



AGRHYMET Regional Center

# SARRA-H

Crop growth simulation model



## User Manual

Alhassane A., Traore S. B., Bonnal V., Baron C.

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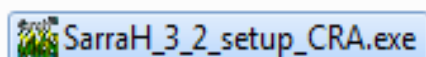
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## I Overview:

## II Background:

## III Installation

Sarra-H can be distributed on CD, USB or via the Internet, in two versions: the user version and the modeler version. The user version setup program is as follows:



To install Sarra-H on your computer, simply double-click the **setup** (which must first be copied to your computer) and follow the instructions on the screen. By default, Sarra-H is installed in the **Program File** of your hard drive, but it is recommended to install it directly on the **C drive** of your computer, by clicking on "**browse**" ... At the end of the installation, SARRA-H is automatically launched.

Installing Sarra-H leads to the creation of several folders and files on your hard drive. At the end of the



installation, you have two programs: SarraH\_Interface\_v3.exe and SarraH\_Moteur\_v3.exe installed under the directory that you have specified. In addition, for data management, the Borland BDE Administrator is also installed in the program file directory of the C Drive.

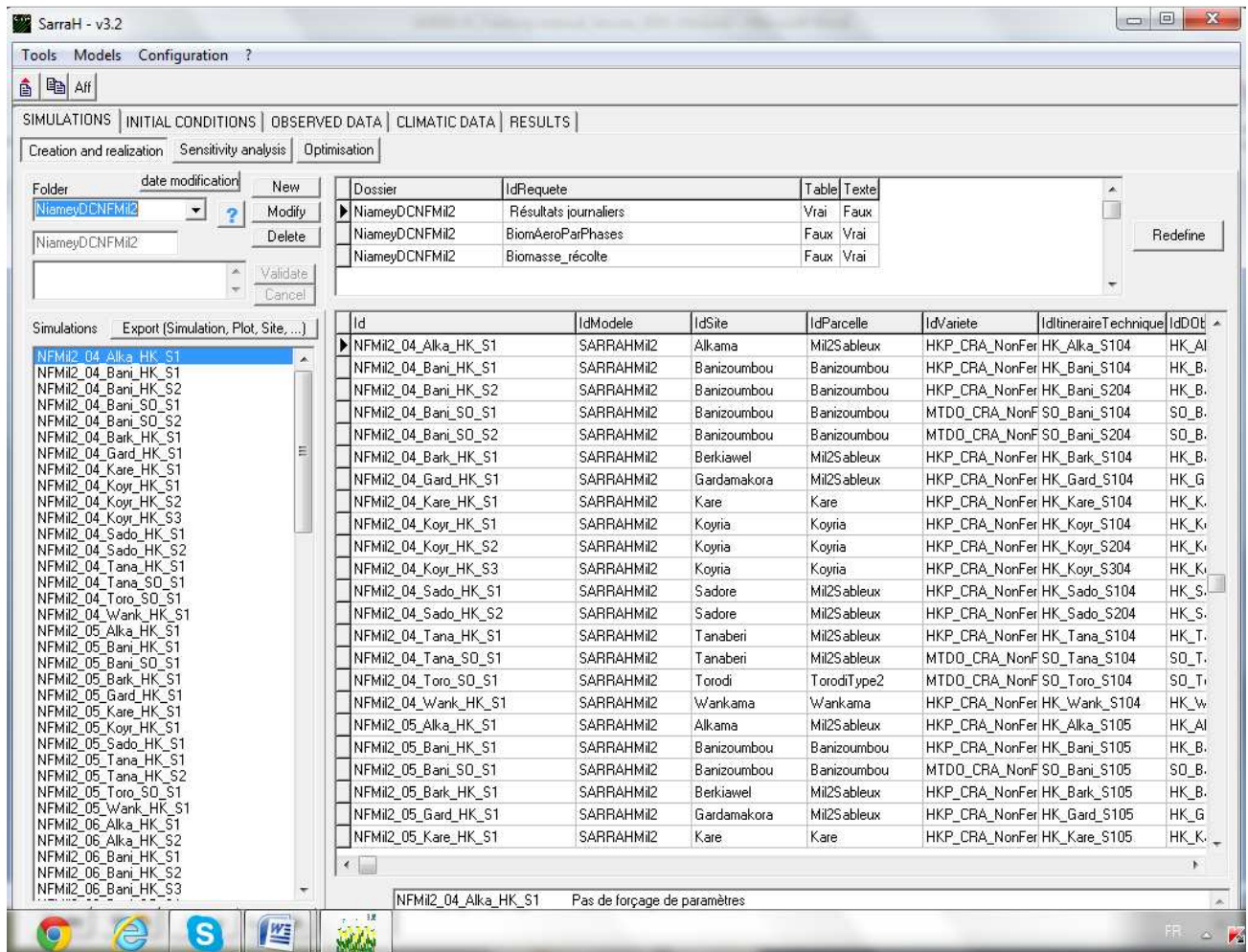
Here are some details about the installed files by the setup program:

- ⇒ **BDE Administrator:** the Borland BDE Administrator is used by Sarra-H as support for the data engine. You can access the BDE administrator as follows "Start/Control Panel/BDE Administrator". For your information, you will see at least six database aliases: DBGeoClimato, DBResul, DBModele, DBPlanteSol, DBObserve and DBSimulation. These databases are those used in Sarra-H and they are specific to it;
- ⇒ **Sarra-H program:** As already mentioned above, Sarra-H installs in the directory of your own choice. By default, we recommend you to install it on **C:|Sarra-H|**. If you explore this directory, you will find a series of files (including executables) and another directory named DBEcosys. It is in this last directory that the database files are hosted. Currently, Sarra-H uses PARADOX as databases manager;
- ⇒ **Minimum System Requirements:** Intel or AMD processor clocked at least 266MHz, Microsoft Windows 2000 to 2007, Windows Vista, Windows Me, 98, 95, Windows XP (Windows NT 4.0 not tested), 32 MB of RAM,  
8 MB of disk space in anticipation of minimal use, the simulated data and the input data being stored in the database,  
CD-ROM drive,  
Monitor VGA or higher resolution,  
Mouse or other pointing device

## IV Starting the Sarra-H

When installing Sarra-H, a shortcut is automatically created on the desktop of your computer. This shortcut lets you run Sarra-H by simple double-click. You can also launch Sarra-H by clicking on the "**Start**" button, then "**All Programs**", and "**Sarra-H**". Finally, click on **Sarra-H V3.2**.

Once Sarra-H V3.2 is activated on your computer, every time you launch Sarra-H v3.2, you will see the screen shown in the figure below (in alphabetical order, a folder of simulations appears, if it already existed). You can display a folder of simulations of your choice (if it is already created) by clicking on the button unfold of "**Folder**".



This is the Sarra-H modeling interface.

It should be noted that Sarra-H is actually composed of two functional parts: the **user interface** and the **simulation engine**.

The user interface is the software that allows the user to "prepare" his/her simulations and launch them.

The simulation engine function is to run simulations defined in the interface. This separation, that gives full power to the model, was designed to enable third-party softwares to drive the simulation engine. The same principle is used with R. We will discuss this part later.

In the user interface, a number of tabs are present. We shall distinguish the main tabs and their sub-tabs (each of which being attached to a main tab). There are five main tabs:

- ⇒ The "**SIMULATIONS**" tab: allows you to create simulations (defining the sites used, the characteristics of the plots, crop characteristics, technical itineraries, and the observed data) and realize them. The execution of simulations is performed from this tab, which has three sub-tabs:
  - The "**Creation and realization**" sub-tab that enables to create, modify, delete and launch simulations. At the bottom of the page that opens after clicking on the sub-tab, you have the following buttons: "**Create**", "**Modify**", "**Delete**" and "**Launch**".
- ⇒ The "**INITIAL CONDITIONS**" tab: soil and ecophysiological characteristics of the crop(s) of interest are predefined and configured in this tab. One can enter and set the characteristics of the plot and soil, climatic zone (:
  - The "**Plot and soil**" sub-tab for defining the type of soil and its physical characteristics with respect to the water management;
  - The "**Climatic Zone**" sub-tab that enables you to select and establish a link between Ids (codes) of meteorological and rainfall stations to be used for simulations;
  - The "**Crops**" sub-tab that allows to parameterize the model for a given crop/variety by defining a range of parametric values whose harmony reflects the biological and physiological characteristics of growth and development of the considered crop, in link with the physico-chemical characteristics of the plot;
  - The "**Cropping practices**" sub-tab that allows you to enter the sowing date, seeding rate, and other parameters.
- ⇒ The "**OBSERVED DATA**" tab : allows entering and viewing PET data and observed data on the crop:
  - The "**PET Data**" sub-tab allows to display and have access to the values of imported PET, calculated by the model for a set of stations or a particular station;
  - The "**observed data**" sub-tab allows you to view, enter or modify data observed on the crop or the soil.
- ⇒ The "**CLIMATE DATA**" tab: allows you to view and manage rainfall and meteorological data imported into Sarra-H and used during simulations.
- ⇒ The "**RESULTS**" tab: allows the exploitation of simulation data through a display interface in a table or a simplified graph (graphical visualization of model outputs and comparison with the observed data).

The menu bar consists of three items:

- ⇒ "Tools" item: provides access to a set of tools to facilitate data management in Sarra-H.

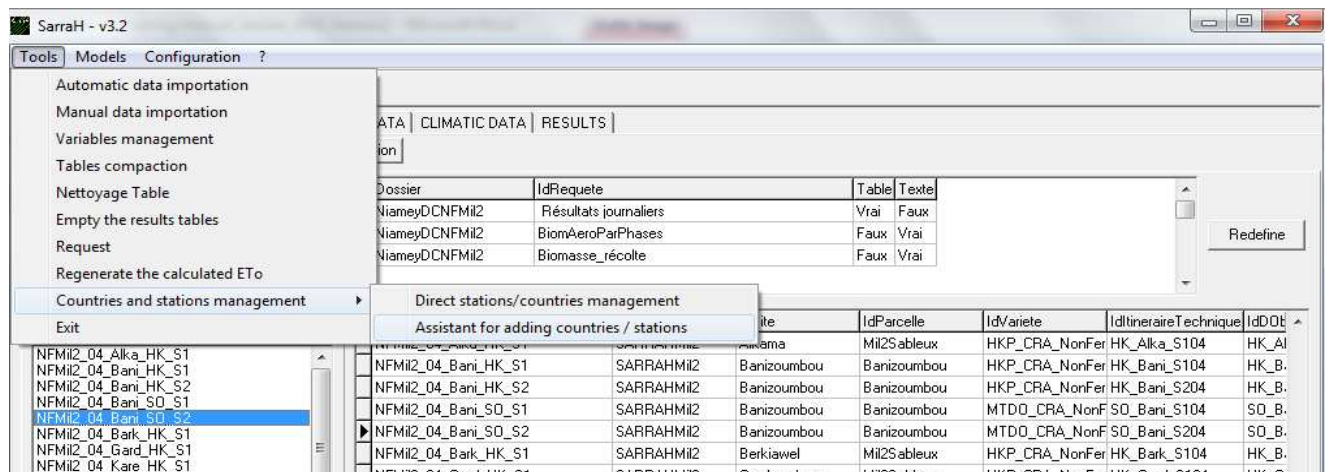
⇒ "Item?" allows access to the CIRAD website, report bugs and reaching the dialog box.  
These tabs and menus are detailed in the appendix to this manual.

## V Creating a country and a rainfall or a weather station

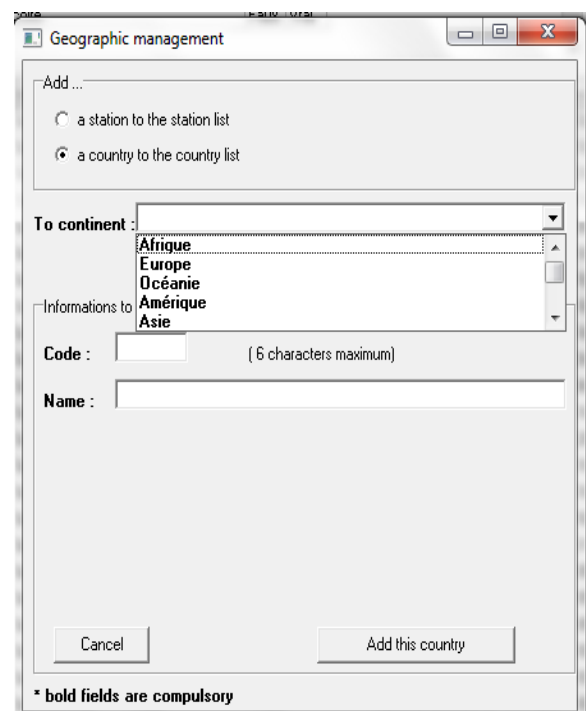
The use of Sarra-H tool requires at first the creation of the country and weather and rainfall stations concerned by the simulations.

The procedure begins as shown by the **figure below**:

*Click on "Tools", select "Countries and stations management" and "Helper for adding Countries/Stations").*



After clicking "*Helper for adding Countries/Stations*", a window is displayed as shown in the two figures below:



**To create a country, you must check out:**

⇒ *A country to the country list*

The country is created by making a selection from a list of the five continents of the world and it is defined by a code and a name.

**To create a station you must check out:**

⇒ *a station to the station list*

The stations are created in the model with a more detailed geo-referencing that consists not only in defining the continent, the country, the code and the name of the station, but also by specifying the latitude, longitude and altitude of the location of the station. The type of station (synoptic station, rainfall ...) must also be specified. Thus, after ticking on add a station to the station list; we get the following window (Figure below):

**Attention!!!** It is written in the figure below (bottom): "**bold fields are compulsory**". This notification doesn't need to be checked!! If the "**longitude**" box is not filled in, it creates a bug in the station creation process. Whence, it is compulsory to fill in all fields in order to avoid the bug. It gives the possibility to fill in the boxes (Latitude, Longitude and Altitude) in decimal degrees or degrees-minutes-seconds (°, ' and "). In all cases, all the fields must necessarily be filled in to make it work. For degrees-minutes-seconds, if there are no numerical values for the seconds ("), it will be necessary to put "00".

Geographic management

Add ...

☒ a station to the station list  
☐ a country to the country list

To continent : Afrique

To country:

Informations to

Code :

Name :

Latitude : ( decimal degrees ex: 12,52) or ° ' "

Longitude : ( decimal degrees ex: -9,01) or ° ' "

Altitude : ( meter ex: 250)

Type :

Cancel Add this station

\* bold fields are compulsory

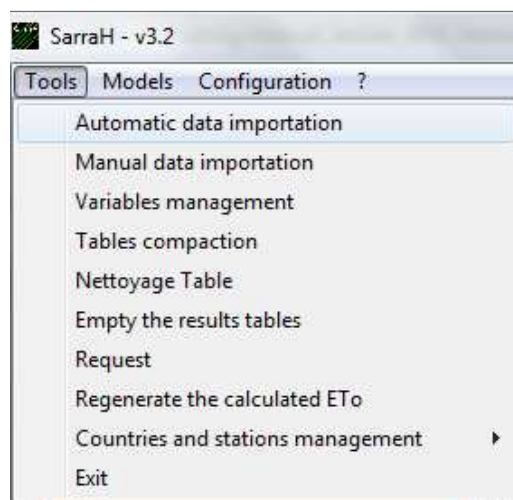
## VI Importing weather and rainfall data:

Climate data (rainfall and weather) must exist, at a daily time on a continuous basis for the period of simulations. Before importing, the data must be saved in **text** format (. **txt**) within the **Importation folder** of the **DBEcosys** of SARRA-H model. To reach **Importation**, you must click on:

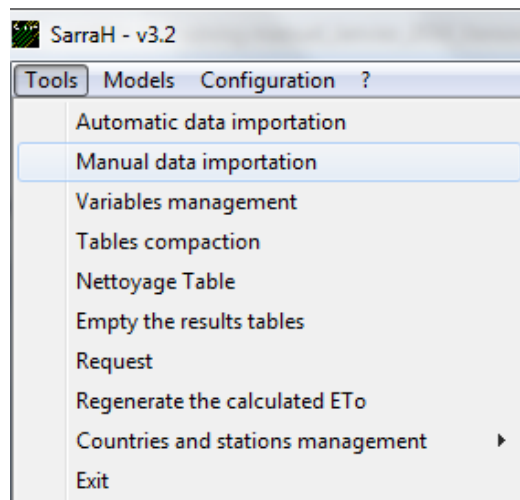


## C:\Sarrah-H\DBEcosys\Import

The import of weather and/or rainfall data is done by clicking on "**Tools**" in the SARRA-H interface. A window appears and it shows two data import options: *automatic data importation* (figure below, left) and *manual data importation* (figure below, right).



**Figure 8A**



**Figure 8B**

### Automatic data importation

The automatic data importation is more convenient and it is not used only for weather and rainfall data. It lets you import many types of data at once (by a single click): rainfall data, weather data, and observed data from the plot/soil, crop, cropping practices and scenarios of simulations. However, for the automatic data importation to succeed, it must be ensured that the data to be imported are saved in **Import**, in formats required by the model. Indeed, the names of files to be imported into SARRA-H should not have accents and their spelling should start (depending on case) by:

- **Rainfall\_** (+ name or code of the station), for rainfall data ;
- **Meteorology\_** (+ name or code of the station), for meteorological data) ;
- **Folder\_** (+ an Id), for a folder on a set of simulations
- **SoilType\_** (+ an Id), for data on soil characteristics
- **ObsPlot\_** (+ an Id), for data observed on crop in the plot
- **Site\_** (+ an Id), for data defining the weather and rainfall stations in the site
- **Plot\_** (+ an Id), for the soil type, surface thicknesses and soil depth defined for the simulations
- **Model\_** (+ an Id), for the model used for simulations
- **TechnicalItinerary\_** (+ an Id), the technical itineraries data
- **Simule\_** (+ an Id), for scenarios of simulations
- **Variety\_** (+ an Id), for the variety characteristics data
- **Etc,**

**NB:** The import runs systematically for all text files (.txt) in the **Import** folder. So, if there are some data (in Import folder) that you don't want to import, then they should be put in a subfolder, deleted or compressed.

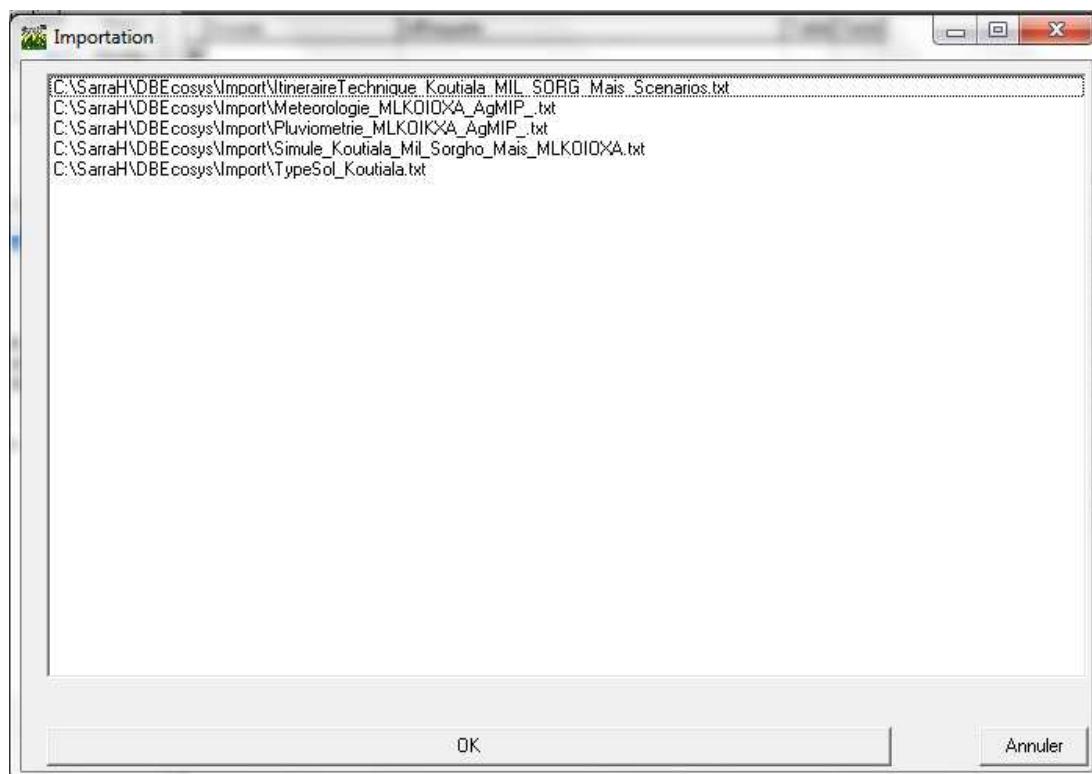
Also, particularly for meteorological and rainfall data, it must be ensured that the **data column names** are written in the same way as originally foreseen in the model. The order of columns matters little in SARRA-H, version 3.2. But spelling, case (uppercase, lowercase) and spaces after the column titles of the file to be imported shall strictly comply to those indicated below:

- CodeStation, Day and Rain, *for rainfall data* ;
- CodeStation, Day, TMax, TMin, TAvG, HMax, HMin, HAvG, Vt, Ins et Rg, *for meteorological data*.

**Attention!** To avoid bugs, don't add measurement units (mm, ° C, %, m / s, etc) in the columns names of weather and rainfall data that you wish to import.

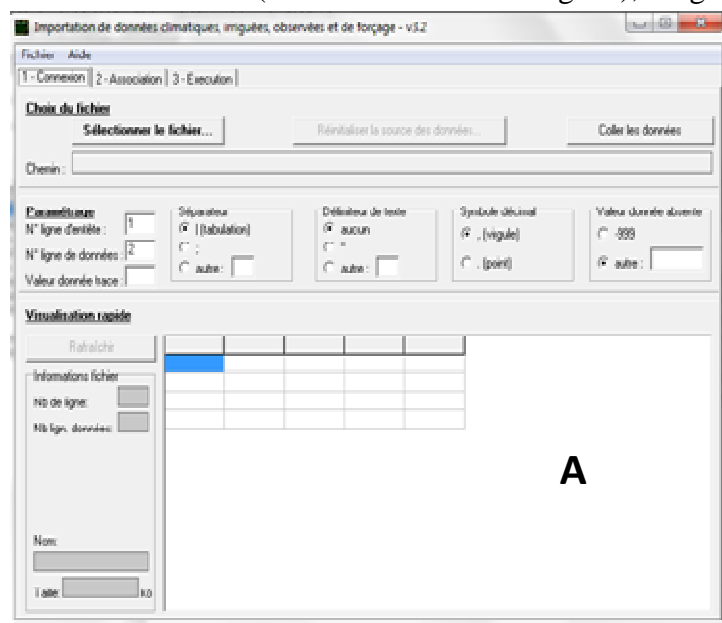
We must also ensure that the decimal symbol (dot or comma) used for the data to be imported is the same as that selected in the computer (*start* ⇒ *Control panel* ⇒ *Regional options* ⇒ *Customize* ⇒ *Decimal symbol* ⇒ and choose the same decimal (point or comma) as for the file(s) you wish to import into SARRA-H). The change of decimal symbol may also be done in the SARRA-H model by using manual importation of data option (see next chapter).

The figure below shows an example of data files ready to be imported automatically into SARRA-H model, after clicking on: **Tools** and **automatic data importation**.

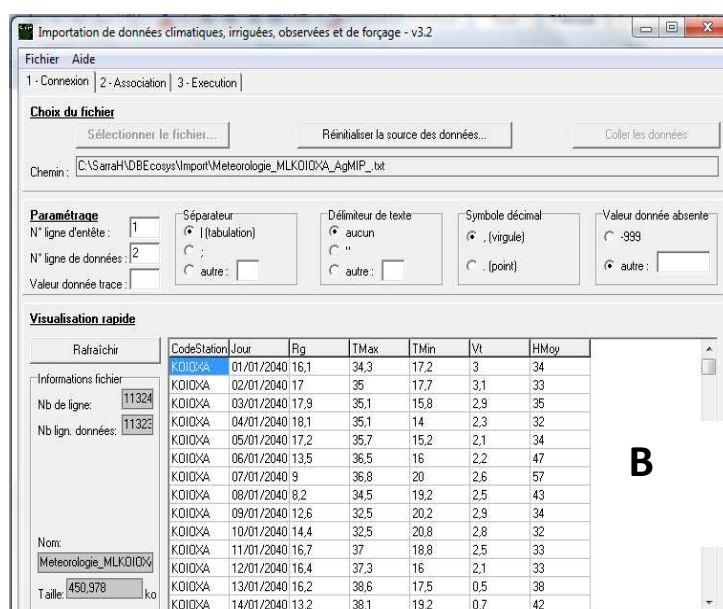


## Manual data importation

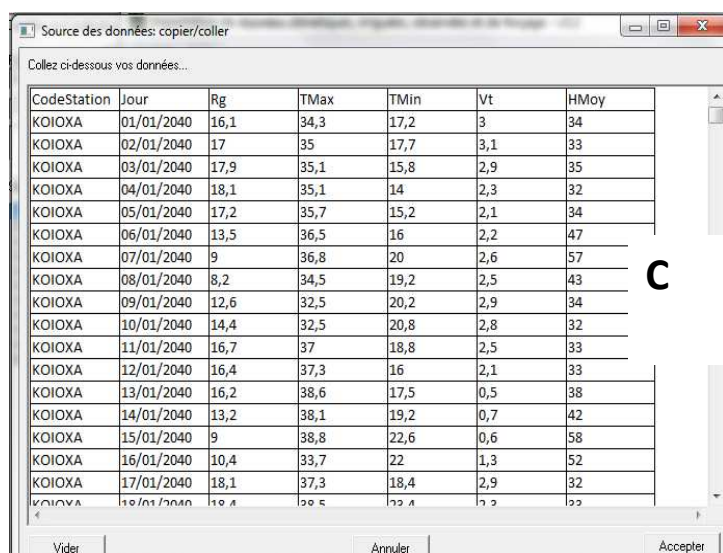
The manual data importation can also be used to import various types of data into the SARRA-H model: Climate data (rainfall and meteorological), irrigation, data observed on crop and the model's



A



B



C

forcing data. When you click on **Tools** and then **manual data importation**, a window is displayed as shown in Figure A (above). This window shows (top left) that the manual data importation involves three (3) successive steps: **(1) Connection (2) Association (3) Execution**.

**1) Connection step:** This tab gives access to data to be imported by using one of the following access options: **"Select File ..."** (top left) and **"Paste data"** (top right)

a) **"Select file ..."** provides access to the data file you wish to import from a directory where it is stored in the computer, by using the classical procedure for opening folders and files with Windows Explorer. Once the data file to be imported is reached, just click on the file (txt. format) and then click **Open** and the data is displayed in the box provided for this purpose in the import window as shown by the Figure B (above) (an example for rainfall data).

b) **"Paste Data"** This option gives the same visualization of the data to be imported as in Figure B, by copying and pasting the data directly in the window provided for this purpose. *But, be careful!!! this operation cannot be performed on too many data :*

- Open the data file to be imported, select all the data (with column names), then click on copy ;

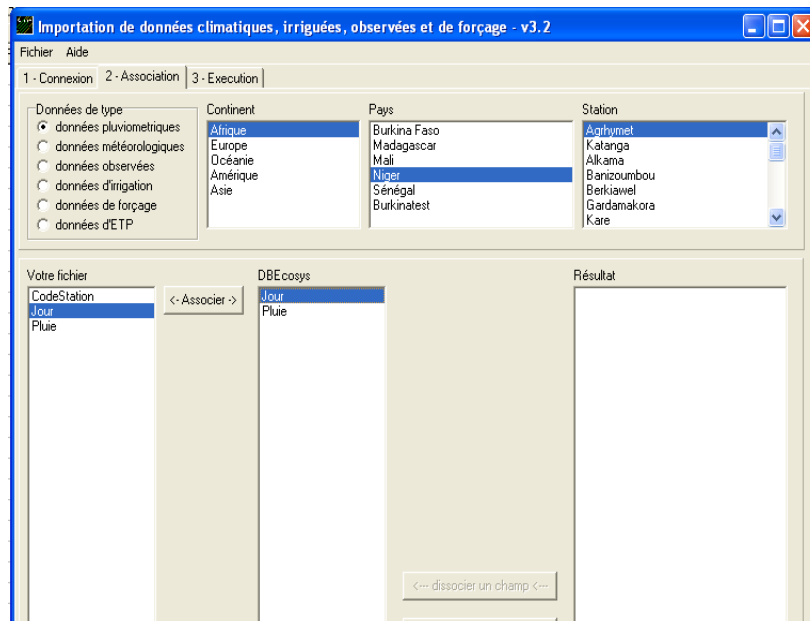
- Go into SARRA-H, click **Tools**, **manual data importation** and then click **paste data**. The data pasted into the open window are displayed as shown in Figure C. The importation should then be validated by clicking on **accept** (bottom, right of the window).

This second data access option to manual importation has the advantage of enabling to use not only data stored in text format (txt.), but data in Excel format.

**2) Association Step:** it comes after the connection step. It helps establish a

matching link between column names assigned to data to be imported and those initially provided in SARRA-H for the same data types. This procedure of association allows bypassing respect constraints for the columns names spelling in the case of an automatic data import.

To perform the association, you must click on **2-Association**, then select in the window that opens,



type of data to import (see figure in left). Once we have ticked the type of data to be imported, the model gives (through sub windows that open gradually, the opportunity to choose the continent, country and the station concerned by the envisaged simulation or simulations.

The association is made by selecting, each time in the two named columns, **your file and DBEcosys** (figure above), the couplet of similar parameters and by clicking on **<- Association->** (see in between columns, **your file and DBEcosys** (Figure above)).

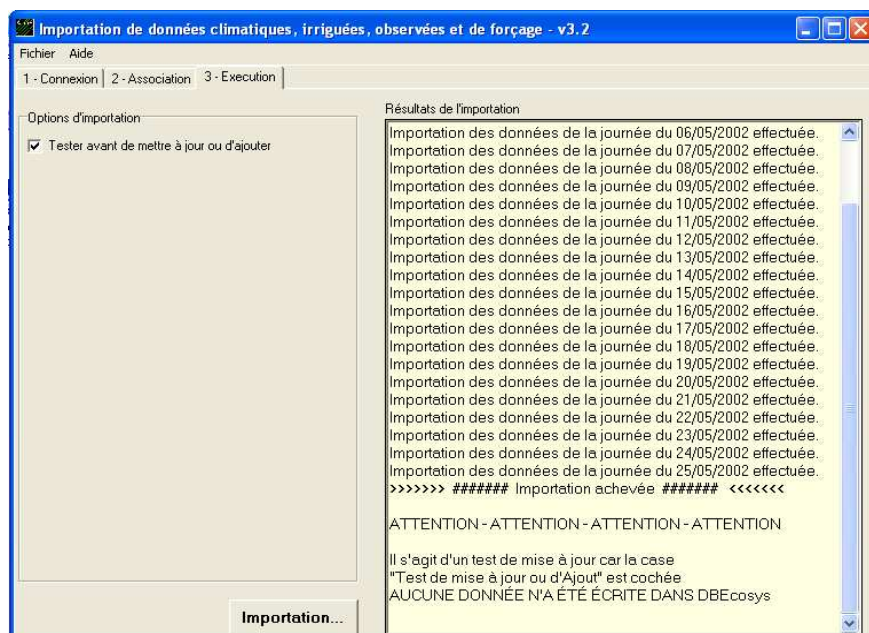
Once this is done, the association's result appears in the **Result** column (figure above, right). This exercise of association by correspondence is done for all parameters whose names appear both in the two columns; **your file and DBEcosys**. Once associations completed, proceed to Step 3

**3) Execution step:** this is the last step of the manual data importation. It requires little manipulation. Just click on **3-Execution** (top) then click on **Import** (bottom) for running the data importing process as shown in the figure below. However, the figure doesn't show an example of a complete process of data import. For realizing it, we must read what is written under the figure:

## ATTENTION - ATTENTION - ATTENTION

This is an update test because the "Update test or Add test" box is checked

**NO DATA HAS BEEN WRITTEN IN DBECOSYS**



Indeed, this is just a test (optional) of update or import. To run the definitive data importation, you have to uncheck the **Test box before**



**updating or adding** (to the top left of the figure cons), then click on **Import** (this can be done without going through the update Test). One can verify the effectiveness of the importation in the **Importation Result** sub window (figure cons) before leaving the manual data importation window.

## VII Management of Meteorological and rainfall data:

Click on the tab "**Climate Data**". It enables to display at the same time, meteorology data (in a table on the right) and rainfall data (in a table on the left), as shown in the figure below.

By selecting the continent, the country then the station, you can visualize the desired rainfall and meteorological data.

The input field "Filtering the year" makes it possible to quickly have a view on a given year. To stop the process of year's filtering, click the button named: **[Filter]**.

At the bottom of the window, there are two sub-tabs: "Switch to modification mode" and "Chart". The "Switch to modification mode" sub-tab is used to display and manage (modify or enter) meteorology and rainfall input data that can be used for simulations.

Indeed, the data grid is by default in read only mode. This functionality becomes useful when you spot an outlier. It also allows you to force a climate value, manually. When you click on this button, it is renamed **[Skip in consultation]** and an alert message warns you when you switch to modification mode. The SARRA-H platform's environment turns into light blue (see figure below).

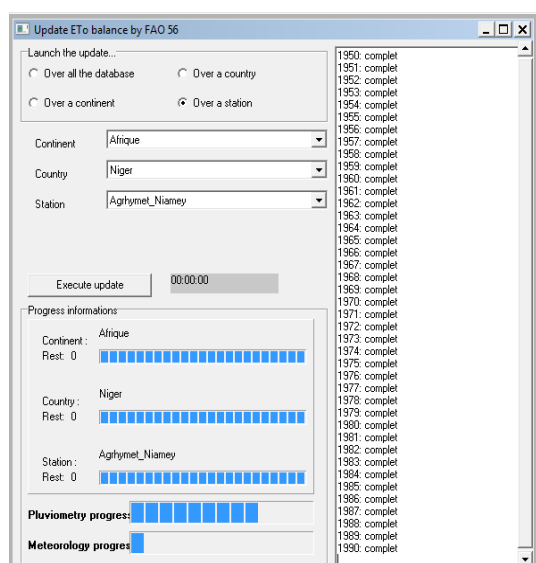
**Note:** note that any modification/deletion is saved immediately in the DBEcosys database and no backtracking is possible. It is therefore important if you wish to modify temporarily these data that you take note of changes made manually, so that you can reenter the original values.

To return to the normal mode, consultation mode, click **[Switch to consultation]**.

## VIII Calculating PET and Verifying Climate Data

The verification may be made by updating the ETo balance sheet. To achieve this, click on "Tools", a window will display, and select "**Regenerate the calculated ETo**". A window (see figure below) will open. This window shows that it is possible to update the ETo: "*for all the database*", a given "*continent*", "*country*" and/or "*station*". The procedure consists of selecting the button corresponding to what one wants to do, among the four listed (4) options. After making your choice, the boxes "Continent", "Country" and/or "Station" (figure below) are activated (according to cases) for you to choose the continent, the country and/or station for which you wish to verify climate data through the ETo update.

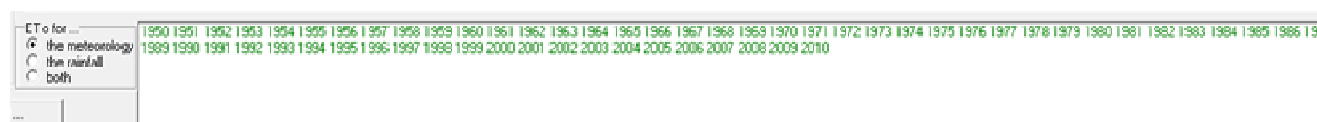
It is only after these steps that you can launch the update (verification) by clicking the "**Execute Update**" button (figure below).



During this update, SARRA-H will explore the content of your climate database to verify if data contained in your climate base allow the calculation of evapotranspiration (reference evapotranspiration, FAO procedure-Penman-Monteith called FAO 56 - ). At the end, it will analyze the data and verify their presence over the concerned year.

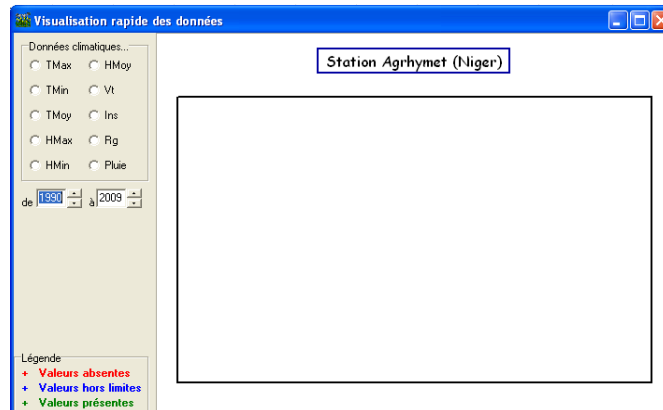
Indeed, the ETo procedure recommended by FAO, requires having minimum and maximum (or average) temperature, minimum or maximum (or average) relative humidity of wind and global radiation (or sunshine duration). If for a given year, the data is missing, the display for the year in question will be in **gray**. If one single data (eventually for one single day) is missing within the concerned year, the display of the year in question will be in **red**. If all the necessary data are present, the display will be in **green** (see

example figure below). This information box is always present in the "**Climate Data**" tab.



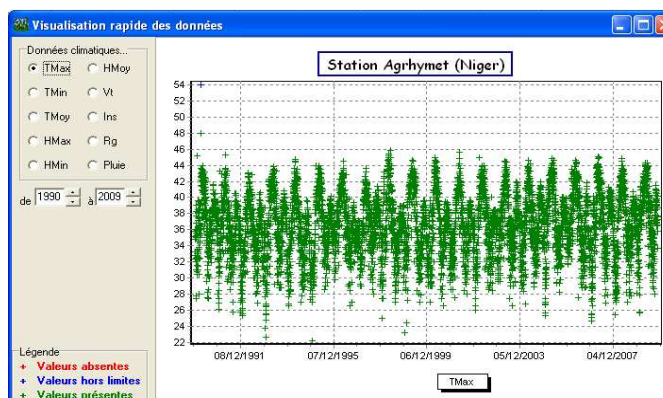
### Other procedure for a rapid check of climate data

The procedure consists in clicking on the "**Chart**" button (see the bottom of the figure above, in "**Climate Data**" tab). A window opens as follows:



This tool allows visualizing quickly and graphically the consistency of your data for the selected station.

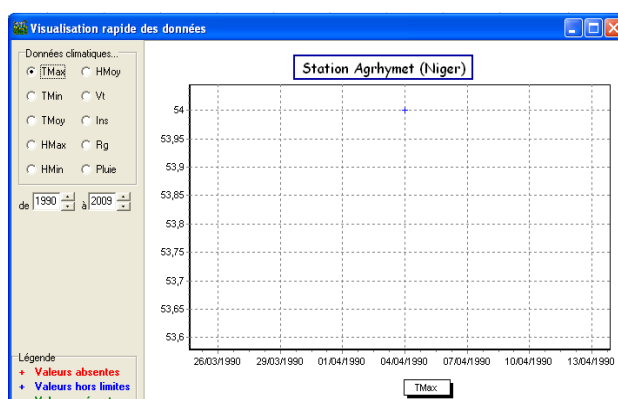
**Example 1:** Maximum temperatures data:



This figure shows that there is no missing data for Tmax (for the AGRHYMET station) over the 1991-2007 periods. For example, if there are empty records (missing data) the corresponding period is marked by + + + in red. If there are out of range values (excessive temperature and/or outliers notified by the model which nevertheless takes them into account as such in the simulations), the corresponding period or day(s) are marked by + + + in blue. For the existing and valid values, they are always marked by + + + in green.

**Zoom:** The chart can be zoomed quickly. For this, click with the left mouse button on the chart and hold it, then move down and to the right. It draws a rectangle. When you release the mouse, the chart will zoom in on the area included in the rectangle

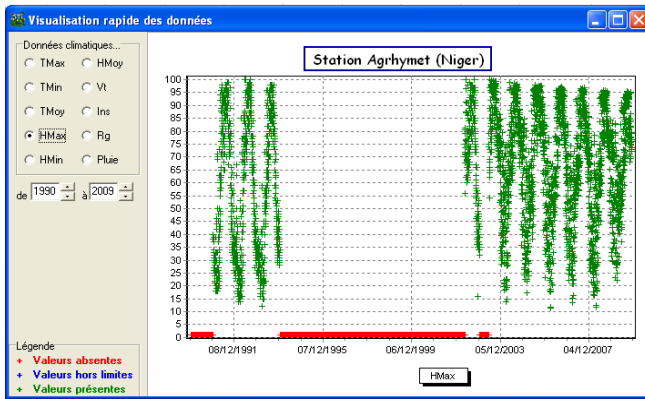
To stop the zoom, click and hold on the click and move the mouse to the left and upward.



By zooming for a certain number of times, one can visualize the exact dates of out of range or missing values (figure on the left).

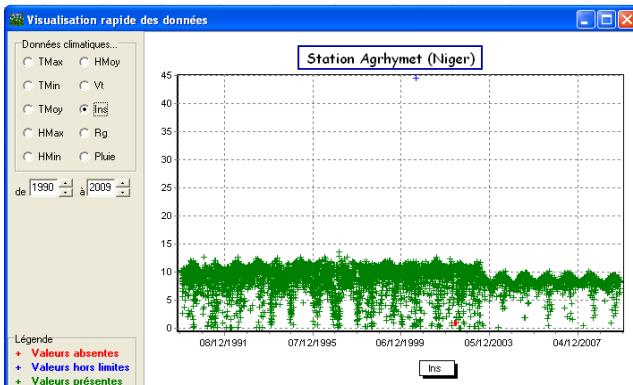
To zoom, click to the area you want to enlarge. Make a rectangle from top to the bottom from left to the right and release the button. The zoom will appear.

To "unzoom", click on the graph from bottom to the top, from right to the left.



### Example 2: Maximum relative humidity data

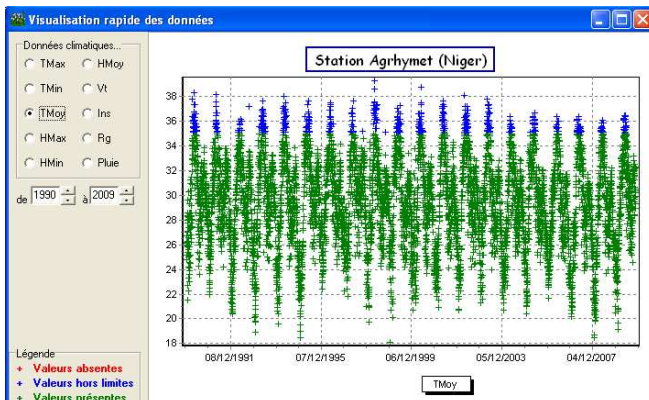
For example, here, there are missing data of maximum relative humidity over the entire 1994-2003 period. We can see also that there are missing values in 1990.



### Example 3: Sunshine duration data

We can easily observe that there was missing data of sunshine duration in 2002 (below, in red) and out of range values in 2000 (on top, in blue) for the AGRHYMET station.

### Example 4: Average temperature data



We see that these data are all correct although there are out of range values (in blue).

These out of range values are all correct for the case of Niamey station, AGRHYMET. The coloration (bleu) here is just a visual aid to attract the user attention, and it doesn't prevent performing simulations with these values.



## IX Climate data exportation

To export climate data, you must first display the station you want to recover data (e.g. the AGRHYMET station in the figure below).

Once the station is selected, you have to click on **"export"** (see **A** on figure below):

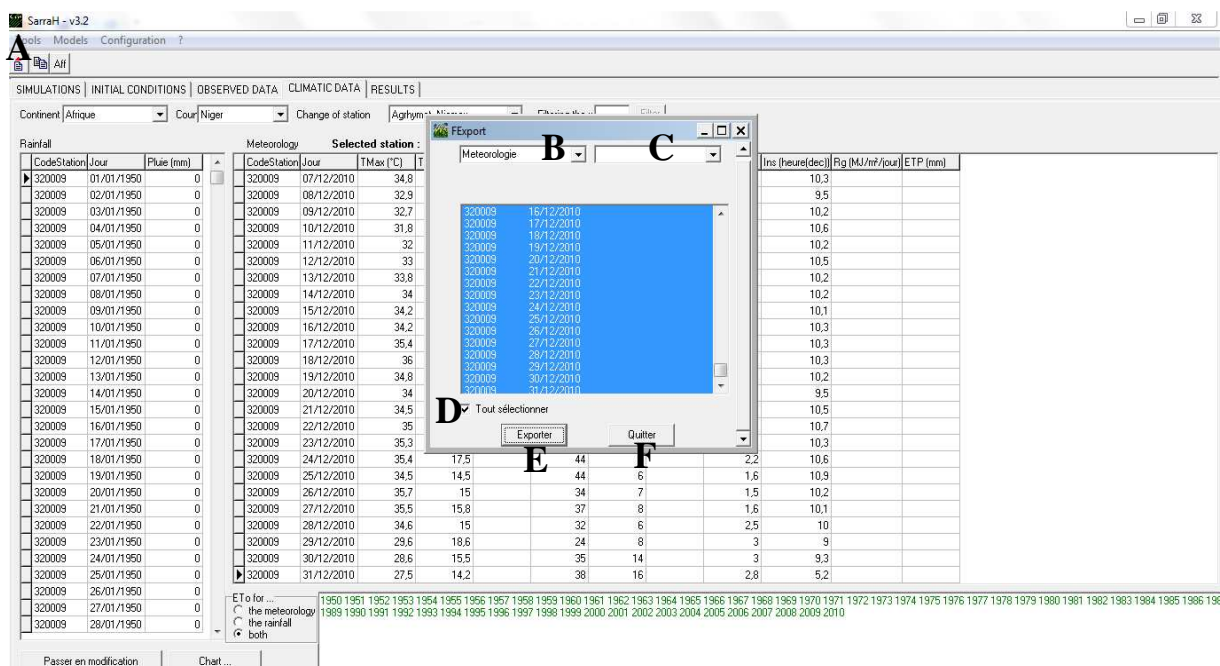
**B** = this pop-up window allows you to select the type of data you want to export (rainfall data, weather, observed data of a country, station, etc.)

**C** = this pop-up window allows you to specify the station (station code) you want to export the data.

**D** = when this button is checked, it allows you to export the data (depending on type) of a continent, a country, stations or folder. When it is not checked, you can select within the window (press Ctrl for multiple selections) the type and / or data set you want to export.

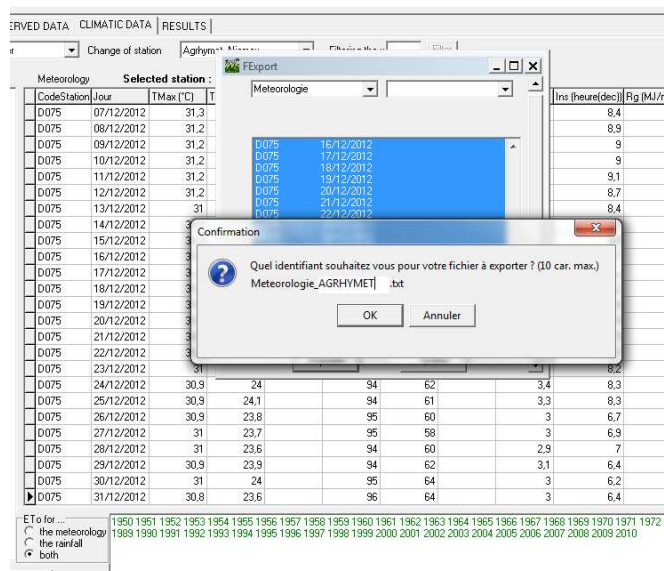
**E** = this button allows you to execute the exportation

**F** = press this button to exit the action



Once the station is selected, you need to choose what types of data should be exported (meteorological data, rainfall, observed data, etc...).

Once the export is launched, another small window opens as shown in the figure below; to give you the possibility of assigning an Id for the file you want to export. This Id (10 characters in maximum), is always preceded by another Id automatically displayed by the model, depending on the type of data (meteorology, rainfall, ObsParcelle (data observed from the plot), etc...).



After giving the Id, then click on **"OK"**, the exported data can be recovered (in txt. format) in the **"Export"** folder of DBEcosys. To get there, you must go through C: \ Sarrah\DBEcosys\Export.

**Important Note:** You cannot export rainfall data and meteorological data directly by selecting both at once. This must be done separately, that is, one single exportation for each data type.

**NB :** In the same way, can also be exported simulation folders (Folder), simulations (simulate), simulation results (Resjour), site data (Site), information on the plot (Plot), irrigation data (Irrigation), data of technical itineraries (technical itineraries), the observed data (ObsParcelle), information on a continent (Continent), a country (Country) and a station (station) with all their characteristics).

## X Crop parameter management

The management of crop parameters is carried out via the **"INITIAL CONDITIONS"** tab and sub-tab **"Crops"**.

The sub-tab named **"Crops"** allows you to view and modify plants characteristics used during the simulations. It consists of a grid of organized data in the form of parametric values, defined to take into account the different physiological and environmental factors that govern the growth and development of cereal varieties. The parametric values enshrined in the grid (figure below) are used to calibrate the SARRA-H model for different varieties, and each according to its own physiological characteristics (phenology, biomass accumulation, allometry, etc...). During calibration and model simulations, some parameters may vary depending on the species and varieties, but others may still remain invariable, especially for varieties of the same species.

Tools Models Configuration ?

Plot and soil

Id	SDJLevee (°C.d)	SDJBVP (°C.d)	SDJRPR (°C.d)	SDJMatu1 (°C.d)	SDJMatu2 (°C.d)	KRdPotA (kg/ha)	KRdPotB (kg/ha)	PPExp (none)	SeuilPP (heure(dec))	PPSens (none)	PPCrit (heure(dec))	TBase (°C)	TOpt1 (°C)	TOpt2 (°C)	TLim (°C)	Pc
Mais_BenDMRV3.2	70	400	330	510	260	0.9	1000	0	13.6	5	11	8	26	34	44	
Mais_Br_Pioner	70	510	540	740	300	0.75	1000	0	13.6	5	11	8	26	34	44	
Mais_Br_V3.2	70	400	550	650	300	0.75	1000	0	13.6	5	11	8	26	34	44	
Mais_Fr_Furio	70	330	500	630	200	0.9	1000	0	13.6	5	11	6	26	34	44	
Mais_Ta_TMV1	70	390	500	520	230	0.5	1000	0	13.6	5	11	8	26	34	44	
Mais_USA_Gold	70	320	450	550	200	0.9	1000	0	13.6	5	11	8	26	34	44	
Mil_120j	70	900	400	340	170	0.4	800	0.0001	13.6	3	11	11	30	34	44	
Mil_80j	70	260	400	340	170	0.4	800	0.0001	13.6	3	11	11	30	34	44	
Mil_90j	70	400	400	340	170	0.4	800	0.0001	13.6	3	11	11	30	34	44	
Mil_NighK_V33NF	50	580	400	340	170	0.15	800	0.12	13.6	0.66	11	11	32	36	46	
Mil_Nig_HK_V33F	50	580	400	340	170	0.15	800	0.12	13.6	0.66	11	11	32	36	46	
Mil_photoper	70	260	400	340	170	0.4	800	0.18	13.6	0.85	11	11	30	34	44	
MTDO_CRA_NonF	70	800	500	340	170	0.5	800	0.08	13.6	0.56	11	11	30	38	45	
MZ_BarkaFet0	70	375	560	340	150	0.2	1000	0.0001	12.5	3	12	8	26	34	44	
MZ_BarkaFet1	70	375	560	340	150	0.2	1000	0.0001	12.5	3	12	8	26	34	44	
MZ_BarkaFet2	70	375	560	340	150	0.2	1000	0.0001	12.5	3	12	8	26	34	44	
MZ_BarkaFet3	70	375	560	340	150	0.2	1000	0.0001	12.5	3	12	8	26	34	44	
MZ_BarkaFet4	70	375	560	340	150	0.2	1000	0.0001	12.5	3	12	8	26	34	44	
MZ_BarkaFet5	70	375	560	340	150	0.2	1000	0.0001	12.5	3	12	8	26	34	44	
MZ_BarkaFet6	70	375	560	340	150	0.2	1000	0.0001	12.5	3	12	8	26	34	44	
NiORO_CiVT	70	620	500	225	172	0.2	800	0.3	13.6	0.69	12	11	30	35	40	
NiORO_CiVTfet0	70	620	500	225	172	0.2	800	0.3	13.6	0.69	12	11	30	35	40	
NiORO_CiVTfet1	70	620	500	225	172	0.2	800	0.3	13.6	0.69	12	11	30	35	40	
NiORO_CiVTfet2	70	620	500	225	172	0.2	800	0.3	13.6	0.69	12	11	30	35	40	
NiORO_CiVTfet3	70	620	500	225	172	0.2	800	0.3	13.6	0.69	12	11	30	35	40	

Cliquez sur les entités pour voir la description du champs...

## XI Soil texture management

The sub-tab "Plot and Soil" is composed of a grid of data representing the characteristics of soil textures usable during simulations. When you click on the sub-tab, a window opens and displays two complementary tables, as shown below:

- The first table is used to define the textural characteristics of the soil (soil typology), in relation with its capacities to contain water according to two depth levels: a superficial level (surface reservoir) and a level of depth (depth reservoir covering the soil portion that can be explored by the plants roots). This table enables defining (by typing) :
  - the soil Id (Id), (1<sup>st</sup> column),
  - the soil name (2<sup>nd</sup> column),
  - the stock of soil water usable by the plant in the superficial level (3<sup>rd</sup> column), at sowing (*it is considered as null (0.00) for seedlings without roots (seeds), but must have another value > or = 0.00, in link to the level of soil moisture for transplanted crops having roots for water tapping from the soil, at the outset*),
  - the stock of soil water usable by the plant in depth (4<sup>th</sup> column), at sowing (*it is considered as null (0.00) for seedlings without roots (seeds), but must have another value > or = 0.00, in link to the level of soil moisture for transplanted crops having roots for water tapping from the soil at the outset*),
  - the soil thickness favorable for the soil evaporation on surface "EpaisseurSurf (mm)" (generally fixed at 20 cm ( 200 mm for typing into the model) for sandy soils and less for clay soils),
  - the soil thickness containing the consumable water by the plant "EpaisseurProf (mm)". It represents the soil depth achievable by the plant roots. For cereals, it can reach 2 m (2,000 mm) in the case of sandy soil and below when it comes to a clay soil texture. For a soil depth of 1.8 m, we will consider 1,800 mm,
  - the last column is not reserved to any manual process of data input, but it allows establishing a link (by correspondence) with the complementary information registered in the 2<sup>nd</sup> table below, for each soil type. For this, we must make two separate clicks (different from double-click) in the box corresponding to the selected soil type. A scrollable window will appear to allow you select the Id of complementary characteristics of the soil type that is located in the 2<sup>nd</sup> table.
- The second table (complementary to the first) indicates the values assigned to the following soil parameters :

- the threshold runoff "SeuilRuiss" (in mm) which indicate a threshold of an amount of rain from which the water begins to run off on a particular soil type,
- the percentage of runoff "PourcRuiss" (%) indicates the percentage of rainwater that can run off once the runoff threshold is reached on the soil type,
- the soil available water content (RU) (in mm/m),
- Water field capacity « HumCR » of the soil,
- Permanent wilting point « HumPF » of the soil,
- Soil moisture threshold « HumSat »,
- etc.

Tools Models Configuration ?										
SIMULATIONS INITIAL CONDITIONS OBSERVED DATA CLIMATIC DATA RESULTS										
Plot and soil Climatic zone Crops Cultural practices										
Id	Nom	StockInSurf (mm)	StockInProf (mm)	EpaisseurSurf (mm)	EpaisseurProf (mm)	Ref_idTypeSol				
LDArgPP	LDArgPP	0.00	0.00	200	400	LD_Argileux				
LDArg_SablP	LDArg_SablP	0.00	0.00	200	1800	LDArg_sableux				
LDArg_SablPP	LDArg_SablPP	0.00	0.00	200	400	LDArg_sableux				
LOSablP	LOSablP	0.00	0.00	200	1800	LO_Sableux				
LOSablPP	LOSablPP	0.00	0.00	200	400	LO_Sableux				
Mi2Argileux	Mi2Argileux	0.00	0.00	200	1600	Argileux				
Mi2Sableux	Mi2Sableux	0.00	0.00	200	1600	Sableux				
POBE	CRAFFPOBE	0.00	0.00	200	1000	CRAFFPOBE				
Sableux_pprof	Sableux	0.00	0.00	200	600	Sableux				
Sableux_prof	Sableux	0.00	0.00	200	1800	Sableux				
Sablo-limo_Nav1	Sablo-limoneux	0.00	0.00	200	1000	Sablo-limo_Nav1				
Sablo-limo_Nav2	Sablo-limoneux	0.00	0.00	200	1000	Sablo-limo_Nav2				
Sablo-limo_Nav3	Sablo-limoneux	0.00	0.00	200	1000	Sablo-limo_Nav3				
Sablo-limo_Ppro	Sablo-limoneux	0.00	0.00	200	600	Sablo-limoneux				
Sablo-limo_Prof	Sablo-limoneux	0.00	0.00	200	1800	Sablo-limoneux				
Sorgho v2	Sorgho v2	0.00	0.00	100	1500	VaD205				
TorodiType2	SoilTypeTorodi2	0.00	0.00	200	1100	SoilTorodiType2				
Wankama	SoilTypeWankama	0.00	0.00	200	1100	SoilTypeWankama				

Id	SeuilRuiss (mm)	PourcRuiss (%)	Ru (mm/m)	HumCR	HumPF	HumFC	HumSat	PEvap	PercolationMax	Edit
CRAFFPOBE	20	30	112	0.327	0.215		0.58	0.2	5	-1
Gen-Gibbsic Fe	20	30	94	0.29	0.2	0.19	0.55	0.2	5	-1
Kout1_Sablo-lim	20	30	100	0.43	0.1	0.104	150	0.3	5	-1
Kout2_Limo-Argi	20	30	110	0.43	0.16	0.186	150	0.3	5	-1
Kout3_Sableux	30	20	100	0.37	0.1	0.16	150	0.3	5	-1
Kout4_Sablo-Arg	20	30	100	0.41	0.18	0.176	150	0.3	5	-1
LD_Argileux	20	30	130					0.3	5	-1
LO_Sableux	20	30	80	0.15	0.02	0.15	120	0.2	5	-1
Sableux	20	30	100	0.15	0.02	0.12	120	0.2	10	-1

## XII. Creating a site

To create the site, it is necessary to have rainfall and meteorological stations already created in the Sarra-H model. It is created by clicking on the tab **"Initial conditions"**, then on **"Climatic Zone"** sub-tab. After the clicks, we get the following window:

ToolsModelsConfiguration ?

Alt

SIMULATIONS

INITIAL CONDITIONS

OBSERVED DATA

CLIMATIC DATA

RESULTS

Plot and soil

Climatic zone

Crops

Cultural practices

Un site est une entité géographique. Celui-ci est défini par diverses caractéristiques (le seuil de pluie, le KPa), mais

Direct management of stations/country

Assistant for adding country / station

Id	KPar (MJ/MJ)	Ref_CodeStationPluie	Ref_CodeStationMeteo
NE_Birni Nkonni	0.50	320025	320025
NE_Gaya	0.50	320018	320018
NE_Maine Soroa	0.50	320072	320072
NE_Maradi Aero	0.50	320047	320047
NE_Niamey Aero	0.50	320009	320009
NE_Tahoua Aero	0.50	320023	320023
NE_Tillabery	0.50	320004	320004
NE_Zinder Aero	0.50	320062	320062
Navigo_2012	0.50	NVR012	NVR012
Navigo_Baseline	0.50	NavBSL	NavBSL
Navigo_GCM_1	0.50	NAIE>F	NAIE>F
Navigo_GCM_2	0.50	NAID>F	NAID>F
Navigo_GCM_3	0.50	NAIK>F	NAIK>F
Navigo_GCM_4	0.50	NAIO>F	NAIO>F
Navigo_GCM_5	0.50	NAIR>F	NAIR>F
NiameyAeroport	0.50	320933	320800
NiameyORSTOM	0.50	320934	320800
Sadore	0.50	320908	320800
Sandideye	0.50	320935	320800
Tanaberi	0.50	320909	320800
Torodi	0.50	320910	320800
Wankama	0.50	320911	320800
Yillade	0.50	320936	320800

ETo for ...

the meteorology

the rainfall

both

1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

- In the "**Id**" column, you must enter the Id (name) of your site (eg "**Alka**", as in the figure below);
- In the "**KPar(MJ/MJ)**" column, enter the default value 0.50, which corresponds to the proportion of the photosynthetically active global radiation;
- In the "**Ref\_CodeStationPluie**" column, click twice (not double click, but two separate clicks) in the Id line (name) that you have just entered. A scrollable window appears as in the figure below, to allow access to the code of your rainfall station. Unroll, by clicking on the arrow to select the code of your rainfall station.

Id	KPar (MJ/MJ)	Ref_CodeStationPluie
Agrhymet	0,50	320800
▶ Alka	0,50	200026
Alkama	0,50	320901

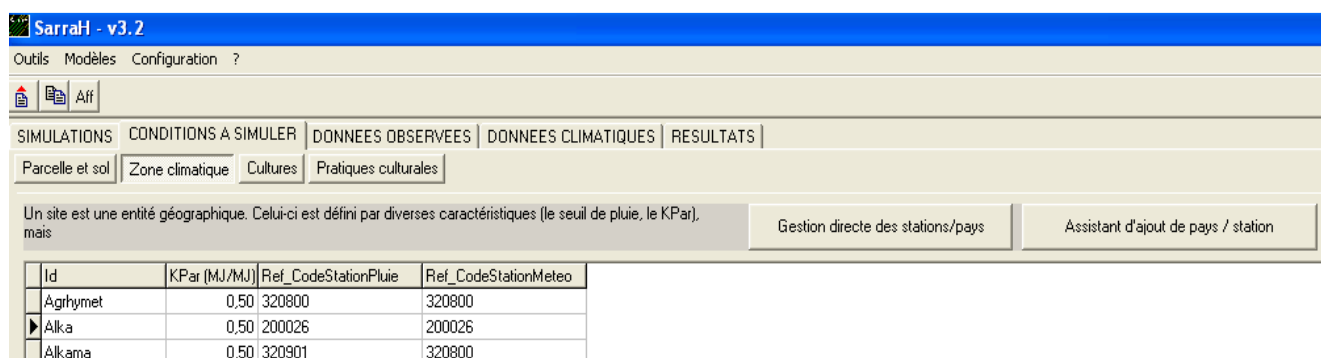
- In the "**Ref\_CodeStationMeteo**" column, as for the rainfall station, click twice in the same line. A scrollable window also is displayed to allow access to the code of your meteorological station. Unroll, by clicking on the arrow to select the code of your meteorological station as follows:

**Attention!!!** If you just create your rainfall and meteorological stations, you can find their codes in the scrollable windows "**Ref\_CodeStationPluie**" and "**Ref\_CodeStationMeteo**" only by closing necessarily Sarra-H and reopen it (Sarra-H saves your changes systematically anytime you close it). Also, the current version of Sarra-H V3.2 allows you to modify a site already created, **but it does not allow you to delete it (even in case of error)!!!**

Id	KPar (MJ/MJ)	Ref_CodeStationPluie	Ref_CodeStationMeteo
Agrhymet	0,50	320800	320800
▶ Alka	0,50	200026	200026
Alkama	0,50	320901	320800

Once this is done, you have finished creating your Site.

The "**Climatic Zone**" window also provides access to the direct management of stations/countries and to adding country/station, by clicking, according to the case, on one of the following buttons: "**Direct management of stations/country**" and "**Assistant for adding country/station**" (see the figure below, right).





### XIII. Creating a simulation

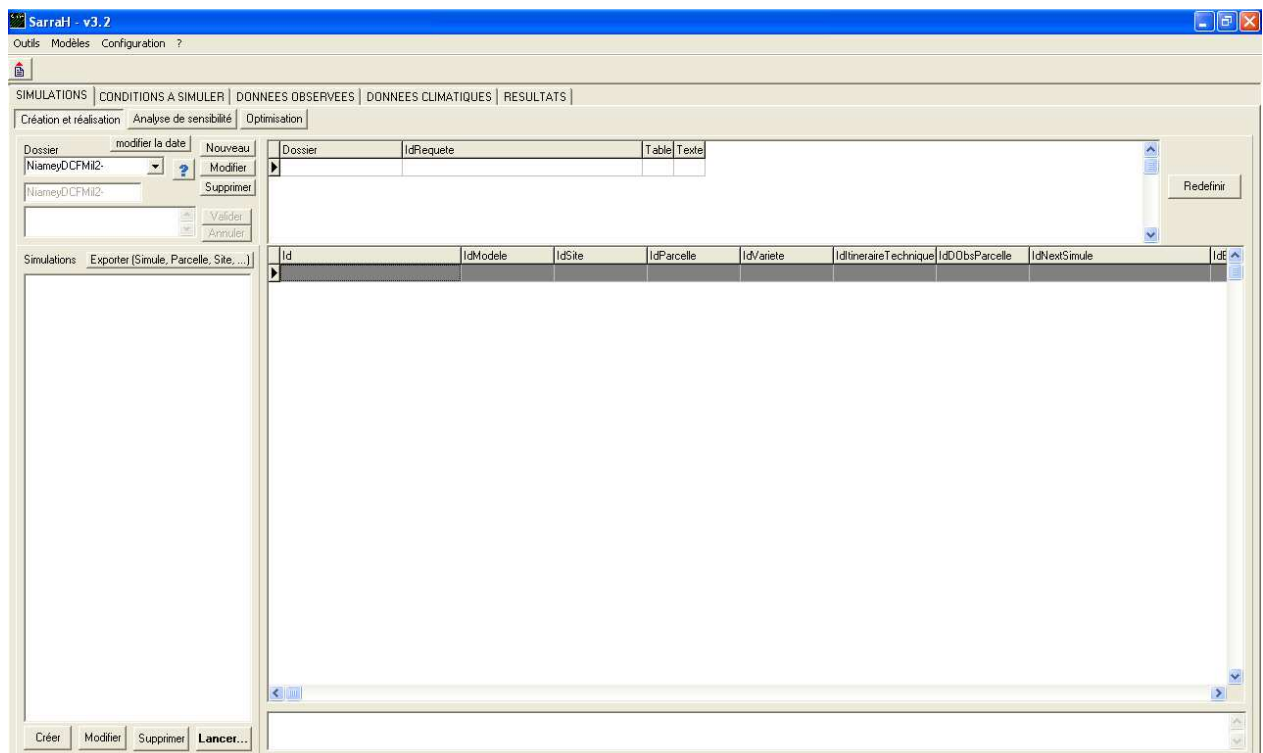
Sarra-H is a **crop model** software. The exploitation of this software is based primarily on a stream of input data from a database named DBEcosys. Current data (ecophysiological characteristics, declaration from the cropping site, the plot, technical management ...) as well as climate data are hosted in this database. The **DBEcosys** relies on a local type of database management system, located on your hard drive. Thus, as already mentioned above, the Sarra-H model saves systematically data that are modified, imported or entered by the user.

To perform a simulation, this model requires a certain number of input parameters (climate data, data characterizing the crop, the site, the plot ...). As already noted above, rainfall and meteorological data must exist in the Sarra-H model, on daily time series, on a continuous basis which corresponds to the period of your simulation.

To create a simulation, you must have previously defined:

- ⇒ In the **"Initial conditions"** tab: the characteristics of the plot and soil, the cropping site (in the **"Climatic Zone"** sub-tab), ecophysiological characteristics of the crop (in the **"Crops"** sub-tab) and cropping practices;
- ⇒ Climate data (rainfall and meteorology) collected from your cropping site;
- ⇒ Observed data, for eventual comparisons with model outputs.

Once the environment is characterized, just create your simulation (period x model x site x plot x variety x technical management (observed data being facultative)) in the **"Simulations"** tab, the **"Creation and realization"** sub-tab and the **"Create"** button (see in the corner, down the figure below).



When you click on **"Create"**, the following window opens systematically to allow you to create your simulation by linking (by selecting as shown by the blue bands in the figure below) the parameters that you already defined for your plot, your site, your variety, your technical management and the type of model you want to use. In that same window, you must also define:

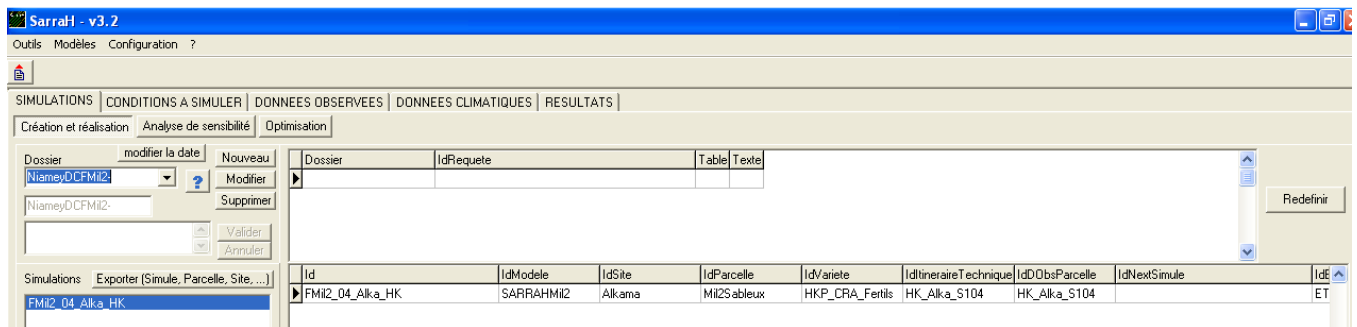
- **Plot** : Select the plot attached to the declared Site above, on which you want to launch the simulation;
- **Model**: Select the model you want to use for the simulation;
- **Site** : Select the site on which you want to launch the simulation;
- **Technical management**: Select your plot technical management (sowing date, sowing density, etc.);
- **Observed data**: choose the observed data on your crop with a view to compare them with the model simulations (their choice is optional)
- **Simulation dates**: *the year of the beginning first simulation and the year of the ending last simulation must be in the format [yyyy]. For the beginning of the cropping period and the end of the cropping period, they must be in the format dd/mm. These dates correspond to the beginning and the end of the simulation. The fields format [yyyy], enables you to use Sarra-H for simulations on a multiannual period. In the case of a mono-annual simulation, these fields must be identical, as shown in the figure below. In the case of a multiannual simulation, these two dates are generally situated on the same year for the northern hemisphere and on two years maximum for the southern hemisphere. Here is a sample of chronological configuration:*
  - Annual Simulation, northern hemisphere:
    - First cycle: 15/05/2004 to 31/10/2004, Simulation year (s): 2004 to 2004
  - Multiannual Simulation, northern hemisphere:
    - First cycle: 15/05/2004 to 31/10/2008, Simulation year(s): 2004 to 2008
  - Annual Simulation, Southern Hemisphere:
    - First cycle: cycle : 15/10/2004 to 31/05/2005, Simulation year(s): 2004 to 2005
  - Multiannual Simulation, Southern Hemisphere:
    - First cycle : 15/10/2004 to 31/05/2008, Simulation year(s): 2004 to 2008
  - Simulation of perennial crop :
    - First cycle : 15/05/1950 to 31/10/2008, Simulation year(s): 1950 to 2008
- **Id** (= your simulation name), it must characterize the simulation that you will create (see the bottom of the figure, below: **Simul\_Alka\_2004**, for example);
- **Folder**: it allows you to create a virtual folder in which your simulation (s) will be hosted. By selecting a folder (in the dropdown list, only simulations defined in this folder will be displayed. Further details are given on creating folder in Appendix 2.

<input type="checkbox"/> <b>Parcelle</b> Mil2Sableux Mil2SableuxFAO Ouagadougou Aer P101 P120 P214 SableuxV32 Sarrahn v2	<input type="checkbox"/> <b>Site</b> Agrhymet Alka Alkama Alpille Antsirabe Bakfassagal Bambey Exp. Ranizumhru	<input type="checkbox"/> <b>Variété</b> HKP_CRA_Fertils HKP_CRA_FertPre HKP_CRA_FSV3ini HKP_CRA_NF_Prec HKP_CRA_NF_Sav HKP_CRA_NF_V3 HKP_CRA_NonFert HKP_CRA_Pauvre	<input type="checkbox"/> <b>Itinéraire Tech.</b> HK_Alka_S104 HK_Alka_S105 HK_Alka_S106 HK_Alka_S107 HK_Alka_S108 HK_Alka_S204 HK_Alka_S206 HK_Alka_S306	Choix de l'évapotranspiration Eto Etplmp - Données personnelles
<input type="checkbox"/> <b>Modèle</b> SARRAHMI2 SarrahMil2Conse SARRAHMI2TestS SarrahV3 SarrahV32 SarrahV32KcTot SarrahV3DD SarrahV3FANI TR	<input type="checkbox"/> <b>Données Observées</b> (facultatives) GuineaLoD204 GuineaLoD205 GuineaLoD305 HK_Alka_S104 HK_Alka_S105 aucune	<b>Dates de simulation</b> Année de début de la 1ère simulation: 2004 (format aaaa) Année de fin de la dernière simulation: 2004 (format aaaa) Début de la période de la culture: 15/4 (format jj/mm) Fin de la période de la culture: 30/11 (format jj/mm)		
Dossier : NiameyDCFMil2    Identifiant : Simul_Alka_2004    [Annuler]    [Valider]				

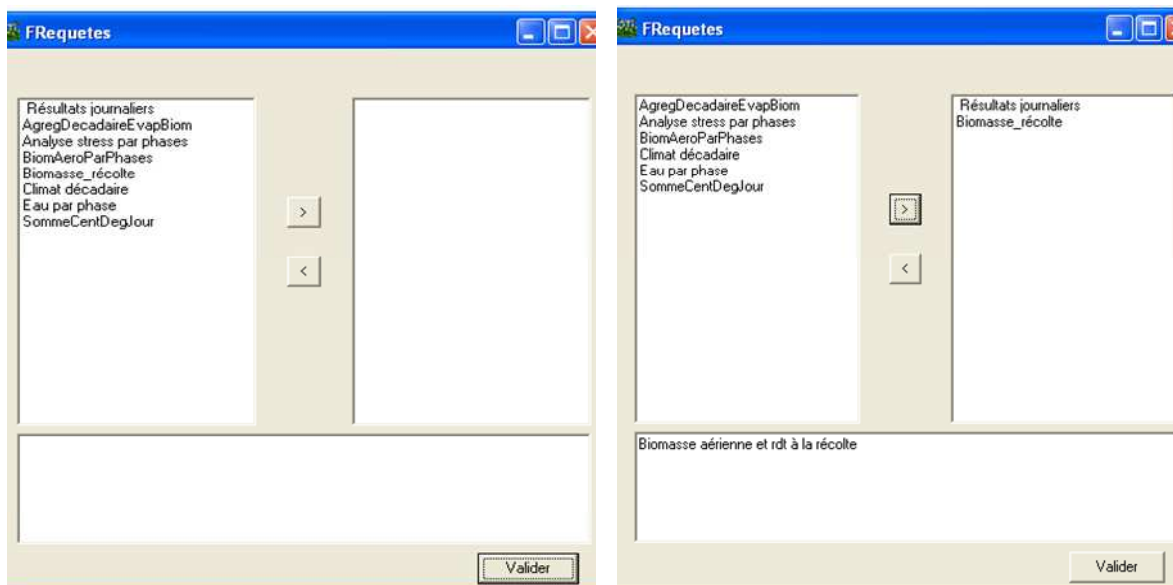
*Cacher les entités que vous souhaitez voir apparaître dans le nom de la simulation...*

Once the various elements or items are defined as indicated in the figure above, you click on **"Validate"** (see bottom of the figure) to save your so created simulation. You can also cancel the creation of your simulation by clicking on **"Cancel"**.

After clicking on **"Validate"**, your simulation is displayed in your folder sheet, as shown in the figure below.



**Attention!!!** Your simulation doesn't execute as long as the Ids of your query are not defined, that is what you want the model to give you as simulation outputs. For this, you must click on **"Redefine"** (see top right of the figure above) to have the window below named **"FRequetes"**.



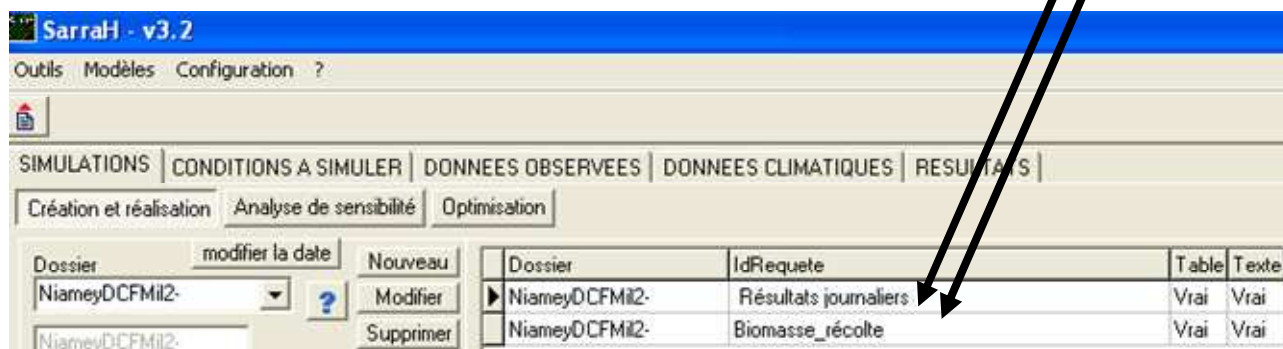
This window allows you to select the output of your simulation by selecting into the left box and displacing into the one at the right, using the ">" button. The "<" button allows the movement in the opposite direction.

If you select **Daily results**, as shown in the second figure below, this allows you to have, as output, the daily results (in digital form visualizable in graphical form) of the simulation about the biomass evolution. **"Biomasse\_récolte"** gives you access to the simulated values about the yield components at the end of the cycle; that is the harvest.

After defining your query elements, click on **"Validate"** to save it.



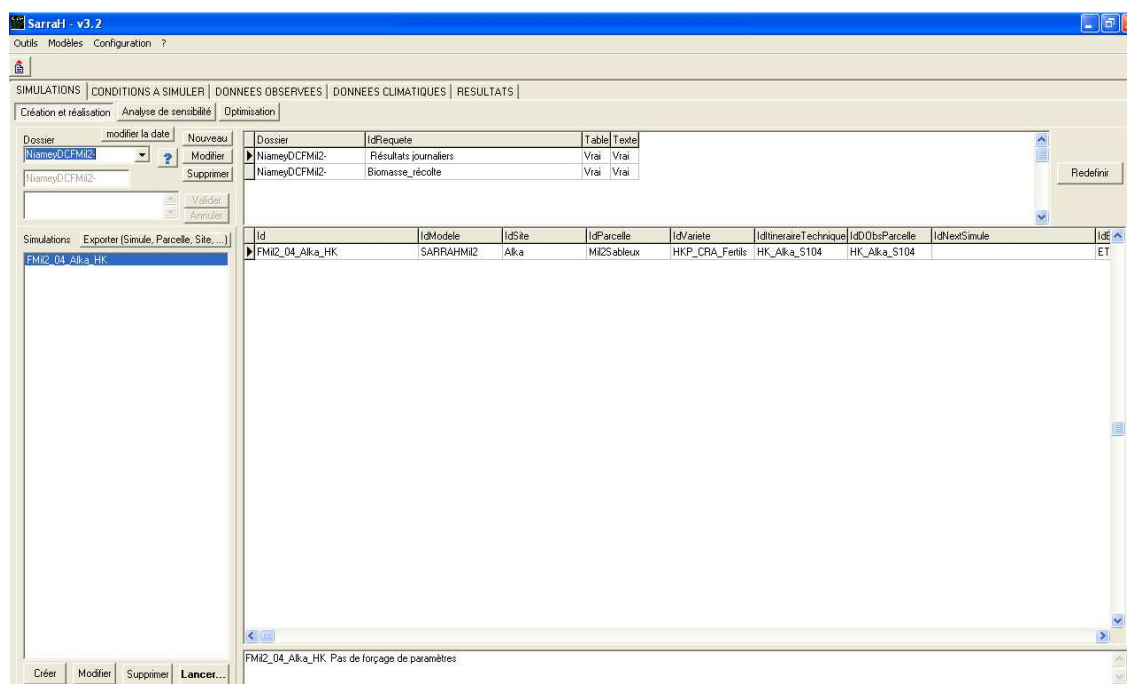
Après validation, les éléments de votre requête s'affichent comme montré dans cette figure



This redefinition of your query elements allows your simulation to run normally.

## XIV. Running simulations

In the **"Simulation"** tab and **"Creation and realization"** sub-tab, you can run your simulation by clicking on the **"Launch"** button (see bottom of the left column). But before, you must first click into your left column to select your simulation, as shown in the figure below. Then, click on **"Launch"** (bottom of the same column)



The **"Creation and realization"** sub-tab is composed of three main parts:

- The left column contains the simulations list already defined and allows you to create new ones. The management of simulations names and the folder to which you wish to connect the simulation is also done at this level. It is also possible to delete, modify or export the simulations at this level (we'll talk about it later).
- the right part allows to display the parameters used by the simulations,
- The top box, where the redefined elements for the simulation query are displayed.

To launch a simulation or a set of predefined simulations, select the desired list of simulations and click the **"Launch"** button.

To modify a simulation (you cannot modify several simulations at the same time), select the simulation you want to modify and click the **"Modify"** button.

To delete a (or a set of) simulation (s), select the simulations list you want to delete and click the **"Delete"** button.

To add a new simulation, you must click on the **"Create"** button and select parameters of your new simulation in the window that will appear (see above under the subtitle, creating a simulation).

The simulation execution is fast, but it is particularly slower when you run multiple simulations at once. You can see that the interface launches a small window (Figure below). In fact, this is the simulation engine, the core of the software. You can stop the execution of the simulation by clicking the **"Stop simulation"** button.

Attention!!! Attention! When you stop ongoing simulations, most often a bug occurs and it blocks the entire Sarra-H engine. If this bug occurs, Sarra-H is completely blocked and you cannot even close it by the normal procedure. To solve the problem, you must press **"Ctrl" "Alt" "Delete / del"**, select **Sarra-H-V3.2** and click **"Stop session"**.

It will then be necessary to relaunch SARRA-H to continue your work. But more often, this action **"Stop Session"** requires a compacting of the model tables for automatic correction (by the model itself) of bugs or errors into its management system as a result of **"End session "**. For this purpose, when the model is relaunched, a window displays to warn about the need for a compacting.

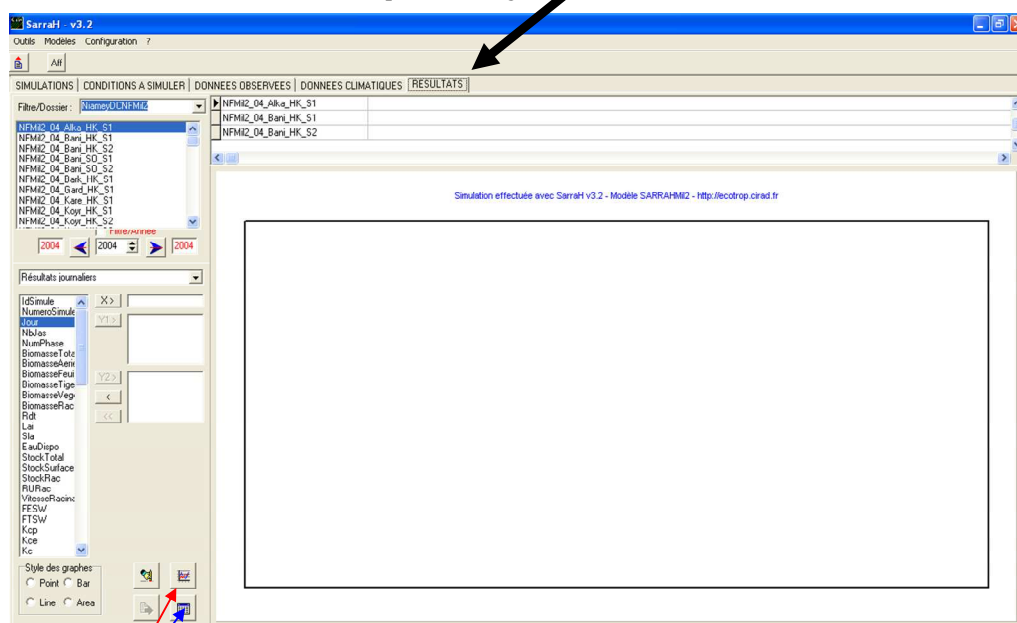


The information displayed in this engine are only useful in case of technical problem and for parameter optimization.

When the engine disappears (the small window closes itself), that means the simulation was successful and there was no error. The simulated results are now available in the **"Results"** tab

## XV Results visualization

Pour visualiser les résultats, il faut cliquer sur l'onglet "**Résultats**"



Il y a deux options de visualisation des résultats : option numérique et option graphique.

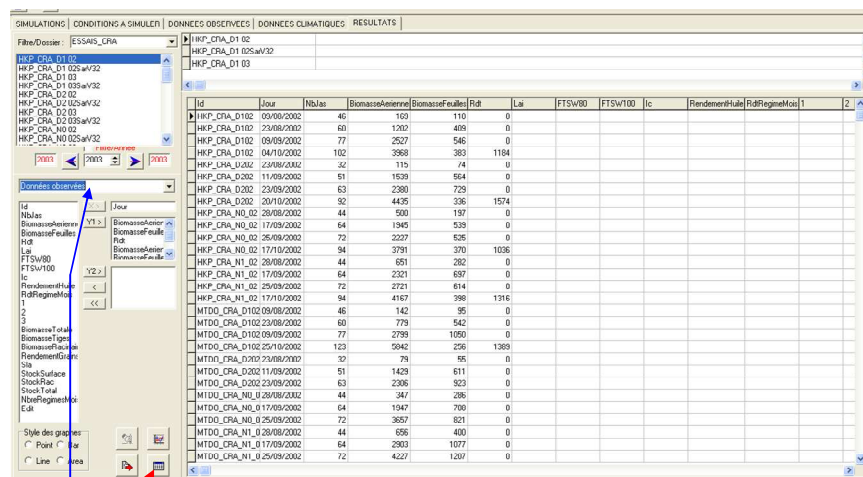
Pour passer d'une option à une autre, il suffit de cliquer sur l'un des boutons suivants :

Ici, pour visualiser les résultats numériques

Ici, pour visualiser les résultats graphiques

## Data table mode or digital visualization of results

The figure below shows a visualization of observed data through the "**RESULTS**" tab (data can also be viewed via the "**OBSERVED DATA**" tab).




La procédure consiste à :

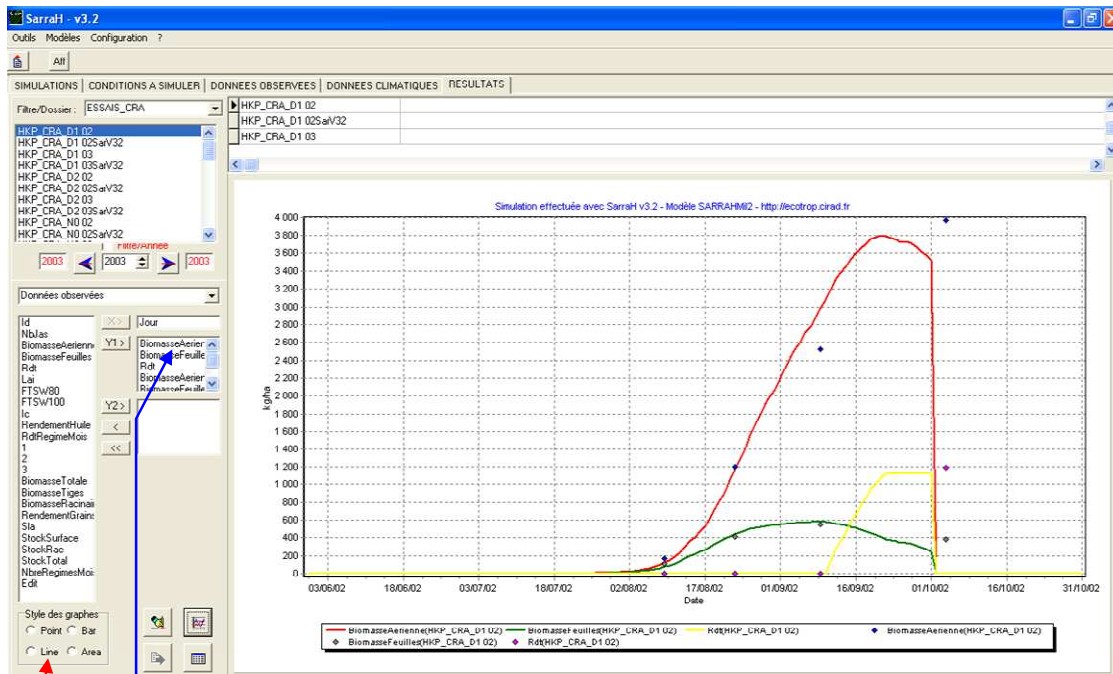
- Sélectionner "**Données observées**", dans cette case déroulante et à
- cliquer sur ce bouton

With the same procedure, one can visualize the simulated values (for all variables) by selecting "**Daily Results**" in the scrollable box. The figure below shows an example of visualization of simulated values. As visible from the scrollable box in this figure, one can also visualize other types of data (meteorology, rainfall etc.).



The button  allows you to remove (clear) all the variables used for the X-axis and Y-axes.

The chart below shows an example of a chart visualization about the evolution of above ground biomass (red curve), the leaf biomass (green curve) and grain yield (yellow curve). For each variable, the points represent the observed values and the continuous lines, the simulated values.



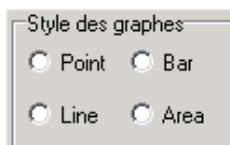
Pour choisir l'option de représentation graphique en "**Points**", "**Lignes**", "**Barres**", ou "**Aire**", il suffit de :

- Sélectionner la variable dans la liste Y1 ou Y2

Puis dans "**Style des graphiques**"

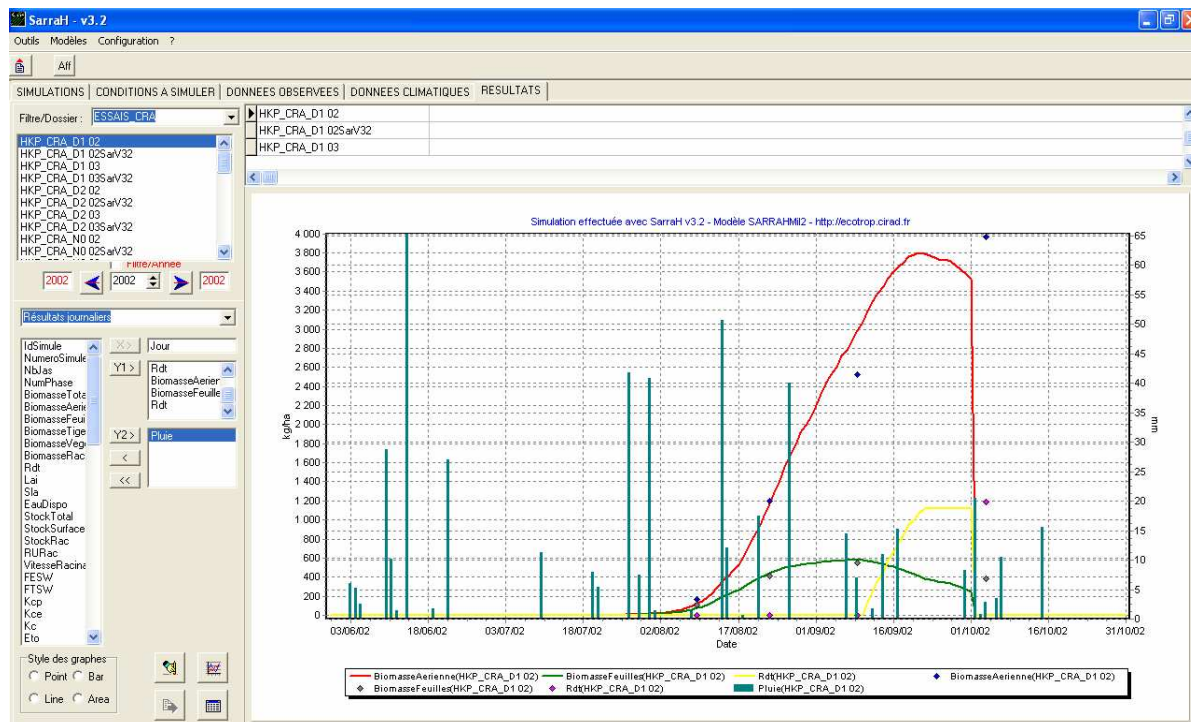
- cliquer (selon le choix) sur "**Point**" (point), "**Line**" (ligne), "**Bar**" (barre) ou "**Area**" (aire)

The button group named **type of charts** allows determining the chart type to be applied to one or more variables.



For this, simply select from the list Y1 or Y2, one or more variables (hold down the Ctrl button), then click on the desired type. The graph is redrawn immediately.





Y1 axis (left axis): Evolution of aboveground biomass, foliage biomass and grain yield according to the date (*Line* style).

Y2 axis (right axis): Daily rainfall according to the date (*Bar* style)

**Note:** You can copy or print a chart. For this, place your cursor on the chart and then right click. A shortcut menu appears:

Copier

Imprimer

The chart is then stored in Windows clipboard, then paste it simply in a word processing or spreadsheet.

**Attention!!!** When you are in chart visualization mode, if you modify an observed value, the chart curves become disorganized into points cloud. To avoid this bug, one must switch to data table mode before proceeding to the modification. In case the bug has already occurred, just erase the chart and redraw it to correct the bug.

## XVI. How to create a multiannual simulation?

To create a multiannual simulation, the procedure is the same as creating a simple simulation (annual). The only difference lies in the definition of "*Year of the beginning first simulation*" and "*Year of the ending last simulation*", as shown by the figure below. Indeed, the two small boxes; "*1961*" and "*2000*" as an example in this figure are used to define (by choice) a range of years for which you want to run simulations. However, for the simulations to succeed, it is first necessary to have in the Sarra-H model; meteorological and rainfall data for the entire selected years range. The results of these simulations are annual, and one cannot, for now, directly get **one single simulated value**, for a whole considered range of years.

**Attention:** multiannual simulations work well for years following the year of the sowing date. However, the current version of Sarra-H doesn't permit to launch simulations for past years, with respect to the year of sowing date as defined in the tab "INITIAL CONDITIONS" and the sub-tab "cropping practices ". So for the simulations to work, it is necessary that the sowing date be reduced to the year of the beginning first simulation!!! For example, for launching multiannual simulations over the period 1961-2000, it would be necessary to have the sowing date in 1961.

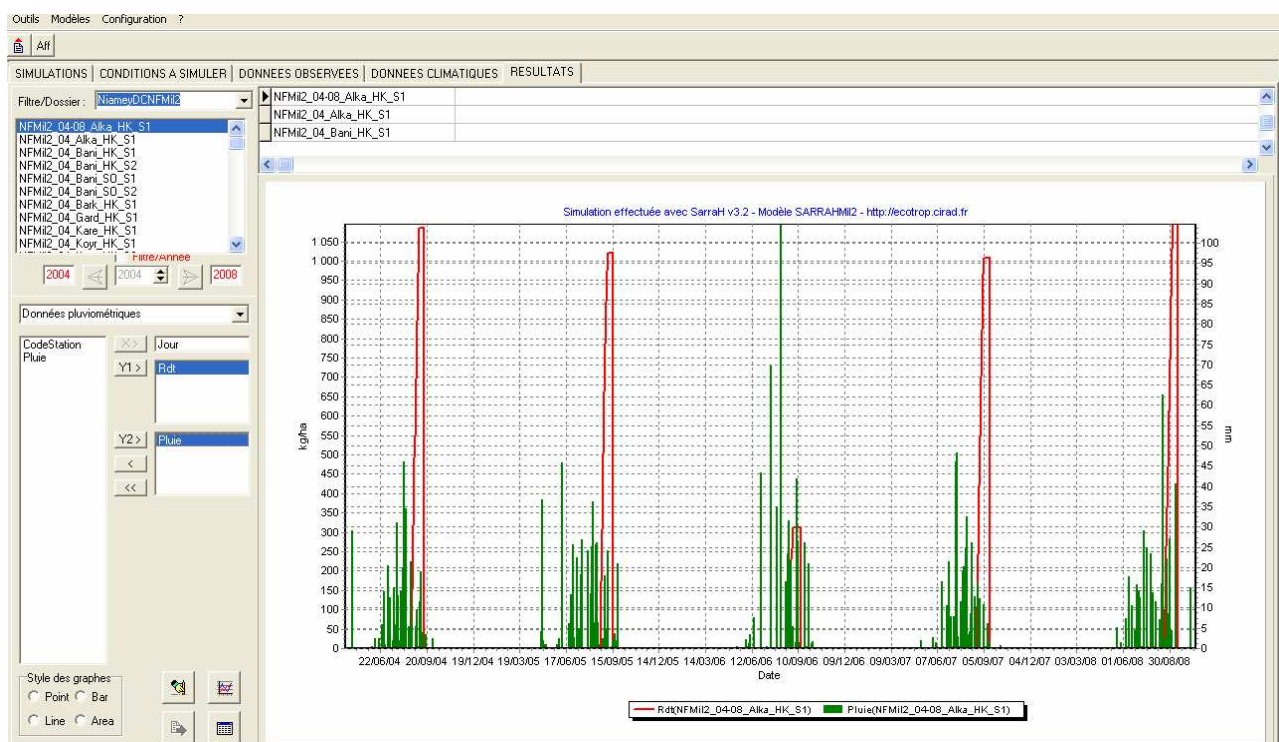
The screenshot shows the Sarra-H configuration interface. Key sections include:

- Parcelle:** BAMBEY96Pluie, Mi2Sableux
- Site:** Anglymet
- Variété:** HK\_CRA\_Fertile, HK\_CRA\_NonFert, Mi\_Souna3, Rice\_E933, Souna3\_F\_V3
- Itinéraire Tech:** CRA\_D1\_02, CRA\_D2\_02, CRA\_HKP\_N0\_02, CRA\_HKP\_N1\_02, CRA\_HKP\_N1\_03
- Modèle:** RizPluvPap, RizPluvStr, RizStr\_Semiscal, RizStr2, RizStr3, SARRAH06, SARRAHMI1, SARRAHMI2
- Données Observées (facultatives):** 96PluieF2, 96SiresFloF2, AntsE933, HKP\_CRA\_D102, HKP\_CRA\_N002, aucune
- Dates de simulation:**
  - Année de début de la 1ère simulation: 1961 (format aaaa)
  - Année de fin de la dernière simulation: 2000 (format aaaa)
  - Début de la période de la culture: 30/5 (format j/mm)
  - Fin de la période de la culture: 31/10 (format j/mm)
- Dossier:** Demo
- Identifiant:** Simul\_Pluviennelle
- Buttons:** Créer, Modifier, Supprimer, Lancer..., Annuler, Valider

Define here (in format aaaa),  
*The year of the beginning first simulation*  
 and  
*The year of the ending last simulation*

## XVII How to create charts in the case of a multiannual simulation?

To display all the years of the simulation, uncheck the box labeled *Filter/Year*. In this case, the chart will be as the following:



## Annex 1

- The modeler version, which is complementary to the User version (adding items "**Models**" and "**configuration**" in the Sarra-H menu bar).

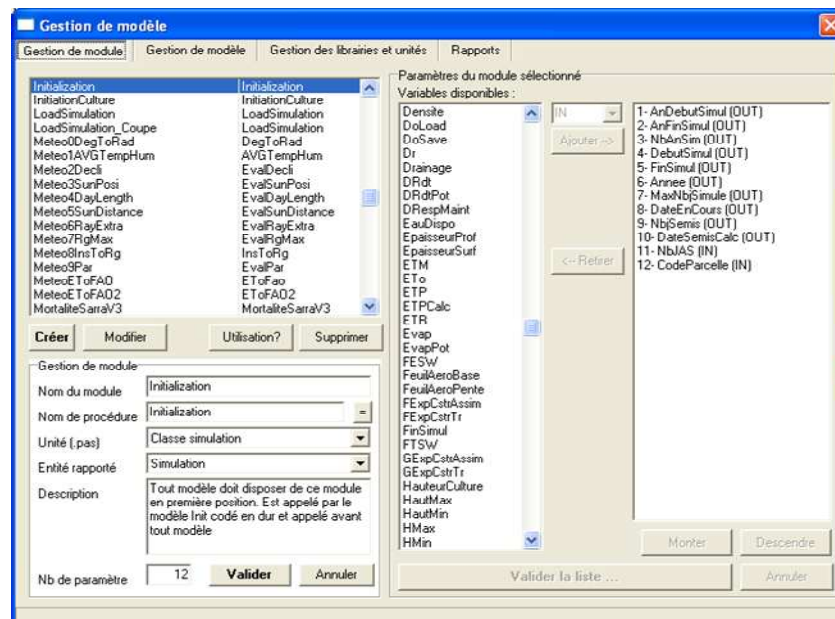


SarraH\_3\_2\_modelisateur.exe

Only persons authorized to make or suggest changes in the management and configuration of the Sarra-H model are provided with the version **modélisateur.exe**. To install it in your computer, simply double-click the **modélisateur.exe** and follow the instructions on the screen. This version (complementary to the previous one) simply allows to have access and to use "**Models**" and "**Configuration**" items (which don't appear in the user Version), as shown in Figures 1 and 2. (See Annex x.x)

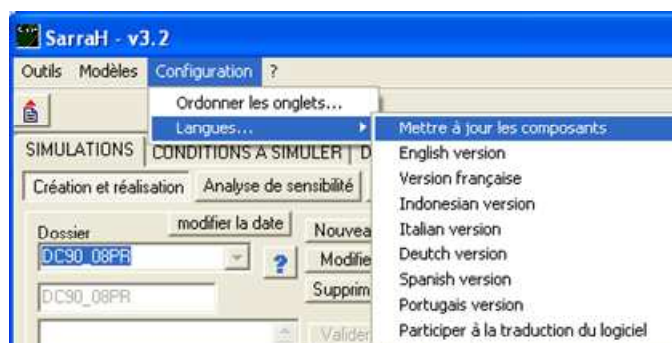


Si vous cliquez sur "**Gérer...**", la fenêtre ci-dessous s'ouvre pour permettre l'accès au module, au modèle, aux bibliothèques et unités et aux rapports.

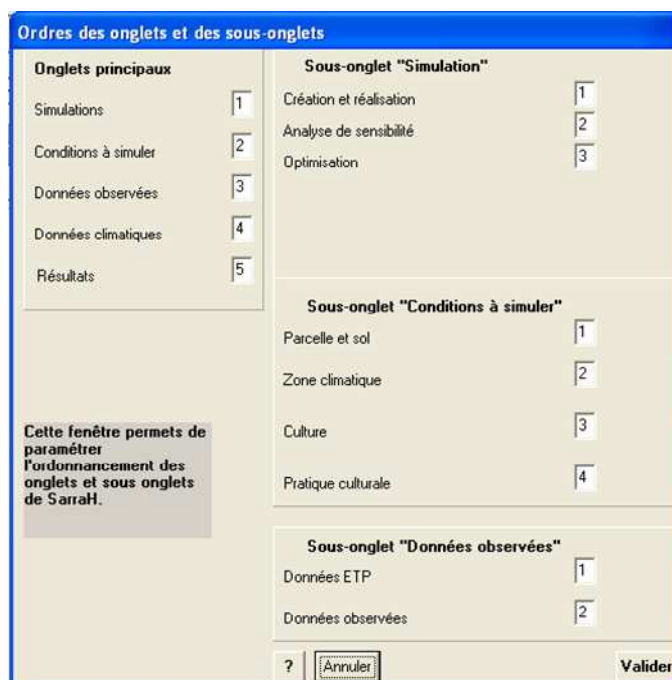




## Annex 1 (continued)



Si vous cliquez sur **"Ordonner les onglets..."**, la fenêtre ci-dessous s'ouvre pour permettre de choisir les onglets et sous-onglets dans l'ordre que vous voulez.



## Annex 2



You must define the folder for the sake of organization of your simulations. The folder should be created beforehand (before creating the simulation) in the "**Simulations**" tab, the "**Creation and realization**" sub-tab and the "**Folder**" checkbox (figure on the left): the "**New**" button allows to create the new folder, the "**Modify**" button to modify it and "**Delete**", to delete it.



When you click on "**New**", two boxes open to allow you to enter the name of your folder and validate it by clicking on "**Validate**" (Figure on the left). This figure shows that you can cancel the creation of your folder.

**Attention!!!** It is the name entered into the smallest box that is determinative and it must not contain a large number of characters, to avoid a bug.

### **Annex 3: ACRONYMS AND ABBREVIATIONS USED IN SARRA-H**

**Biomfeuille:** Leaf biomass

**Biomgainj:** Daily gain in biomass

**Biomtot:** Total biomass

**BiomTotStadeIp:** Biomass at the panicle initiation stage

**BiomtotStadeRPR:** Biomass at the flowering stage

**BVP:** Basic Vegetative Period

**CSTR:** Stress Constant

**DayRdt:** Daily yield

**DayRdtPot:** Potential daily yield

**$\epsilon_b$  (Epsilon b) :** Conversion efficiency of intercepted radiation to dry matter

**ETM or ETRM:** Maximum Evapotranspiration

**ETo:** Reference Evapotranspiration

**ETR:** Actual Evapotranspiration

**EvapPot:** Potential Evaporation

**EVj :** Daily Evaporation

**FESW:** Fraction of evaporable soil water

**FTSW:** Soil water transpirable fraction

**HI:** Harvest index

**IRESP:** Expected yield index

**JAS:** Days after sowing

**K:** light extinction Coefficient

**Kbasefeuille:** Basis of the relationship between above ground biomass and leaf biomass/above ground biomass

**K<sub>C</sub>:** crop coefficient

**K<sub>CE</sub>:** Part of the crop coefficient due to soil evaporation

**K<sub>C</sub>MAX:** Maximum crop coefficient

**K<sub>CP</sub>:** Part of the crop coefficient due to plant transpiration

**Kmulch :** Coefficient of soil roughness

**KPar :** coefficient of photosynthetically active radiation ( $K_{par} = 0,48 \text{ à } 0,5$ )

**Kpentefeuille:** slope of the relationship between (leaf biomass/above ground biomass) and the above ground biomass

**kRdt:** Potential yield evaluation coefficient from the difference of biomass between the flowering and the panicle initiation stages

**Krealloc:** Reserves reallocation coefficient

**LAI:** Leaf area index

**LTR:** Light radiation fraction unintercepted by the cover

**Matu1:** Maturity stage from flowering to waxy maturity

**Matu2:** Maturity stage from waxy maturity to total maturity

**MAT:** Maturity

**P:** Water supply due to rainfall

**PAR :** Photosynthetically Active Radiation

**parP:** Specific Parameter to each species which expresses the soil water critical threshold at which the water stress reduces linearly the plant transpiration

**pF4:** Wilting point

**pFactor:** Transpiration rate calculation coefficient

**PSP:** Photoperiod-sensitive phase

**R:** lateral water exchanges

**RC:** Water capillary rise in the root zone

**RDU:** Hardly usable water reserve

**Rdt:** Grain Yield

**RdtPot:** Potential grain yield

**RespMaint:** Maintenance respiration

**Resterois:** Growth deficit

**RFU:** Easily usable water reserve

**Rg:** Global radiation

**Rn:** Net radiation

**RPR:** Reproductive period

**RR:** Reflected radiation

**RU:** available water reserve

**RUR:** Root available water reserve

**SARRA-H:** Regional Agroclimatic Risks Analysis System

**SLA:** Specific Leaf Area

**Somtemp:** Sum of temperatures (in degree days)

**Tbase:** Minimum basic temperature

**Tlim:** Limit temperature

**Tmax:** Maximum temperature

**Tmin:** Minimum temperature

**Topt:** Optimum temperature

**TR:** Actual transpiration

**TRj:** Daily transpiration

**TrPot:** Potential transpiration