PREPAR
    2     2     3 M.S. RACINES  (G/HA)     PLANTAGO                              PREPAR
    1     2       M.S. TOTALE   (G/HA)     PLANTAGO                              PREPAR
    2     3     2 M.S. TIGES    (G/HA)     AUTRES LIGNEUX                        PREPAR
    2     3     3 M.S. RACINES  (G/HA)     AUTRES LIGNEUX                        PREPAR
    1     3       M.S. TOTALE   (G/HA)     AUTRES LIGNEUX                        PREPAR
                                                                                 PREPAR
    2     1     1 M.S. POUSSES  (G/HA)     RANTHERIUM                            PREPAR
    2     2     1 M.S. POUSSES  (G/HA)     PLANTAGO                              PREPAR
    2     3     1 M.S. POUSSES  (G/HA)     AUTRES LIGNEUX                        PREPAR
    2     4     1 M.S. FEUILLES(G/HA)      ANNUELLES                             PREPAR
    2     4     2 M.S. RACINES  (G/HA)     ANNUELLES                             PREPAR
    1     4       M.S. TOTALE   (G/HA)     ANNUELLES                             PREPAR
                                                                                 PREPAR
    3     1       M.S.  (G/HA) PARTIE AERIENNE SECHE                             PREPAR
    3     2       M.S.  (G/HA) LITIERE                                           PREPAR
    3     3       M.S.  (G/HA) RACINES MORTES                                    PREPAR
                                                                                 PREPAR
    5     2      TEMPERATURE DE L'HORIZON 2 DU SOL/.05-40. CM                    PREPAR
    5     3      TEMPERATURE DE L'HORIZON 3 DU SOL/40-100 CM                     PREPAR
```

```
        7         TEMPERATURE (AIR)                                     PREPAR
        6        PLUIE (MM)                                             PREPAR
                                                                        PREPAR
        4    2    POTENTIEL EAU(BAR)-HOR.2(0.05 A 40.0 CM)              PREPAR
        4    3    POTENTIEL EAU(BAR)-HOR.3(4). A 100. CM)               PREPAR
                                                                        PREPAR
        9    2   EAU TOTALE (MM) DANS L'HORIZON 2/.05-40. CM            PREPAR
        9    3   EAU TOTALE (MM) DANS L'HORIZON 3/40-100 CM             PREPAR
                                                                        PREPAR
        8    1   PHENOLOGIE DE L'ESPECE 1(RANTHERIUM SUAV.)             PREPAR
        8    2   PHENOLOGIE DE L'ESPECE 2(PLANTAGO ALB.)                PREPAR
        8    3   PHENOLOGIE DE L'ESPECE 3(AUTRES LIGNEUX)               PREPAR
        8    4   PHENOLOGIE DE L'ESPECE 4 (ANNUELLES)                   PREPAR
                                                                        PREPAR
      100                                                   FIN         PREPAR
   LAST CARD
```

Output Example

```
                          ........................
                          .   G  A  B  E  S      .
                          .   *************      .
                          .       KM-52          .
                          ........................
         (FRANCOIS ROMANE  - LOGAN, AVRIL 1974)
CECI EST UN  ESSAI ,POUR AJUSTER LES PARAMETRES.

  ENTREE INDMRP
  ENTREE INDMEX
  ENTREE INDMPN
  ENTREE INDMFO
  ENTREE INDMTR
  ENTREE INDMDT
  ENTREE INDMDM
  ENTREE INDMDL
  ENTREE INDMED
  ENTREE INDMEV
  ENTREE INDMDG
  ENTREE INDMWT
WATER       POTENTIAL   CONDUCTIVITY DIFFUSIVITY      C(I)      DEPTH         W-DEPTH      H-DEPTH      RDF-DEPTH    SE-DEPTH
0.          -.8200E+06   .8000E-09   .2492E-03    .1093E-05  0.            .6500E-01   -.2085E+05   0.           0.
.1000E-01   -.5085E+06   .1000E-08   .5607E-03    .1093E-05   .1000E+00    .6500E-01   -.2085E+05    .5000E+00    .5200E+02
.2000E-01   -.2034E+06   .1500E-08   .1018E-02    .1093E-05   .7990E+02    .6300E-01   -.2268E+05    .5000E+00    .4127E+02
.3000E-01   -.1017E+06   .2000E-08   .1222E-02    .1093E-05   .1200E+03    .6300E-01   -.2268E+05   0.            .4127E+02
.4000E-01   -.8136E+05   .2800E-08   .1279E-02
.5000E-01   -.4068E+05   .3800E-08   .1433E-02
.6000E-01   -.2543E+05   .5200E-08   .1513E-02
.7000E-01   -.1627E+05   .7000E-08   .1577E-02
.8000E-01   -.1017E+05   .9600E-08   .1635E-02
.9000E-01   -.9153E+04   .1300E-07   .1648E-02
.1000E+00   -.7628E+04   .1700E-07   .1674E-02
.1100E+00   -.6611E+04   .2300E-07   .1698E-02
.1200E+00   -.5594E+04   .3200E-07   .1730E-02
.1300E+00   -.4577E+04   .4400E-07   .1775E-02
.1400E+00   -.3560E+04   .6000E-07   .1836E-02
.1500E+00   -.2848E+04   .8100E-07   .1894E-02
.1600E+00   -.2237E+04   .1100E-06   .1961E-02
.1700E+00   -.1831E+04   .1500E-06   .2022E-02
.1800E+00   -.1424E+04   .2100E-06   .2107E-02
.1900E+00   -.1017E+04   .2900E-06   .2225E-02
.2000E+00   -.8136E+03   .3800E-06   .2303E-02
.2100E+00   -.7882E+03   .5400E-06   .2316E-02
.2200E+00   -.7628E+03   .7200E-06   .2335E-02
.2300E+00   -.7373E+03   .9900E-06   .2360E-02
.2400E+00   -.7119E+03   .1400E-05   .2395E-02
.2500E+00   -.6865E+03   .1900E-05   .2444E-02
.2600E+00   -.6611E+03   .2500E-05   .2507E-02
.2700E+00   -.6356E+03   .3500E-05   .2596E-02
.2800E+00   -.6102E+03   .4800E-05   .2718E-02
.2900E+00   -.5848E+03   .6500E-05   .2884E-02
.3000E+00   -.5594E+03   .9000E-05   .3112E-02
.3100E+00   -.5339E+03   .1200E-04   .3418E-02
.3200E+00   -.5085E+03   .1700E-04   .3850E-02
.3300E+00   -.4831E+03   .2300E-04   .4435E-02
.3400E+00   -.4577E+03   .3200E-04   .5248E-02
.3500E+00   -.4322E+03   .4400E-04   .6367E-02
.3600E+00   -.4068E+03   .5800E-04   .7841E-02
.3700E+00   -.3814E+03   .7000E-04   .9621E-02
.3800E+00   -.3560E+03   .8600E-04   .1181E-01
.3900E+00   -.3305E+03   .1000E-03   .1435E-01
.4000E+00   -.3051E+03   .1200E-03   .1740E-01
.4100E+00   -.2797E+03   .1500E-03   .2122E-01
.4200E+00   -.2543E+03   .1800E-03   .2579E-01
.4300E+00   -.2288E+03   .2200E-03   .3139E-01
.4400E+00   -.2034E+03   .2600E-03   .3800E-01
.4500E+00   -.1780E+03   .3200E-03   .4613E-01
.4600E+00   -.1526E+03   .3800E-03   .5579E-01
.4700E+00   -.1271E+03   .4600E-03   .6749E-01
.4800E+00   -.1017E+03   .5600E-03   .8173E-01
.4900E+00   -.7628E+02   .6600E-03   .9851E-01
.5000E+00   -.5085E+02   .8000E-03   .1188E+00
.5100E+00   -.2543E+02   .9800E-03   .1438E+00
.5200E+00   0.           .1200E-02   .1743E+00
.5300E+00    .1017E+10   .1200E-02   .1220E+07
DELX        DETT        GRAVY        CONQ         DELW        TIME
.7600E+01   .2400E-02   .7600E+01    .5000E-01   .1000E-01 0.
 TT          CUMT        TAA          HLOW         HHI         HRES
```

```
 .1000E+01  .2400E+02  .1000E+01 -.1600E+05 0.           .1050E+01
  HDRY        HWET         CB          SYSTD
 -.3000E+05 0.           .1000E+01  .1000E+00
  WATL( 1)    WATL( 2)    WATL( 3)    WATL( 4)    WATL(
   .300E-01    .300E-01    .500E-01    .500E-01
  WATH( 1)    WATH( 2)    WATH( 3)    WATH( 4)    WATH(
   .520E+00    .520E+00    .520E+00    .520E+00
   ALAMBA      SOURCE       DIFO        DIFA        DIFB        SUCUN
  .1000E+01  0.            .1000E-01   .1000E-02   .1000E+01   .1000E+00
   ENTREE INFILL


 GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) PUTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.           .5700E-01 -.3000E+05 0.         0.         0.          .1110E+02
  .1000E+00  .6475E-01 -.2108E+05 0.          .5202E+02  .3368E+01  .1108E+02
  .7990E+02  .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9118E+01
  .1200E+03  .6304E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET          EOR         CUM.TRANS.  RUNOFF      HROOT       CWF         CUMS
   1    .2400E+02 -.6118E-02 -.4894E-02 0.          0.          -.1600E+05 -.9906E-02 -.9906E-02


 GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS

JOUR= 10 MOIS= 11 ANNEE 1971 JOURS SIMULES=    0

PLUIE(MM) TEMP.(AIR)  DAPHOT   DAYRAD   DALITE    TRAIN
 0.        .111E+02  .991E+01  .275E+03  .222E-02 0.

            M.S./ORG.       M.S./SP.         PHENOLOGIE  LIGHTF      TEMPF      PHSF       PSRATE     PHSATE
 RANTH.S.                   2108337.             3          0.         0.         0.         0.         0.
   POUSSES      31000.
   TIGES      1173000.
   RACINES     904337.
 PLANT.A.                    145262.             3          0.         0.         0.         0.         0.
   POUSSES      23000.
   RACINES     122262.
 A. LIGNE                    210681.             3          0.         0.         0.         0.         0.
   POUSSES      39000.
   TIGES        88000.
   RACINES      83681.
 ANNUELLE                     30940.             5          0.         0.         0.         0.         0.
   FEUILLES     17000.
   RACINES      13940.


 MATERIEL MORT
 P.A.S.                       27080.
 LITIERE                      84000.
 RAC.MORT                    112422.
 PUITS                            0.


ETAT HYDRIQUE DU SOL
 HORIZON  POTENTIEL(BARS)  EAU TOTALE     PF
    1         -29.50          0.03       4.47
    2         -20.72         25.87       4.32
    3         -22.30         37.77       4.35
    4         -22.26         12.64       4.35
ET=-.6118E-02  EVAP=-.4894E-02CM/HEURE


 GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) PUTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.           .5200E+00 0.         0.         0.         0.          .1110E+02
  .1000E+00  .7506E-01 -.1319E+05 0.          .5128E+02  .3849E+01  .1110E+02
  .7990E+02  .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9858E+01
  .1200E+03  .6304E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET          EOR         CUM.TRANS.  RUNOFF      HROOT       CWF         CUMS
   9    .1000E+01  0.          .5000E+00  0.          .2606E+00 -.1600E+05  .4018E+00  .4739E+00


 GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) PUTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.           .1798E+00 -.1432E+04 0.         0.         0.          .1110E+02
  .1000E+00  .8596E-01 -.9564E+04 0.          .5060E+02  .4349E+01  .1110E+02
  .7990E+02  .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9858E+01
  .1200E+03  .6304E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET          EOR         CUM.TRANS.  RUNOFF      HROOT       CWF         CUMS
   9    .1000E+01  0.          .5000E+00  0.          .6433E+00 -.1600E+05  .8375E+00  .4357E+00


 GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) PUTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.           .5200E+00 0.         0.         0.         0.          .1110E+02
  .1000E+00  .9730E-01 -.8040E+04 0.          .4998E+02  .4863E+01  .1110E+02
  .7990E+02  .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9858E+01
  .1200E+03  .6304E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET          EOR         CUM.TRANS.  RUNOFF      HROOT       CWF         CUMS
   9    .1000E+01  0.          .5000E+00  0.          .4728E+00 -.1600E+05  .1290E+01  .4527E+00
```

```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) POTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.          .4155E+00 -.2656E+03 0.          0.          0.          .1110E+02
 .1000E+00   .1087E+00 -.6744E+04 0.          .4944E+02  .5374E+01  .1110E+02
 .7990E+02   .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9858E+01
 .1200E+03   .6304E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET            EUR        CUM.TRANS.  RUNOFF      HROOT        CWF          CUMS
   9   .1000E+01  0.             .5000E+00  0.          .4499E+00  -.1600E+05   .1745E+01    .4550E+00
```

```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) POTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.          .4852E+00 -.8840E+02 0.          0.          0.          .1110E+02
 .1000E+00   .1211E+00 -.5484E+04 0.          .4892E+02  .5923E+01  .1110E+02
 .7990E+02   .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9858E+01
 .1200E+03   .6304E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET            EUR        CUM.TRANS.  RUNOFF      HROOT        CWF          CUMS
   9   .1000E+01  0.             .5000E+00  0.          .4925E-01  -.1600E+05   .2240E+01    .4951E+00
```

```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) POTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.          .5200E+00 0.         0.          0.          0.          .1110E+02
 .1000E+00   .1323E+00 -.4345E+04 0.          .4849E+02  .6414E+01  .1110E+02
 .7990E+02   .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9858E+01
 .1200E+03   .6304E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET            EUR        CUM.TRANS.  RUNOFF      HROOT        CWF          CUMS
   9   .1000E+01  0.             .5000E+00  0.          .5260E+00  -.1600E+05   .2688E+01    .4474E+00
```

```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) POTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.          .5700E-01 -.3000E+05 0.          0.          0.          .1110E+02
 .1000E+00   .1311E+00 -.4469E+04 -.1681E-05  .4854E+02  .6361E+01  .1110E+02
 .7990E+02   .6300E-01 -.2268E+05 0.          .4127E+02  .2600E+01  .9858E+01
 .1200E+03   .6305E-01 -.2264E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET            EUR        CUM.TRANS.  RUNOFF      HROOT        CWF          CUMS
   9   .1800E+02  -.5973E-02   -.4778E-02  -.1230E-02  0.          -.1600E+05   .2639E+01   -.4723E-01
```

```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS

JOUR= 18 MOIS= 11 ANNEE 1971 JOURS SIMULES=    8

PLUIE(MM) TEMP.(AIR)  DAPHOT    DAYRAD    DALITE    TRAIN
 .300E+02  .111E+02  .968E+01  .275E+03  .217E-02  .600E+01

         M.S./ORG.      M.S./SP.         PHENOLOGIE  LIGHTF     TEMPF     PHSF      PSRATE    PHSATE
RANTH.S.               2109435.              3      .786E+00  .956E+00  .308E+00  .116E-01  .338E+03
  POUSSES     28946.
  TIGES     1174468.
  RACINES    906020.
PLANT.A.                147285.              3      .786E+00  .956E+00  .308E+00  .116E-01  .269E+03
  POUSSES     23272.
  RACINES    124013.
A. LIGNE                214015.              3      .786E+00  .956E+00  .308E+00  .116E-01  .425E+03
  POUSSES     36416.
  TIGES       90957.
  RACINES     86641.
ANNUELLE                 27754.              5      .786E+00  .956E+00  .100E+01  .376E-01 0.
  FEUILLES    15249.
  RACINES     12504.


MATERIEL MORT
P.A.S.                   30629.
LITIERE                  78286.
RAC.MORT                118828.
PUITS                    19036.

ETAT HYDRIQUE DU SOL
 HORIZON  POTENTIEL(BARS)  EAU TOTALE    PF
    1          -29.50         0.03      4.47
    2           -4.39        52.36      3.64
    3          -22.30        37.77      4.35
    4          -22.26        12.64      4.35
ET=-.5973E-02  EVAP=-.4778E-02CM/HEURE
```

```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) POTENTIEL  EXT. RAC.  CONC. SEL  QUANT. SEL TEMP. MIL. HOR.
 0.          .5700E-01 -.3000E+05 0.          0.          0.          .1110E+02
 .1000E+00   .1333E+00 -.4246E+04 -.1794E-05  .4846E+02  .6458E+01  .1110E+02
 .7990E+02   .6302E-01 -.2266E+05 0.          .4127E+02  .2601E+01  .1052E+02
 .1200E+03   .6306E-01 -.2262E+05 0.          .4127E+02  .2602E+01
  DAY   CUM. HOURS  ET            EUR        CUM.TRANS.  RUNOFF      HROOT        CWF          CUMS
  22   .2400E+02  -.5801E-02   -.4641E-02  -.1757E-02  0.          -.1600E+05   .2728E+01   -.6491E-01
```

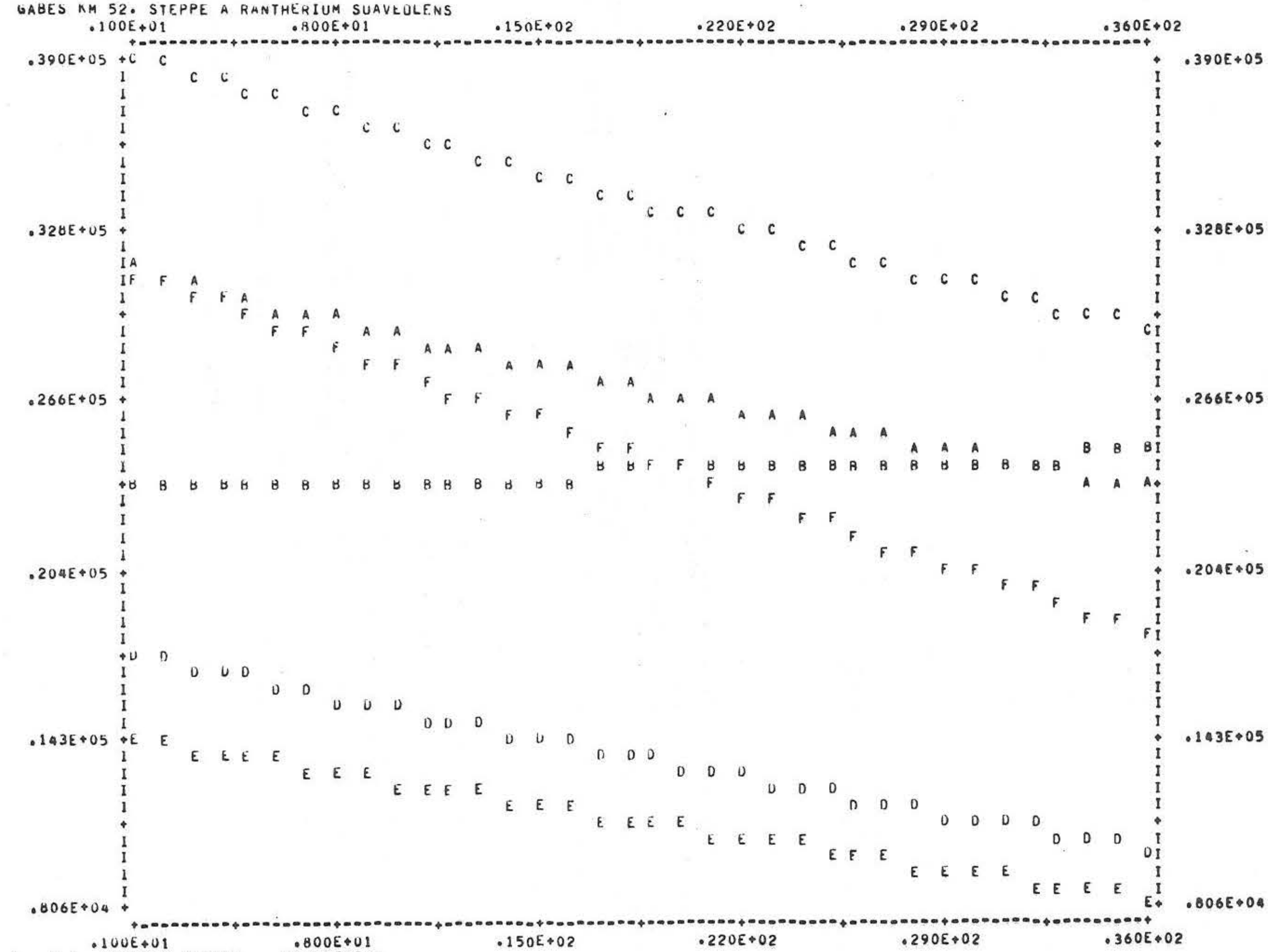
```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS

JOUR=  1 MOIS= 12 ANNEE 1971 JOURS SIMULES=   21

PLUIE(MM) TEMP.(AIR)  DAPHOT   DAYRAD    DALITE    TRAIN
 0.         .111E+02  .940E+01  .275E+03  .211E-02 0.

          M.S./ORG.       M.S./SP.           PHENOLOGIE  LIGHTF     TEMPF     PHSF      PSRATE    PHSATE
 RANTH.S.                 2110833.               3      .786E+00  .956E+00  .309E+00  .116E-01  .303E+03
   POUSSES      25899.
   TIGES      1176517.
   RACINES     908417.
 PLANT.A.                  150626.               3      .786E+00  .956E+00  .309E+00  .116E-01  .275E+03
   POUSSES      23723.
   RACINES     126902.
 A. LIGNE                  218944.               3      .786E+00  .956E+00  .309E+00  .116E-01  .381E+03
   POUSSES      32583.
   TIGES        95335.
   RACINES      91026.
 ANNUELLE                   22805.               5      .786E+00  .956E+00  .100E+01  .376E-01 0.
   FEUILLES     12530.
   RACINES      10275.


 MATERIEL MORT
 P.A.S.                     49172.
 LITIERE                    52787.
 RAC.MORT                  151584.
 PUITS                     117818.

ETAT HYDRIQUE DU SOL
 HORIZON  POTENTIEL(BARS)  EAU TOTALE     PF
    1          -29.50         0.03       4.47
    2           -4.17        53.24       3.62
    3          -22.29        37.78       4.35
    4          -22.25        12.64       4.35
ET=-.5801E-02  EVAP=-.4641E-02CM/HEURE
```

```
 GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS
PROFONDEUR EAU(FRACT.) POTENTIEL  EXT. RAC.   CONC. SEL   QUANT. SEL TEMP. MIL. HOR.
 0.          .5700E-01 -.3000E+05 0.          0.          0.          .1020E+02
  .1000E+00  .1319E+00 -.4388E+04 -.1725E-05  .4852E+02  .6398E+01  .1021E+02
  .7990E+02  .6303E-01 -.2265E+05 0.          .4127E+02  .2601E+01  .1079E+02
  .1200E+03  .6308E-01 -.2261E+05 0.          .4127E+02  .2603E+01
   DAY   CUM. HOURS  ET          EOR         CUM.TRANS.  RUNOFF        HROUT        CWF          CUMS
   36   .2400E+02  -.5534E-02  -.4427E-02  -.1689E-02  0.           -.1600E+05   .2673E+01  -.6323E-01
```

```
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS

JOUR= 15 MOIS= 12 ANNEE 1971 JOURS SIMULES=   35

PLUIE(MM) TEMP.(AIR)  DAPHOT   DAYRAD    DALITE    TRAIN
 0.         .102E+02  .925E+01  .275E+03  .208E-02 0.

          M.S./ORG.       M.S./SP.           PHENOLOGIE  LIGHTF     TEMPF     PHSF      PSRATE    PHSATE
 RANTH.S.                 2111869.               3      .786E+00  .992E+00  .309E+00  .120E-01  .279E+03
   POUSSES      22992.
   TIGES      1178300.
   RACINES     910576.
 PLANT.A.                  154314.               3      .786E+00  .992E+00  .309E+00  .120E-01  .291E+03
   POUSSES      24238.
   RACINES     130076.
 A. LIGNE                  223656.               3      .786E+00  .992E+00  .309E+00  .120E-01  .351E+03
   POUSSES      28926.
   TIGES        99517.
   RACINES      95213.
 ANNUELLE                   17896.               5      .786E+00  .992E+00  .100E+01  .390E-01 0.
   FEUILLES      9833.
   RACINES       8063.


 MATERIEL MORT
 P.A.S.                     83543.
 LITIERE                    25270.
 RAC.MORT                  210013.
 PUITS                     302573.

ETAT HYDRIQUE DU SOL
 HORIZON  POTENTIEL(BARS)  EAU TOTALE     PF
    1          -29.50         0.03       4.47
    2           -4.31        52.68       3.63
    3          -22.27        37.79       4.35
    4          -22.23        12.65       4.35
ET=-.5534E-02  EVAP=-.4427E-02CM/HEURE
   ENTREE PREPAR
```

SYMBOLES SUPERPOSES DANS LE GRAPHIQUE SUIVANT(A=ANCIEN.N=NOUVEAU)
PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*
2 2. A=F* 4 4. A=F* 19 19. B=F* 20 20. B=F* 31 31. A=B* 32 32. A=B* 33 33. A=B*

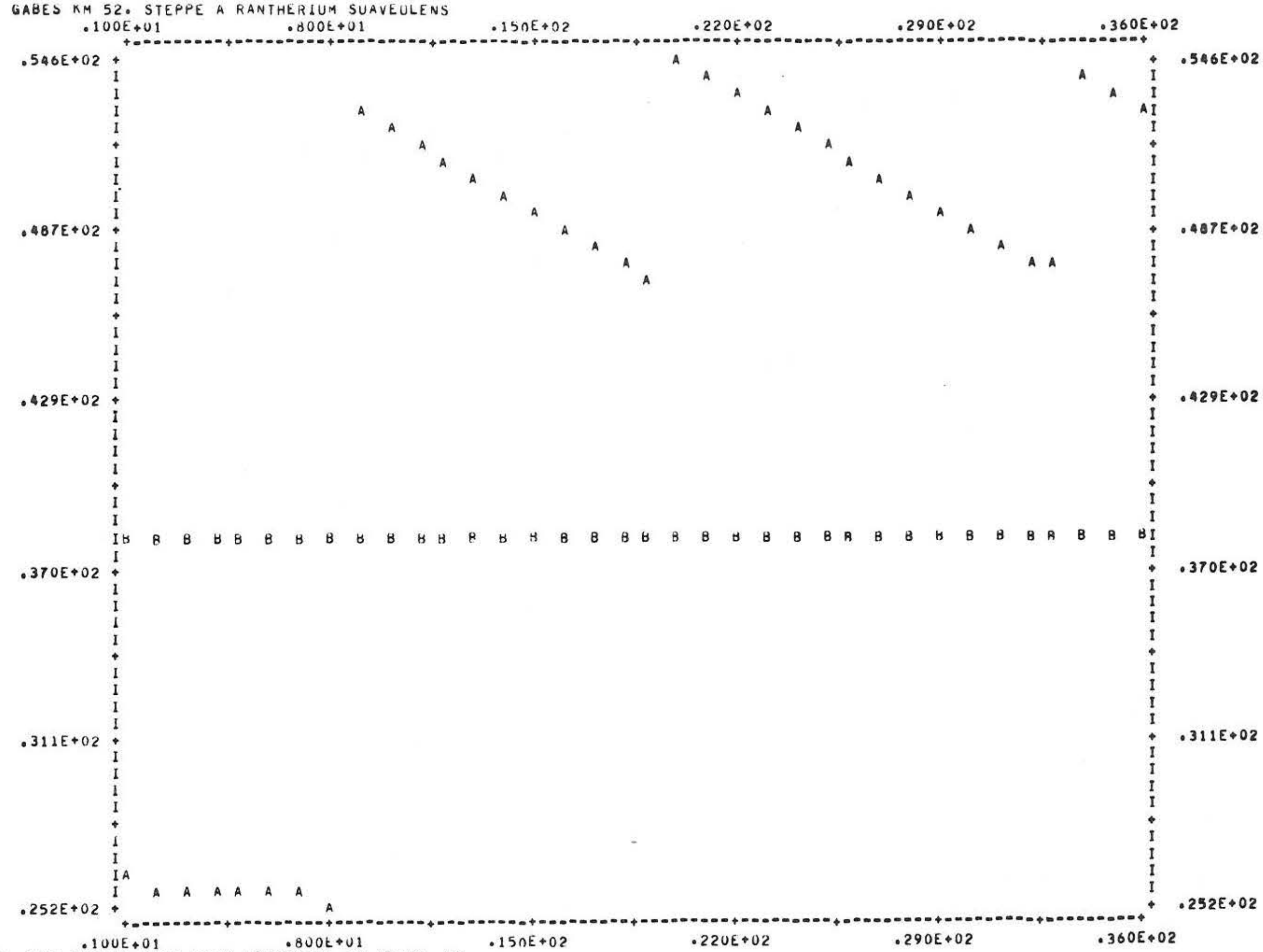
GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS



A M.S. POUSSES (G/HA) RANTHERIUM
B M.S. POUSSES (G/HA) PLANTAGO
C M.S. POUSSES (G/HA) AUTRES LIGNEUX
D M.S. FEUILLES(G/HA) ANNUELLES
E M.S. RACINES (G/HA) ANNUELLES
F M.S. TOTALE (G/HA) ANNUELLES
1 COLONNE EN ABSCISSE= .350E+00 1 LIGNE EN ORD.= .619E+03

SYMBOLES SUPERPOSES DANS LE GRAPHIQUE SUIVANT(A=ANCIEN,N=NOUVEAU)
PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*PAS JOUR A=N*

GABES KM 52. STEPPE A RANTHERIUM SUAVEOLENS



A EAU TOTALE (MM) DANS L'HORIZON 2/.05-40. CM
B EAU TOTALE (MM) DANS L'HORIZON 3/40-100 CM
1 COLONNE EN ABSCISSE= .350E+00 1 LIGNE EN ORD.= .587E+00