SUPERPOSE- An Excel Visual Basic Program for Fracture Modeling Based on Stress Superposition Method

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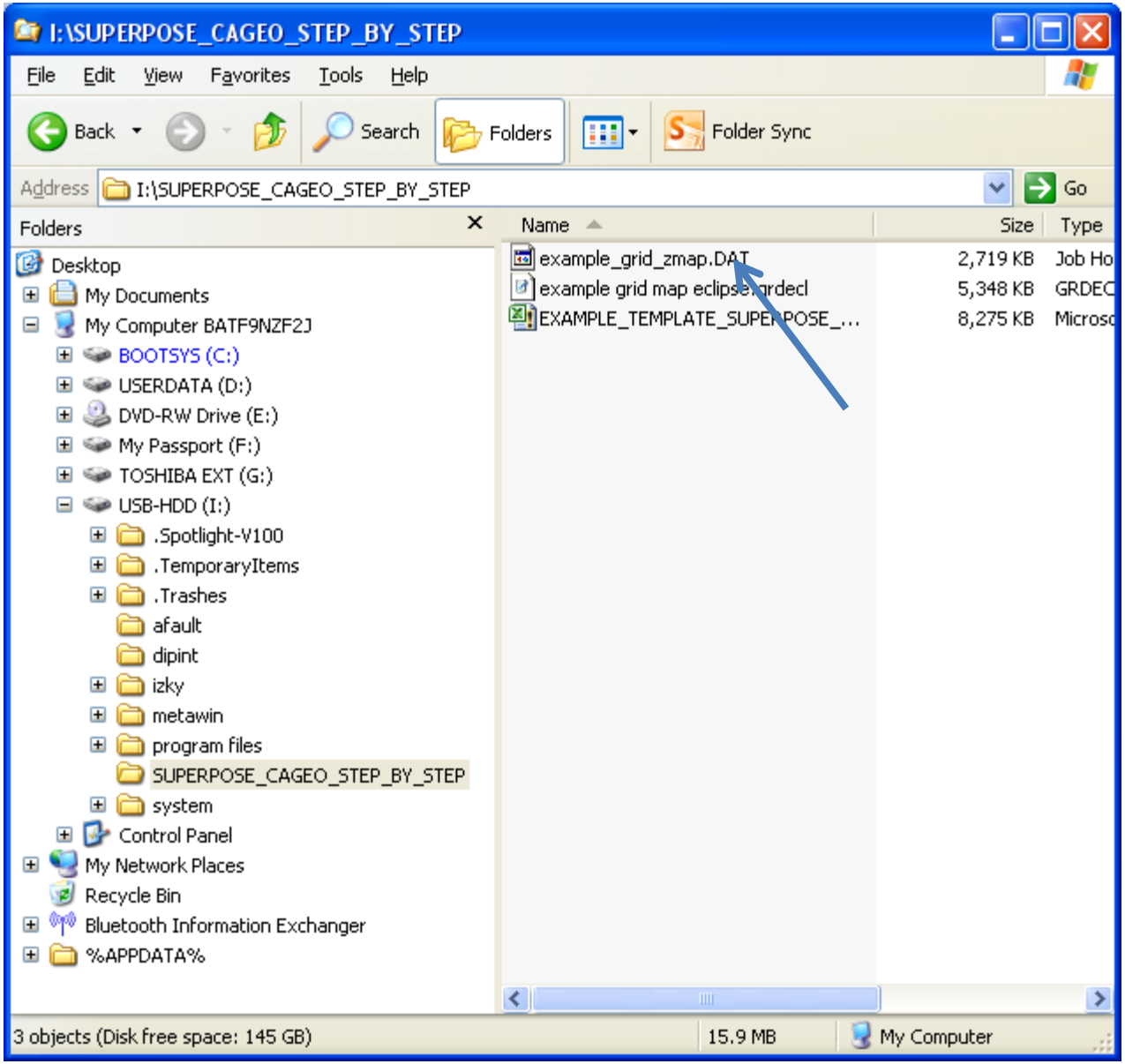
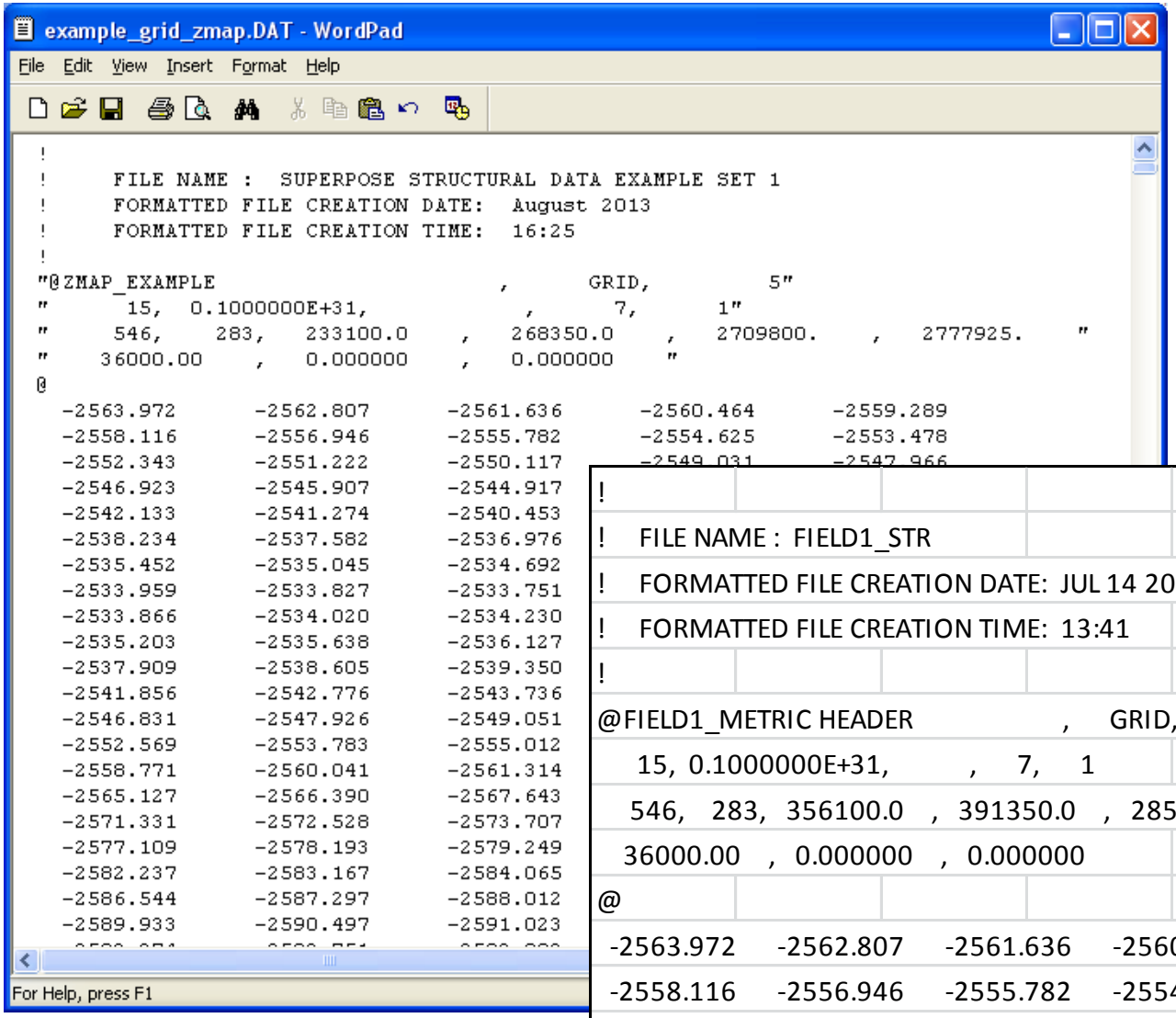
STEP BY STEP QUICK RUN

IMPORTING GRID DATA IN Z MAP .DAT FORMAT



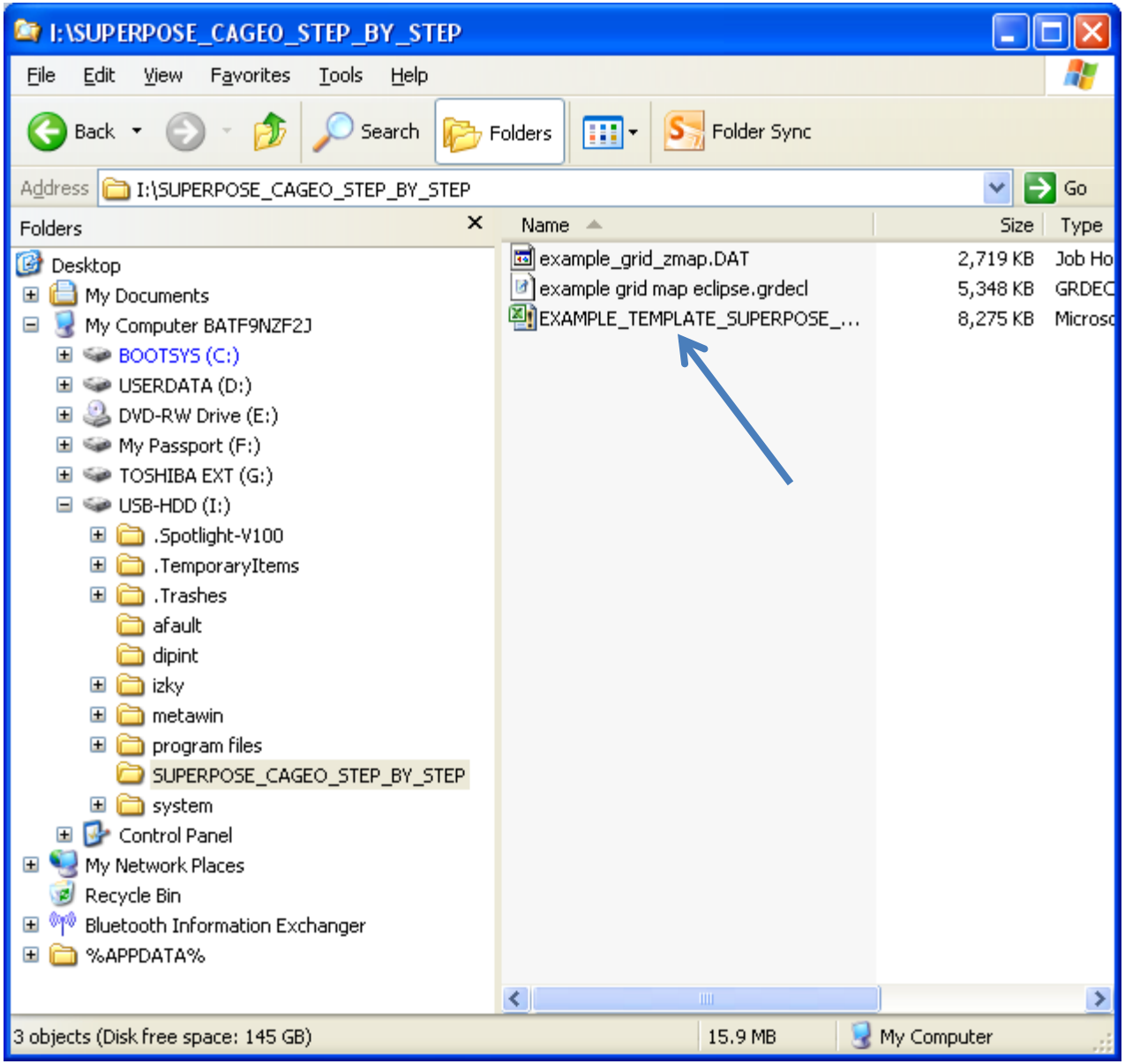
Place the grid data file in your work folder.

Make sure that the file is a text file. Otherwise open the file with pspad or wordpad programs and save as text file.

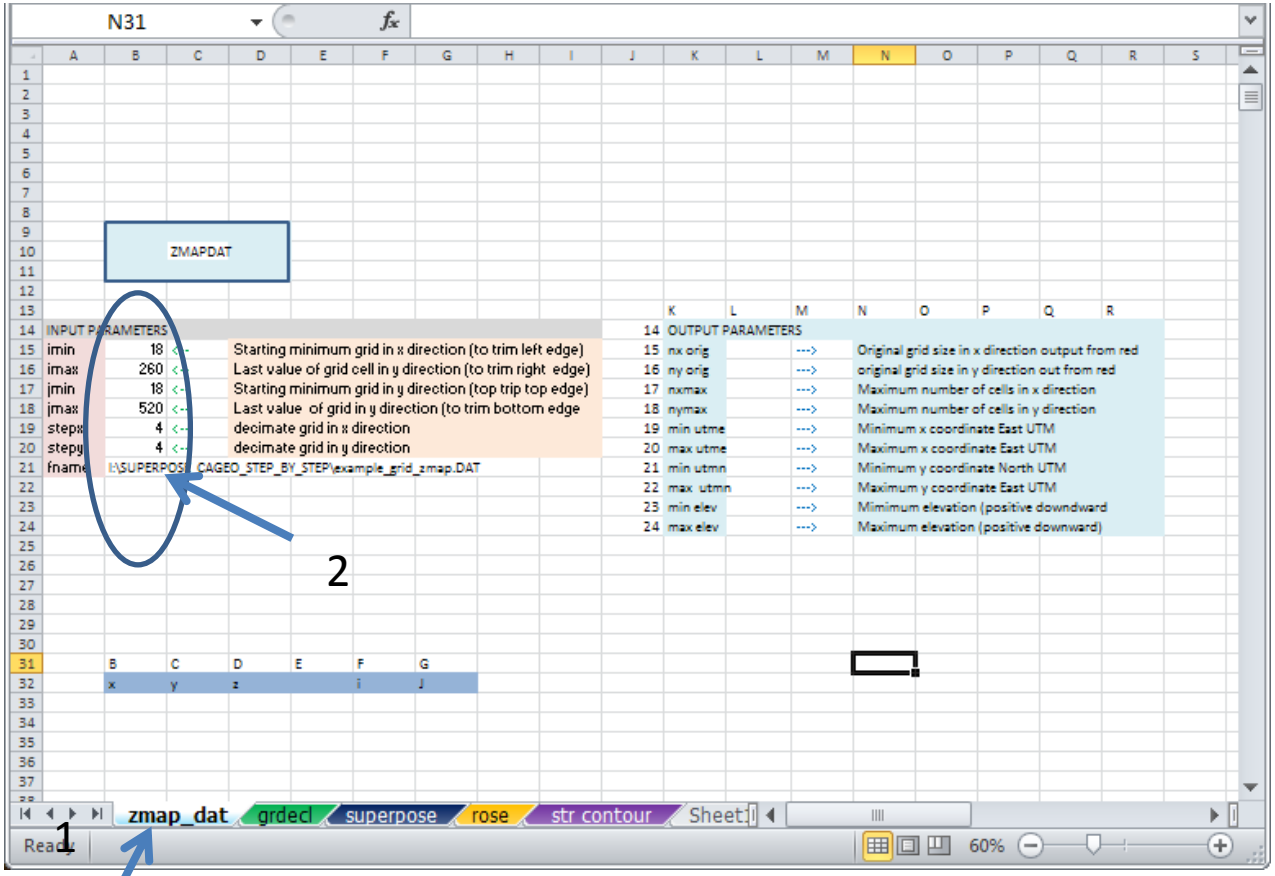


The Zmap file must have the content shown. See the User Guide for explanation.

!				
! FILE NAME : FIELD1_STR				
! FORMATTED FILE CREATION DATE: JUL 14 2013				
! FORMATTED FILE CREATION TIME: 13:41				
!				
@FIELD1_METRIC HEADER , GRID, 5				
15, 0.1000000E+31, , 7, 1				
546, 283, 356100.0 , 391350.0 , 2855000. , 2923125.				
36000.00 , 0.000000 , 0.000000				
@				
-2563.972	-2562.807	-2561.636	-2560.464	-2559.289
-2558.116	-2556.946	-2555.782	-2554.625	-2553.478
-2552.343	-2551.222	-2550.117	-2549.031	-2547.966
-2546.923	-2545.907	-2544.917	-2543.957	-2543.028
-2542.133	-2541.274	-2540.453	-2539.672	-2538.932



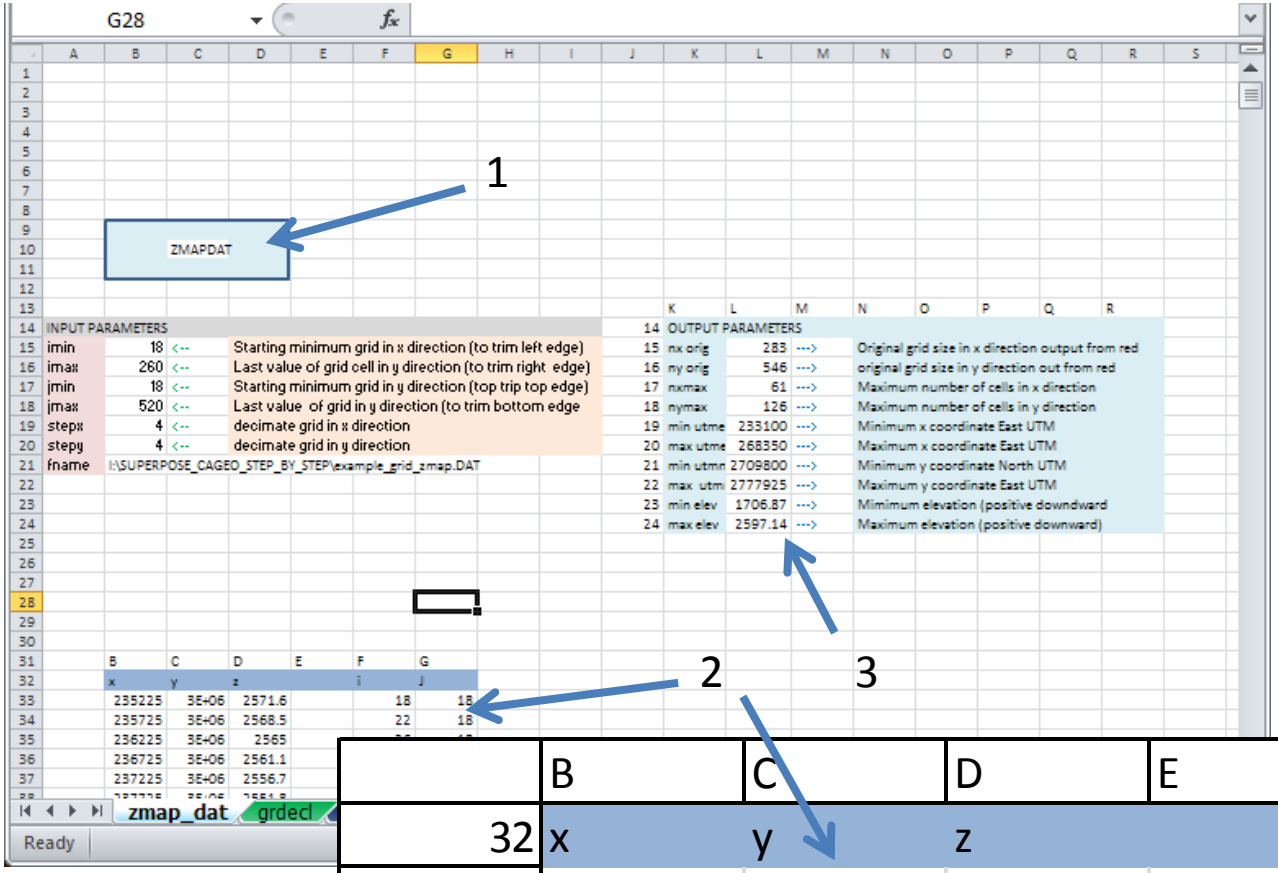
Open the SUPERPOSE Excel template



Open the zmap-data tab (1). Fill in the parameters including the full path of the data import file(2).

	A	B	C	D	E	F	G	H	I
14	INPUT PARAMETERS								
15	imin	18		Starting minimum grid in x direction (to trim left edge)					
16	imax	260		Last value of grid cell in y direction (to trim right edge)					
17	jmin	18		Starting minimum grid in y direction (top trip top edge)					
18	jmax	530		Last value of grid in y direction (to trim bottom edge					
19	stepx	4		Take every nth grid value in x direction skip n cells. n=stepx					
20	stepy	4		Take every nth grid value in y direction skip n cells. n=stepy					
21	fname	i:\TEST.DAT		Import file location and name					

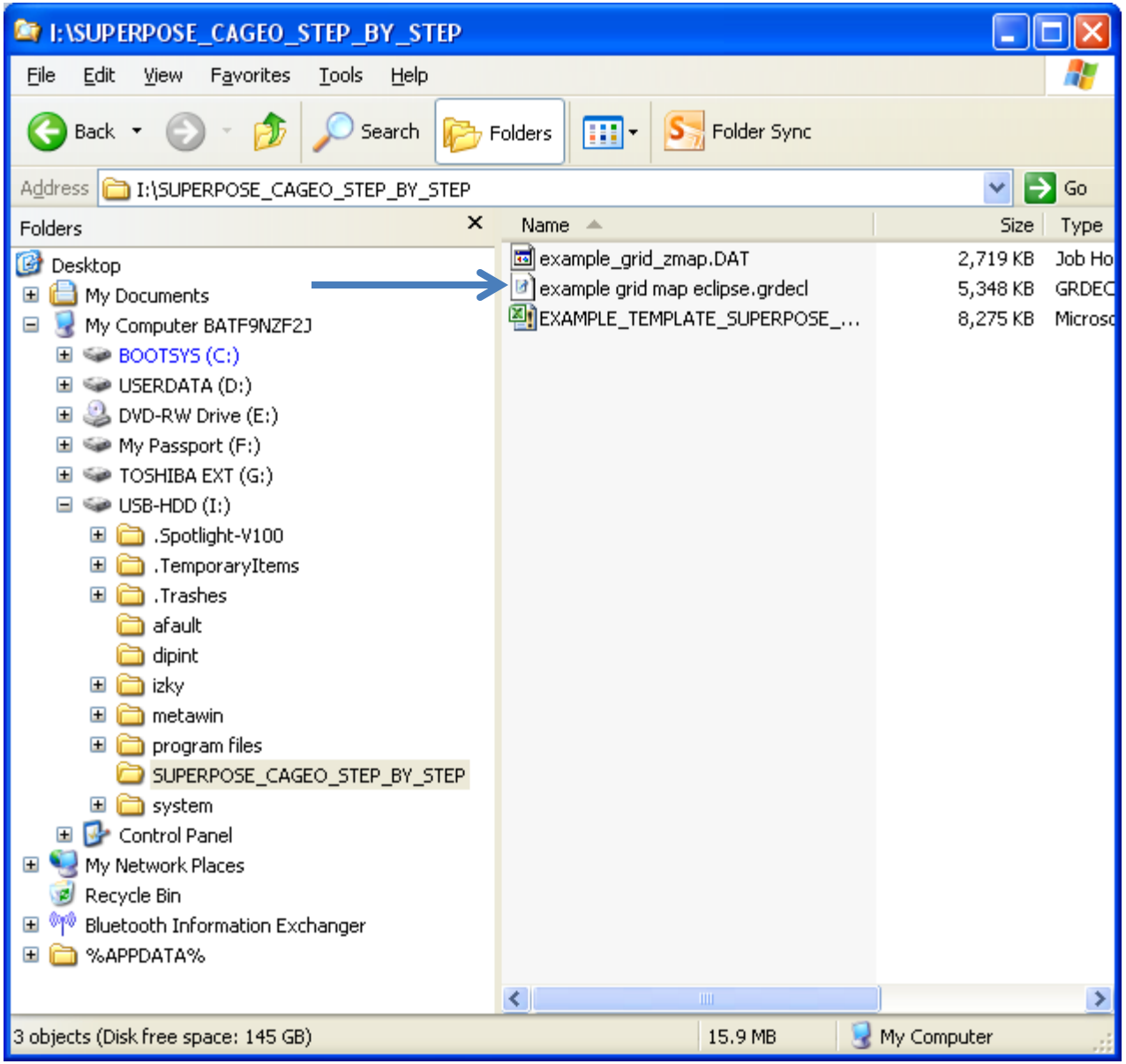
2



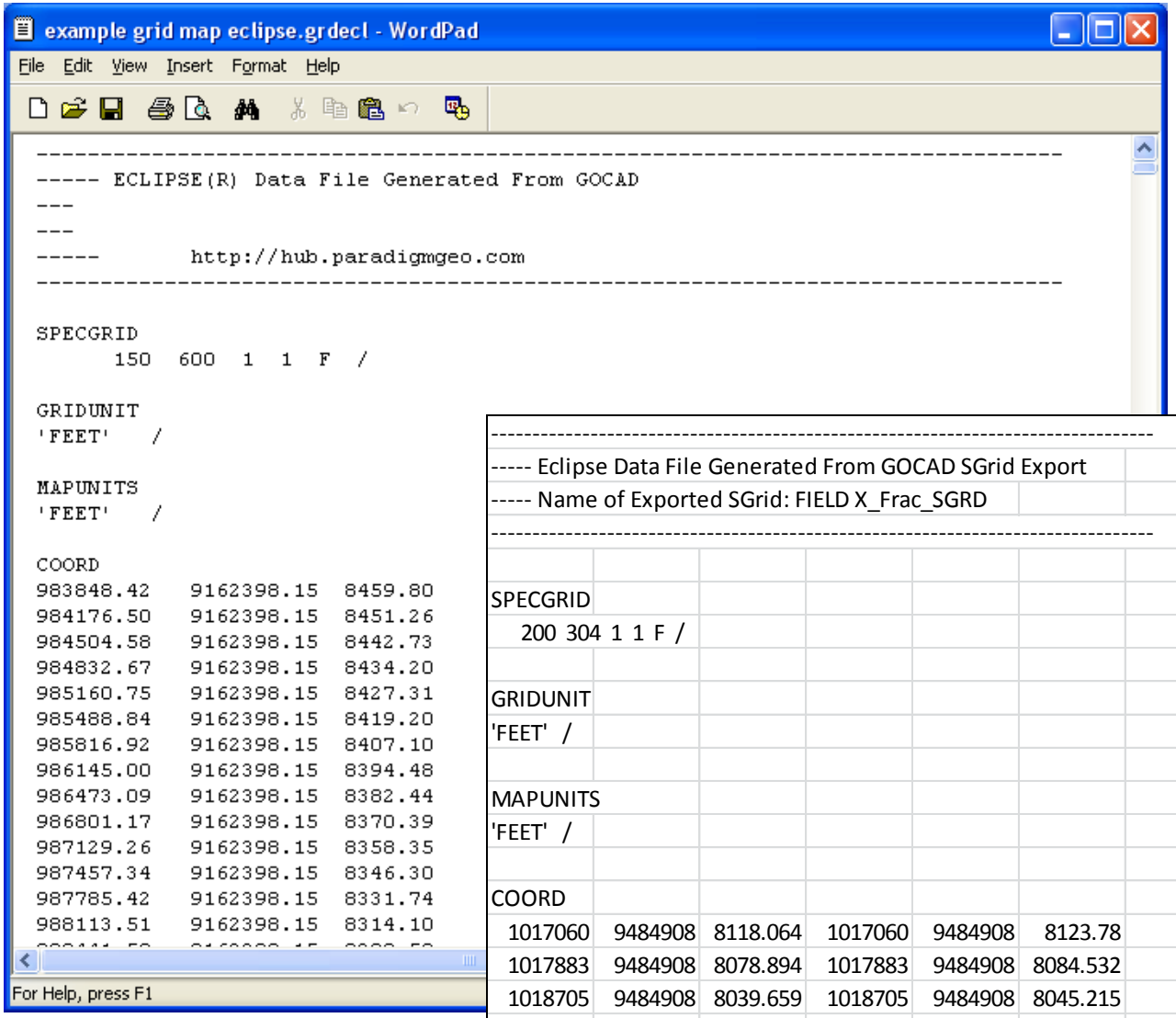
Click on the icon (1) to run the import program. Read the imported grid data (2) and parameters (3).

	B	C	D	E	F	G
32	x	y	z		i	J
33	358100	2923125	2583.682		17	1
34	358600	2923125	2580.978		21	1
35	359100	2923125	2577.859		25	1
36	359600	2923125	2574.265		29	1
37	360100	2923125	2570.146		33	1
38	.....					

IMPORTING GRID DATA IN ECLIPSE .GRDECL FORMAT



Place the data file in your work directory. Make sure the file is a text file. If in doubt, open it with pspad or wordpad program and save as text file.



----- Eclipse Data File Generated From GOCAD SGrid Export

----- Name of Exported SGrid: FIELD X_Frac_SGRD

SPECGRID

200 304 1 1 F /

GRIDUNIT

'FEET' /

MAPUNITS

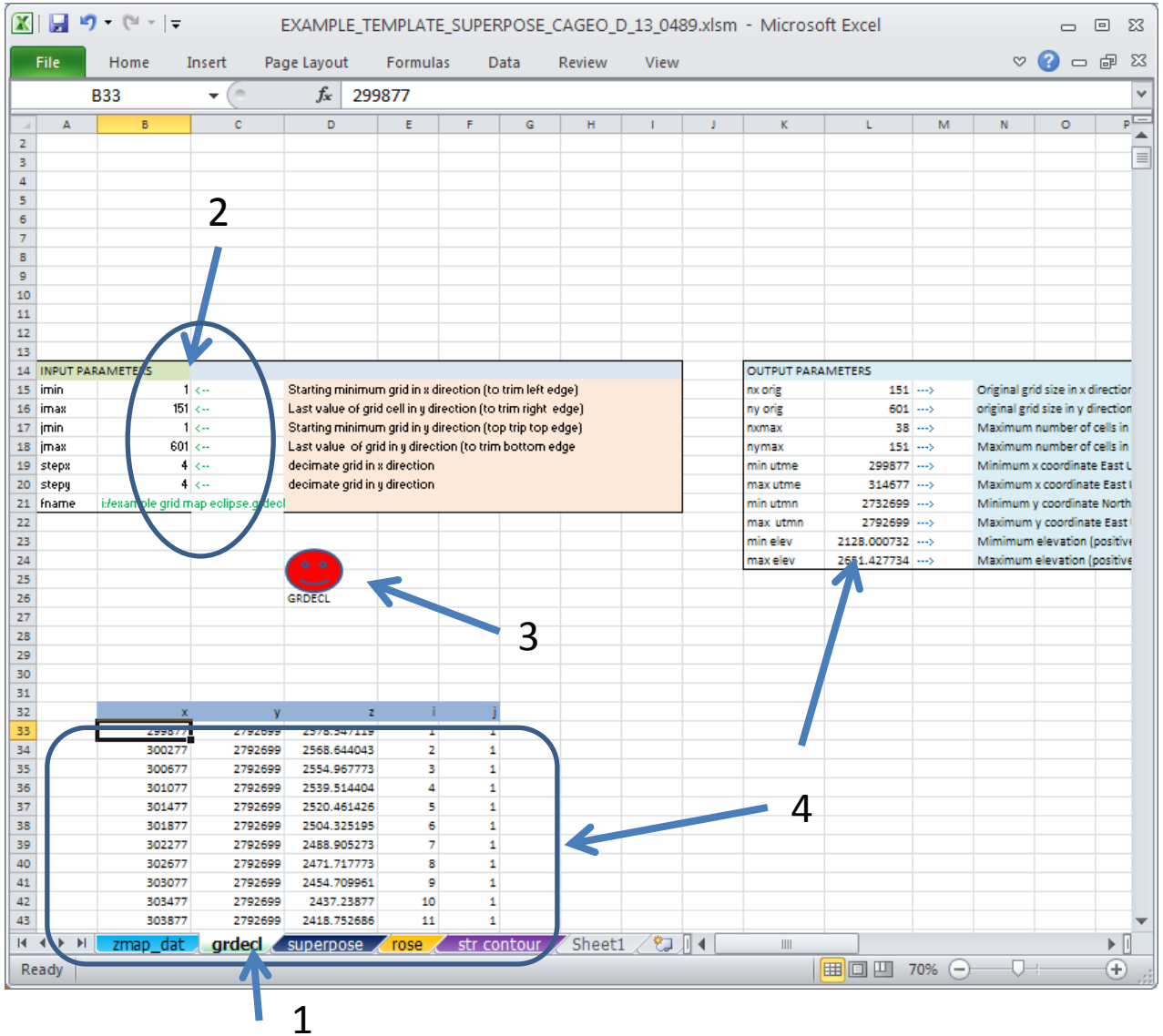
'FEET' /

COORD

1017060	9484908	8118.064	1017060	9484908	8123.78
1017883	9484908	8078.894	1017883	9484908	8084.532
1018705	9484908	8039.659	1018705	9484908	8045.215
1019527	9484908	8000.383	1019527	9484908	8005.856
1020349	9484908	7961.103	1020349	9484908	7966.495
1021172	9484908	7921.799	1021172	9484908	7927.108
1021994	9484908	7882.352	1021994	9484908	7887.58

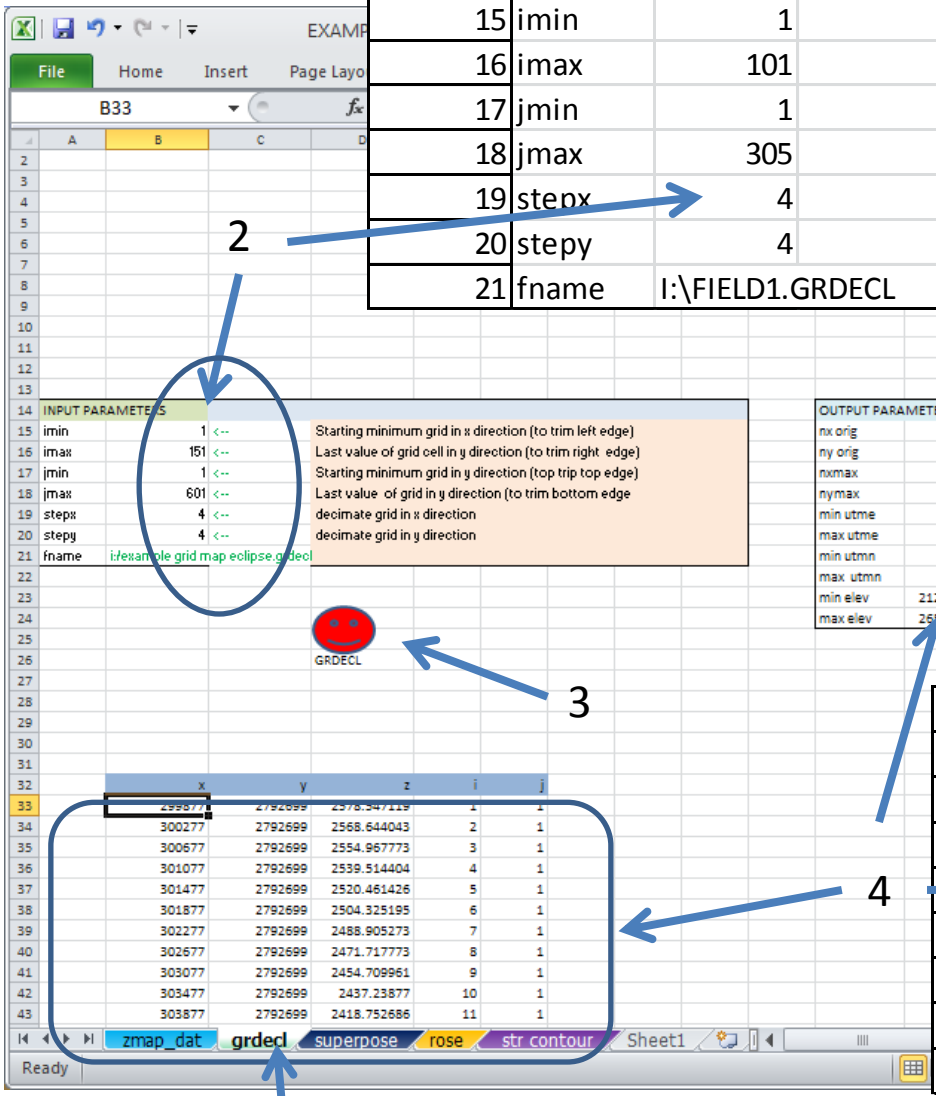
.....

The format of the file must conform the example (1) with the specific key words and data (see User Guide for details).



Open the grdecl tab (1). Place import parameters (2) and click on the icon to run the GRDECL import program (3). The results (data and parameters) are placed as shown (4).

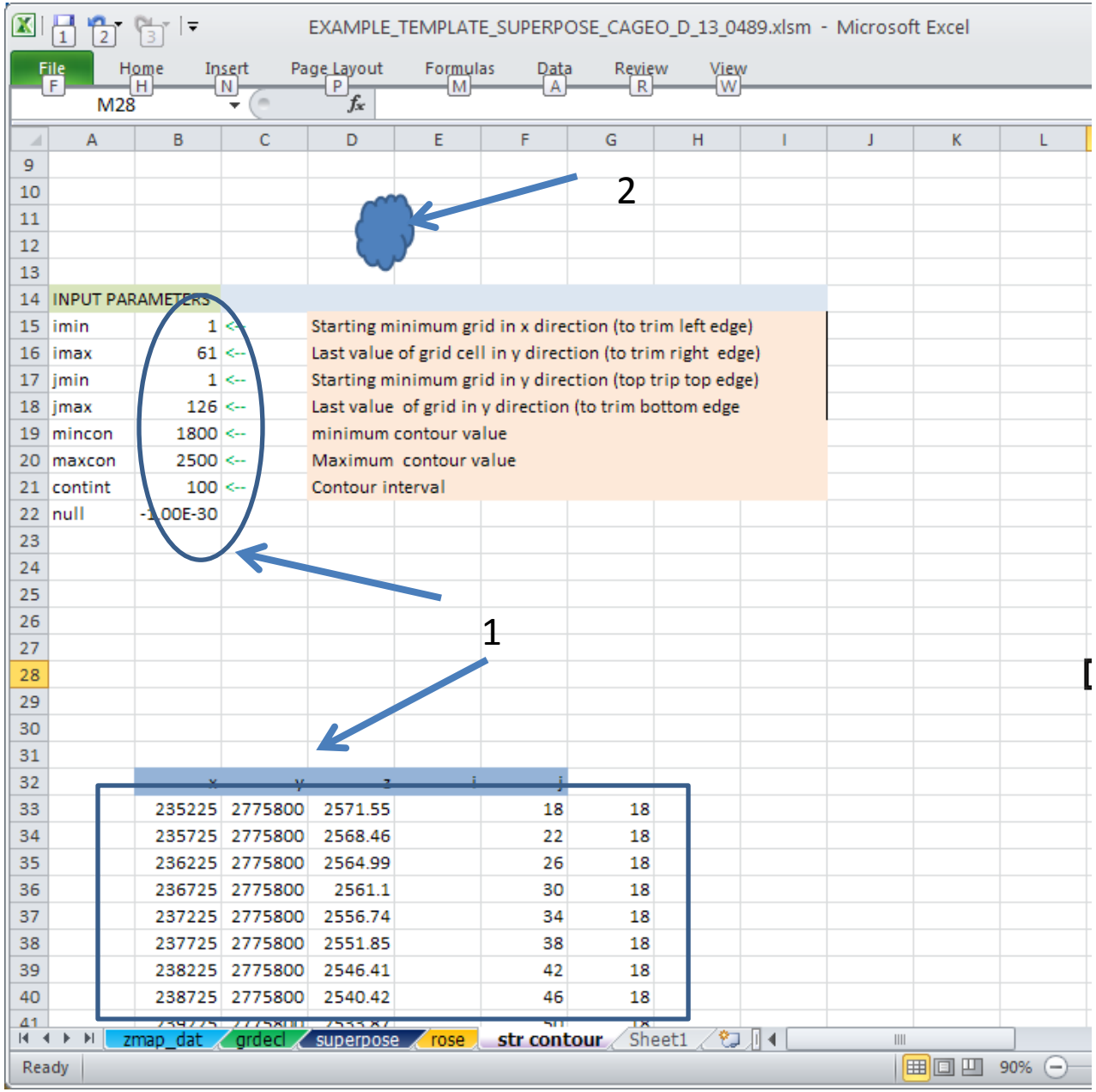
	A	B	C	D	E	F	G	H	I
14	INPUT PARAMETERS								
15	imin	1		Starting minimum grid in x direction (to trim left edge)					
16	imax	101		Last value of grid cell in y direction (to trim right edge)					
17	jmin	1		Starting minimum grid in y direction (top trip top edge)					
18	jmax	305		Last value of grid in y direction (to trim bottom edge					
19	stepx	4		Take every nth grid value in x direction skip n cells. n=stepx					
20	stepy	4		Take every nth grid value in y direction skip n cells. n=stepy					
21	fname	I:\FIELD1.GRDECL		Input data file location and name					



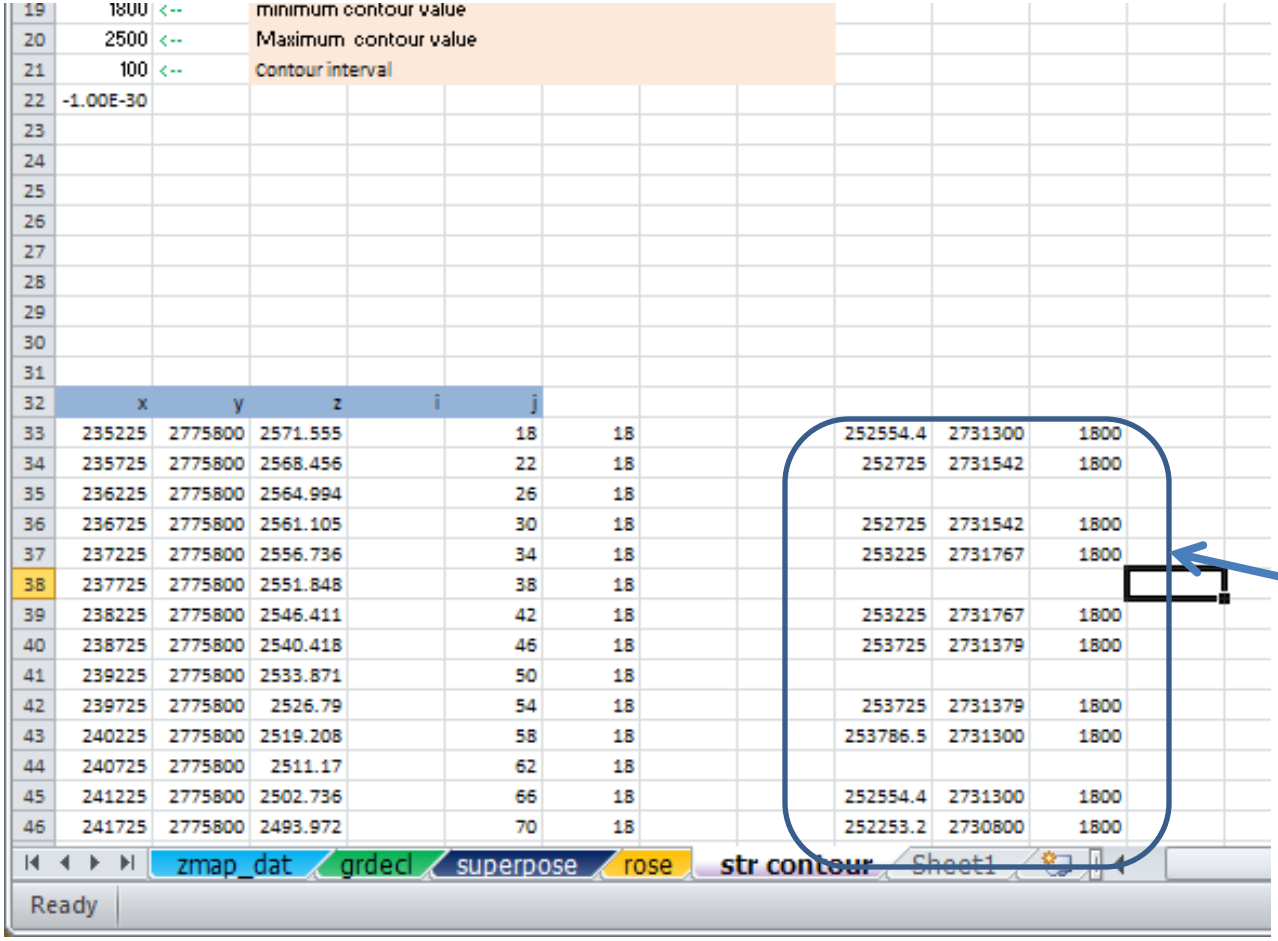
A	B	C	D	E	F
32	x	y	z	j	i
33	310000	2891000	2474.386	1	1
34	311002.5	2891000	2426.544	2	1
35	312005	2891000	2378.066	3	1
36	313007.5	2891000	2325.422	4	1
37	314010	2891000	2268.82	5	1
38	.....				
39	.....				

Open the grdecl tab (1). Place import parameters (2) and click on the icon to run the GRDECL import program (3). The results (data and parameters) are placed as shown (4).

DRAWING STRUCTURE CONTOUR MAP



Fill in the parameters and data (1) from either the ZMAP or GRDECL tabs. Run the contour program by clicking on the icon (2)



1800	<--	minimum contour value	
2500	<--	Maximum contour value	
100	<--	Contour interval	
-1.00E-30			

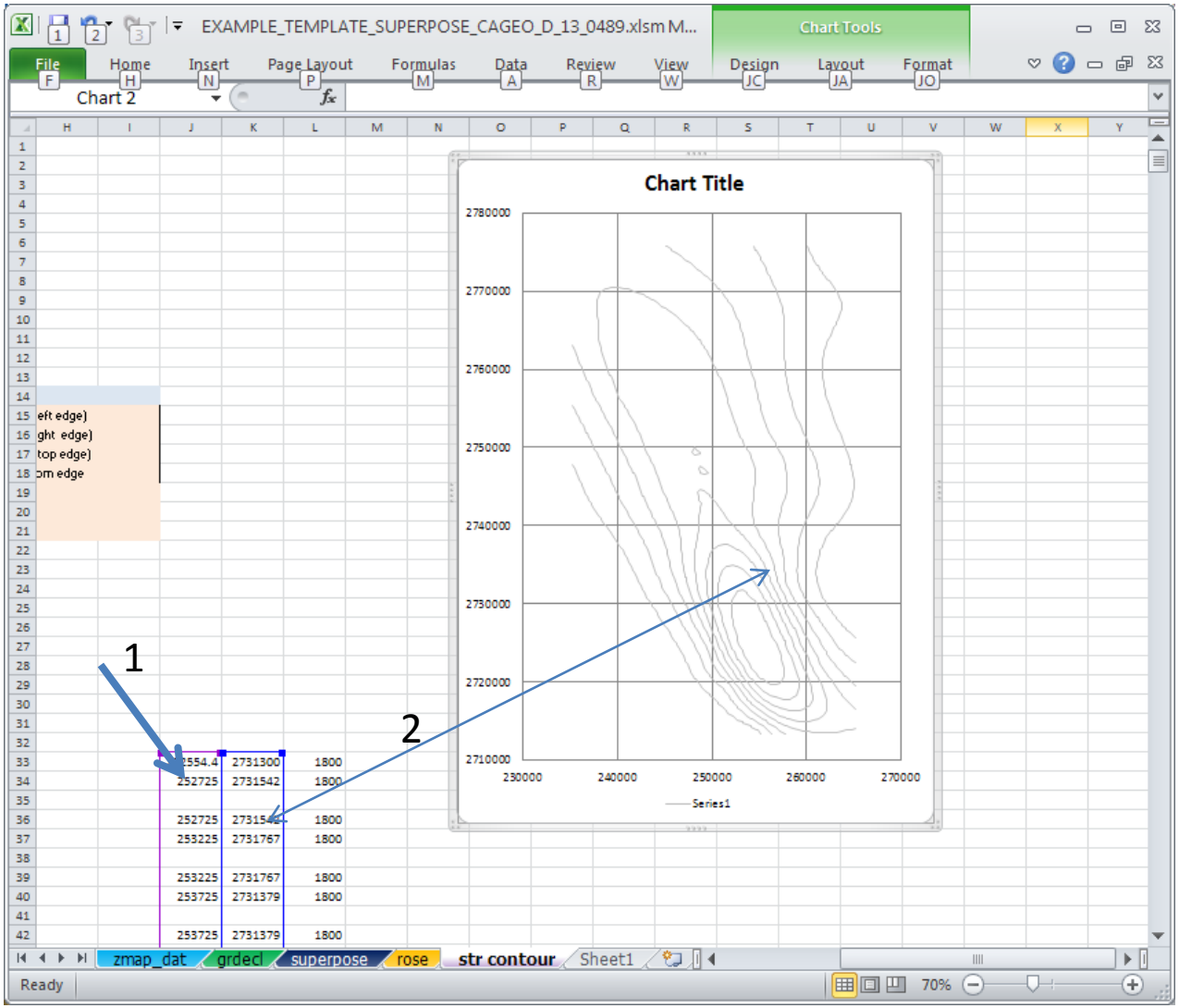
x	y	z	i	j				
235225	2775800	2571.555	18	18		252554.4	2731300	1800
235725	2775800	2568.456	22	18		252725	2731542	1800
236225	2775800	2564.994	26	18				
236725	2775800	2561.105	30	18		252725	2731542	1800
237225	2775800	2556.736	34	18		253225	2731767	1800
237725	2775800	2551.848	38	18				
238225	2775800	2546.411	42	18		253225	2731767	1800
238725	2775800	2540.418	46	18		253725	2731379	1800
239225	2775800	2533.871	50	18				
239725	2775800	2526.79	54	18		253725	2731379	1800
240225	2775800	2519.208	58	18		253786.5	2731300	1800
240725	2775800	2511.17	62	18				
241225	2775800	2502.736	66	18		252554.4	2731300	1800
241725	2775800	2493.972	70	18		252253.2	2730800	1800

zmap_dat | grdecl | superpose | rose | str contour | Sheet1

Ready

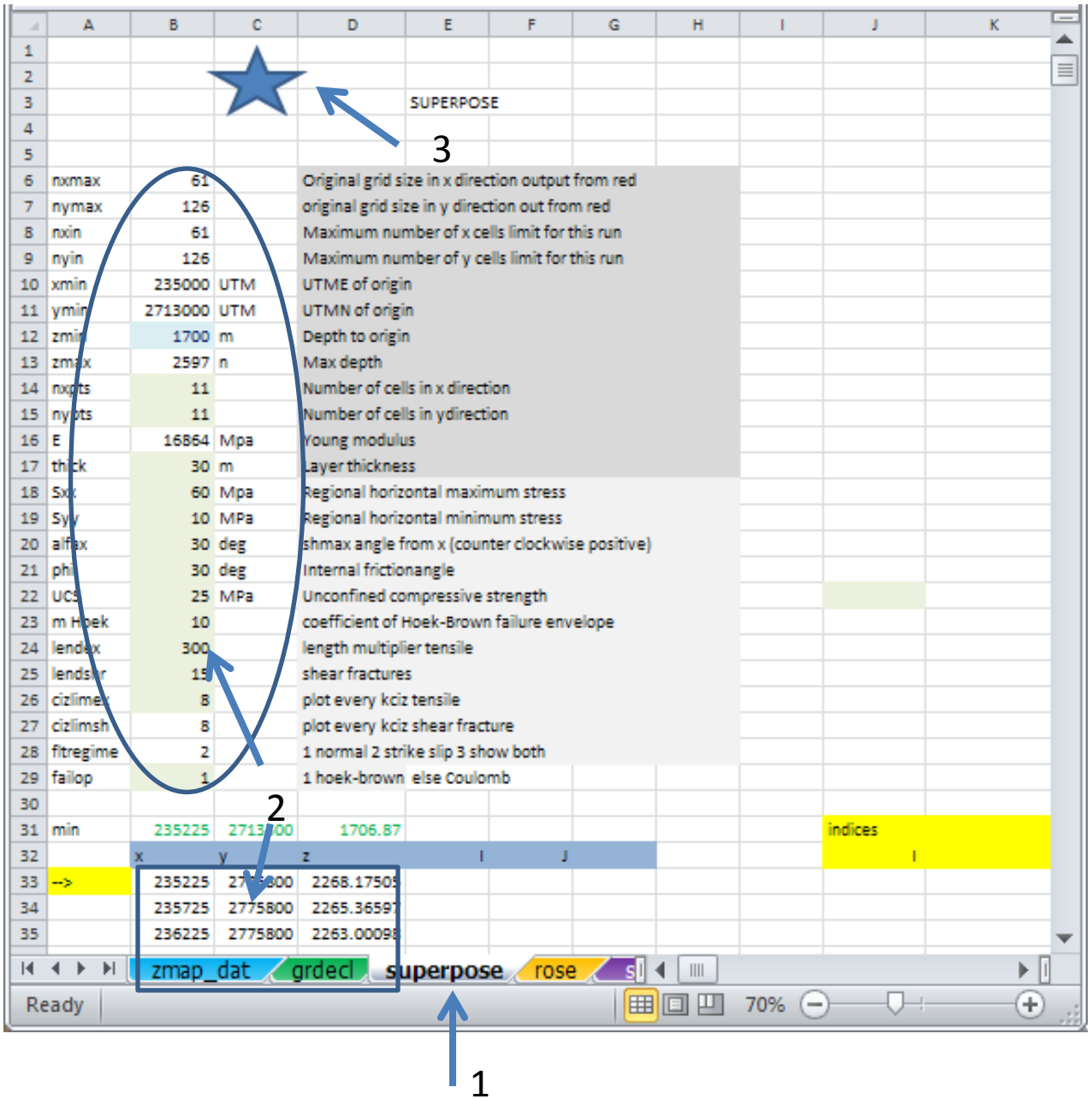
1

The contour program outputs the contours suitable for plotting as an Excel graph (1).



Select plot data (1) and plot a Excel graph (2). Adjust aspect ratio and minimum and maximum east and north UTM values.

RUNNING SUPERPOSE PROGRAM

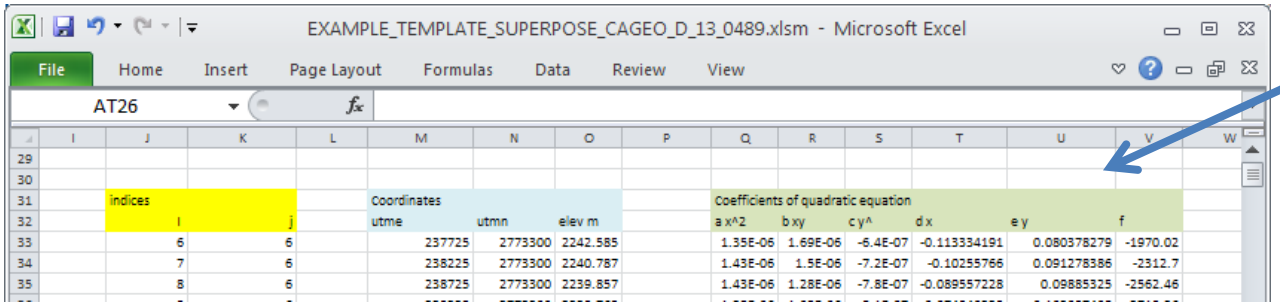


Open the superpose tab in the Excel template(1). Fill in the input parameters and copy and paste grid data from ZMAP or GRDECL tabs (2). Click on the icon to run the SUPERPOSE program (3). See next slide for a close up of the parameters (2).

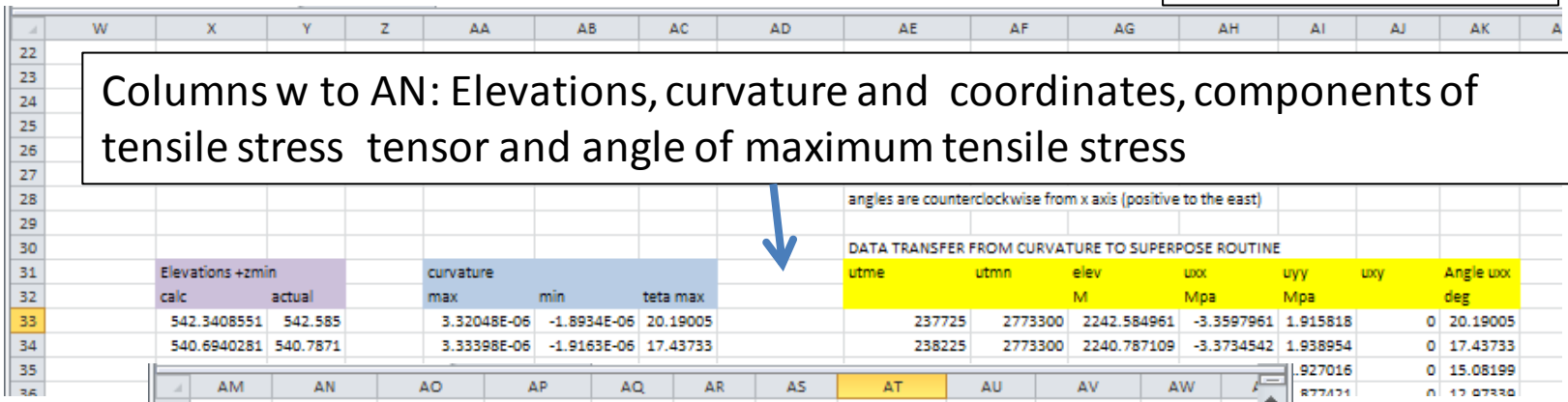
	A	B	C	D	E	F	G	H
6	nxmax	61		Original grid size in x direction output from red				
7	nymax	129		original grid size in y direction out from red				
8	nxin	61		Maximum number of x cells limit for this run				
9	nyin	129		Maximum number of y cells limit for this run				
10	xmin	350000	UTM	UTME of origin				
11	ymin	2850000	UTM	UTMN of origin				
12	zmin	1700	m	Depth to origin				
13	zmax	2597	n	Max depth				
14	nxpts	11		Number of cells in x direction				
15	nypts	11		Number of cells in ydirection				
16	E	16864	Mpa	Young modulus				
17	thick	30	m	Layer thickness				
18	Sv	30		Vertical effective stress				
19	Sxx	120	Mpa	Regional horizontal maximum effective stress				
20	Syy	10	MPa	Regional horizontal minimum effective stress				
21	alfax	20	deg	shmax angle from x (counter clockwise positive)				
22	phi	53	deg	Internal frictionangle				
23	UCS	86	MPa	Unconfined compressive strength				
24	mi Hoek	20		Coefficient of Hoek-Brown failure envelope				
25	lendex	100		Length multiplier for tensile fractures				
26	lendshr	25		Length multiplier for shear fractures				
27	cizlimex	10		Plot every nth tensile fracture. n=cizlimex				
28	cizlimsh	5		Plot every nth shear fracture. n=cizlimsh				
29	failop	2		Failure option: 1 Hoek-Brown else Coulomb				

2

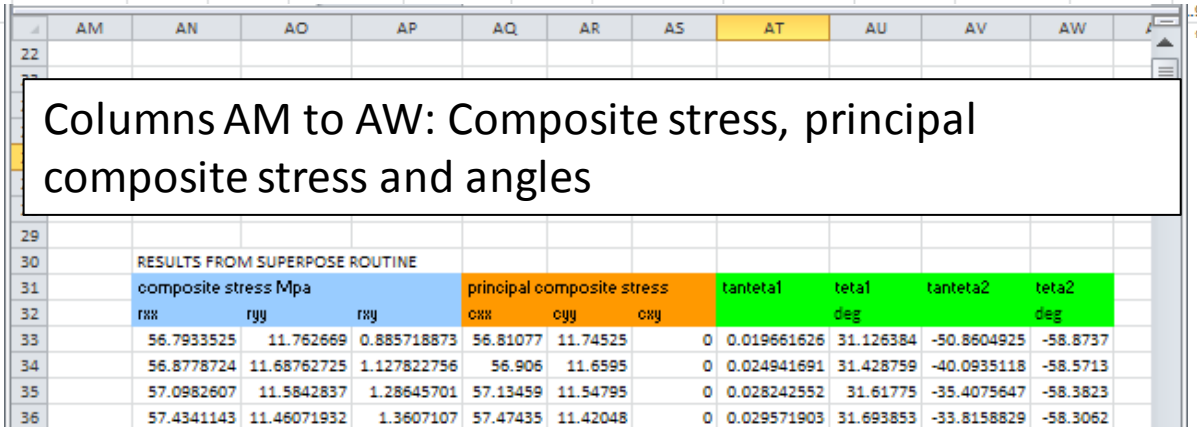
Close up of parameters and example values in previous slide (2).



Columns J to V : Indices coordinates and coefficients of quadratic equations for each window



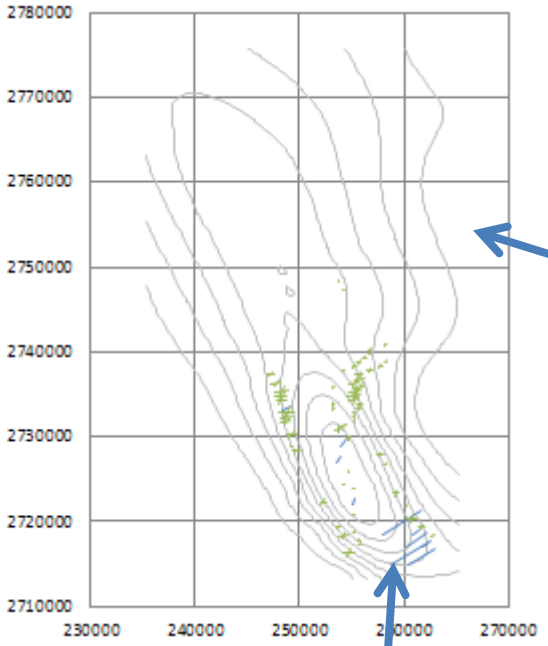
Columns w to AN: Elevations, curvature and coordinates, components of tensile stress tensor and angle of maximum tensile stress



Columns AM to AW: Composite stress, principal composite stress and angles

The results are placed in columns J to CG.

The fracture stick data for tensile fractures is placed at column BQ and BR. Copy the contour map to the SUPERPOSE tab(1). Copy and paste the data onto the contour map (2) and change color chosen for tensile fractures (blue in this example).



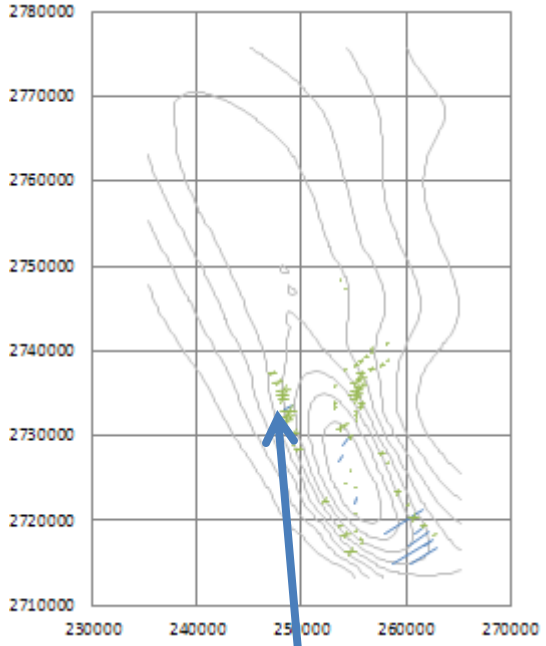
1

2

Columns BD to BR: Tensile fracture sticks

	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR
22															
23															
24															
25															
26															
27															
28															
29															
30		TENSILE FRACTURES					FRACTURE STICKS							EXCEL PLOT AID	
31		Length	Strike	X	Y		tip 1		tip 2					Tip 1 x	tip1 y
32		m	deg	utme	utmn		utme	umtn	utme	utmn				Tip2 x	tip2 y
33		862.7418	56.27857	248725	2733300		248366.2	2733061	249083.8	2733539					
34		1274.483	56.36598	249225	2731300		248694.4	2730947	249755.6	2731653				248366.2	2733061
35		749.7146	55.89773	249225	2730800		248914.6	2730590	249535.4	2731010				249083.8	2733539
36		875.9929	29.45001	253725	2730300		253509.7	2729919	253940.3	2730681					
37		880.7181	29.61821	254225	2730300		254007.4	2729917	254442.6	2730683				253985.4	2728863

The fracture stick data for shear fractures is placed at columns CF and CG Copy and paste the data onto the contour map (1) and change color chosen for shear fractures.(green in this example.



Columns BT to CH: Shear fracture sticks

1

	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH
22															
23															
24															
25															
26															
27															
28															
29															
30	SHEAR FRACTURES					SHEAR FRACTURE STICKS STICKS							EXCEL PLOT AID		
31	Length	Strike	X	Y		tip 1		tip 2					Tip 1 x	tip1 y	
32	m	deg	utme	utmn		utme	umtn	utme	utmn				Tip2 x	tip2 y	
33	33.83671	89.5081	242225	2766300		242208.1	2766300	242241.9	2766300				242208.1	2766300	
34	33.83671	29.50818	242225	2766300		242216.7	2766285	242233.3	2766315				242241.9	2766300	
35	61.85426	89.13495	242225	2765800		242194.1	2765800	242255.9	2765800						
36	61.85426	29.13503	242225	2765800		242209.9	2765773	242240.1	2765827				242216.7	2766285	
37	26.90363	89.19306	244225	2765800		244211.5	2765800	244238.5	2765800				242233.3	2766315	
38	26.90363	29.19314	244225	2765800		244218.4	2765788	244231.6	2765812						
39	105.2603	88.88298	242225	2765300		242172.4	2765299	242277.6	2765301						