Dave Boore's notes on using P and T axes to classify fault types.

Using a program from Bob Herrmann and equations from Stein and Wyssessian, I have computed the trend and plunge of the P, T, and B axes for all events in the NGA v3.2 flatfile. I have included this information in the attached xls file. The plunge of the axes can be used to classify fault types, the advantage being that the classification may be more physically based than a simple classification based on rake, and furthermore the classification is not dependent on the choice of fault plane. I used the classification scheme here:

Orientation of maximum horizontal compressive stress following the convention of Zoback (1992). See http://www-wsm.physik.uni-karlsruhe.de/pub/data_details/regime.html

P/S1-axis	B/S2-axis	T/S3-axis	Regime	
pl > 52		pl < 35	NF	(Normal)
40 < pl < 52		pl < 20	NS	(Normal Oblique)
pl < 40	pl > 45	pl < 20	SS	(Strikeslip)
pl < 20	pl > 45	pl < 40	SS	(Strikeslip)
pl < 20		40 < pl < 52	TS	(Reverse Oblique)
pl < 35		pl > 52	TF	(Reverse)

Using this scheme, Figure 1 shows the classification for all events in the NGA flatfile for which fault strike, dip, and rake are available.

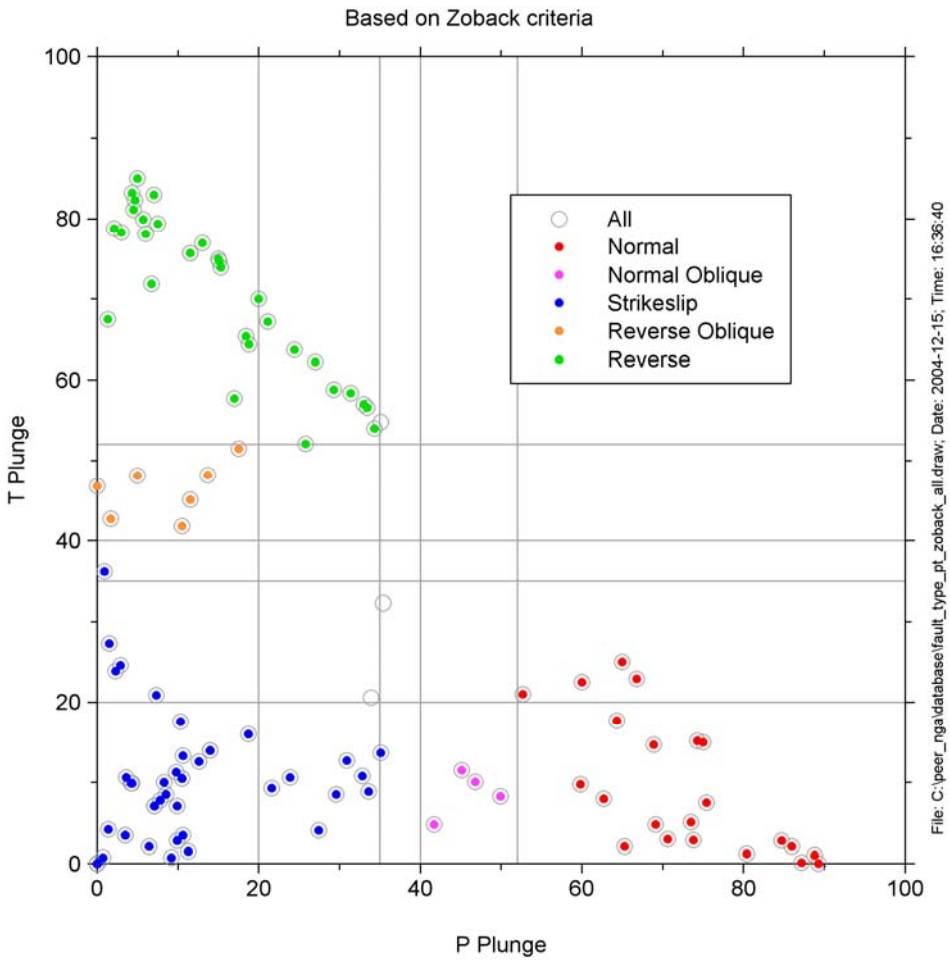


Figure 1.

Note that only three events were not classified using the scheme, and two of these would have been classified with slight changes in the plunges. It turns out that the criteria involving the plunge of the B axis is redundant (the plunge of the P and T axes suffices. By looking at the above figure I recommend the following simple classification scheme:

Reverse faulting: plunge of T axis > 40 degrees

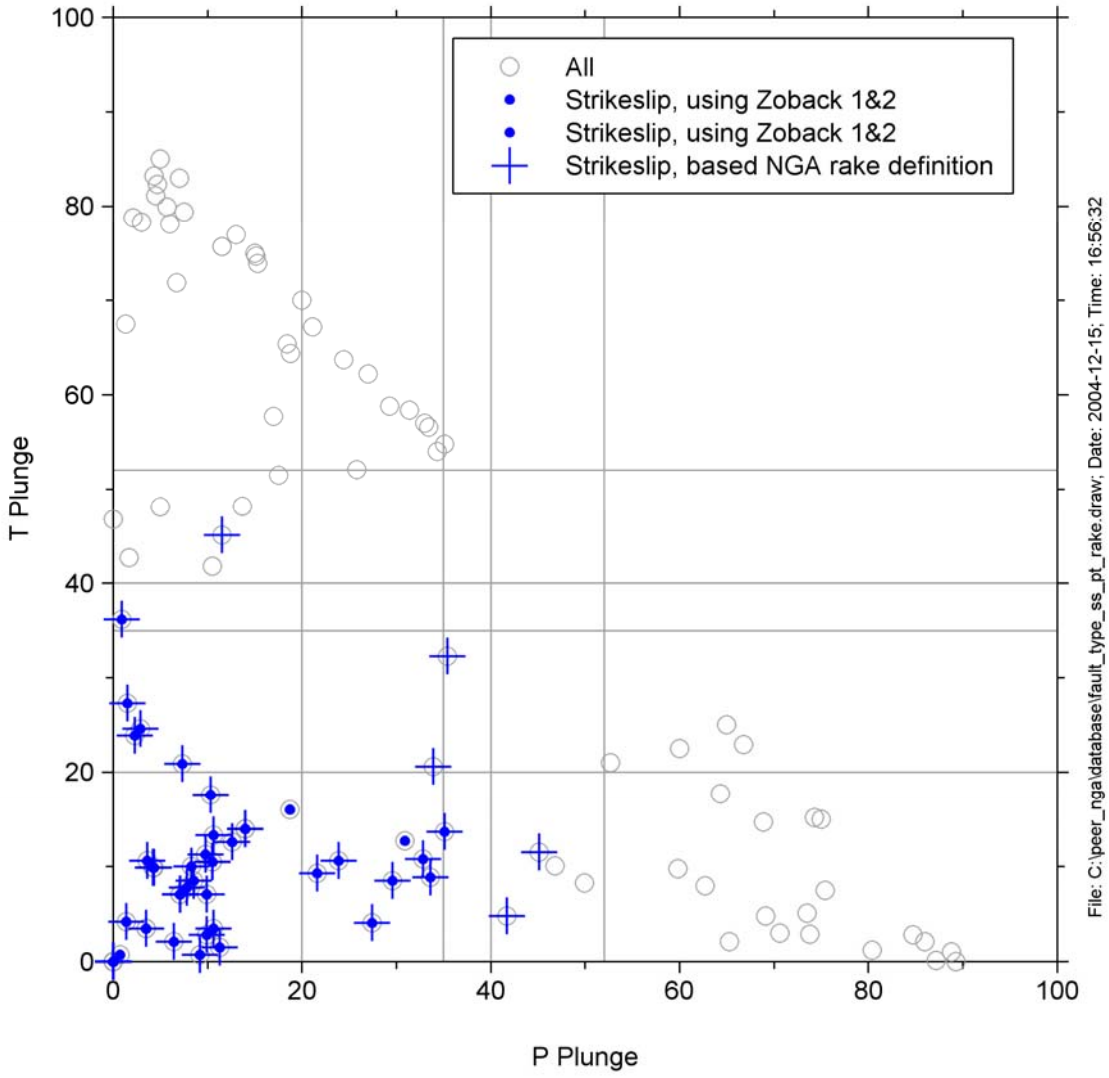
Normal faulting: plunge of P axis > 40 degrees

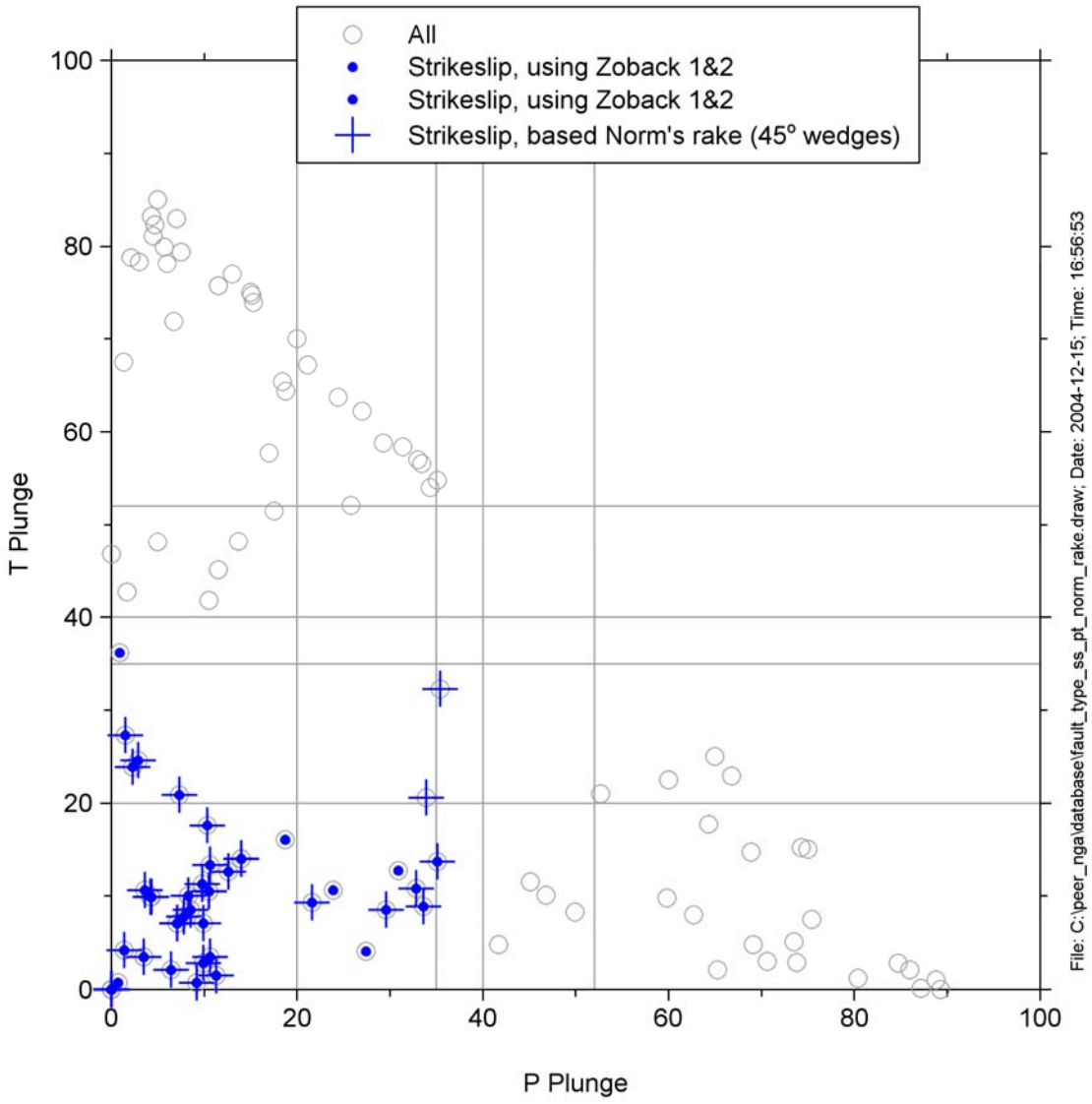
Strikeslip faulting: all others (plunge of P and T axes < 40 degrees)

To see how the classification using rake angles compares with the classification based on the P and T axes, I attach a series of self-explanatory figures (using both the NGA flatfile definition of fault type in terms of rake angle and Norm's definition). As seen in the figures, There is a lot of overlap in the ways of classifying the fault types. I have not attempted to look into those events that have different classifications using the various schemes.

References (for future use if incorporate this into a report):

Bommer, J.J., J. Douglas and F.O. Strasser (2003). Style-of-faulting in ground-motion prediction equations. \bssa{1}{171--203}




All
Strikeslip, using Zoback 1&2
Strikeslip, using Zoback 1&2
Strikeslip, based Norm's rake (45° wedges)
T Plunge
P Plunge
0
20
40
60
80
100
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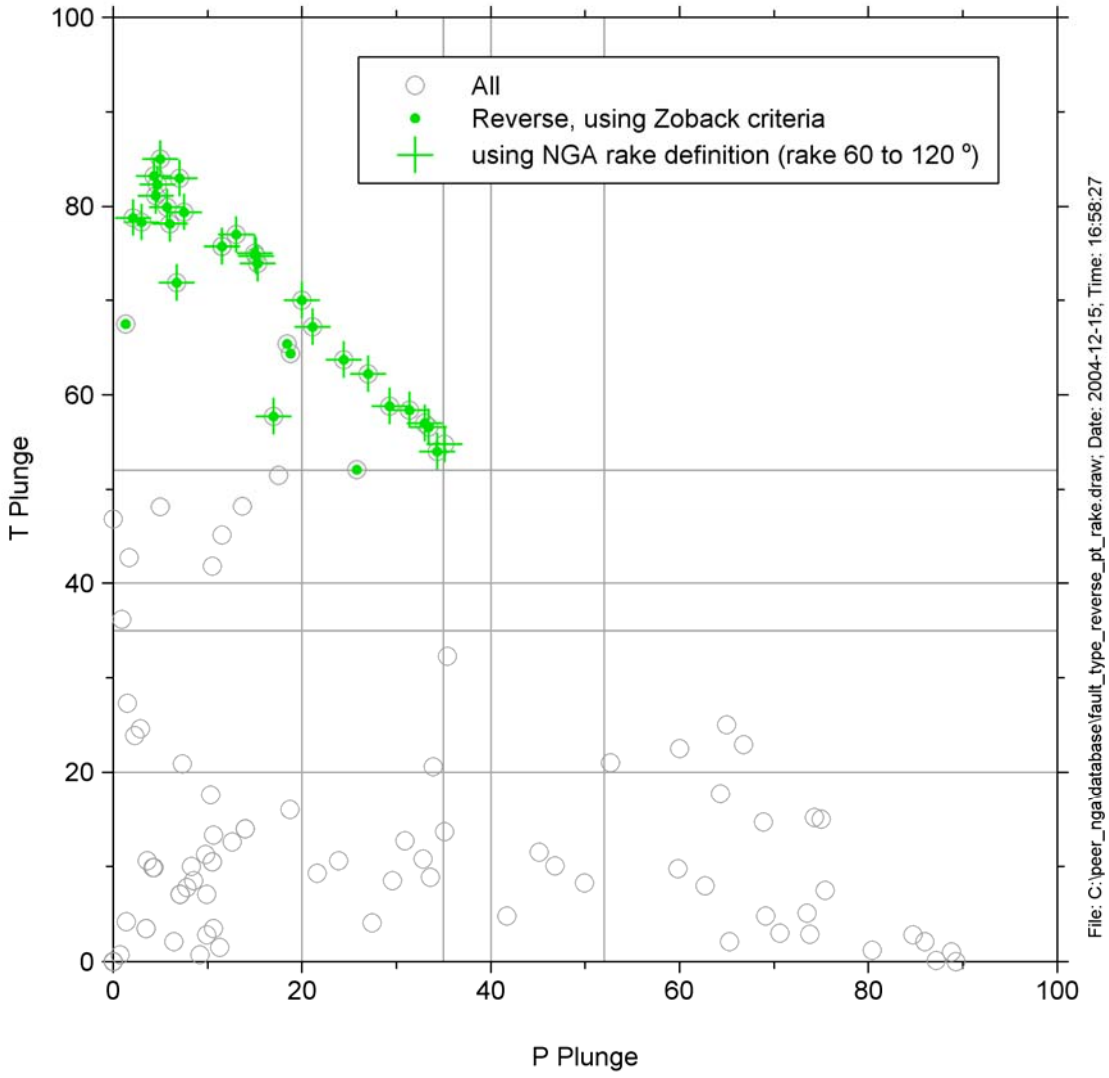
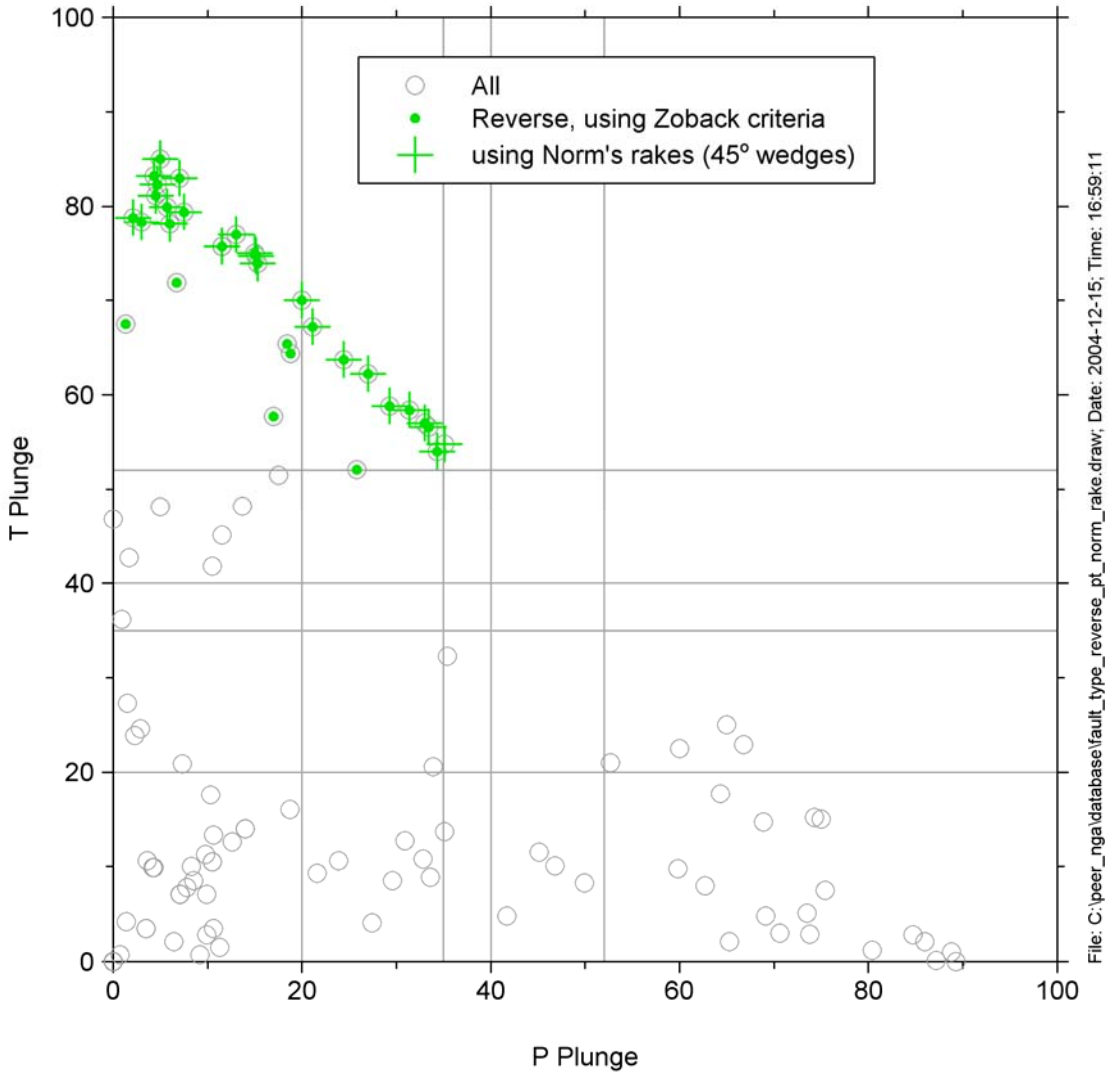
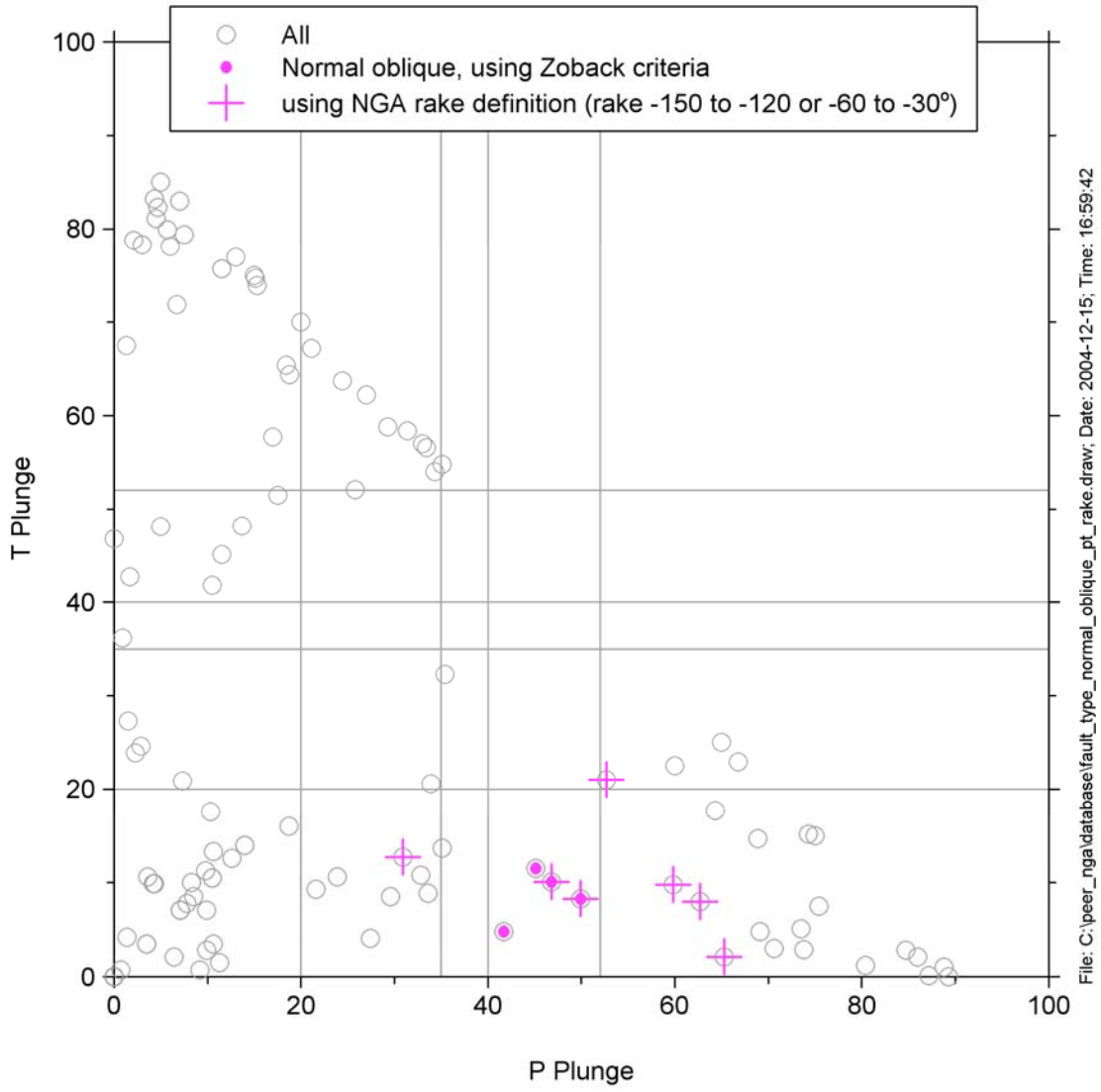
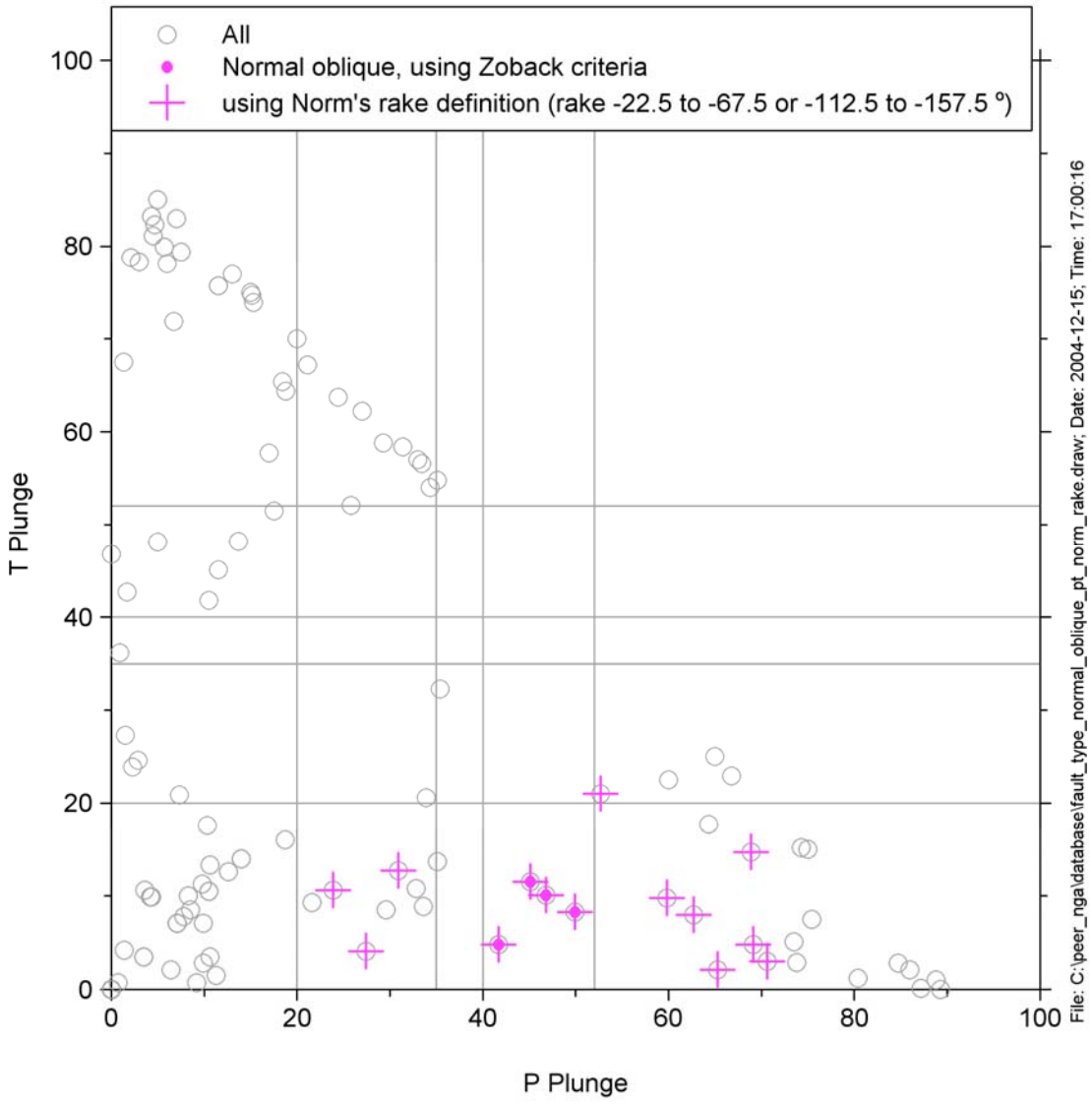

All
Reverse, using Zoback criteria
using NGA rake definition (rake 60 to 120 °)
T Plunge
P Plunge
0
20
40
60
80
100
File: C:\peer_nga\database\fault_type_reverse_pt_rake.draw; Date: 2004-12-15; Time: 16:58:27


All
Reverse, using Zoback criteria
using Norm's rakes (45° wedges)
T Plunge
P Plunge
0
20
40
60
80
100
File: C:\peer_nga\database\fault_type_reverse_pt_norm_rake.draw; Date: 2004-12-15; Time: 16:59:11


All
Normal oblique, using Zoback criteria
using NGA rake definition (rake -150 to -120 or -60 to -30°)
T Plunge
P Plunge
0
20
40
60
80
100
File: C:\peer_nga\database\fault_type_normal_oblique_pt_rake.draw; Date: 2004-12-15; Time: 16:59:42


All
Normal oblique, using Zoback criteria
using Norm's rake definition (rake -22.5 to -67.5 or -112.5 to -157.5 °)
T Plunge
P Plunge
0
20
40
60
80
100
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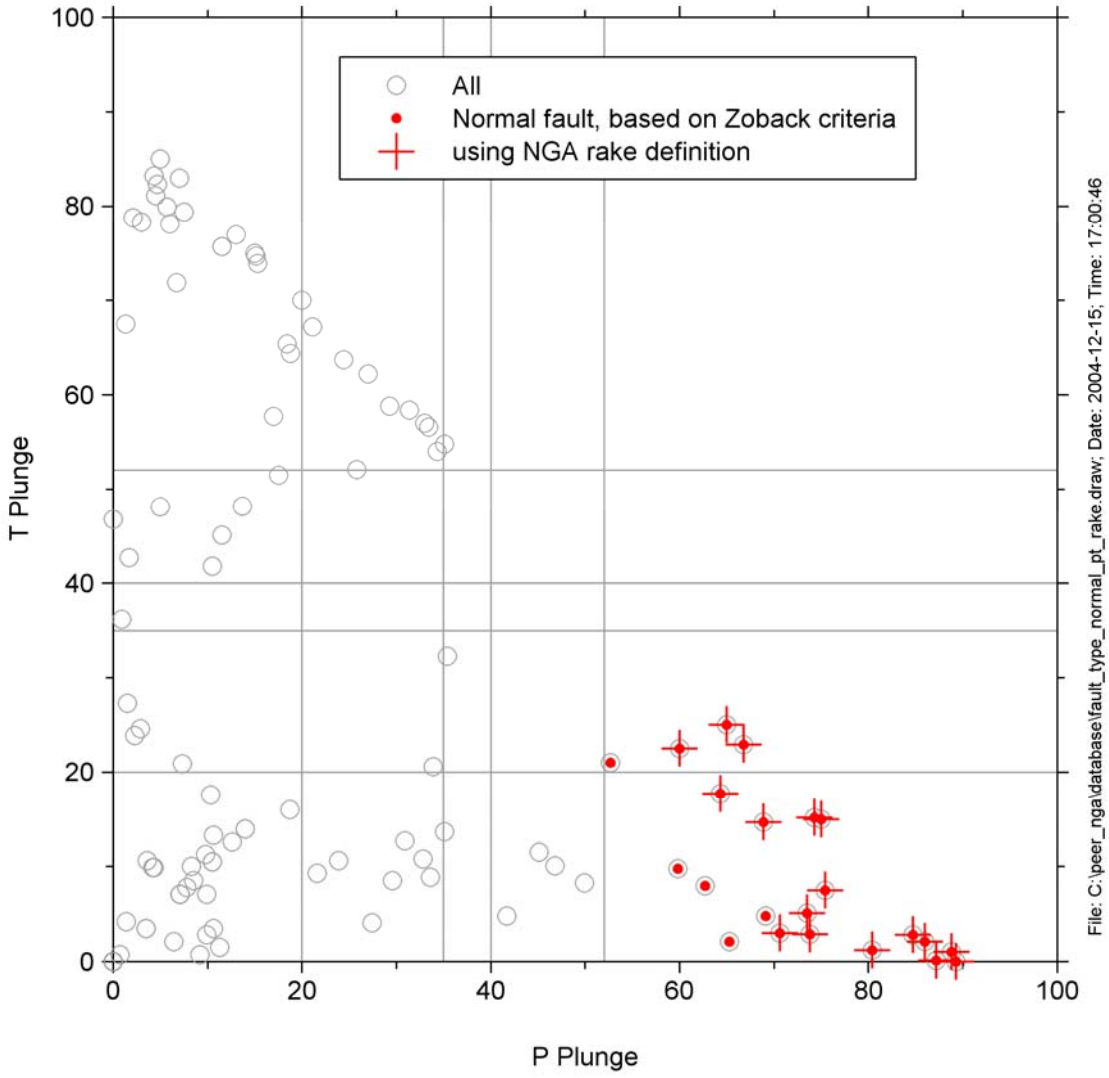
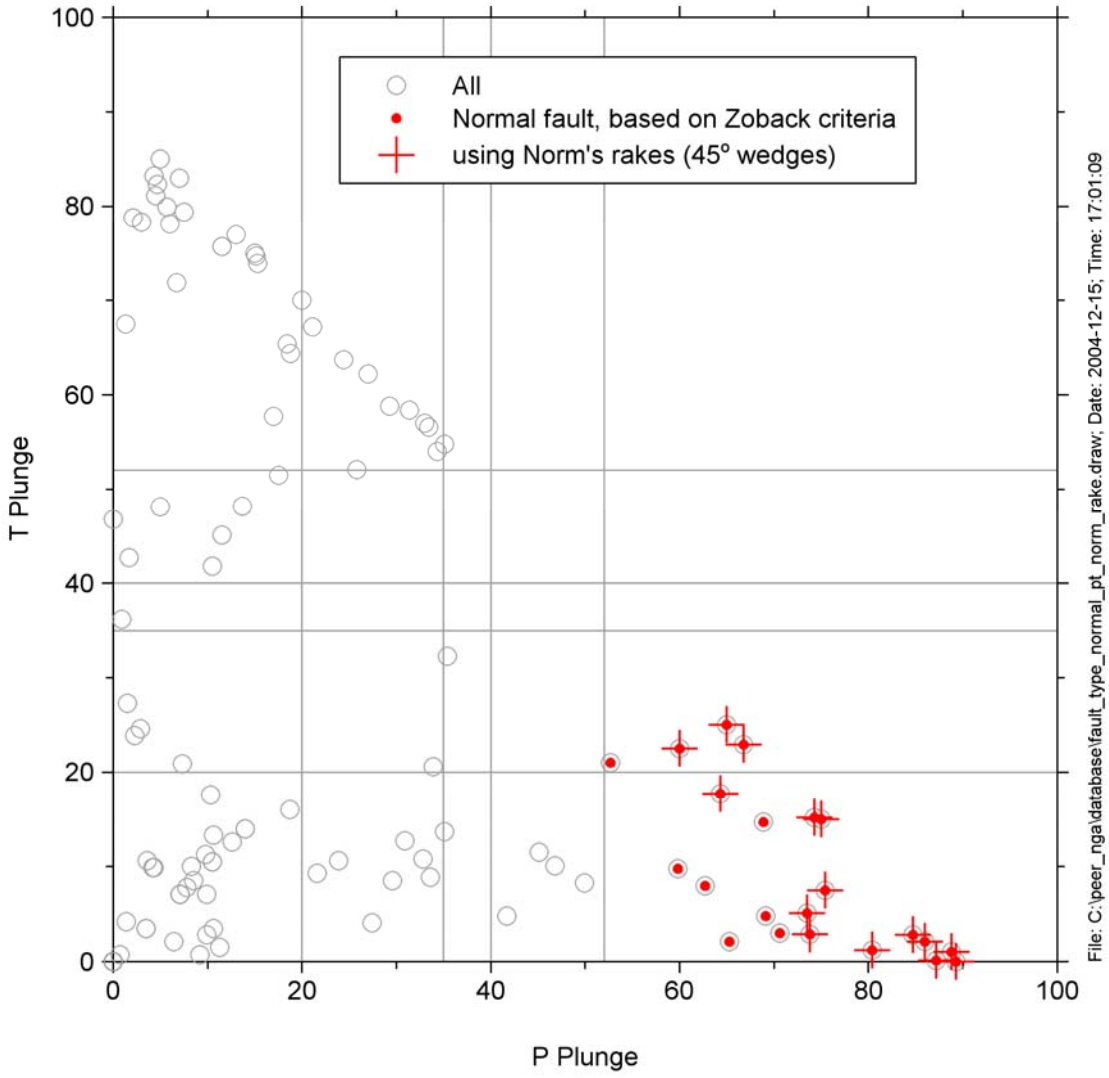
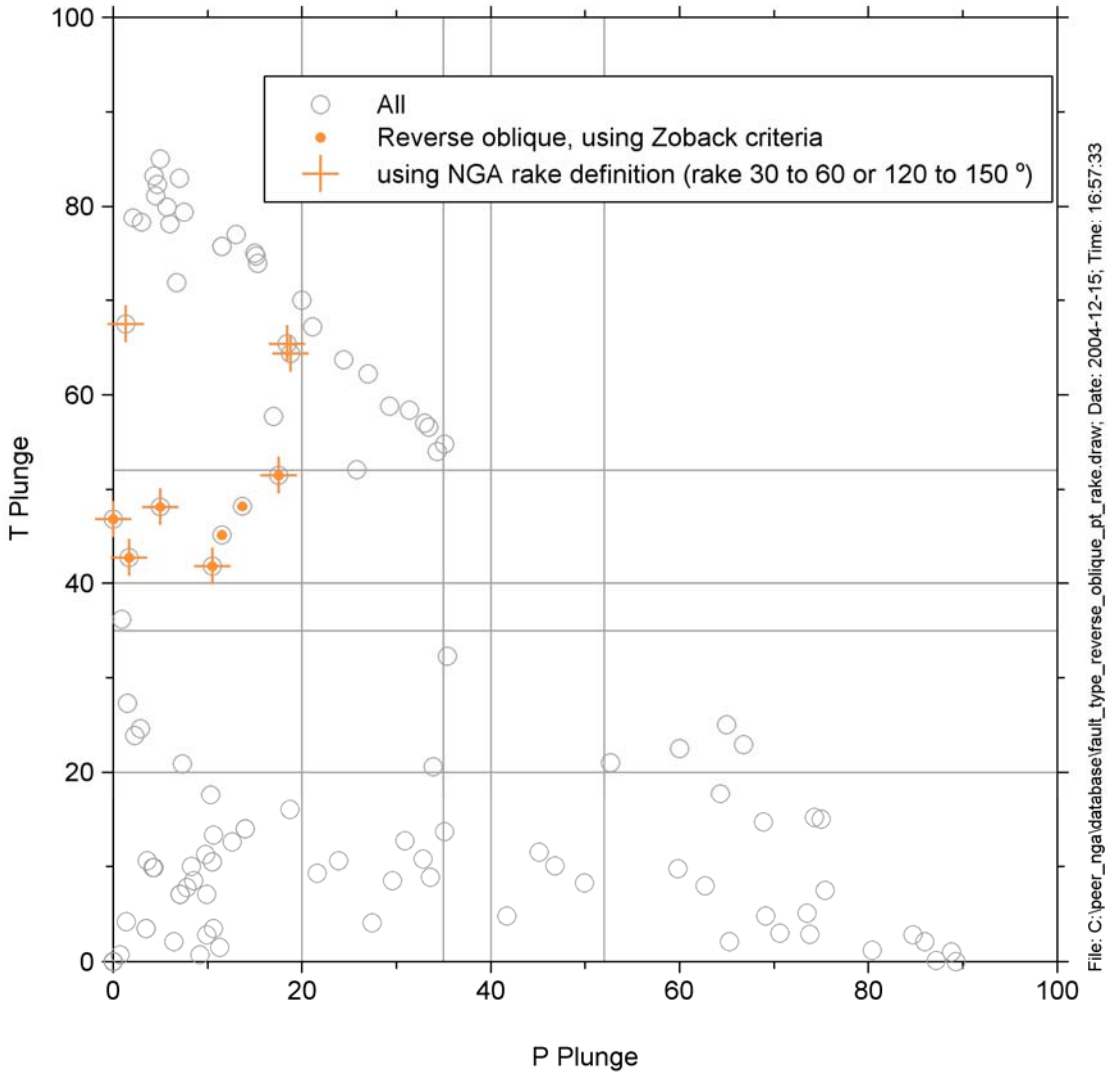
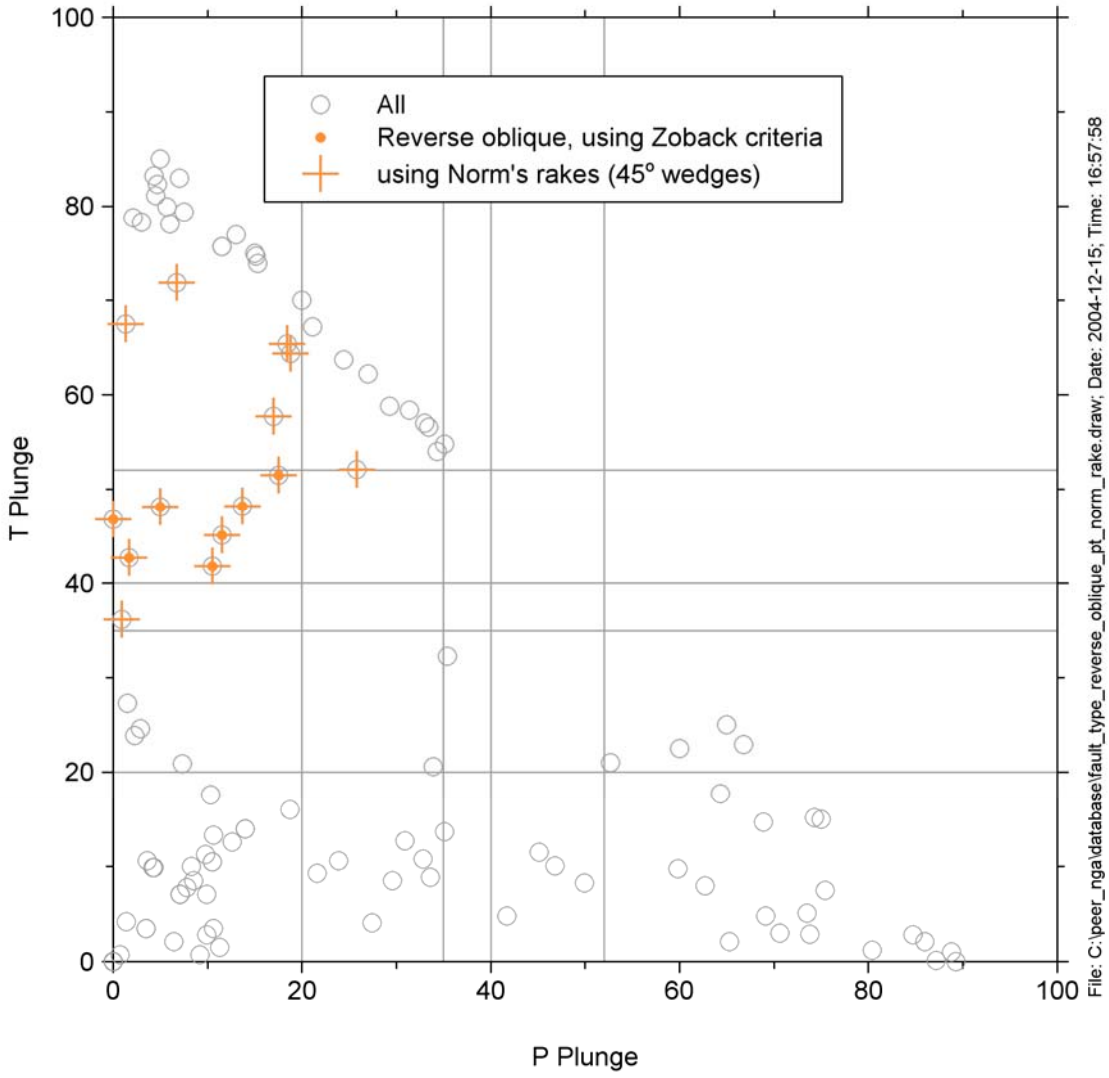

All
Normal fault, based on Zoback criteria
using NGA rake definition
T Plunge
P Plunge
0
20
40
60
80
100
File: C:\peer_nga\database\fault_type_normal_pt_rake.draw; Date: 2004-12-15; Time: 17:00:46


All
Normal fault, based on Zoback criteria
using Norm's rakes (45° wedges)
T Plunge
P Plunge
0
20
40
60
80
100
File: C:\peer_nga\database\fault_type_normal_pt_norm_rake.draw; Date: 2004-12-15; Time: 17:01:09


All
Reverse oblique, using Zoback criteria
using NGA rake definition (rake 30 to 60 or 120 to 150 °)
T Plunge
P Plunge
0
20
40
60
80
100
File: C:\peer_nga\database\fault_type_reverse_oblique_pt_rake.draw; Date: 2004-12-15; Time: 16:57:33


All
Reverse oblique, using Zoback criteria
using Norm's rakes (45° wedges)
T Plunge
P Plunge
0
20
40
60
80
100
File: C:\peer_nga\database\fault_type_reverse_oblique_pt_norm_rake.draw; Date: 2004-12-15; Time: 16:57:58