Fault Mapper 3.2 (MsExcel® workbook) by Roberto Basili (basili_r@ingv.it)
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The Fault Mapper is a Microsoft Excel® workbook, supplied with a few VBA macro commands, which provides the user with an easy way to manipulate the basic parameters of a rectangular fault-plane and obtain the geographic coordinates of its end-points.

This document will guide the user to the main Fault Mapper's functionalities, however it is assumed that he/she is already familiar with the MsExcel basic commands. None of the MsExcel functions and tools are inhibited in the workbook, therefore the user may customize the provided worksheets as he/she prefers. When the file opens a dialog box warnings that the file contains macros. Click the button "enable macros" to activate the Fault Mapper's functionalities.

Intuitive tools aid with the manipulation while the main kinematic and seismological properties of the fault are automatically updated and shown in a summary table. A plot of the fault-plane projection in a geographic context is simultaneously available in the same window. A stereographic projection of the theoretical focal mechanism displays in the upper-right corner of the map.

Five worksheets are provided with the workbook: "read_me", "FM", "cmpt", "Fault_File", and "outline", which store respectively the following information: the text of this user manual; the Fault Mapper's input/output tables and diagrams; necessary formulas, variables and constants for all calculations; the results; the latitude and longitude values to be used in the geographical plot. Notice that the default geographic context is Italy. Data to outline several European Countries are provided in separate files that have to be substituted in the outline worksheet. Manual scaling of x and y axes must be done to adjust the diagram to the aspect of the plotted region.

When the fault location and parameters are set to the desired values the results may be saved in the "Fault_File" worksheet by pressing the "Save Fault to Fault File" button. Each time this button is pressed the significant parameters of the current fault are appended to the "Fault_File" worksheet in reverse order (last fault upper). Each result can be identified by properly setting the fault's identifier "ID". The "Clear Fault File" button returns an empty "Fault_File" worksheet.
Analogously a plot of the fault may be saved in the geographic diagram by pressing the "Plot Fault" button, which also turns the mapped fault to yellow. The "Clear Map" button returns an empty map.
Notice that either "Clear Fault File" or "Clear Map" buttons erases all the faults.

The "FM" worksheet is write-protected to prevent accidental modifications. Only the green cells may be changed in this worksheet for input purpose. To make any change in the worksheet the protection must be deactivated from the "Tools>Protection>Unprotect sheet…" menu. No password is set.

The "FM" worksheet is designed for high quality monitor display (e.g. 19 inch screen with 0.27 dot pitch, 1024x768 resolution, 32 bit colours). If you are using a less quality monitor the Fault Mapper may not display well. To improve readability, especially with portable computer monitors, lower the zoom factor.

Formulas used in the "cmpt" worksheet contain approximations. Usage of this worksheet to calculate geographic coordinates of objects larger then about 50 km may result in significant errors.

DATA INPUT section:
In the data input process it is assumed that the first data to come are from geological observations. Therefore the first action to take is to make the program know the location of the cut-off tips. This is accomplished into two different ways: 1) when one tip, azimuth and length are known; 2) when two tips are known. Click the appropriate “Option button” to select the desired method.
Subsequently different options to enter data in the depth dimension are to be selected from the “List box”. By setting these options the program automatically switch from one method to the other and asks for the appropriate data to be entered.

Fault ID	Identifier of the current fault. Click the spinner to set a number which will identify the fault in the “Fault File” when saved.
Lat A(B); Lon A(B)	Latitude and longitude of fault cut-off end-points. Point A will be your point of reference.
Azimuth:	Angle between the N and the fault directions (positive CW) with respect to point A.
Length:	Length of fault.
Width:	Width of fault down-dip.
Dip:	Angle between the fault-plane and the surface. Positive for right-hand plunging fault, negative for left-hand plunging fault.
Elevation:	Altitude of ground-surface with respect to sea level.
Top Depth:	Depth of upper edge of fault with respect to the ground surface.
Bottom Depth:	Depth of lower edge of fault with respect to the ground surface.
Rake:	Sense of slip. 0° = left-lateral strike-slip; 90° = reverse dip-slip; 180° right-lateral strike-slip; 270° = normal dip-slip.
Slip:	Amount of average slip on fault. Necessary to estimate the seismic moment (Mo).
Auto width:	A width suggested from the Wells & Coppersmith (1994) relationships taking into account the sense of slip and the relations between fault length/fault width versus magnitude.

ADJUSTMENTS section:
Several “Scroll bars” allow incremental adjustments to be made for all the data entered from the DATA INPUT section. They work respectively to: move North-South; move East-West; rotate horizontally clockwise and counter-clockwise; rotate vertically, i.e. increase and decrease dip; lengthen and shorten; enlarge and narrow; move up-down; rotate sense of slip; increase-decrease amount of slip.

RESULTS section (only keys not already presented in the previous sections):

lats(n), lons(n):	Geographic coordinates of fault cut-off (intersection with ground-surface)
lat(n), lon(n):	Geographic coordinates of buried fault plane projected to ground-surface
Area:	Actual area of the fault-plane.
Strike:	Fault direction following the right-hand rule.
Aspect Ratio:	Width divided by Length.
Mw (W&C)	Moment magnitude with respect to fault area, after Wells & Coppersmith (1994).
Mo (Nm2)	Seismic moment. Mo = mu x A x D where mu is the rigidity modulus, A is the area of the fault plane, D is the average displacement.
Mw (K&A)	Moment magnitude with respect to seismic moment, after Kanamori & Anderson (1975).

References.
Wells, D.L., and K. J., Coppersmith, 1994: New Empirical Relationships among Magnitude, Rupture Lenght, Rupture Width, Rupture Area, and Surface Displacement. Bull. Seism. Soc. Am., 84, 974-1002.
Kanamori, H., and D. L., Anderson, 1975: Theoretical basis of some empirical relations in seismology. Bull. Seism. Soc. Am., 65, 1073-1095.