The thick data

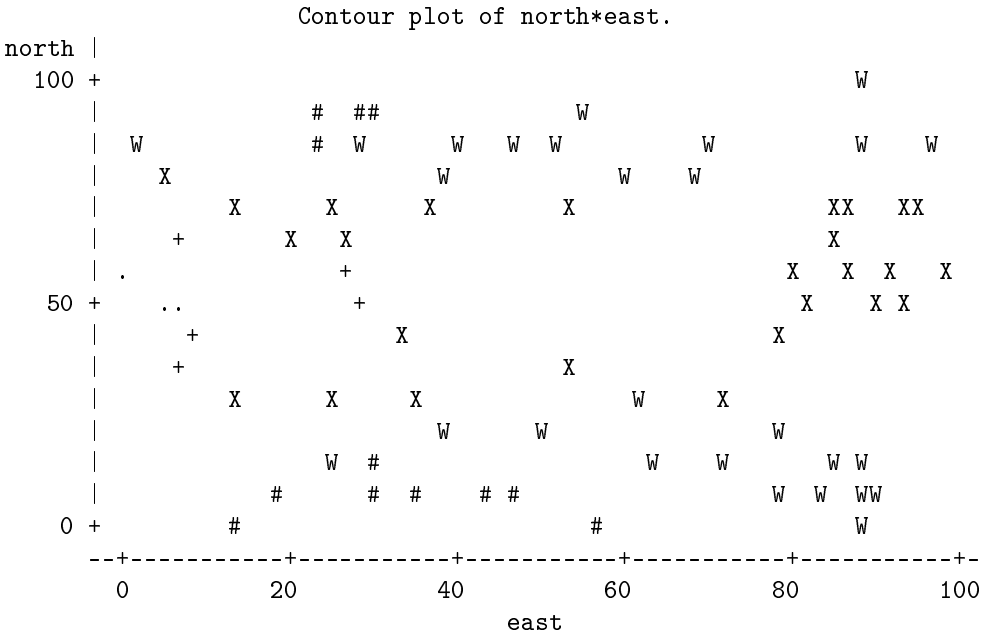
March 24, 2011

The data:

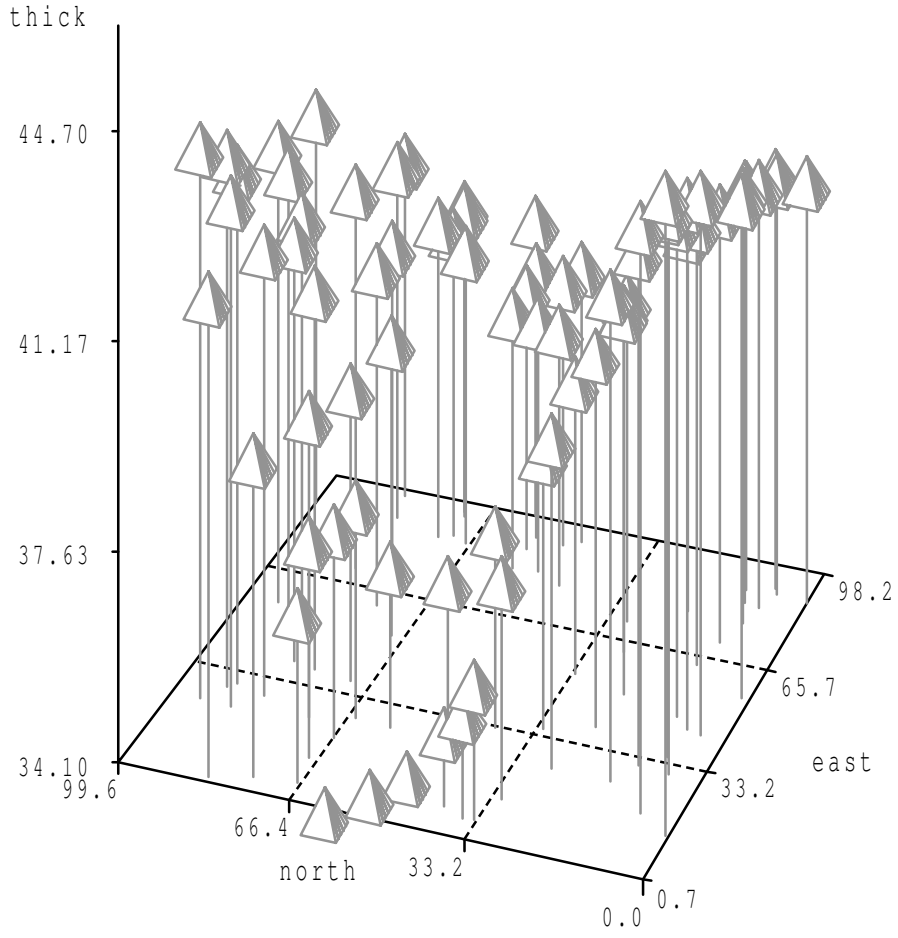
The SAS code and output:

```
options linesize=70;

data thick;
  input east north thick @@;
  datalines;
   0.7  59.6  34.1   2.1  82.7  42.2   4.7  75.1  39.5
   4.8  52.8  34.3   5.9  67.1  37.0   6.0  35.7  35.9
   6.4  33.7  36.4   7.0  46.7  34.6   8.2  40.1  35.4
  13.3   0.6  44.7  13.3  68.2  37.8  13.4  31.3  37.8
  17.8   6.9  43.9  20.1  66.3  37.7  22.7  87.6  42.8
  23.0  93.9  43.6  24.3  73.0  39.3  24.8  15.1  42.3
  24.8  26.3  39.7  26.4  58.0  36.9  26.9  65.0  37.8
  27.7  83.3  41.8  27.9  90.8  43.3  29.1  47.9  36.7
  29.5  89.4  43.0  30.1   6.1  43.6  30.8  12.1  42.8
  32.7  40.2  37.5  34.8   8.1  43.3  35.3  32.0  38.8
  37.0  70.3  39.2  38.2  77.9  40.7  38.9  23.3  40.5
  39.4  82.5  41.4  43.0   4.7  43.3  43.7   7.6  43.1
  46.4  84.1  41.5  46.7  10.6  42.6  49.9  22.1  40.7
  51.0  88.8  42.0  52.8  68.9  39.3  52.9  32.7  39.2
  55.5  92.9  42.2  56.0   1.6  42.7  60.6  75.2  40.1
  62.1  26.6  40.1  63.0  12.7  41.8  69.0  75.6  40.1
  70.5  83.7  40.9  70.9  11.0  41.7  71.5  29.5  39.8
  78.1  45.5  38.7  78.2   9.1  41.7  78.4  20.0  40.8
  80.5  55.9  38.7  81.1  51.0  38.6  83.8   7.9  41.6
  84.5  11.0  41.5  85.2  67.3  39.4  85.5  73.0  39.8
  86.7  70.4  39.6  87.2  55.7  38.8  88.1   0.0  41.6
  88.4  12.1  41.3  88.4  99.6  41.2  88.8  82.9  40.5
  88.9   6.2  41.5  90.6   7.0  41.5  90.7  49.6  38.9
  91.5  55.4  39.0  92.9  46.8  39.1  93.4  70.9  39.7
  94.8  71.5  39.7  96.2  84.3  40.3  98.2  58.2  39.5
```

```
;

proc g3d;
    scatter north*east=thick;

proc plot vpercent=50;
    plot north*east=thick / contour=5;
```




```
 Symbol        thick     Symbol        thick     Symbol        thick
 .....   32.5 - 35.0     XXXXX   37.5 - 40.0     #####   42.5 - 45.0
 +++++   35.0 - 37.5     WWWWW   40.0 - 42.5
NOTE: 2 obs hidden.
```




```
proc variogram;
    compute novariogram;
    coordinates xc=east yc=north;
    var thick;

proc variogram;
    compute nhclasses=30 novariogram;
    coordinates xc=east yc=north;
    var thick;
```

```
proc variogram data=thick outv = outv;
  compute lagd = 5 maxlag = 20;
  coordinates xc=east yc=north;
  var thick;

proc print;

proc gplot;
    plot variog*distance;
```

```
The VARIOGRAM Procedure
Dependent Variable: thick
Number of Observations Read          75
Number of Observations Used          75

             Pairs Information
Number of Lags                          11
Lag Distance                         13.94
Maximum Data Distance in east        97.50
Maximum Data Distance in north       99.60
Maximum Data Distance               139.38

              Pairwise Distance Intervals
                                      Number
  Lag                                    of    Percentage
Class    ---------Bounds---------     Pairs      of Pairs
    0          0.00          6.97        45        1.62%
    1          6.97         20.91       263        9.48%
    2         20.91         34.84       383       13.80%
    3         34.84         48.78       436       15.71%
    4         48.78         62.72       495       17.84%
    5         62.72         76.66       525       18.92%
    6         76.66         90.60       412       14.85%
    7         90.60        104.53       179        6.45%
    8        104.53        118.47        35        1.26%
    9        118.47        132.41         2        0.07%
   10        132.41        146.35         0        0.00%

The VARIOGRAM Procedure
Dependent Variable: thick
Number of Observations Read          75
Number of Observations Used          75

             Pairs Information
Number of Lags                          31
Lag Distance                          4.65
```

Maximum Data Distance in east 97.50
Maximum Data Distance in north 99.60
Maximum Data Distance 139.38

Pairwise Distance Intervals

Lag Class	Bounds		Number of Pairs	Percentage of Pairs
0	0.00	2.32	4	0.14%
1	2.32	6.97	41	1.48%
2	6.97	11.61	69	2.49%
3	11.61	16.26	86	3.10%
4	16.26	20.91	108	3.89%
5	20.91	25.55	120	4.32%
6	25.55	30.20	139	5.01%
7	30.20	34.84	124	4.47%
8	34.84	39.49	128	4.61%
9	39.49	44.14	143	5.15%
10	44.14	48.78	165	5.95%
11	48.78	53.43	146	5.26%
12	53.43	58.07	140	5.05%
13	58.07	62.72	209	7.53%
14	62.72	67.37	184	6.63%
15	67.37	72.01	170	6.13%
16	72.01	76.66	171	6.16%
17	76.66	81.30	149	5.37%
18	81.30	85.95	150	5.41%
19	85.95	90.60	113	4.07%
20	90.60	95.24	89	3.21%
21	95.24	99.89	60	2.16%
22	99.89	104.53	30	1.08%
23	104.53	109.18	19	0.68%
24	109.18	113.83	11	0.40%
25	113.83	118.47	5	0.18%
26	118.47	123.12	1	0.04%
27	123.12	127.76	1	0.04%
28	127.76	132.41	0	0.00%
29	132.41	137.06	0	0.00%
30	137.06	141.70	0	0.00%

The VARIOGRAM Procedure
Dependent Variable: thick
Number of Observations Read 75
Number of Observations Used 75

The VARIOGRAM Procedure

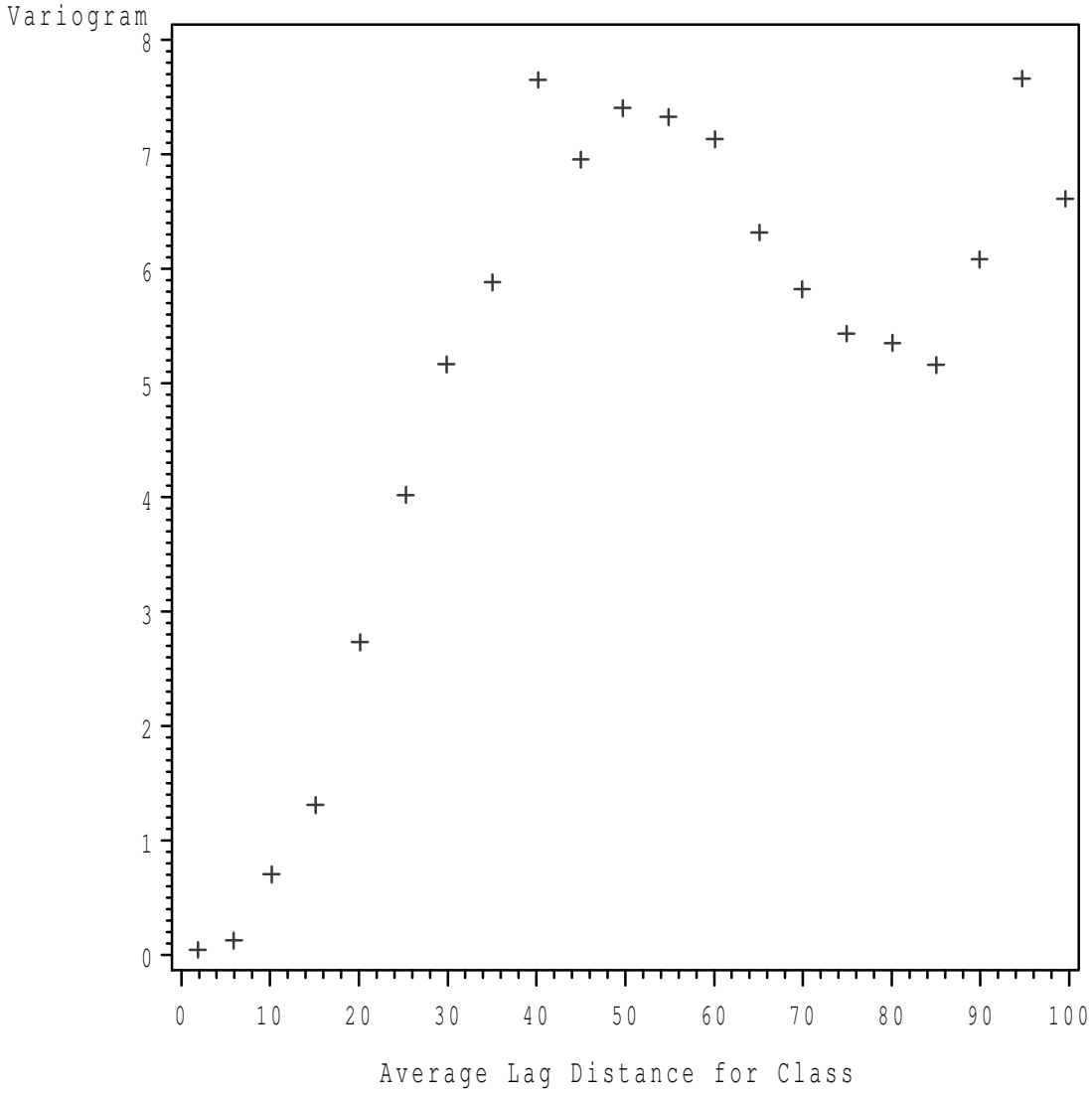
Dependent Variable: thick

Empirical Semivariogram

Lag Class	Pair Count	Average Distance	Semivariance
0	4	1.89	0.0425
1	51	5.94	0.1236
2	76	10.17	0.7024
3	104	15.12	1.3100
4	123	20.15	2.7324
5	136	25.31	4.0214
6	130	29.87	5.1648
7	150	35.06	5.8808
8	137	40.18	7.6515
9	163	45.03	6.9541
10	165	49.70	7.4056
11	159	54.88	7.3282
12	219	60.10	7.1324
13	194	65.10	6.3167
14	180	69.93	5.8192
15	190	74.93	5.4322
16	155	80.11	5.3506
17	151	85.03	5.1577
18	117	89.90	6.0803
19	73	94.66	7.6629
20	47	99.54	6.6128

Obs	VARNAME	LAG	COUNT	DISTANCE	AVERAGE	VARIOG	STDERR	COVAR
1	thick	-1	75	.	40.1387	.	.	5.59592
2	thick	0	4	1.8919	40.1250	0.04250	0.03005	6.73456
3	thick	1	51	5.9367	40.4382	0.12363	0.02448	5.54671
4	thick	2	76	10.1651	40.0428	0.70243	0.11395	3.72434
5	thick	3	104	15.1243	40.1115	1.31000	0.18166	3.29897
6	thick	4	123	20.1472	40.0516	2.73240	0.34842	2.68629
7	thick	5	136	25.3109	39.8081	4.02140	0.48767	1.88510
8	thick	6	130	29.8661	39.8746	5.16485	0.64062	0.64092
9	thick	7	150	35.0573	39.8130	5.88077	0.67905	-0.51211
10	thick	8	137	40.1762	39.9540	7.65146	0.92448	-1.93853
11	thick	9	163	45.0273	39.8837	6.95408	0.77030	-1.85804
12	thick	10	165	49.6994	39.8558	7.40564	0.81533	-2.31356
13	thick	11	159	54.8782	39.8881	7.32824	0.82189	-2.23589
14	thick	12	219	60.0973	40.0637	7.13244	0.68160	-2.08081
15	thick	13	194	65.1025	40.2987	6.31673	0.64137	-1.71279
16	thick	14	180	69.9306	40.2514	5.81919	0.61340	-0.91277
17	thick	15	190	74.9328	40.3763	5.43221	0.55733	0.05297
18	thick	16	155	80.1055	40.4206	5.35065	0.60779	0.36238
19	thick	17	151	85.0293	40.4940	5.15768	0.59358	1.69427

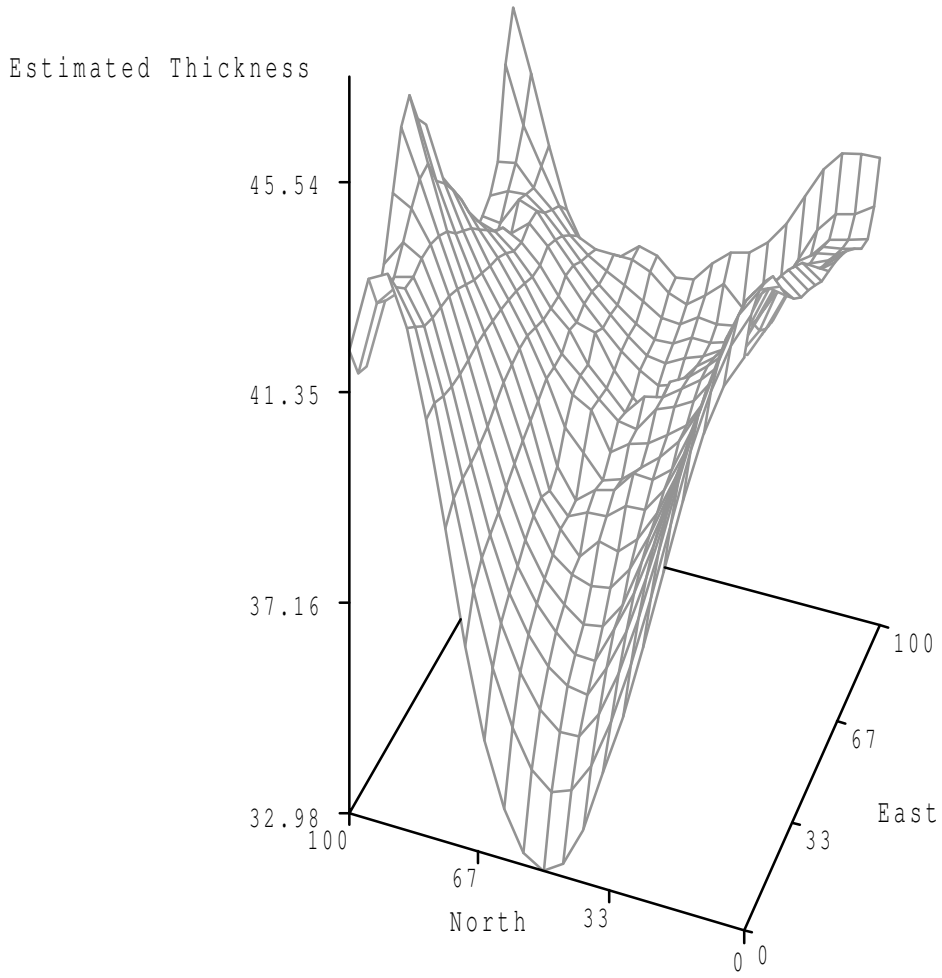
```
 20  thick   18  117   89.9044 40.2175 6.08030 0.79496  0.98993
 21  thick   19   73   94.6578 40.1733 7.66295 1.26838  0.18459
 22  thick   20   47   99.5352 40.8447 6.61277 1.36411  0.30689
```



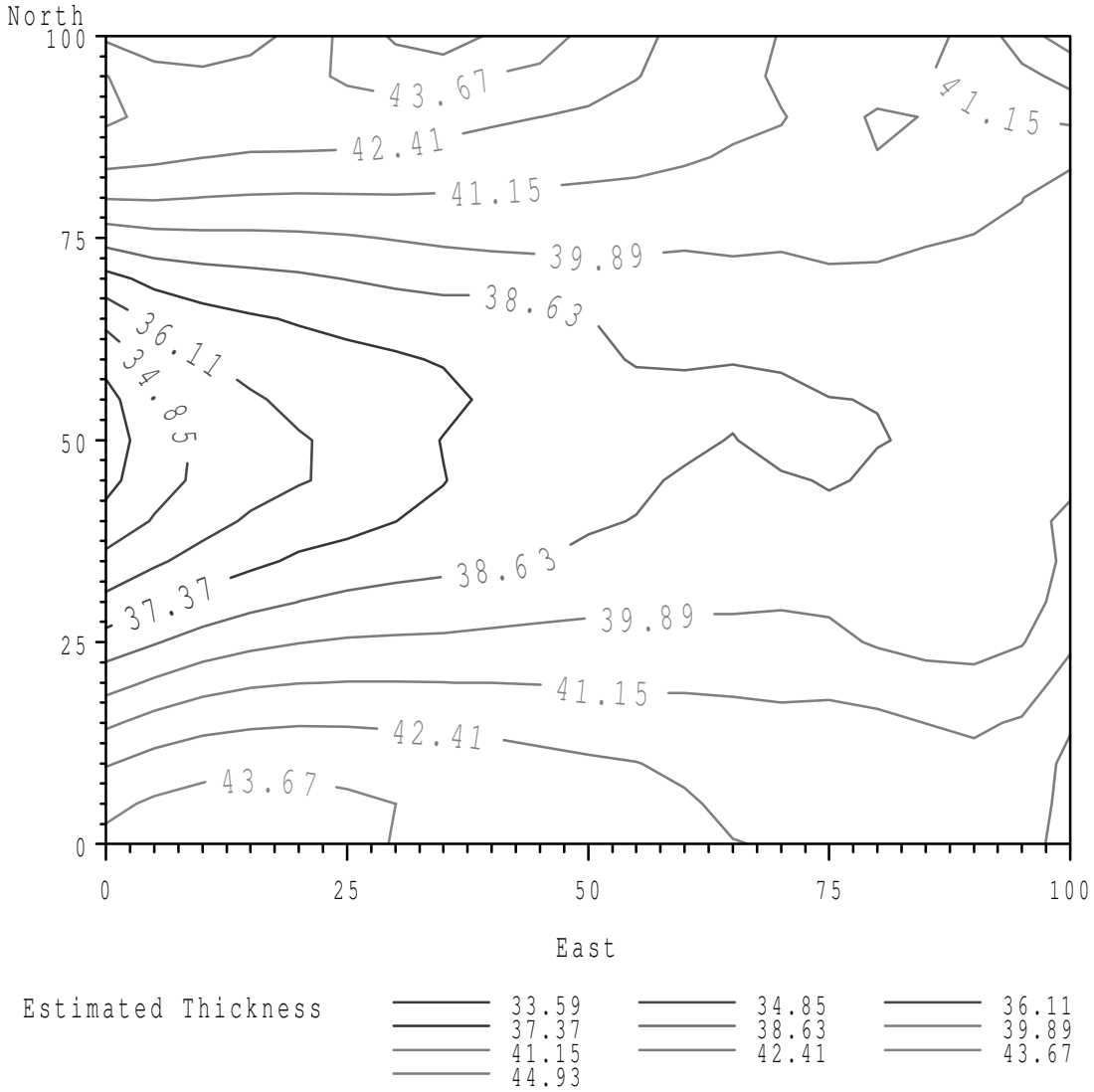

```
proc krige2d data=thick outest=est;
  coord xc=east yc=north;
  grid x=0 to 100 by 5 y=0 to 100 by 5;
  pred var=thick r=10;
  model scale=7 range=30 form=gauss;
```

```
proc print data = est (obs = 10);

proc g3d data=est;
  plot gyc*gxc=estimate;
  label gyc      = 'North'
        gxc      = 'East'
        estimate = 'Estimated Thickness';
```

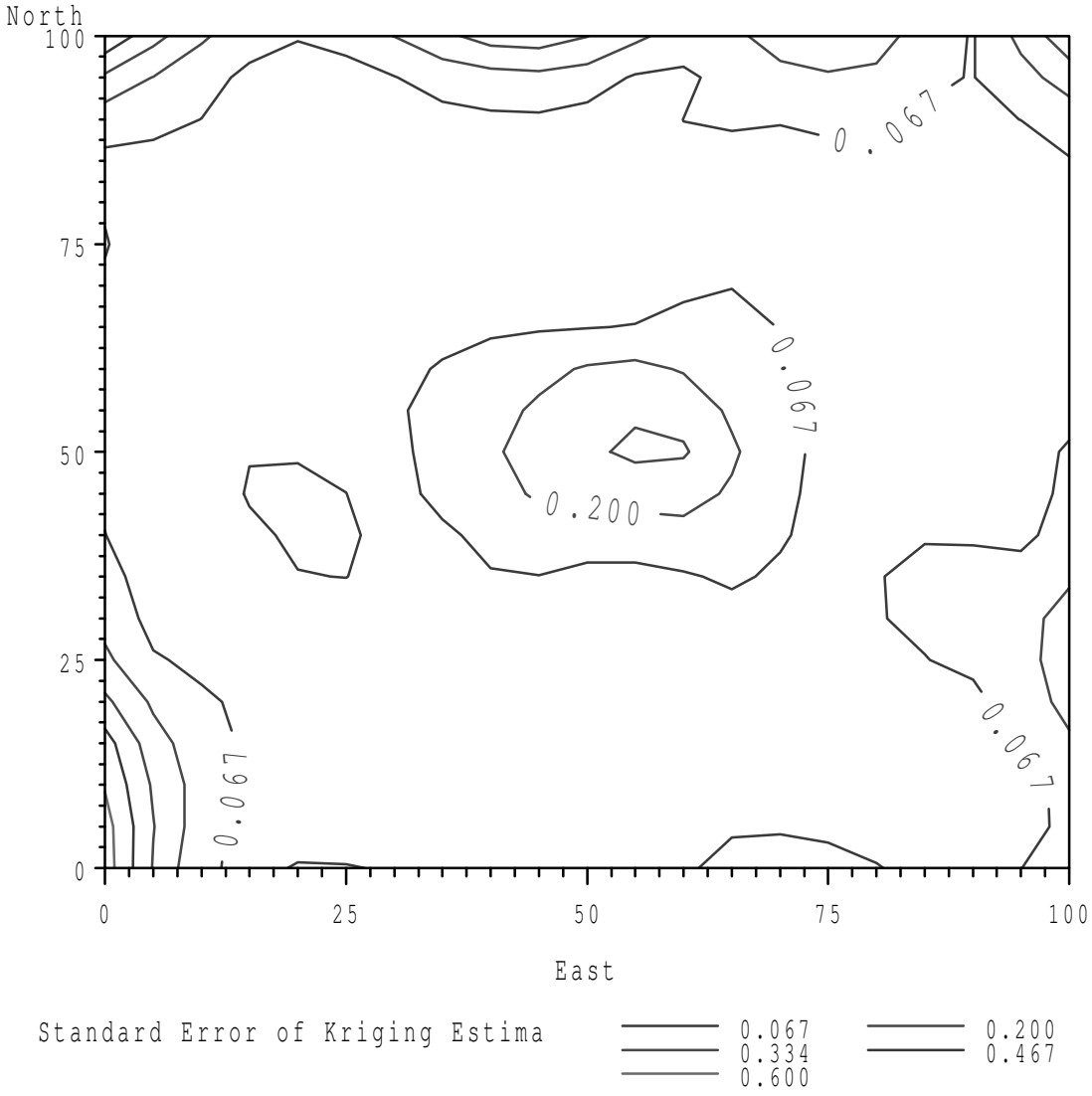
```
The KRIGE2D Procedure
Dependent Variable: thick
Number of Observations Read          75
Number of Observations Used          75

                 Kriging Information
Prediction Grid Points                              441
Type of Analysis                                  Local
Neighborhood Search Radius                           10
Grid Points with Radius Incremented                 441
Maximum Radius                                56.048283
Minimum Neighbors                                    20
Maximum Neighbors                  All Within Radius

The KRIGE2D Procedure
Dependent Variable: thick
Prediction: Pred1, Model: Model1
Covariance Model Information
Type                Gaussian
Sill                       7
Range                     30
Effective Range    51.961524
Nugget Effect              0

Obs     LABEL      VARNAME  GXC  GYC  NPOINTS  ESTIMATE   STDERR
  1  Pred1.Model1   thick    0     0     20      44.0107  0.66714
  2  Pred1.Model1   thick    0     5     20      43.3504  0.65143
  3  Pred1.Model1   thick    0    10     20      42.3169  0.59026
  4  Pred1.Model1   thick    0    15     20      40.9308  0.52172
  5  Pred1.Model1   thick    0    20     20      39.4097  0.36240
  6  Pred1.Model1   thick    0    25     20      37.8804  0.22627
  7  Pred1.Model1   thick    0    30     20      36.3949  0.15932
  8  Pred1.Model1   thick    0    35     20      35.2236  0.10873
  9  Pred1.Model1   thick    0    40     20      33.9929  0.06815
 10  Pred1.Model1   thick    0    45     20      33.2266  0.05748
```




```
proc gcontour data=est;
    plot gyc*gxc=estimate / nlevels=10 autolabel;
  label gyc      = 'North'
        gxc      = 'East'
        estimate = 'Estimated Thickness';
```




```
proc gcontour data=est;
    plot gyc*gxc=stderr / nlevels=5 autolabel;
  label gyc      = 'North'
        gxc      = 'East'
        estimate = 'SE of Est Thickness';


run;
```


North
100
75
50
25
0
0
25
50
75
100
East
0.067
0.067
0.200
0.067
0.067
Standard Error of Kriging Estima
0.067
0.200
0.334
0.467
0.600