

5 - EXAMPLES OF USE

In the MacMul user manual, various examples were used to perform different analyses. Here we will use the same examples to show in detail how to obtain certain figures with GraphMu. We will not consider the examples concerning the drawing of ellipses and Gauss curves, which have already been explained in the MacMul manual.

All the figures were produced on a Macintosh SE/30, system 6.0.3 with Multifinder, 4Mbyte memory, 40 Mbyte hard disk and Radius TPD A3 black and white screen (882 by 1152 pixels). The programs used were GraphMu version 4.06, MacMul version 2.14, Microsoft Word 4, SuperPaint 1.0 and MacDraw II. In all cases, a Macintosh Plus with 1 Mbyte memory and a 20 Mbyte hard disk would be sufficient. Digitization is however easier with a larger screen (e.g., Apple's 12 inch screen).

Factor planes

The most used graphic (for want of being the most relevant) in data analysis is the factorial diagram, or "factor plane". In GraphMu terminology it is a "Character map" graphic. Figures 6.7 and 6.8 of the MacMul user manual gives the F1 x F2 factor plane of the rows and columns of the PCA of the data set used by Doledec et Chessel:

Doledec, S. et Chessel, D., (1987). Rythmes saisonniers et composantes stationnelles en milieu aquatique. I - Description d'un plan d'observation complet par projection de variables. *Acta Oecologica, Oecologia Generalis*, **8**, 403-426.

Reading this article and the paper by Thioulouse and Chessel:

Thioulouse J. et Chessel D. (1987). Les analyses multitableaux en écologie factorielle. I: De la typologie d'état à la typologie de fonctionnement par l'analyse triadique. *Acta Oecologica, Oecologia Generalis*, **8**, 463-480.

will help in understanding the examples considered here.

We will examine how these graphics are obtained from the files created by MacMul. The factor coordinates of the rows and columns are arranged in the "cn1.CPLI" (row coordinates) and "cn1.CPCO" (column coordinates) files. The number of **columns** of these files is equal to the number of **factors** saved in the analysis, here 4. The number of **rows** of the "cn1.CPLI" file is equal to the number of **rows** of the data table (i.e. 24) and the number of **rows** of the "cn1.CPCO" file is equal to the number of **columns** of the data table (i.e. 10).

The first stage in drawing the F1 x F2 factor plane of the rows consists in selecting the "Character map" command of GraphMu "Graphics" menu (figure 3.1). This gives access to the first dialog window (figure 3.4). Just click the "File XY" button

and select the "cn1.CPLI" file using the standard file selection window. The "Rows" and "Columns" fields are automatically filled with the suitable values (24 and 4, cf. figure 4.1). The file name can also be typed directly in the corresponding field on the keyboard, but in this case you must remember the number of rows and columns of the file and type them in the next two fields. Then type the number of the columns of the "cn1.CPLI" file which are to be used for the abscissae and ordinates (1 and 2 since we want to draw the F1 x F2 factor plane).

There is no need to click the "File G" button, as this file is optional. The corresponding fields can be left empty. The default row selection option corresponds to the "All" button which means that all the rows of the "cn1.CPLI" file will be used to draw the graphic (figure 4.1).

The user can then click the "OK" button which passes to the dialog window for the general graphics parameters (figure 3.6)

Figure 4.1:
Main dialog window of the Map command.
Example of use in the case of the PCA of the "Meau" file.

To obtain a graphic quickly, just click the OK button again. The graphic will appear on the screen in a new window called "Map 1".

In the case of factor planes however we need to have a graphic in which the height/width ratio is exactly equal to the height/width ratio of the values represented (orthonormal reference). This is possible whatever the shape (square or rectangular) of the graphic.

There are therefore several possibilities which we will describe in detail beginning with the simple case of square graphics. As explained before ("Shape of graphics" paragraph), if square graphics are required, one must:

- either select a **square** drawing in the dialog window of the general parameters (figure 3.6) and indicate a number of horizontal graphics equal to the number of

vertical graphics. The window size, defined with the "Screen size" command of the "File" menu (figure 2.17), has no influence.

- or select a **rectangular** drawing and indicate numbers of horizontal and vertical graphics such that their ratio is equal to the height/width ratio of the drawing. The window size, defined with the "Screen size" command of the "File" menu, (figure 2.17) must therefore be taken into account.

In both cases each graph will be square and the height/width ratio of the values represented must thus be equal to 1. By default, GraphMu automatically calculates the minimum of the graphic abscissae and ordinates ("Comput.: Yes/No" buttons, figure 3.6) and uses these values as graphic limits. If the height/width ratio is to be equal to 1, these values must be changed. This is possible by clicking the "Modif.: Yes" button (figure 3.6). In this case, before drawing the graphic, GraphMu displays the minimum and maximum values found in the file and they can thus be changed. Figure 4.2 shows the result obtained for our example.

We can see that these values are not exactly the extreme values found in the X and Y columns of the "cn1.CPLI" file, which are [-7.234; +2.332] for the abscissae and [-1.543; +2.927] for the ordinates (see table 5 of the MacMul manual). This is because GraphMu automatically takes account of the place taken by the character strings which are written on the factor plane.

Min. abscissa:	-7.234
Max. abscissa:	2.648
Min. ordinate:	-1.543
Max. ordinate:	3.040

OK

Figure 4.2:
Dialog window to change the minima and maxima of the abscissae and ordinates

As we requested a square diagram and specified a number of horizontal and vertical graphics equal to 1, we must replace these values with values whose ratio is equal to 1, while respecting the fact that the zone so defined must be large enough for all the points to be inside it.

One can choose the interval [-8; +3] for abscissae and [-5; 6] for ordinates: this will give a square area (height/ width = $(6 + 5)/(3 + 8) = 11/11 = 1$). The exact values chosen in the MacMul user manual were [-7.3; +2.7] and [-5; +5], which gives a slightly more precise graphic.

Another possibility, still using square graphics, is to request a rectangular drawing and numbers of horizontal and vertical graphics such that their ratio is equal to the height/width ratio of the drawing.

Figure 4.3 shows the result obtained on requesting a rectangular drawing in a window of size 400 x 600 pixels, with 3 horizontal graphics and 2 vertical graphics. The minima and maxima of the abscissae and ordinates were fixed at [-8; +3] and [-6; +5]. This figure is not deformed in comparison with figure 6.7 of the MacMul manual.

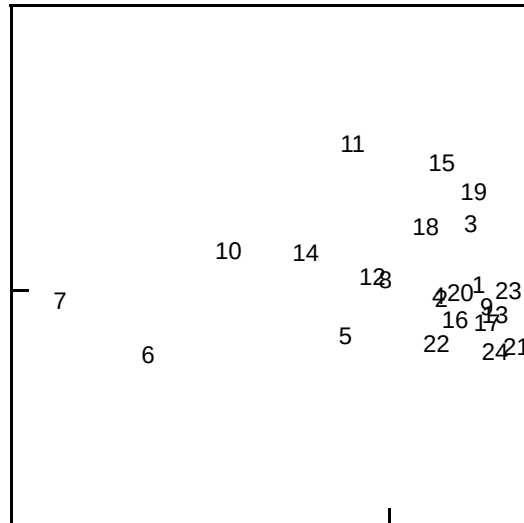


Figure 4.3:
F1 x F2 factor plane, drawn with a rectangular drawing, 3 horizontal graphics and 2 vertical graphics, in a window of size 400 by 600 pixels.

Rectangular graphics can also be used. So that the figure is not deformed, one must thus indicate, for the minimum and maximum of the abscissae and ordinates, values such that the width/height ratio of the area to be represented is equal to the width/height ratio of the graphic.

As an example, (figure 4.4) one can, in a window of size 200 by 300 (height/width ratio = 2/3), draw a rectangular drawing, with just one horizontal and vertical graphic, on condition that as limits one has [-8.25, +8.25] for the abscissae and [-5.5, +5.5] for the ordinates, i.e. a height/width ratio of $(5.5 + 5.5)/(8.25 + 8.25) = 11/16.5 = 2/3$.

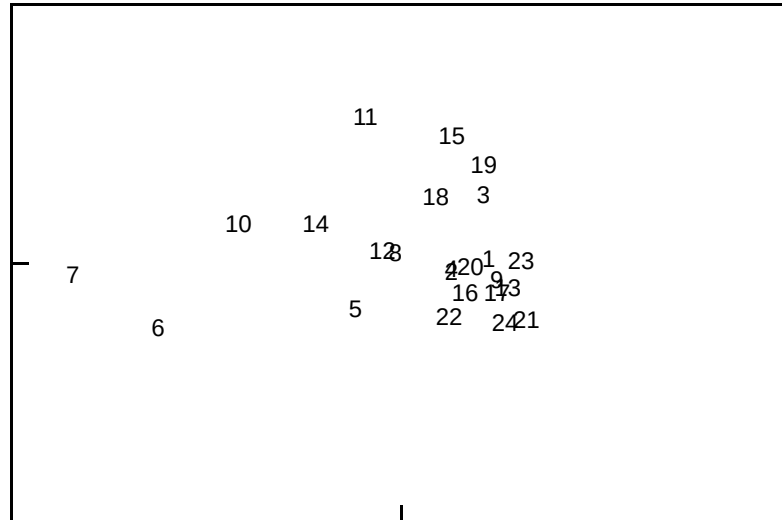


Figure 4.4:
F1 x F2 factor plane, drawn with a rectangular drawing, 1 horizontal graphic and 1 vertical graphic, in a window of size 200 by 300 pixels.

We should remember that after the drawing has been completed, various parameters (files, selection of rows and/or columns, number of horizontal and vertical graphics, minimum and maximum of the abscissae and ordinates) can be changed just by using the corresponding commands of the "Modif." menu. Scales can also be added, using the "Legend scales" command of the same menu. Figure 4.5 shows the result obtained with the preceding example and the rulings indicated in figure 4.6.

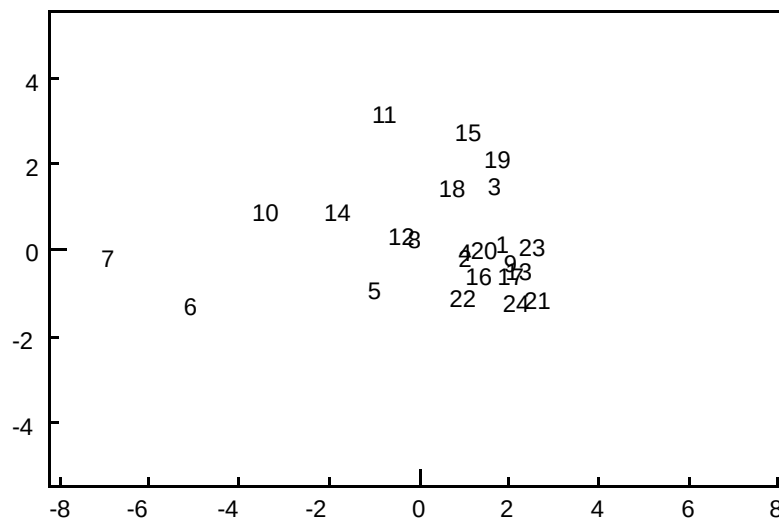


Figure 4.5:
Graphic of figure 4.4 on which scales have been added with the rulings indicated in the dialog window of figure 4.6.

One can see on these figures that the number of graduations required (figure 4.6) may not be respected by GraphMu: in the case of the abscissa axis the user asked for 10 graduations, but the program has only drawn 9, so that these graduations correspond to integer values (here whole numbers).

Horizontal axis:		Vertical axis:	
Graduations:	<input checked="" type="radio"/> Yes <input type="radio"/> No	Graduations:	<input checked="" type="radio"/> Yes <input type="radio"/> No
Values:	<input checked="" type="radio"/> Yes <input type="radio"/> No	Values:	<input checked="" type="radio"/> Yes <input type="radio"/> No
Minimum:	<input type="text" value="-8.250"/>	Minimum:	<input type="text" value="-5.500"/>
Maximum:	<input type="text" value="8.250"/>	Maximum:	<input type="text" value="5.500"/>
Nb. grad.:	<input type="text" value="10"/>	Nb. grad.:	<input type="text" value="5"/>
<input type="button" value="Cancel"/>		<input type="button" value="OK"/>	

Figure 4.6:
Dialog window for the ruling of scales.

The drawing may then be saved in a file, or copied and then pasted in a Macintosh drawing program (here SuperPaint) and its appearance improved.

One can, for example, (figure 4.7), add arrows to symbolise the axes, add the inertia percentages corresponding to each factor, change the size and the style of the font for certain points or draw a line around them to stress a type.

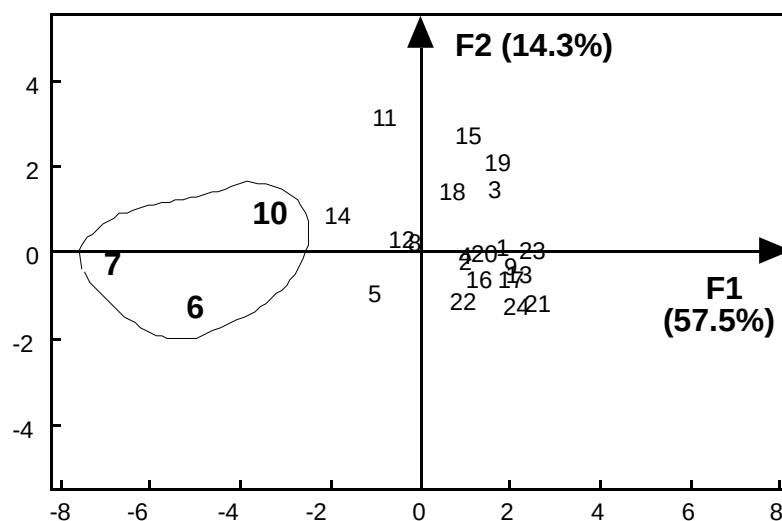


Figure 4.7:
Example of modifications of a drawing made with GraphMu.

In the case where one does not wish to use as point identifier (lines or columns) their order number in the data file, a G file should be used. For character maps, this

file should be a TEXT file and should contain the character strings which must be placed on the factor plane. In our example, the 24 rows of the table correspond to 6 sites sampled on 4 dates. One might thus wish to represent the 4 dates by different symbols, the 6 sites having the same symbol. By using the symbols + (date 1), * (date 2), o (date 3) and x (date 4), one creates the G file represented in table 1.

+ * o x + * o x + * o x + * o x + * o x + * o x

Table 1

Contents of the G file used to draw the graphic of figure 4.8 (the file must have only one character per line).

This file has just one character per line and a number of lines equal to the number of lines of the "cn1.CPLI" file. This information is given by the user in the corresponding fields of the dialog window of figure 4.1 (these values cannot be assigned automatically by opening the file with the "File G" button). The following operations are the same as previously and the graphic of figure 4.8 is obtained, on which one can easily see the arrangement of the 6 sites for each date.

It would obviously have been possible to use a G file containing longer character strings, allowing characterisation of each site at each date (e.g. S11, S12, S13, S14, S21, S22, S23, ...).

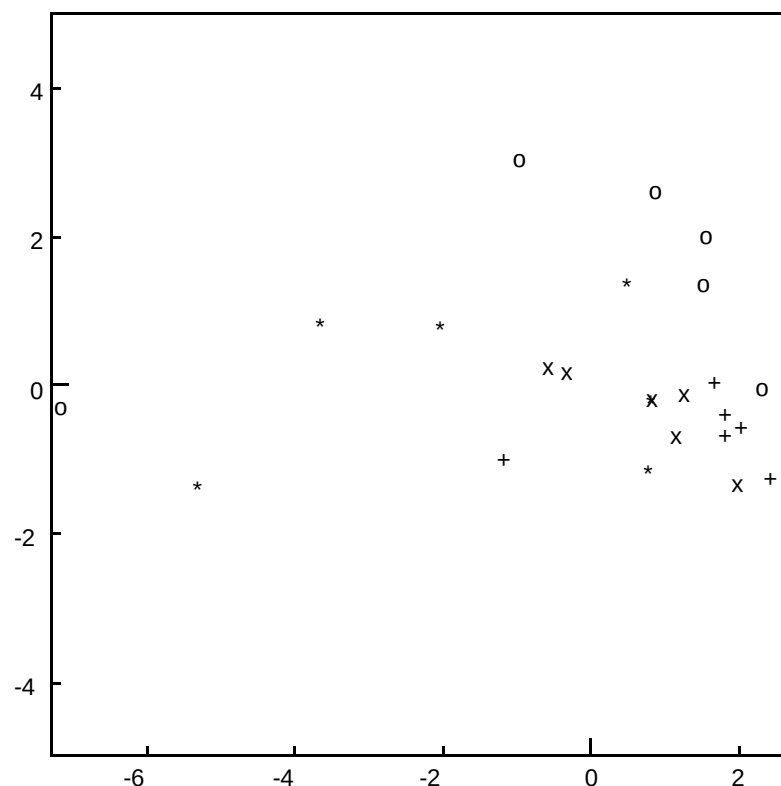


Figure 4.8

Factor plane produced using a symbol file (G file).

One of the most important possibilities offered by GraphMu however is the possibility of making collections of graphics. We will now look at how a collection of factor planes can be made, each diagram corresponding to a group of rows of the data table.

The aim here will be to produce a series of 4 graphics (one graphic per date), each graphic containing the 6 sites sampled on one date. This drawing is represented in figure 4.9: one will easily find, for each date, the 6 sites numbered from 1 to 6. The G file used here is different from the previous one, it contains the characters

1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 6 6 6 6 (one character per line).

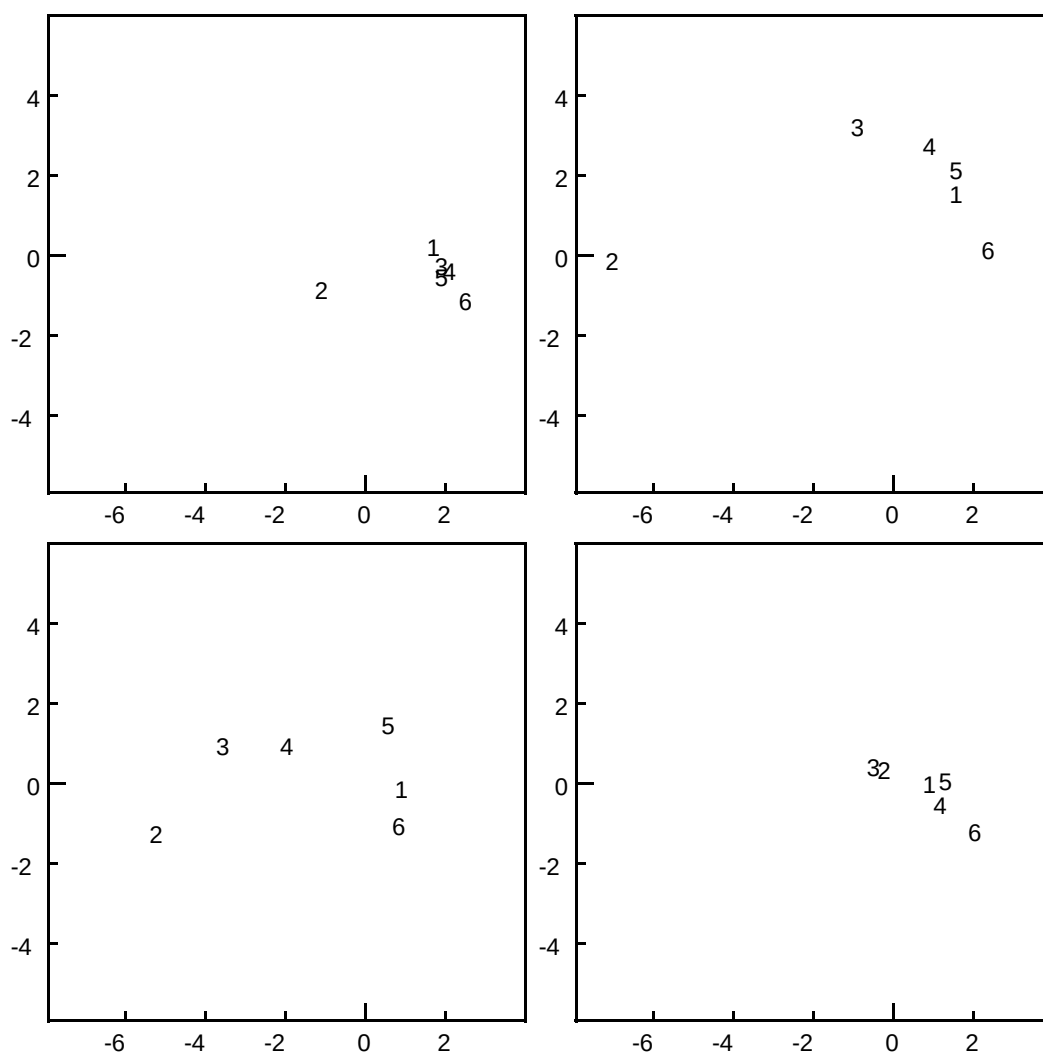


Figure 4.9
Collection of factor planes, each diagram corresponding to a date

The lines can be selected with GraphMu in two ways: selection on the keyboard or selection using a selection file. We will study how to use each of these two methods to obtain the selection required.

Selection on the keyboard is obtained by clicking the "Keyboard" button of the main dialog window (figure 4.1). In this case, instead of obtaining the general parameter dialog window (figure 3.6) immediately, one obtains the row selection dialog window (figure 1.4). For each graphic one must type the corresponding line numbers of the "cn1.CPLI" file. In our example, the first graphic corresponds to date number 1, the rows corresponding to the 6 sites are lines number 1, 5, 9, 13, 17 and 21. These 6 values are typed, separated by semi-colons, then the "Validate" button is clicked. For date number 2 and therefore the second graphic, the corresponding rows are 2, 6, 10, 14, 18 and 22. These new values are typed, again separated by semi-colons, then the "Validate" button is clicked. When the row

numbers corresponding to the 4th graphic have been typed and validated, just click the "End" button. Operations continue normally.

In the example above, typing the row numbers associated with each graphic is not very easy because these numbers do not correspond to neighbouring rows in the file. If a "symmetrical" drawing is required, i.e. 6 graphics, (one graphic per site), each containing the 4 sampling dates for a site, typing would have been easier, because it would just have been necessary to type "1to4", then "5to8", "9to12", "13to16", "17to20" and "21to24" for the 6 graphics to obtain figure 4.10 (rectangular drawing, 2 vertical graphics, 3 horizontal graphics, window 300 by 450 pixels). The G file is however different from the preceding: it must contain the following characters: 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 (one character per line).

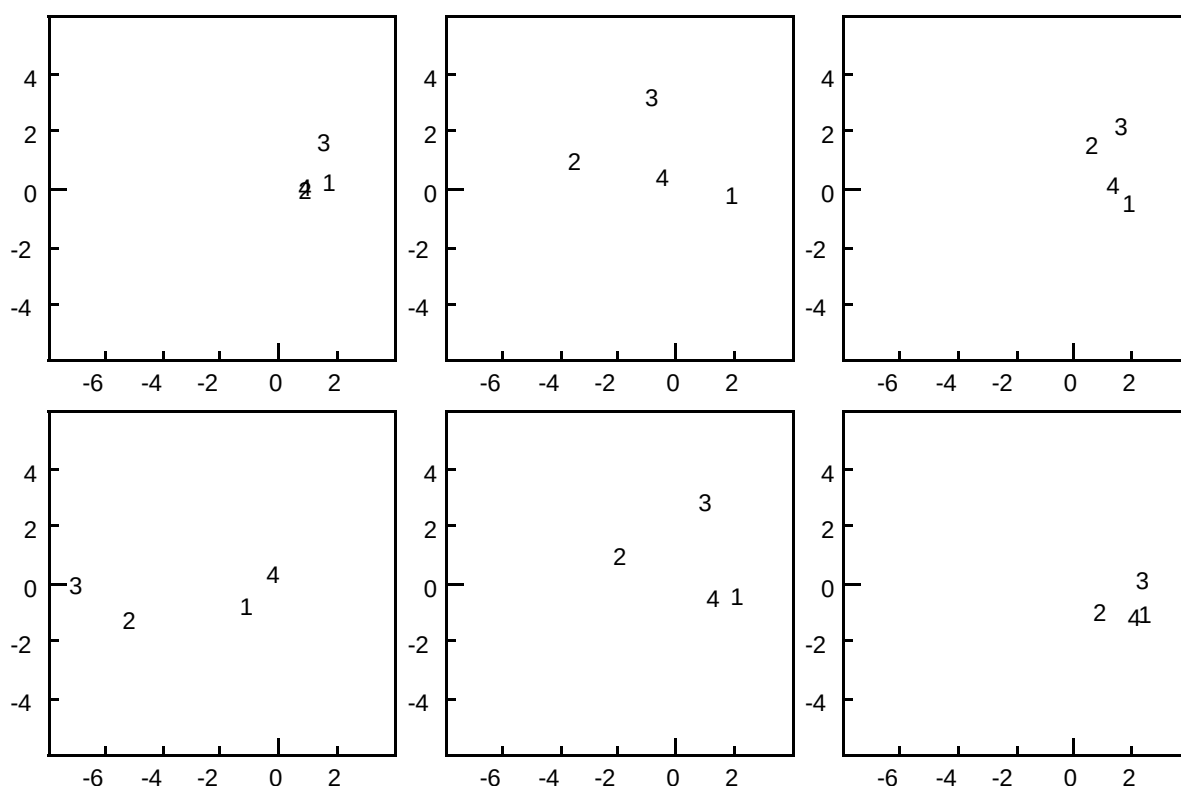


Figure 4.10
Collection of factor planes, each diagram corresponding to a site

It is clear in figures 4.9 and 4.10 that the type of graphical display used is very important for the legibility of the PCA results. The same factor coordinates grouped according to dates show the between-sites structure of the process of pollution and restoration of the watercourse (see the paper) and grouped according to sites stress the chronological aspect (summer/winter opposition).

Selecting rows using a selection file gives a solution to the case of large data files with complex structure, for which typing the row numbers associated with each elementary graphic would be tedious, if not impossible.

This selection mode is obtained by clicking the "File" button of the main dialog window (figure 4.1). In this case, instead of obtaining the row selection dialog window (figure 1.4), one obtains the window of figure 1.5, in which the name and characteristics of the selection file can be specified. The selection system has been explained before, and we will not discuss it in detail

again here. In the example of

interest to us, the selection files which could be used to produce figures 4.9 and 4.10 are given in table 2 (one can use just one file with two columns).

1	1
2	1
3	1
4	1
1	2
2	2
3	2
4	2
1	3
2	3
3	3
4	3
1	4
2	4
3	4
4	4
1	5
2	5
3	5
4	5
1	6
2	6
3	6
4	6

Table 2

Contents of the selection files used to produce figures 4.9 and 4.10. The left column corresponds to the selection file of figure 4.9 and the right column to that of figure 4.10.

These files must be binary files (use the "Transfo TEXT -> BIN" command of the "File" menu). They contain the number of the graphic in which each row must be drawn. One can, e.g., check that the maximum value in each column corresponds to the total number of graphics of the two figures: 4 graphics for figure 4.9 and 6 for figure 4.10.

Furthermore, it is interesting to remark that the selection file of figure 4.9 corresponds exactly (apart from the fact that it is in binary) to the G file of figure 4.10 and vice versa. On the practical level, in this case one just needs to transform the G file of the one into binary to obtain the selection file of the other.

Functional display

The functional display of a factor is a type of graphical display used in data analysis in which the values of a factor are represented as a function of a variable structuring the data table. For example, if the rows of a table processed by an analysis correspond to dates, a functional display could consist in displaying the values of the factors as a function of these dates. In the same way, if the rows correspond to sampling points, the geographical coordinates of which are known, the factor values can be displayed on a map. GraphMu is particularly suitable for this type of display. We will study how to produce the display in time of the values of the 4 PCA factors of our example.

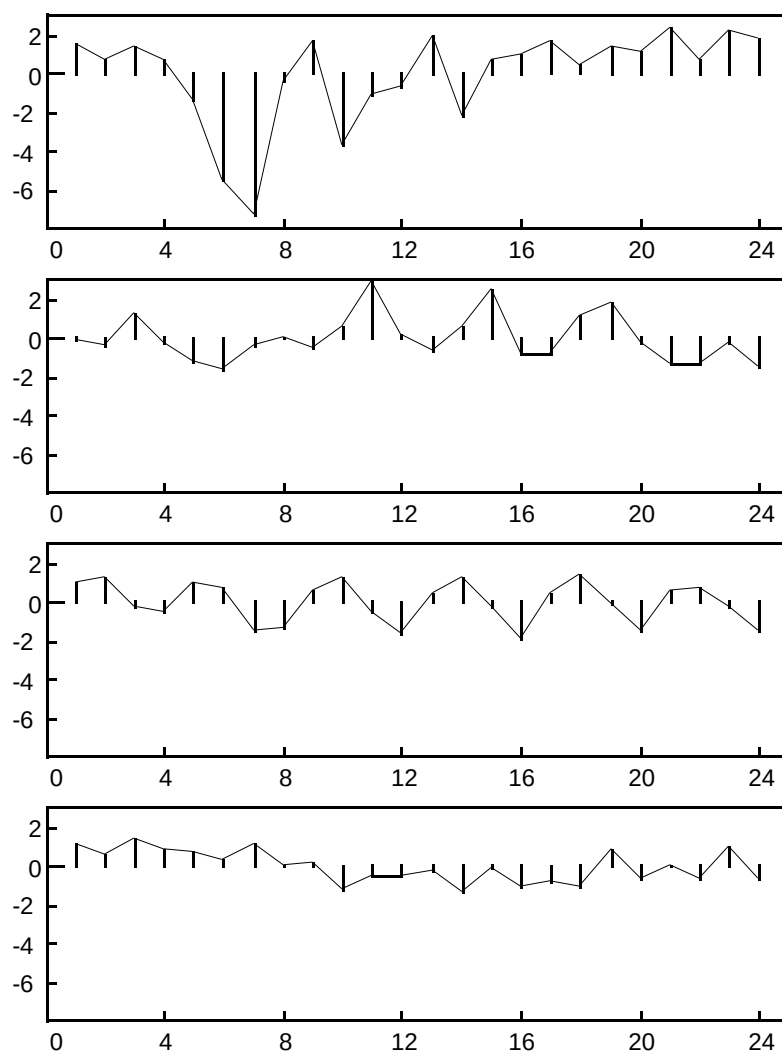


Figure 4.11.

Display of the values of the 4 PCA factors as functions of the number of rows.

A first attempt leads to figure 4.11 in which the values of the first 4 factors (one below the other) are represented by overlaying a curve by lines and a curve by bars. This display is however not satisfactory, because the two structuring factors (dates and sites, i.e. time and

space) are mixed on the same axis. There are two ways of

separating the two structures: by dates or by sites: figures 4.12 and 4.13 show the graphics corresponding to each strategy.

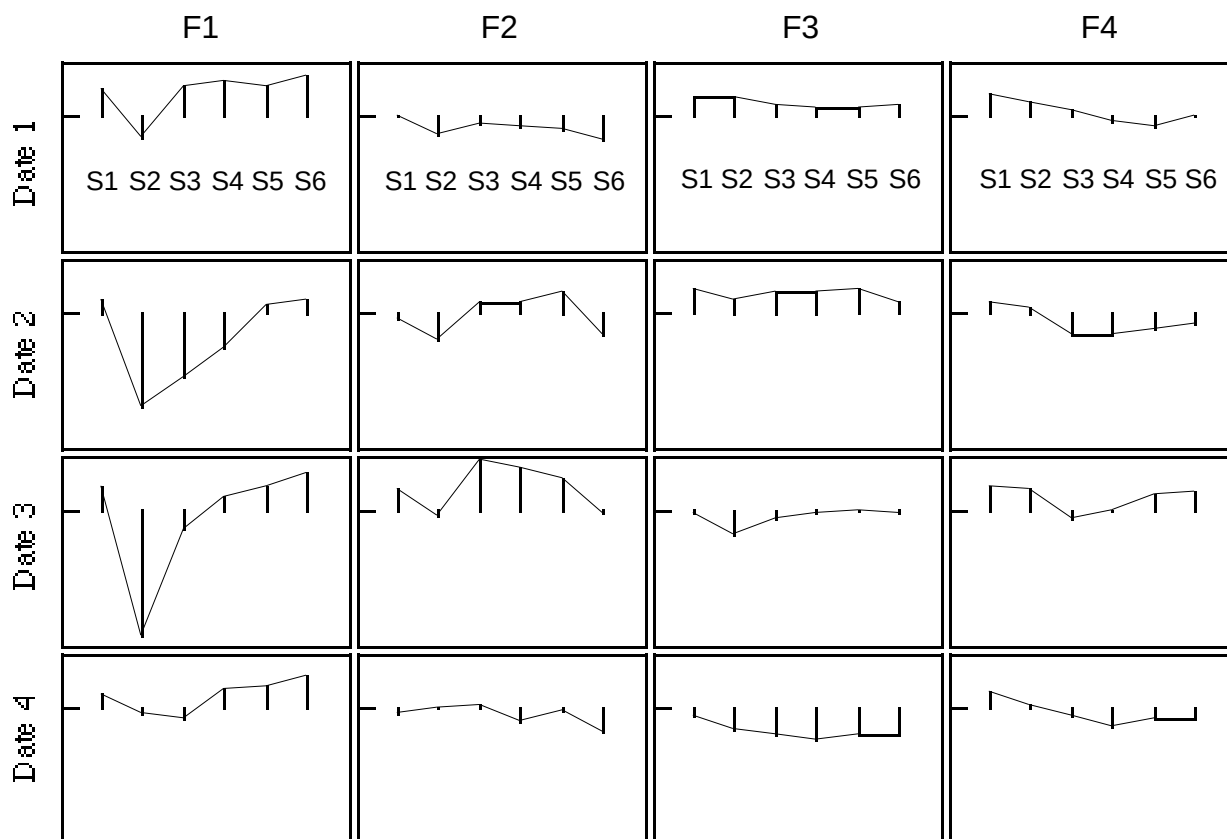


Figure 4.12.
Display of the values of the 4 PCA factors as functions of the sites for each date.

The display of the sites for each date (figure 4.12) stresses, as previously in figure 4.9, the between-sites structure (pollution is greatest at site 2, except on the 4th date, where it is greatest at site 3). The advantage of figure 4.12 as compared to figure 4.9 is that here the 4 factors can be displayed simultaneously.

The display of dates for each site (figure 4.13) shows clearly that the chronological structure of the pollution phenomenon is only clearly perceptible at sites 2, 3 and 4. Here also, use of a collection of graphics allows a direct comparison of the structures expressed by each of the 4 factors.

On the practical level, figures 4.11, 4.12 and 4.13 were produced using the "Line curves" and "Bar curves" commands of the "Graphics" menu. In the first dialog window (figure 3.2), the user just clicks the "File G" button to select the "cn1.CPLI" file; the dimensions of this file (number of rows and columns) are then filled in automatically. The number of columns to use must then be indicated. Here we have used the 4 factors and one must type in the input field "Cols. used" the characters "1to4". In figure 4.11, the 4 graphics thus correspond to the 4 columns of the "cn1.CPLI" file, i.e. to the 4 PCA factors. As the X file is optional, there is no need to fill the corresponding fields and the abscissa values will be chosen automatically as being 1, 2, 3, etc.. If displays were to be drawn in which the abscissa were not equally spaced, but respected the time periods between the dates exactly, or the geographical distances between the sites, one could have used an X file (binary) containing the abscissae required.

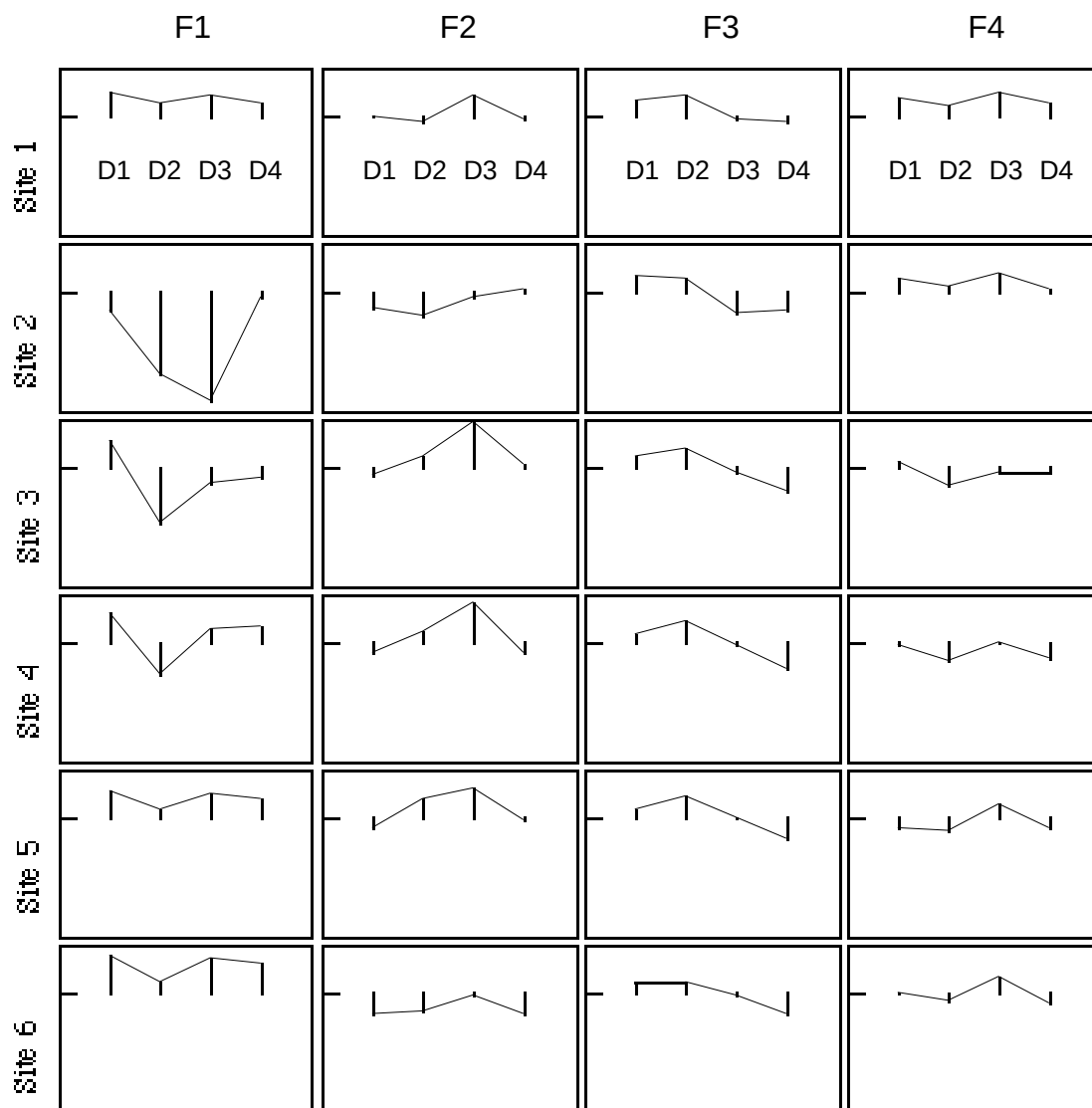


Figure 4.13.

Display of the values of the 4 PCA factors as functions of the dates for each station.

For figure 4.12 and 4.13 we used selection files while for figure 4.11 we just selected all the lines. The selection files were obviously the same as those used for figures 4.9 and 4.10. The values contained in these files determine the total number of graphics which will be drawn: the maximum value contained in the file (here multiplied by the number of columns selected in file G) corresponds to the number of graphics. For figure 4.12, the selection file corresponds to the left column of table 2: the maximum value is 4, multiplied by 4 selected columns, which gives 16 graphics. For figure 4.13, the selection file corresponds to the right column of table 2: the maximum value is 6, multiplied by 4 selected columns, which gives 24 graphics.

For figure 4.11, we then indicated in the general graphic parameter window that we wanted 2 horizontal graphics and 4 vertical graphics and a rectangular diagram (the window used was 400 by 600 pixels). The minimum and maximum of the abscissae and ordinates were fixed at [0; 25] (values calculated automatically by GraphMu) and [-8; +3]. The scales were then added with the "Modif." menu, specifying 5 graduations for the vertical and horizontal axes and saving the minimum and maximum values displayed in the dialog window: [0; 25] and [-8;

+3]. The same operation was carried out by then using the "Line curves" command and the two drawings were overlaid by copy/paste in GraphMu. The figure was then copied and pasted directly into this manual (Word 4 document).

In the case of figures 4.12 and 4.13, the operations are very similar. For figure 4.12, the number of horizontal and vertical graphics are both equal to 4, the drawing is rectangular, in a window 300 by 450 pixels. As there are exactly 16 graphics to draw, all the graphics fit in just one window (if not, other windows would have been created automatically). The values of the minimum and maximum of the abscissae and ordinates were fixed at $[0; +7]$ and $[-8; +3]$. The curves by lines and bars were overlaid in GraphMu, then the whole was pasted in MacDraw, where the legends corresponding to the factors (F1, F2, F3 and F4) were added as were the dates (Date 1, Date 2, Date 3 and Date 4) and stations (S1 to S6). The whole was selected, copied then pasted in this manual.

For figure 4.13, there are 4 horizontal graphics and 6 vertical graphics (which allows 24 graphics in one window), the drawing is square, in a window 400 by 400 pixels. The values of the minimum and maximum of the abscissae and ordinates were fixed at $[0; +5]$ and $[-8; +3]$. In the same way as above, MacDraw was used to add the legends for factors, dates and stations.

Map backgrounds

We will study how to produce maps (by circles or squares) overlaid on (geographical) map backgrounds. We will use the same example. Doledec and Chessel in their article present a simplified map of the 6 sites (fig. 2, page 407) which shows the water course (the Méaudret) and the location of the sites (1 to 6).

Figure 4.14 shows the final result required: it shows maps of values of the first PCA factor for the 6 sites (the 4 maps correspond to the 4 dates).

The reading of this figure confirms the previous interpretations, but it has the advantage of integrating the information on the spatial position of the stations.

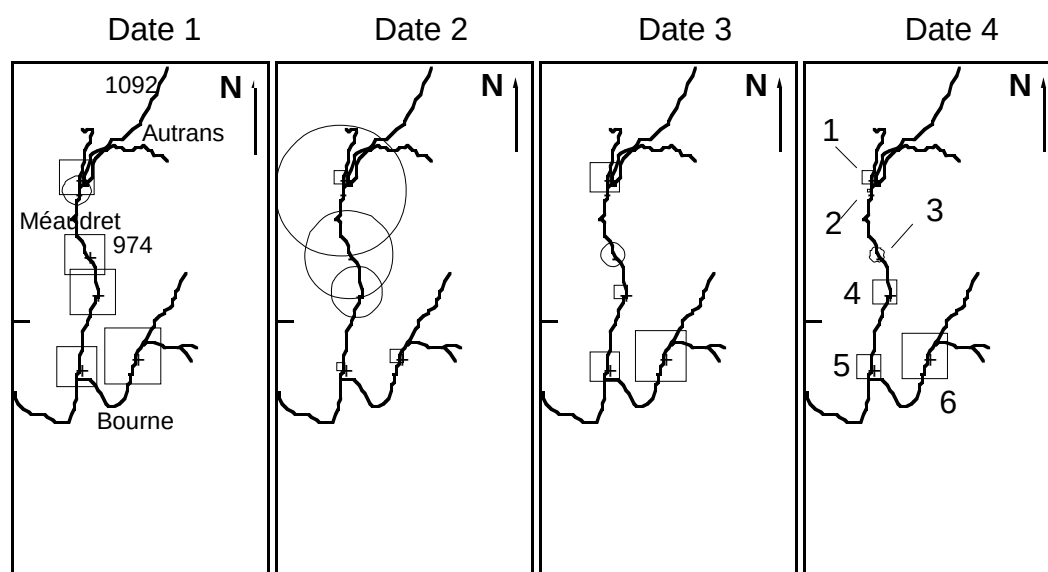


Figure 4.14.

Functional display of the values of the first PCA factor for the 6 sites. The legend for the dates was added and the thickness of all the lines was adjusted to 0.1 points with MacDraw II.

We began by digitizing figure 2 of the paper using a scanner (the Apple scanner at 300 dpi). The resulting document was processed by SuperPaint and MacDraw II to select the part of the drawing corresponding to the map and make a PICT file. Figure 4.15 shows the image thus obtained.

The following stage consists in creating the files needed for the "Digitized map" command of GraphMu. To do this the "Digitization" command of the "File" menu must be used. This operation was performed in a window 400 by 600.

After having named the XY and G files which are going to be created, and having chosen as map background the image previously created (figure 4.15) the size of the digitization area must be chosen (figure 2.13). This size was adjusted to [0; 400] by [0; 400]. The dimensions of the corresponding real space (figure 2.14) are then indicated. The limits chosen for our example

were $[-1; +1]$ and $[-1; +1]$. In our example, the image is taller than it is wide and a digitization area could have been used equal, for example, to $[0; 200]$ in X and $[0; 400]$ in Y , with a corresponding

real space of $[0; +2]$ in Y and $[0; +1]$ in X, which does not change the height/width ratios.

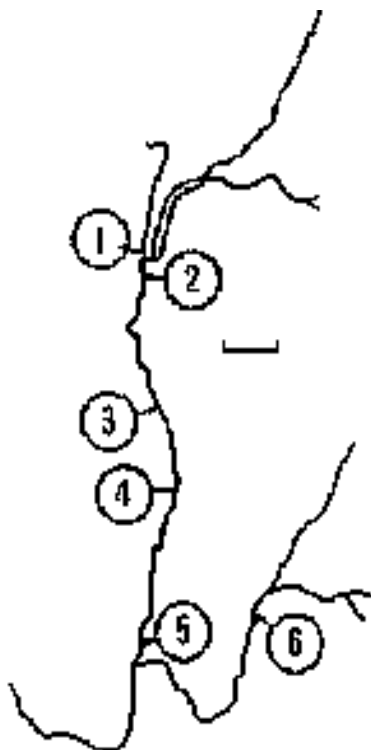


Figure 4.15.

Image obtained by digitization of figure 2 of the paper by Doleddec and Chessel (1987), then reprocessed with SuperPaint and MacDraw.

Once these adjustments were performed the digitization window appeared (figure 4.16) and it was just necessary to click to digitize the map points. In our example, we digitised about 200 points. When the digitisation is complete, the "Stop" button is clicked and the digitization window closed by clicking in the close box (and replying "No" in the dialog asking whether the image of this window is to be saved).

Before being able to make graphics, a file must also be created containing the coordinates of the 6 sites in the same frame and scales as those used for the files created during digitization. The easiest way of creating this coordinate file is to use the "Digitization" command again, by indicating exactly the same parameters as before (except for the output file names) and digitizing only the 6 points corresponding to the 6 sites. A file is thus obtained with 6 lines and 2 columns and containing the coordinates of the 6 sites. To obtain a file with the same organisation as the initial data file (24 lines: 4 dates for each station), one then transforms this file into a TEXT file with the "Transfo BIN -> TEXT" command, it is opened with a word processor and each line is copied 4 times. The resulting file must contain the values of table 3. It is retransformed into binary so that it can be used later.

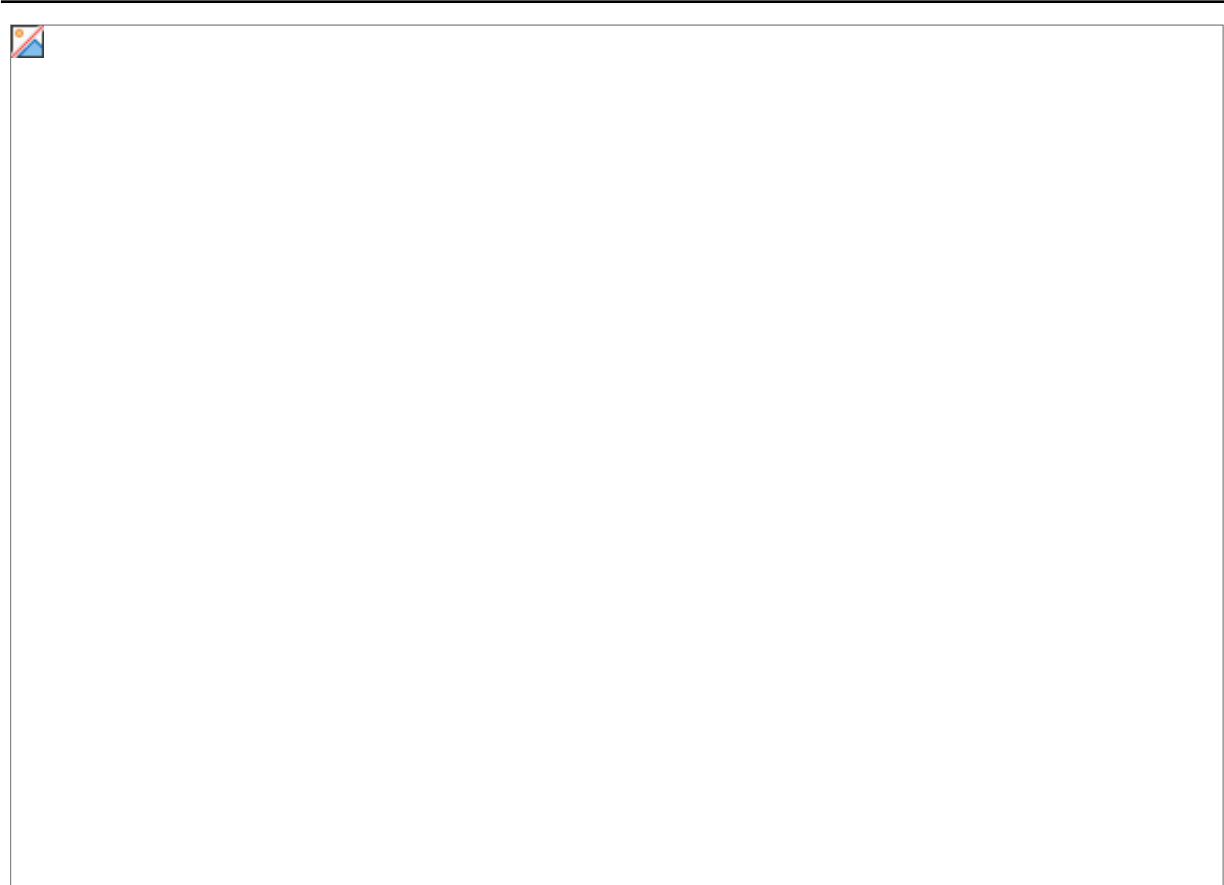


Figure 4.16.
Appearance of the digitisation window during work

-.735	0.550
-.735	0.550
-.735	0.550
-.735	0.550
-.730	0.495
-.730	0.495
-.730	0.495
-.730	0.495
-.705	0.255
-.705	0.255
-.705	0.255
-.705	0.255
-.670	0.105
-.670	0.105
-.670	0.105
-.670	0.105
-.735	-.185
-.735	-.185
-.735	-.185
-.735	-.185
-.515	-.135
-.515	-.135
-.515	-.135
-.515	-.135

Table 3
Contents of the site coordinate file

The following stage consists in drawing the map backgrounds with the "Digitized map" command. In the first dialog window the XY file and the G file created during digitization (200 rows files) are selected using the corresponding buttons. The 2 columns of file XY are used as column X and column Y and column 1 of file G is selected 4 times, so as to obtain 4 maps, by typing "1;1;1;1" in the "Cols. used" field.

In the general parameter dialog window, 6 horizontal graphics and 1 vertical graphic and rectangular drawing are specified and the minimum and maximum values of the abscissae and ordinates are changed. When the corresponding window is displayed, one enters $[-1; 0]$ as extreme value for the abscissae and $[-1; +1]$ as extreme value for the ordinates. In fact (figure 4.16), the real digitised space was $[-1, +1]$ and $[-1, +1]$, but as only the left part of the graphic is used for the map, this area can be restricted by not using the right part. The graphic deformation is thus compensated by the fact that 6 horizontal graphics and 1 vertical graphic are required in a window size 200 by 600 (the result would be identical with 6 horizontal graphics, 2 vertical graphics and a window 400 by 600). This compensation does happen however only if a **rectangular** drawing is required. If the "Square" button is clicked, GraphMu only uses the largest square area available in the window. The result of these operations is represented in figure 4.17 (this figure was pasted directly into Word from GraphMu).



Figure 4.17.
Collection of 4 map backgrounds obtained with the GraphMu "Digitized map" command

The last stage consists in drawing the map with circles and squares. For this, a window of the same size as the preceding (200 by 600) is used. The corresponding command is selected in the "Graphics" menu and the "File XY" button is used to choose the file containing the previously created site coordinates (table 3) and the "File G" button to select the "cn1.CPLI" file. For this file, only column 1 is chosen, typing "1" in the corresponding "Cols. used" field (display of the first factor). At this point remember to indicate that a selection of rows through a selection file is required (for the drawing by date).

The following dialog window specifies the characteristics of the selection file, which is the same as that used to draw figures 4.9 and 4.12 (left column of table 2).

The general parameter dialog window must be filled in the same way as for drawing the map backgrounds: 6 horizontal graphics, 1 vertical graphic, rectangular

drawing, modification of the minimum and maximum of abscissae and ordinates. Likewise, the window corresponding to these 4 values must be filled in the same way as the preceding (besides the values displayed by default are saved and there is no need to retype them if recalculation of the minimum and maximum has not been requested). Figure 4.18 shows the drawing obtained.

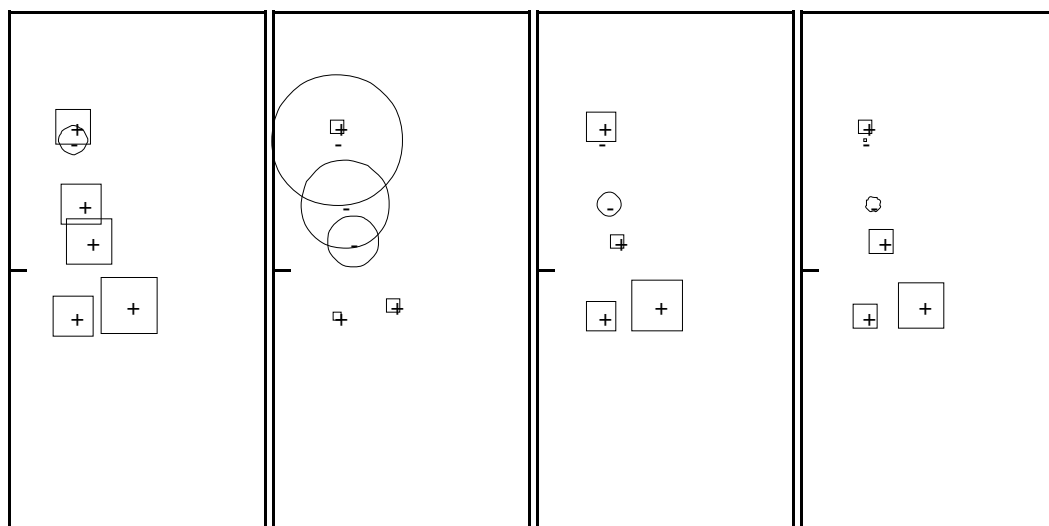


Figure 4.18.

Collection of 4 maps by circles plus squares representing the values of the first PCA factor for the 6 sites at the 4 dates.

Now the drawings of figures 4.17 and 4.18 are overlaid by copy/paste and the whole is pasted in MacDraw II for finishing to obtain figure 4.14.