

# Ellipstat User's Manual

Atsushi YAMAJI

Division of Earth and Planetary Sciences,  
Kyoto University, Kyoto 606-8502, Japan

August 12, 2005

## 1 Introduction

Ellipstat is PC based free software for determining the optimal strain and its error from  $R_f/\phi$  data. Details of the method is described in [1]. The graphics shown in the window can be saved as enhanced metafiles.

I used MATLAB for computation to write the paper [1]. However, MATLAB is not widely used by structural geologists, so that I made Ellipstat as Windows software that runs without additional software or software developing environment. Just double-click an executable file to run the software on Windows Operating System.

## 2 Directions for use

### 2.1 Pre- and Post-strain pages

Run the executable file, "Ellipstat.exe." Fig. 1 shows the screen shot of the software. Ellipstat has two pages that has labels "Post-strain" and "Pre-strain." As soon as a dataset is loaded by clicking the menu item "Open" from File Menu, the Elliott plot [2] of the  $R_f/\phi$  data,  $(p_f^{(1)}, q_f^{(1)}), \dots, (p_f^{(N)}, q_f^{(N)})$ , is shown on the "Post-strain" page, where  $N$  is the number of data. Calculation of the optimal strain and its error follows the plotting. The time of computation depends on data, but the result is usually shown on the window in an instant.

The horizontal and vertical lines on the "Post-strain" page show the  $p$ - and  $q$ -axes of Elliott plot. The gray circle centered at the origin of the plot is the unit circle, so that points on the circle has an aspect ratio of  $\exp(1) \approx 2.72$ . This circle is drawn merely for showing the scale of the plot. Blue open circles indicate the  $R_f/\phi$  data,  $(p_f^{(1)}, q_f^{(1)}), \dots, (p_f^{(N)}, q_f^{(N)})$ . Red cross depicts the optimal strain  $(p_s, q_s)$ , and brown oval (Fig. 2) shows

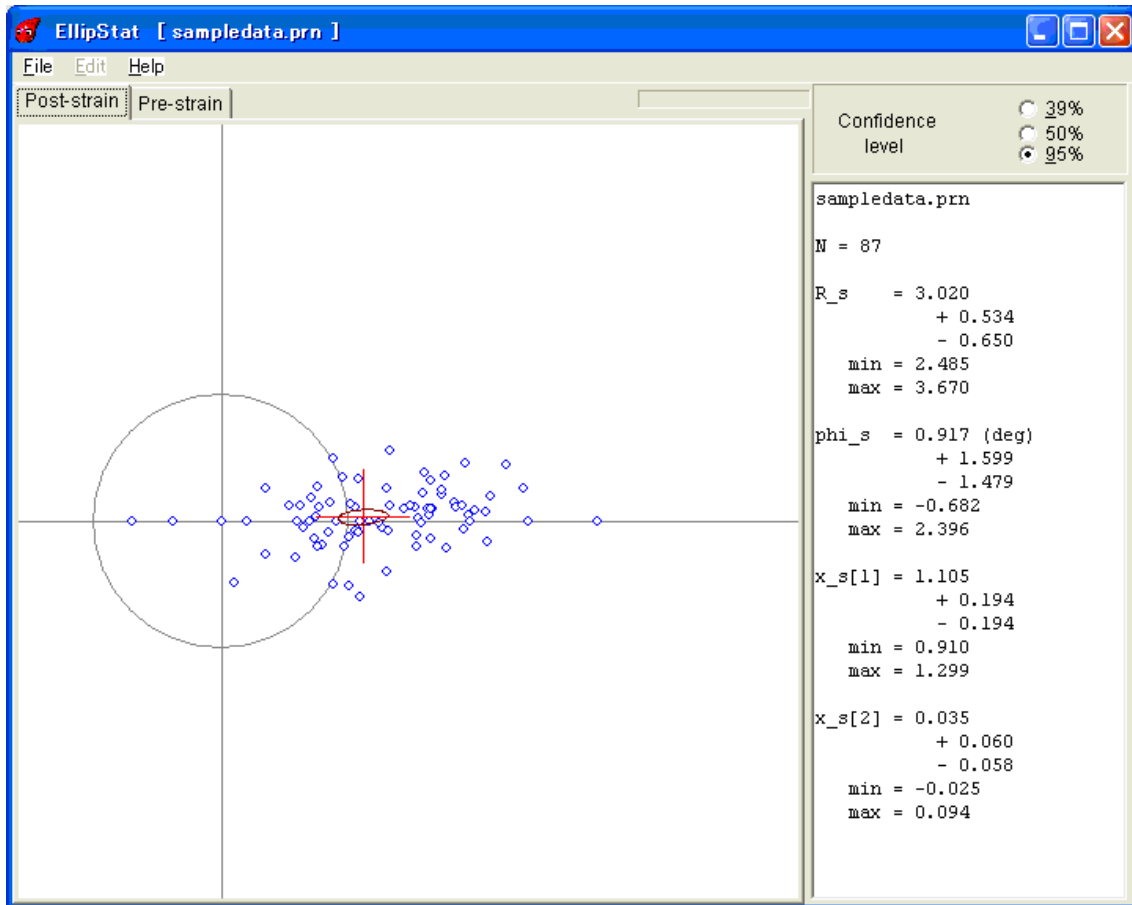


Figure 1: Screen shot taken just after the sample data are loaded.

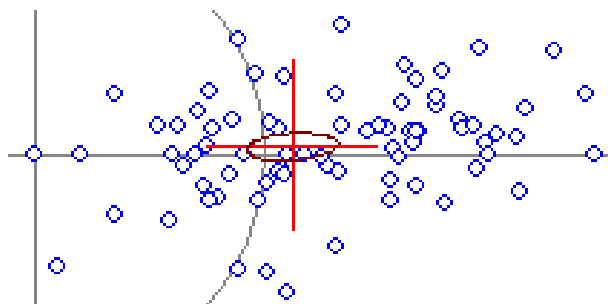


Figure 2: Closeup of the area around the confidence region in Fig. 1.

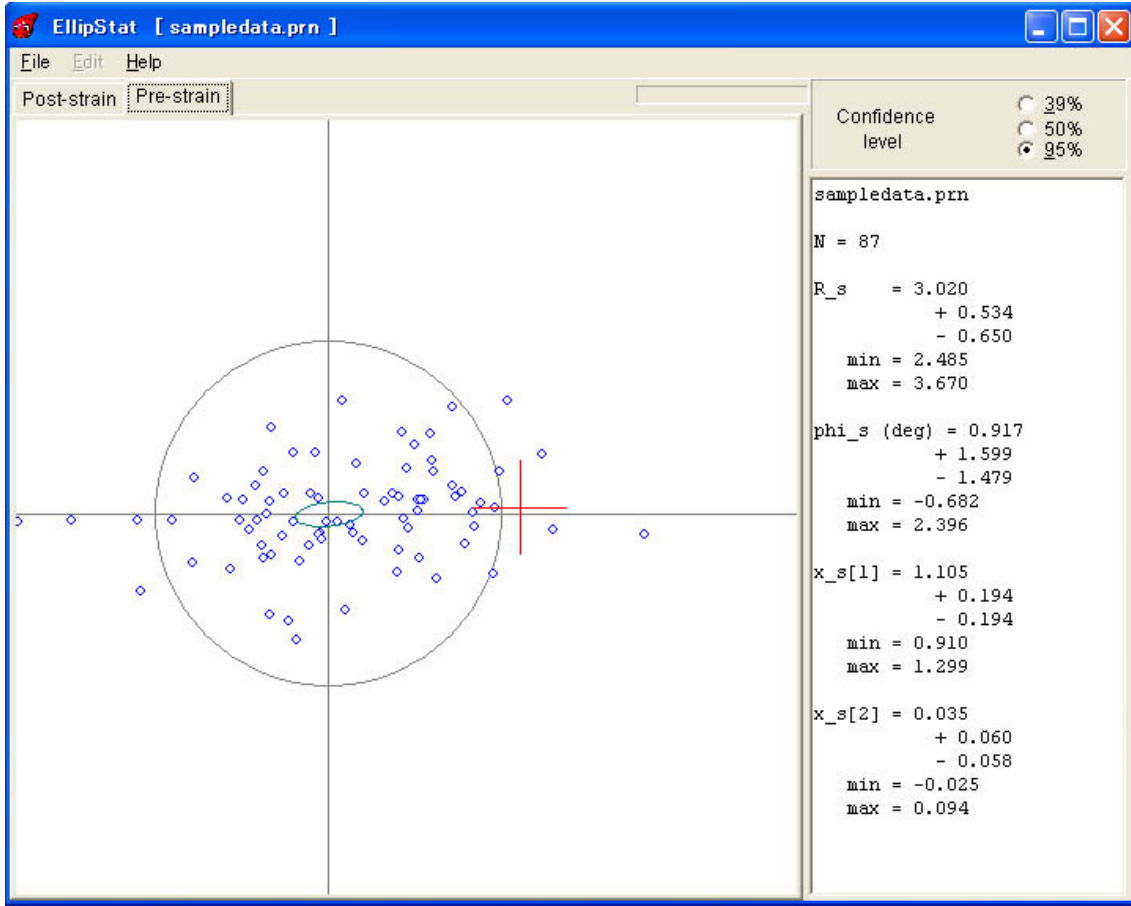


Figure 3: Pre-strain Elliott plot of the sample data.

the confidence region of the optimal strain. Three options for the confidence level, 35% (“one standard deviation”), 50% and 95%.

## 2.2 Save menus

The pre-strain ellipses calculated from the data with the optimal strain,  $(p_i^{(1)}, q_i^{(1)}), \dots, (p_i^{(N)}, q_i^{(N)})$ , are plotted on “Pre-strain” page (Fig. 3). Pale green ellipse designates the confidence region of the mean vector  $\bar{x}_i$  [1]. The graphics shown on the pages can be saved as enhanced metafiles (vector images) by clicking the “Save Picture” from File menu (Fig. 4). The files contains vector images, so that you can decorte the images with drawing software for publication (Fig. 5).

Ellipstat does not show the contours of  $T^2$  statistic [1], but output a text file containing the values of  $T^2$  at 100×100 grid points. MS Excel can draw contours from the file. For this purpose, load the file in Excel with neglecting the first and second lines of the file. Graphic wizard of Excel tells the way to draw the contours.

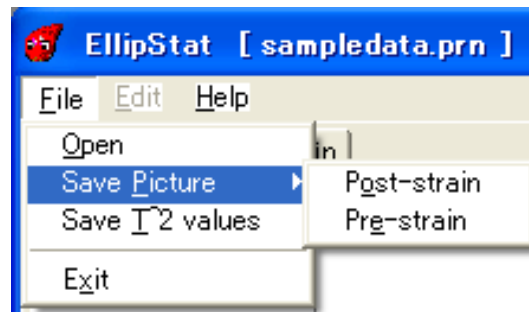


Figure 4: Menu items.

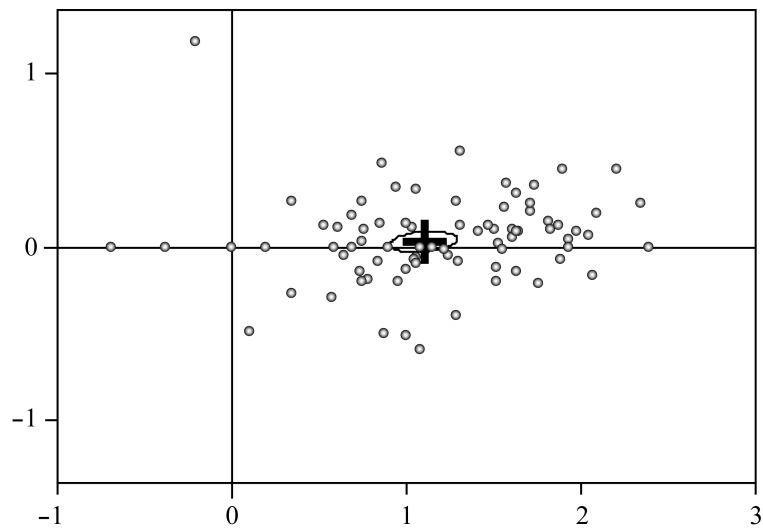


Figure 5: Picture showing the Elliott plot of “sampledata.prn” that was drawn from the EPS file output from Ellipstat.

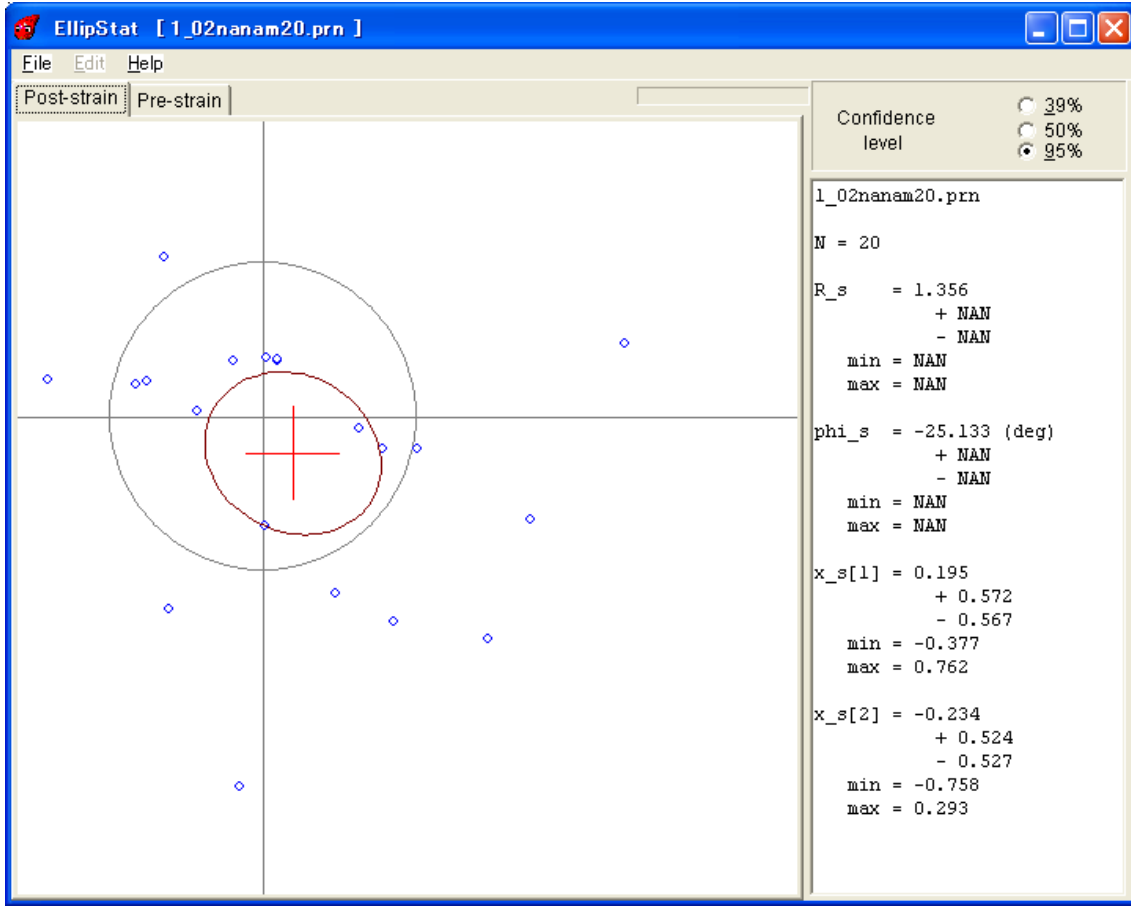


Figure 6: Confidence region encircling the origin of the Elliott plot.

## 2.3 Optimal strain and its error

The optimal strain and its error is also shown by their values in the panel under “Confidence level” (Fig. 1). The top line in the panel shows the name of data file. In Fig. 1,  $N$  in the next line indicates the number of data.  $R_s$  and  $\phi_s$  indicates the aspect ratio and orientation of the optimal strain ellipse,  $R_s$  and  $\phi_s$ , respectively. The upper and lower confidence limits are also shown:  $+0.534$  and  $-0.650$  in Fig. 1 indicate the limits for the optimal aspect ratio of the sample data. Namely, the optimal one is  $R_s = 3.020^{+0.534}_{-0.650}$ . In this case, min and max equals, respectively,  $R_s - 0.650$  and  $R_s + 0.534$ . Likewise, the optimal major-axis orientation is  $\phi_s = 0.917^{+1.599}_{-1.479}^\circ$ . Components of the optimal point  $\mathbf{x}_s = (p_s, q_s)$  are also shown in the panel with their confidence intervals.

If the confidence region, which is shown by a brown oval in “Post-strain” page, contains the origin of Elliott plot, the confidence intervals of  $R_s$  and  $\phi_s$  are not defined [1]. In that case, NaN (not a number) indicates such an undefined interval (Fig. 6).

You can copy the contents of the panel onto the clipboard of your computer.

$R_f$	$\phi_f$
4.56	2.04 ↵
3.50	-1.05 ↵
3.74	2.79 ↵
3.70	-1.73 ↵
1.90	-13.12 ↵
2.00	0.00 ↵
1.55	-18.43 ↵
6.68	-1.00 ↵
↵	

Figure 7: Format of a data file. A carriage return-line feed (CRLF) is indicated by an arrow.

### 3 Installation

Installation of Ellipstat is very easy. The latest version of Ellipstat is available at the web site, “<http://www.kueps.kyoto-u.ac.jp/~yamaji/PDS/indexe.html>.” Here are the instructions for installation:

1. Create a directory with an arbitrary name.
2. Unzip the file “Ellipstat.zip,” the latest version which is available at the web site, in the directory.

The program package contains the sample file shown in Figs. 1 and 3.

### 4 Data format

Ellipstat can read data files with a file extension, “txt,” “csv” or “prn.” The data file must be a plane ASCII text file containing one datum per line of the text (Fig. 7). The first and second items in a line indicate  $R_f$  and  $\phi_f$ . The items in a line should be delimited by spaces or a TAB. Not TAB should be placed before the first item. The file cannot contain no other data. Empty lines are not allowed except for the final line of the file. Look in the file “samplefile.prn” for the format. Ellipstat allows to operate with a maximum of 10,000 data ( $N \leq 10000$ ).

## References

- [1] Yamaji, A., 2005. Finite tectonic strain and its error, as estimated from elliptical objects with a class of initial preferred orientations. *Journal of Structural Geology*, in press.
- [2] Elliott, D., 1970. Determination of finite strain and initial shape from deformed elliptical objects. *Geological Society of America Bulletin*, **81**, 222–236.