Analysis of modelling vertical movements using various techinques

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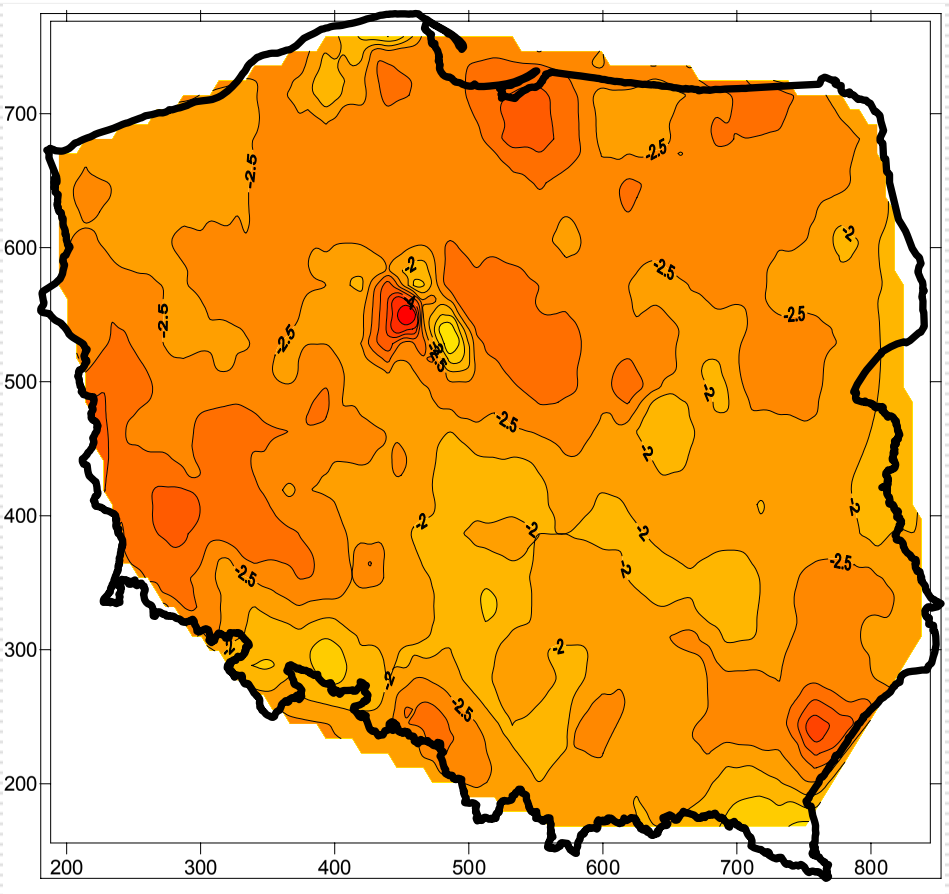
Vertical movements interpolation using „Surfer" software

- *triangulation with linear interpolation*
- *nearest neighbor*
- *natural neighbor*
- *minimum curvaurte*
- *kriging*
- *radial basis function – multicuadric*
- *inverse distance to a power*
- *modified Shepard's metod*
- *polynomial regression*
- *local polynomial*

Used data

- 235 node points from double levelling
- Distance ~30km
- The same points were used in vertical movements model „2006”

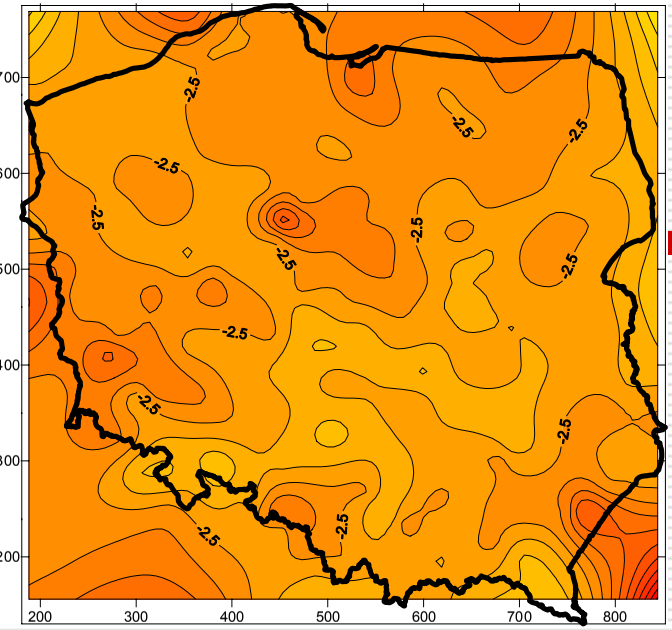
Model „2006” (collocation method)



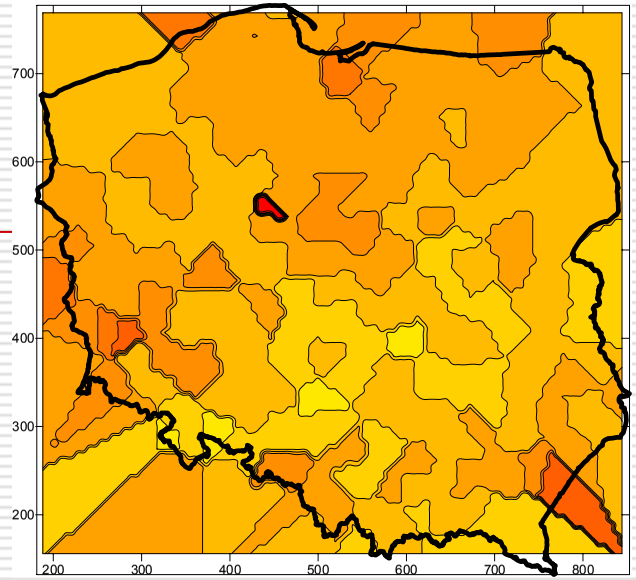
Interpolation Surfer 8.0

- grid was 94 rows by 100 columns which gave 6 x 6 km
- standard setting

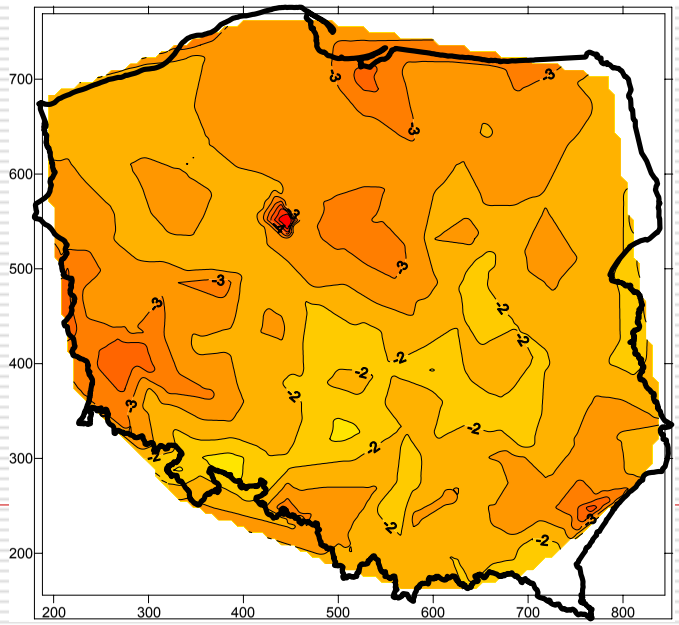
Minimum curvate



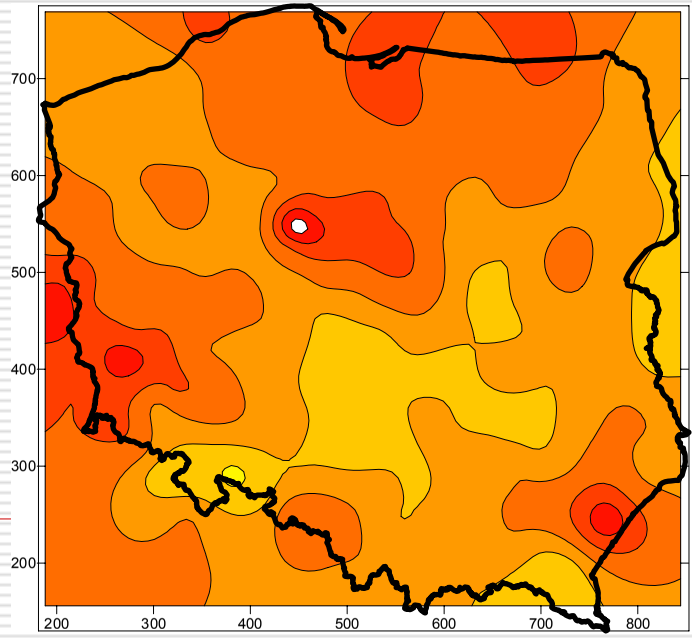
Nearest neighbor



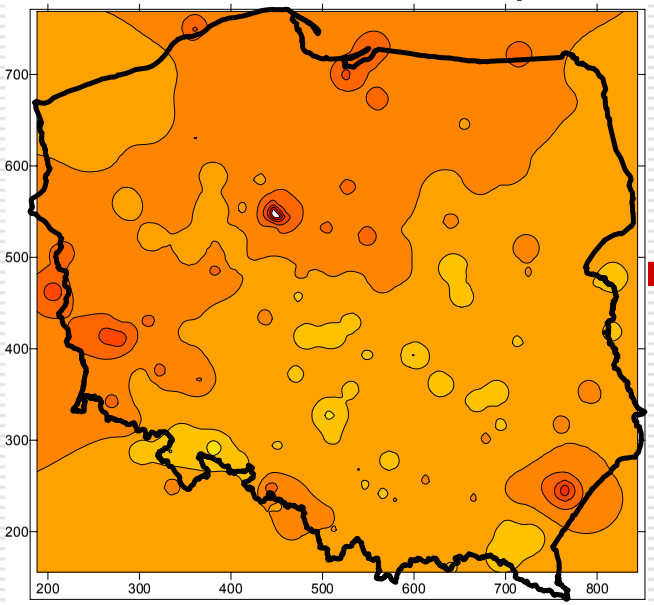
Ttriangulation with linear interpolation



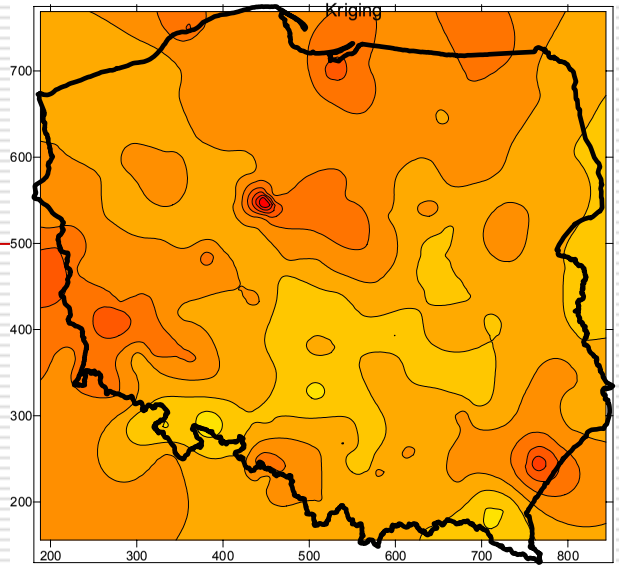
Multiquadric



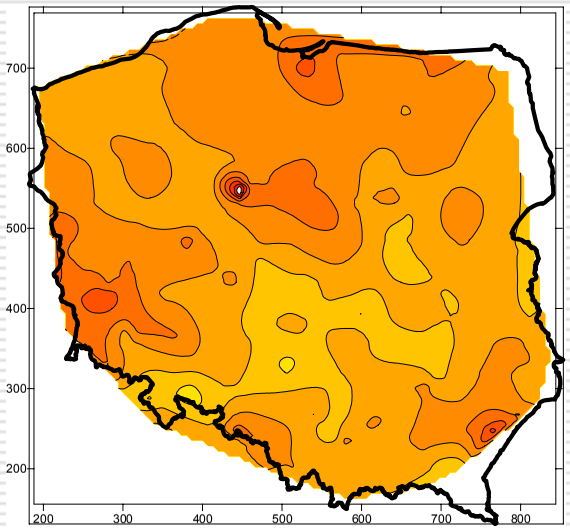
Linverse distance to a power



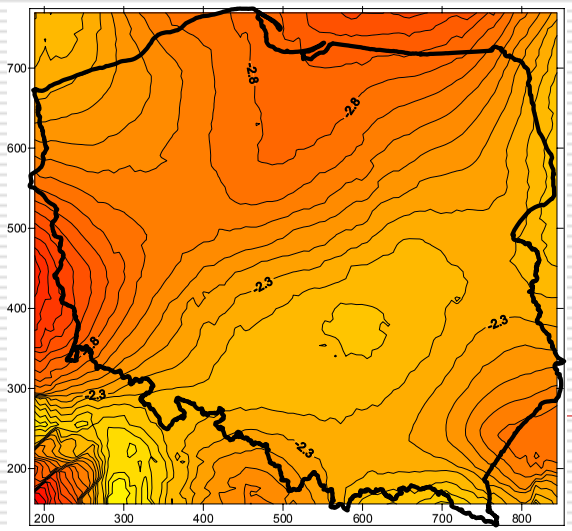
Kriging



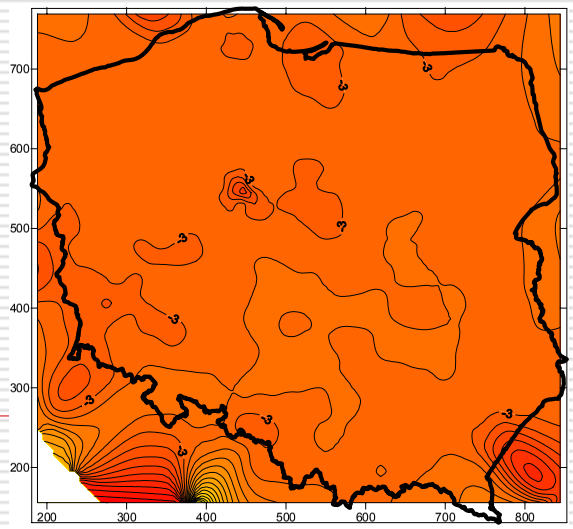
Natural neighbor



Local polynomial



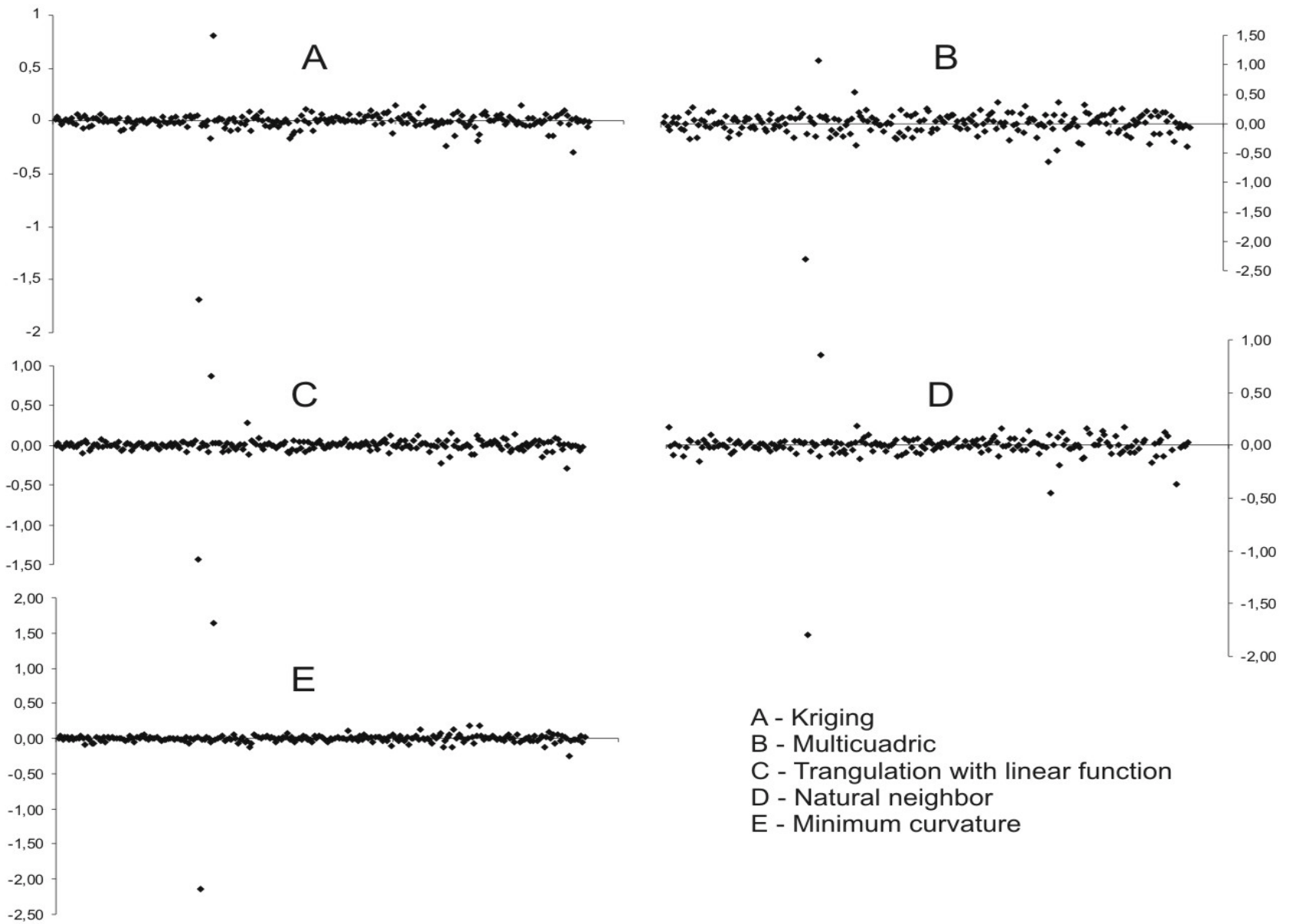
Modified Shepard's metod



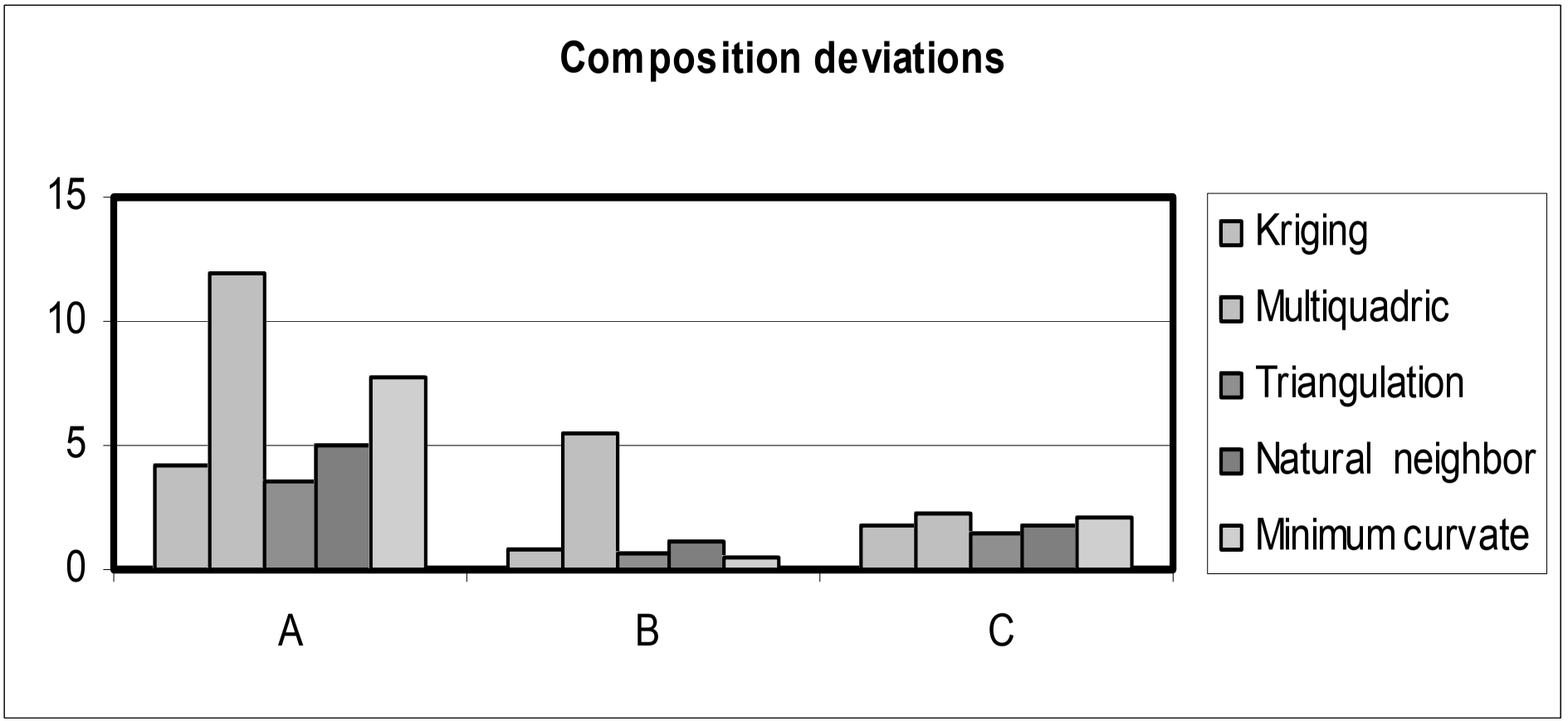
Eliminated four methods from further analysis.

- Nearest neighbor – model is illegible
- Inverse distance to a Power – model is distorted by local extreme values
- Polynomial regresion – results are too smooth
- Modified Shepard's method – model too simple

The deviation of interpolation methods



Interpolation errors

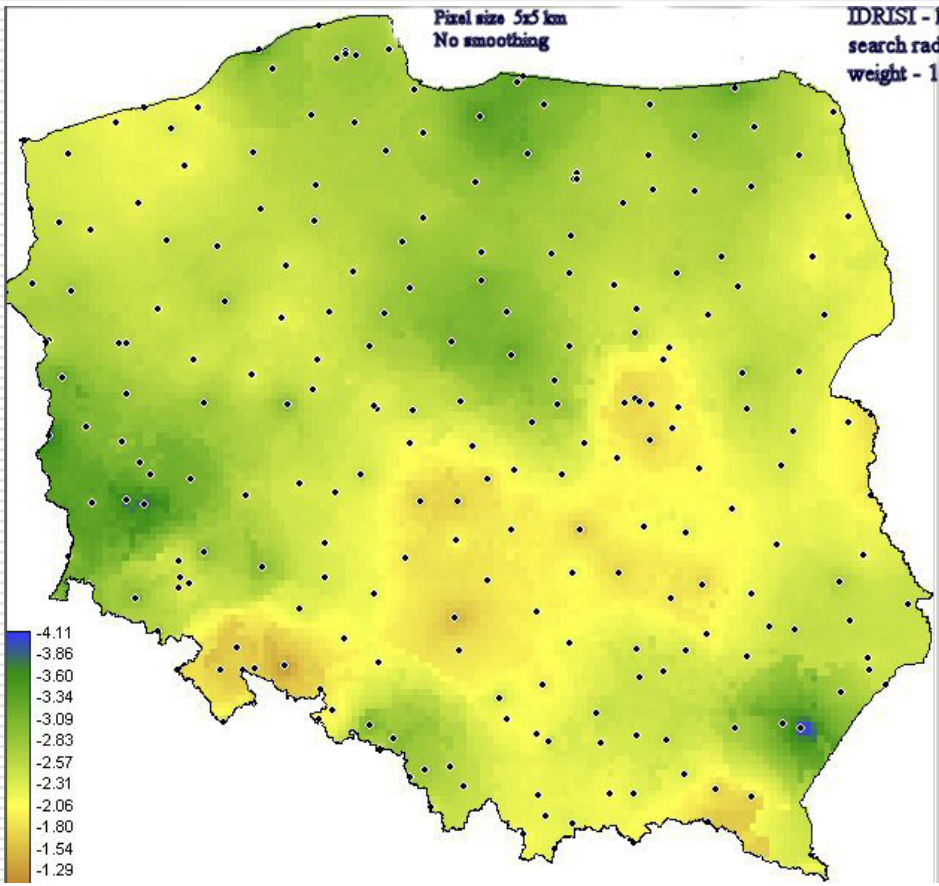


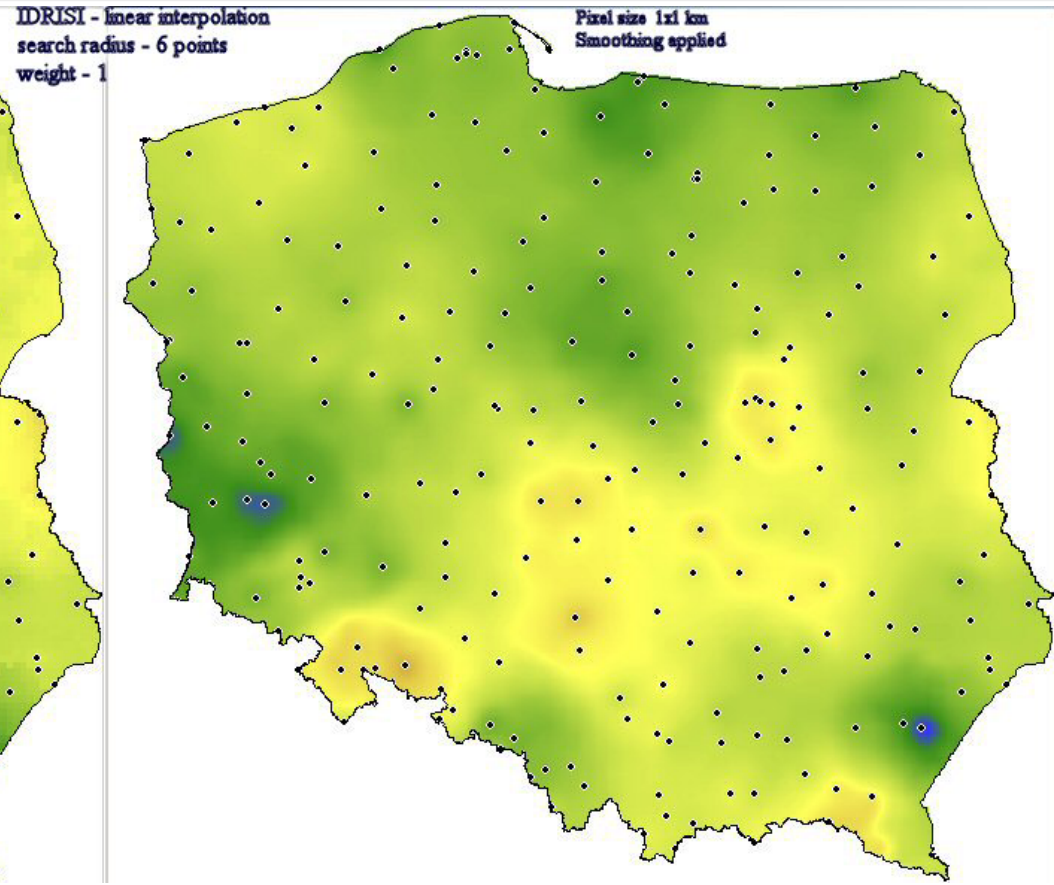
The use of chosen interpolation methods available in GIS packages to modelling of vertical movements.

- Idrisi32 - INTERPOL function
- TINSURF
- ENVI - Rasterizing Point Data

Vertical movements interpolated using Idrisi linear interpolation, search radius 6 points, weight -1;

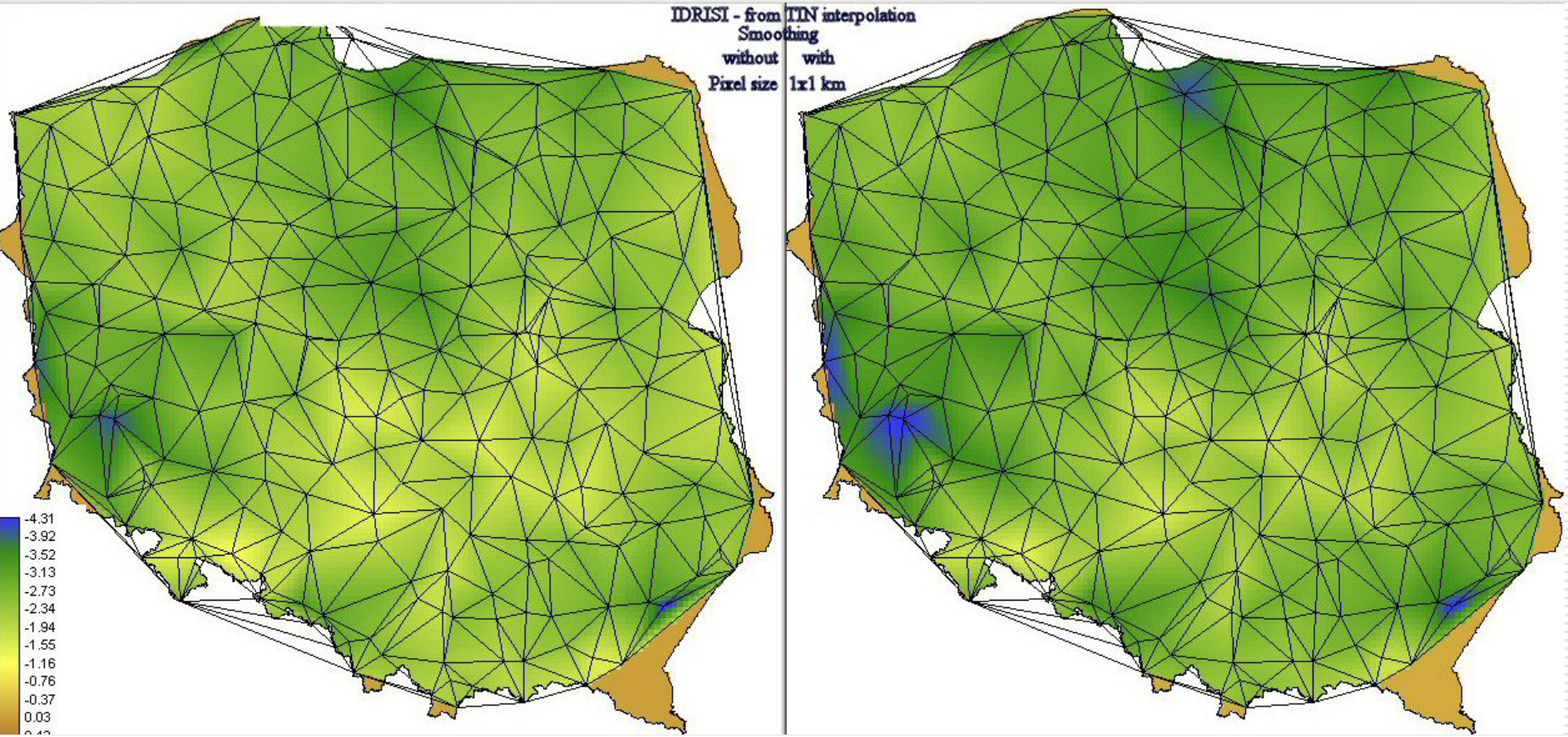
a) without and b) with smoothing filtering





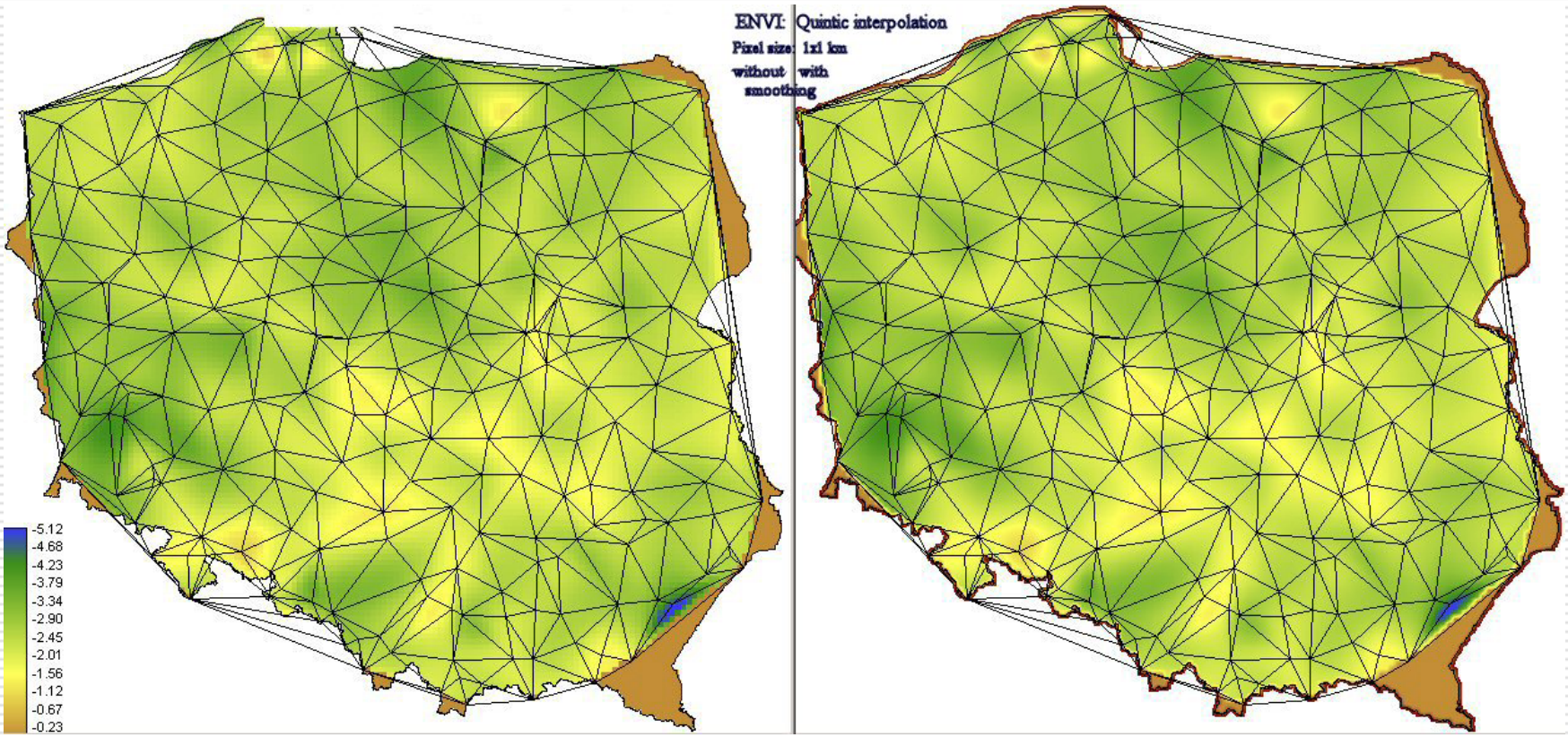
Vertical movements interpolated using Idrisi "from TIN interpolation".

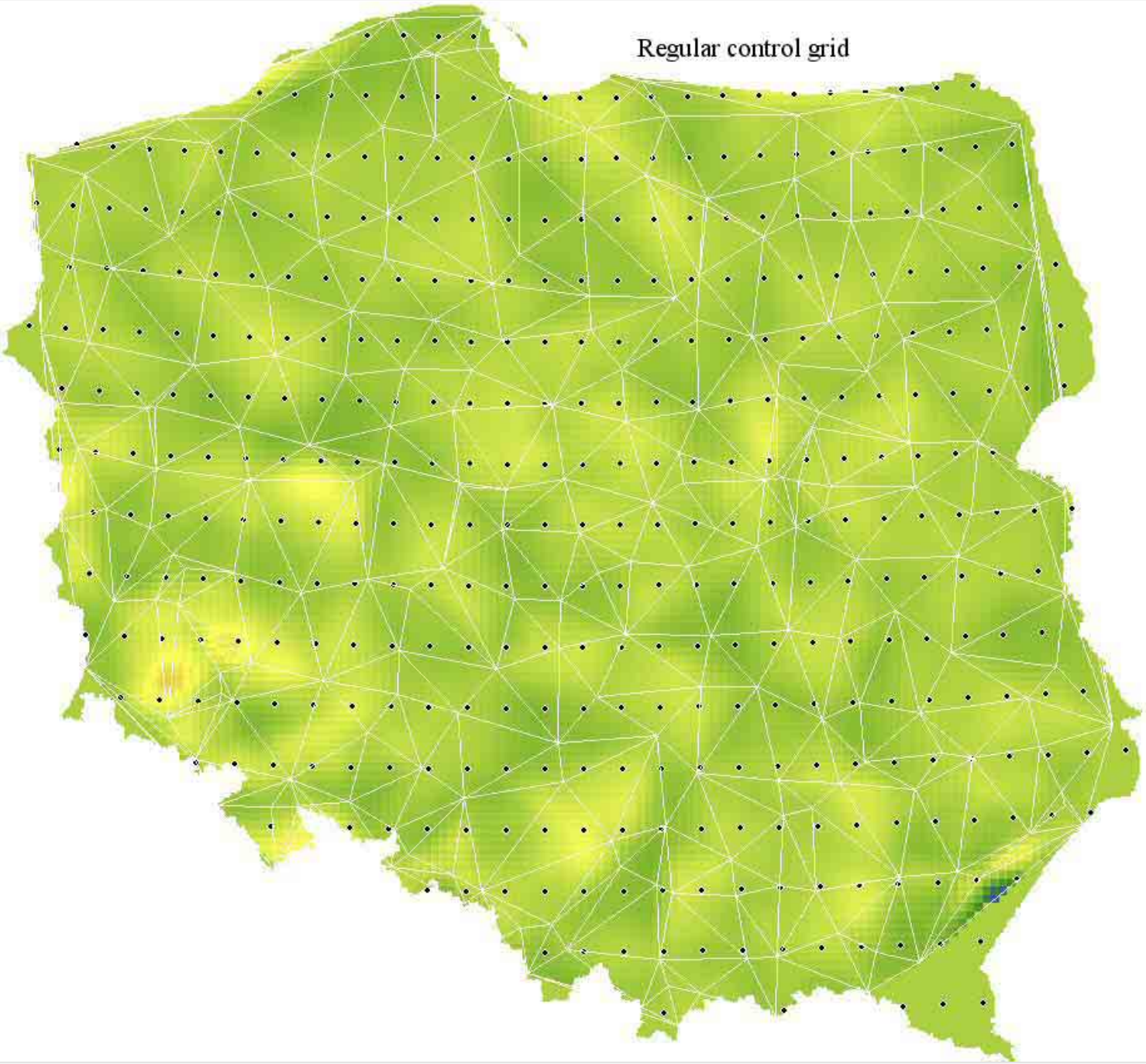
a) without and **b) with smoothing filtering**

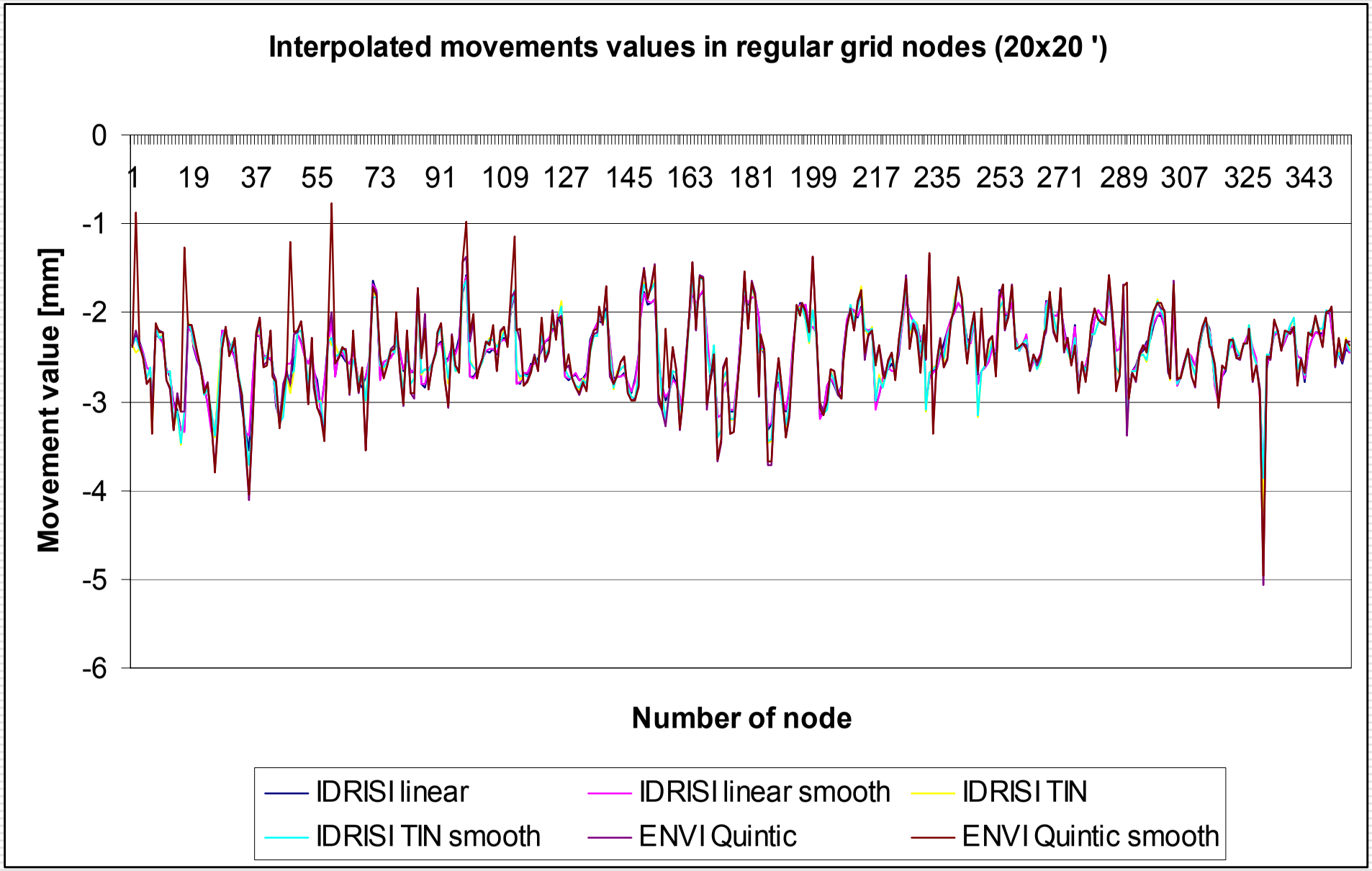


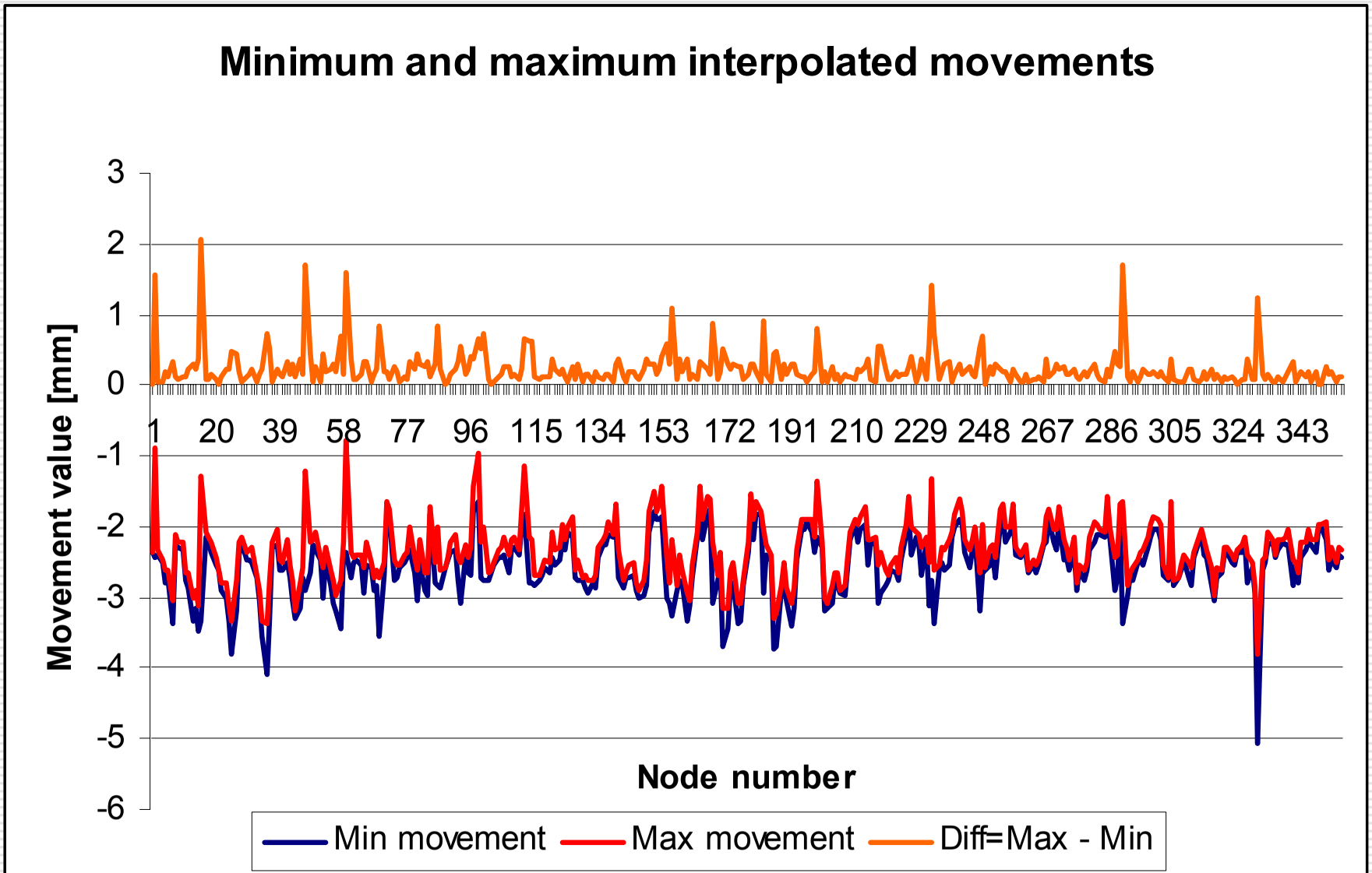
Vertical movements interpolated using ENVI Quintic interpolation.

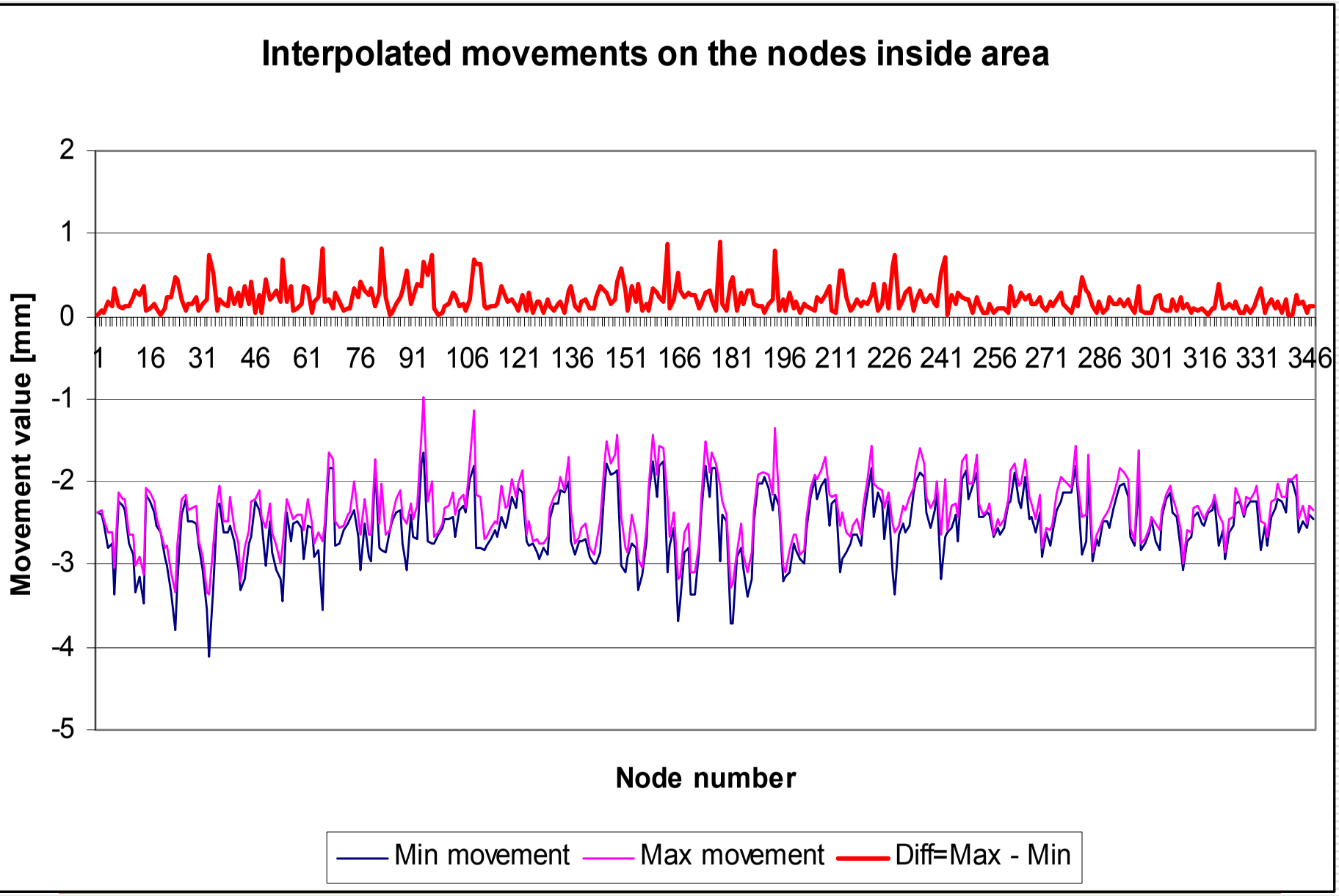
a) without and b) with smoothing filtering

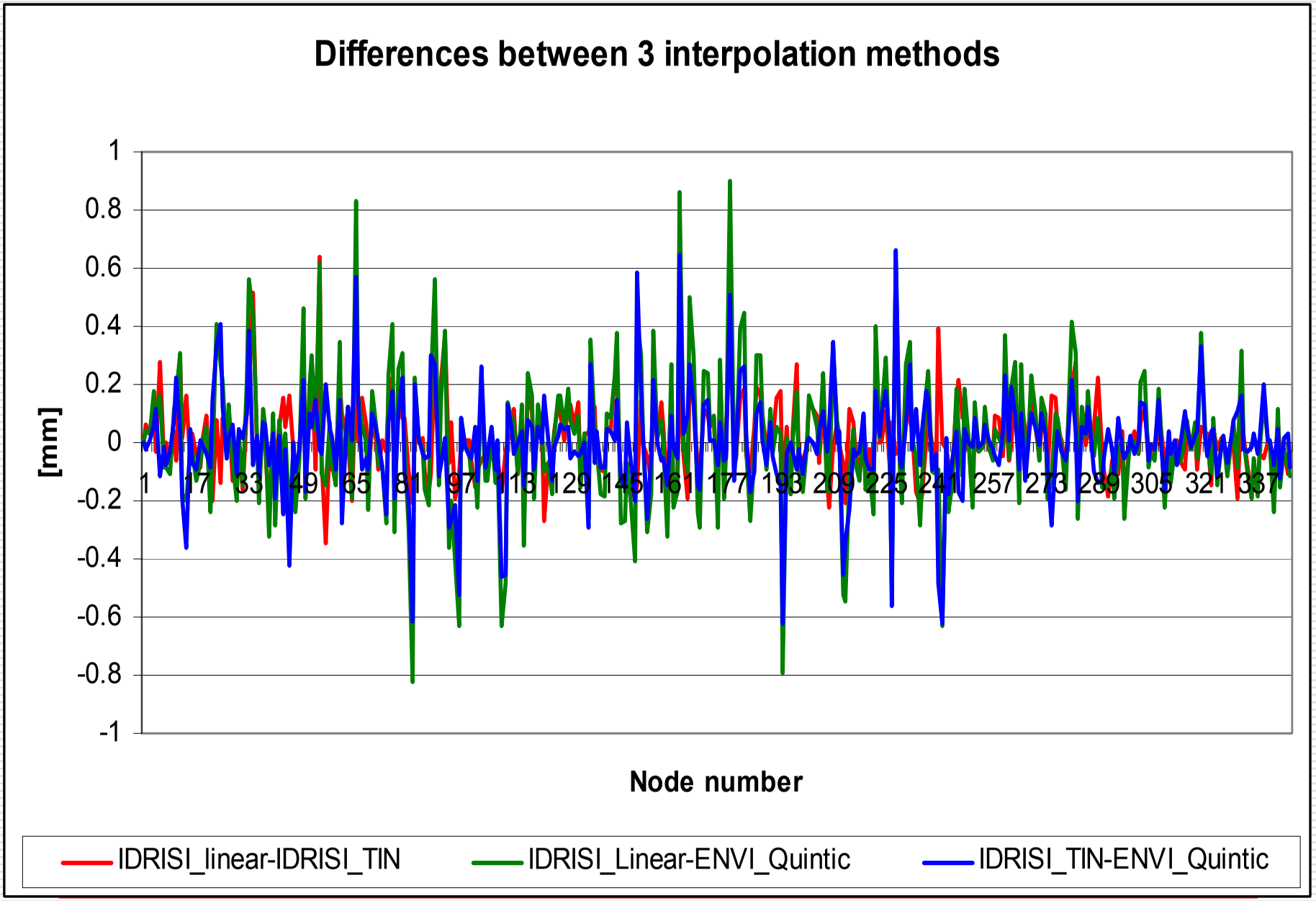


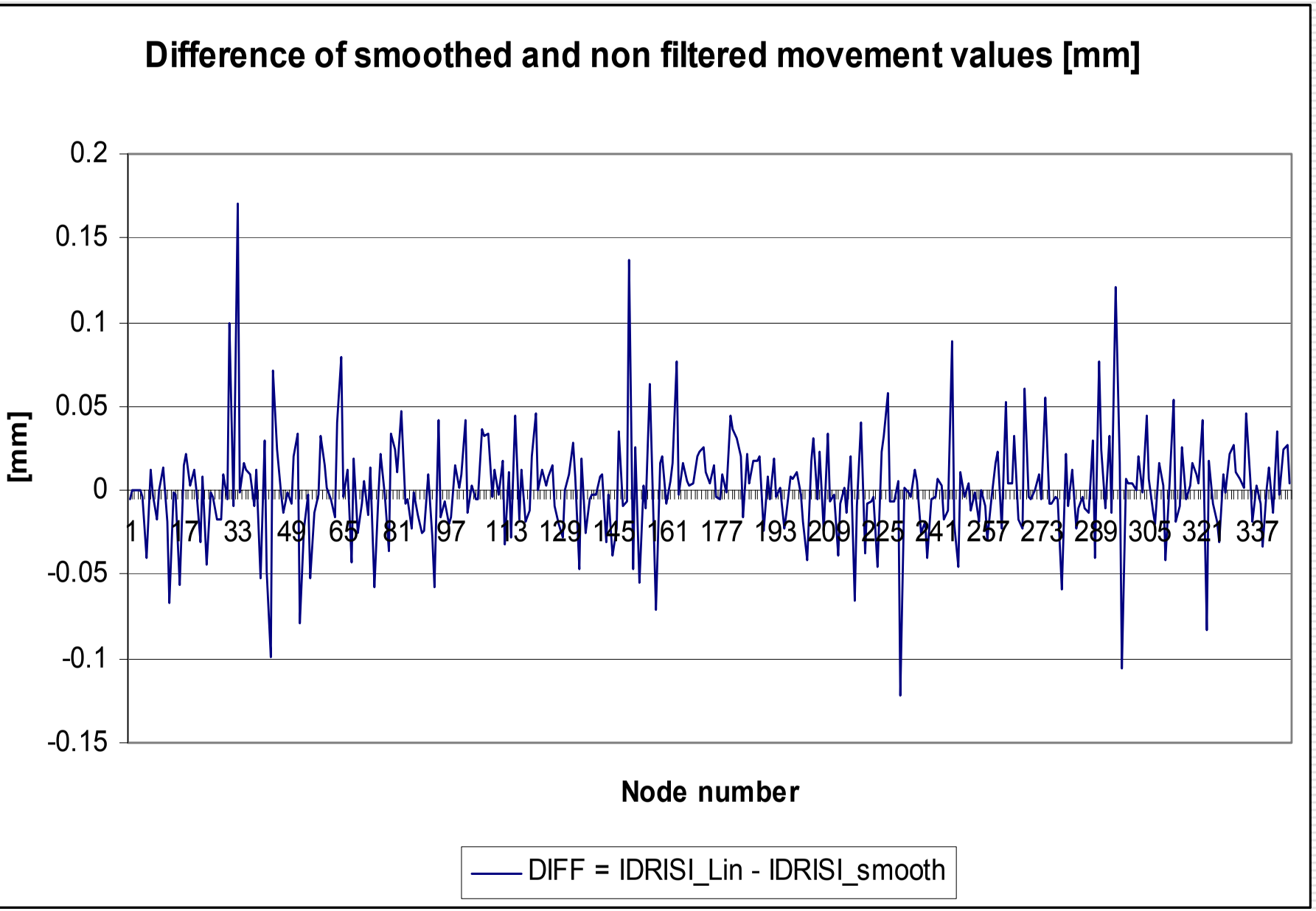

Regular control grid


Interpolated movements values in regular grid nodes (20x20 ')
0
-1
-2
-3
-4
-5
-6
1
19
37
55
73
91
109
127
145
163
181
199
217
235
253
271
289
307
325
343
Movement value [mm]
Number of node
IDRISI linear
IDRISI linear smooth
IDRISI TIN
IDRISI TIN smooth
ENVI Quintic
ENVI Quintic smooth


Minimum and maximum interpolated movements
Movement value [mm]
3
2
1
0
-1
-2
-3
-4
-5
-6
1
20
39
58
77
96
115
134
153
172
191
210
229
248
267
286
305
324
343
Node number
Min movement
Max movement
Diff=Max - Min


Interpolated movements on the nodes inside area
Movement value [mm]
2
1
0
-1
-2
-3
-4
-5
1
16
31
46
61
76
91
106
121
136
151
166
181
196
211
226
241
256
271
286
301
316
331
346
Node number
Min movement
Max movement
Diff=Max - Min


Differences between 3 interpolation methods
[mm]
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1
17
33
49
65
81
97
113
129
145
161
177
193
209
225
241
257
273
289
305
321
337
Node number
IDRISI_linear-IDRISI_TIN
IDRISI_Linear-ENVI_Quintic
IDRISI_TIN-ENVI_Quintic


Difference of smoothed and non filtered movement values [mm]
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
[mm]
1
17
33
49
65
81
97
113
129
145
161
177
193
209
225
241
257
273
289
305
321
337
Node number
DIFF = IDRISI_Lin - IDRISI_smooth

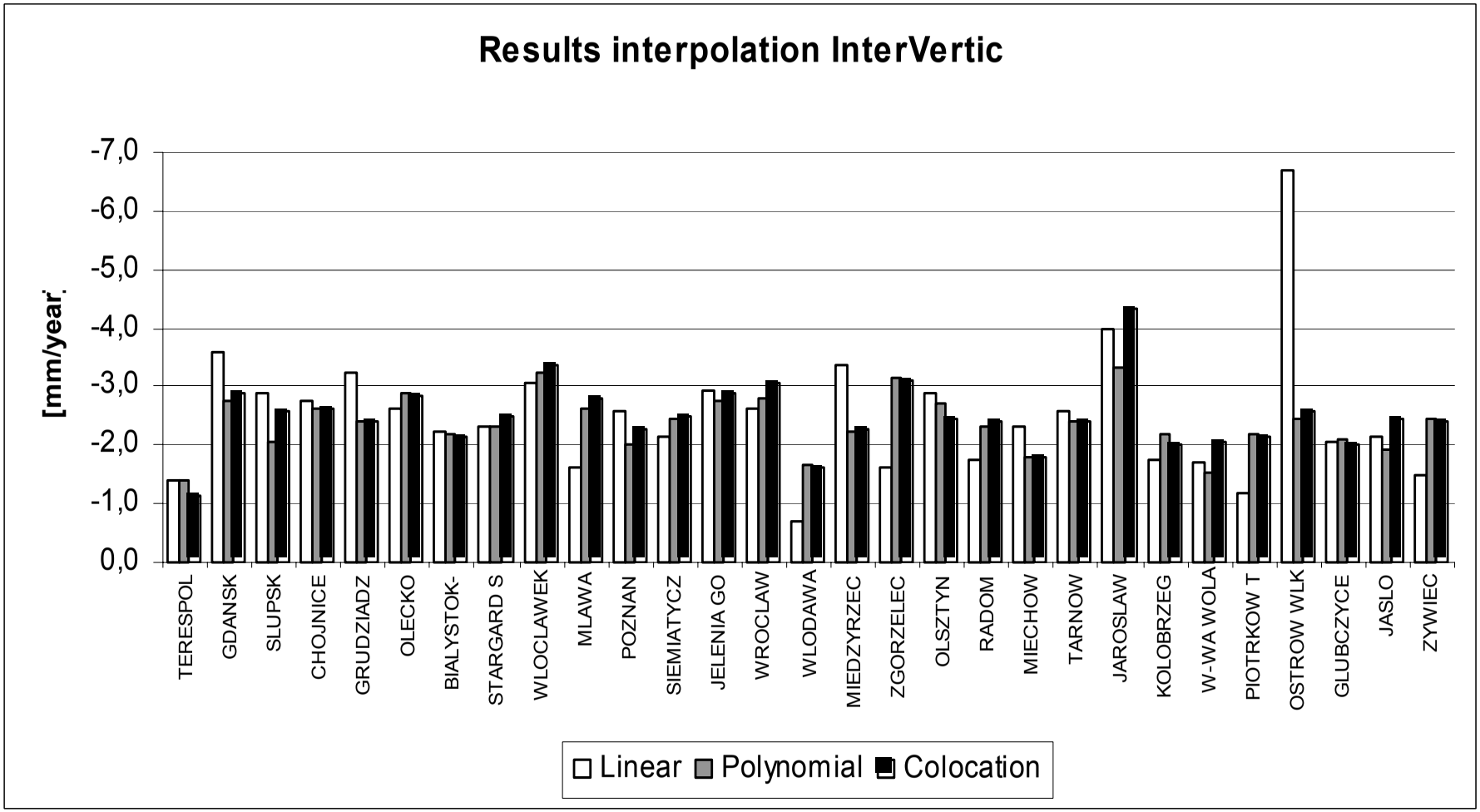
InterVertic – calculation of vertical movement for any place in Poland

- linear (three points)
- polynomial (10 points)
- last squares colocation method was used with local covariance function of Hirvonen (50 km radius)

Test

- 29 points placed (about 15 km from nodes)

Results test



Results

Three of the tested methods of interpolation from Surfer can be used: natural neighbor, triangulation of linear function and kriging. Multicuadric method gives too big errors and Minimum curvature fits too close to source data.

- Points Inowroclaw and Szadłowice must be replaced with pseudo nodal point placed about 5km away.
- Despite small errors of adjustment for select methods of interpolation with programme Surfem 8.0 there exists apprehension that the model is less authentic than GIS's model. Problem is in setting of Surfem program , where the source points are not taken to graphic introduction of the results of interpolation.
- Models created with GIS software approximates movements better the other methods.
- First version of InterVertic software gives good results. In further work it can be used to dense the vertical movement network.