Analysis of different gridding methods using “Surfer7”

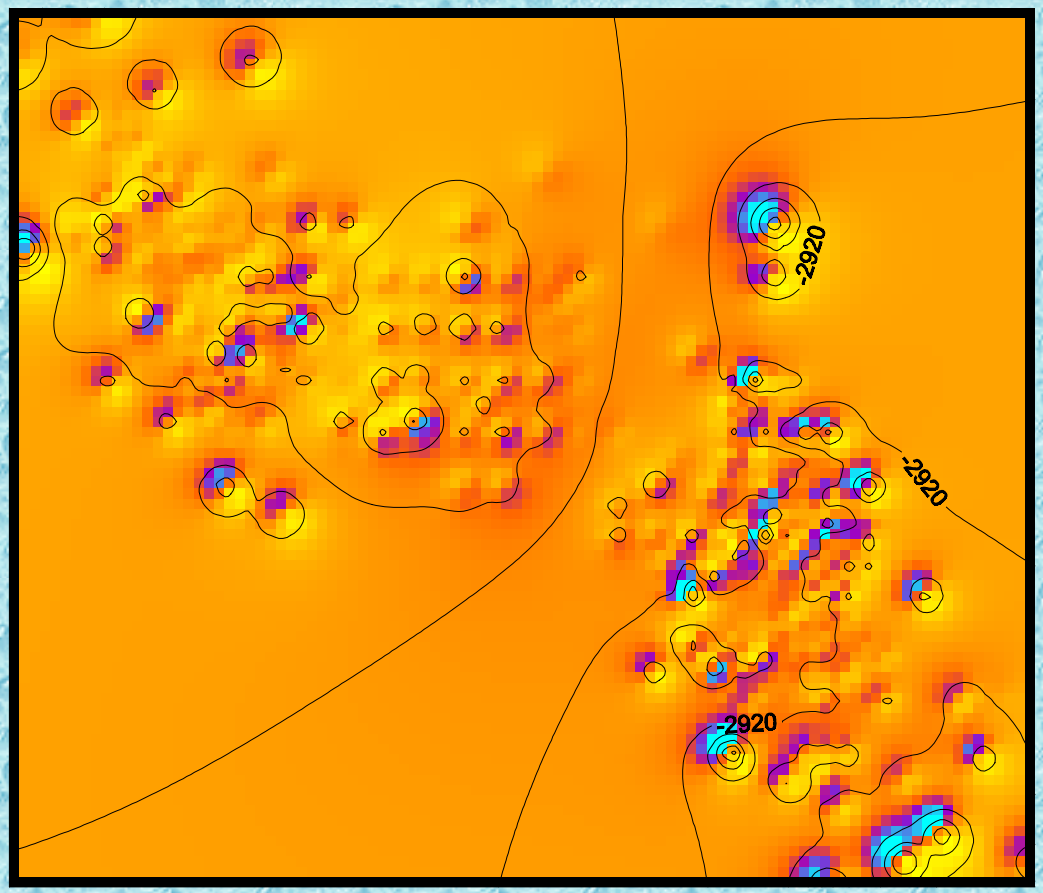

Fig.: Shaded Relief and Contour map

Michigan Technological University

presentation by

Fehmi Kamcili

February 10, 2001

Analysis of different gridding methods using "Surfer7"

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Analysis of different gridding methods using “Surfer7”

Introduction

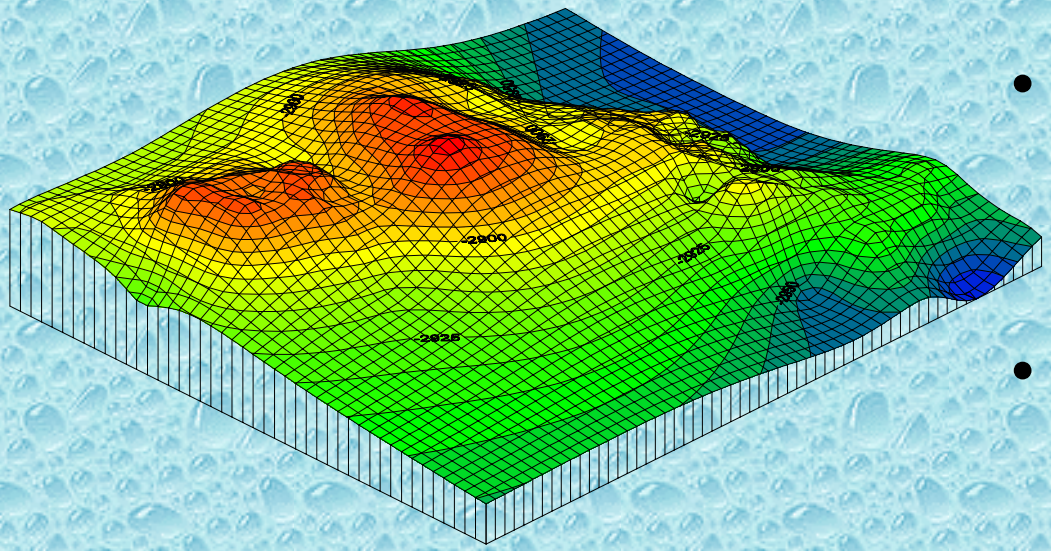


Fig.: Wireframe and Contour Map

- Surfer 7; Feb. 2000 Surface mapping system Golden Software, Inc.
- Differences in created grid-files visualized by overlaying wireframe and contour maps

- Vernon/Rosebuch oilfields in Isabella county, Michigan with 245 well Data-Points (Lat-Long of Top Dundee)

Analysis of different gridding methods using “Surfer7”

Grid Files

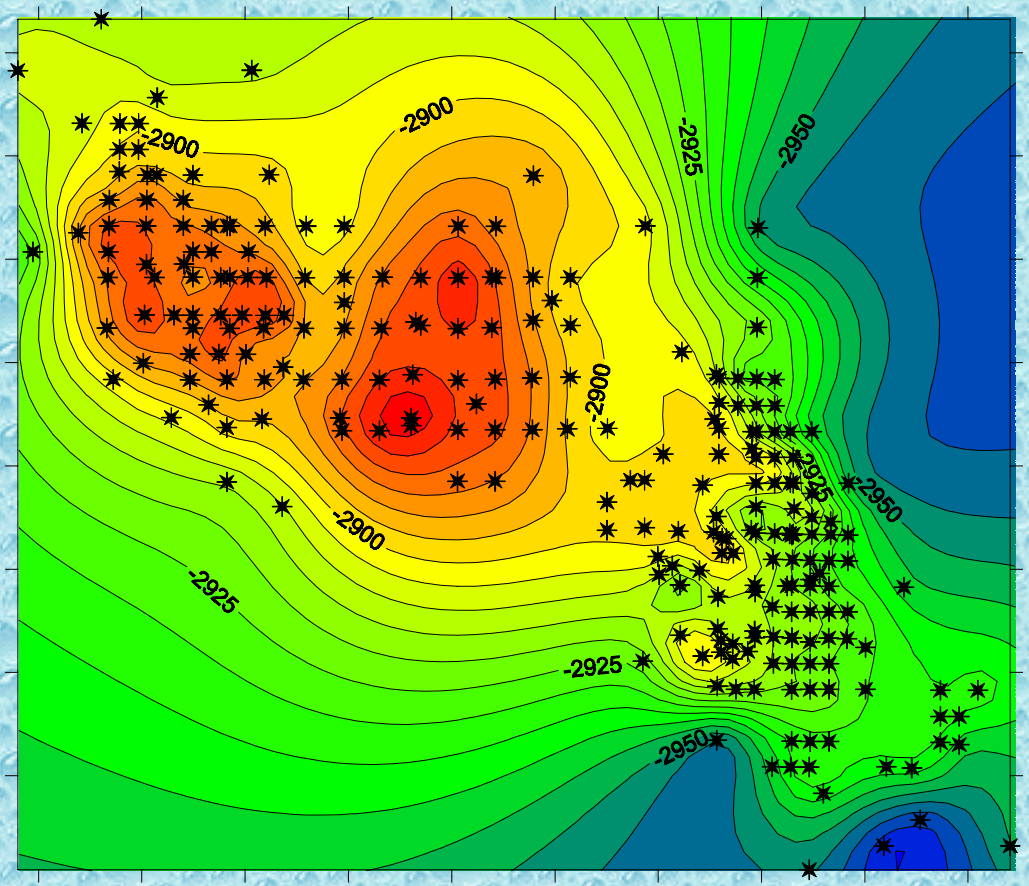


Fig.: Contour and Post Map

- gridding by specifing source file
  -Spreadsheets (Excel)
  -manually in Surfer (Worksheet)
- gridding method
- accuracy of grid
- faults and breaklines
- creates “file.grd”

Analysis of different gridding methods using “Surfer7”

Grid Methods

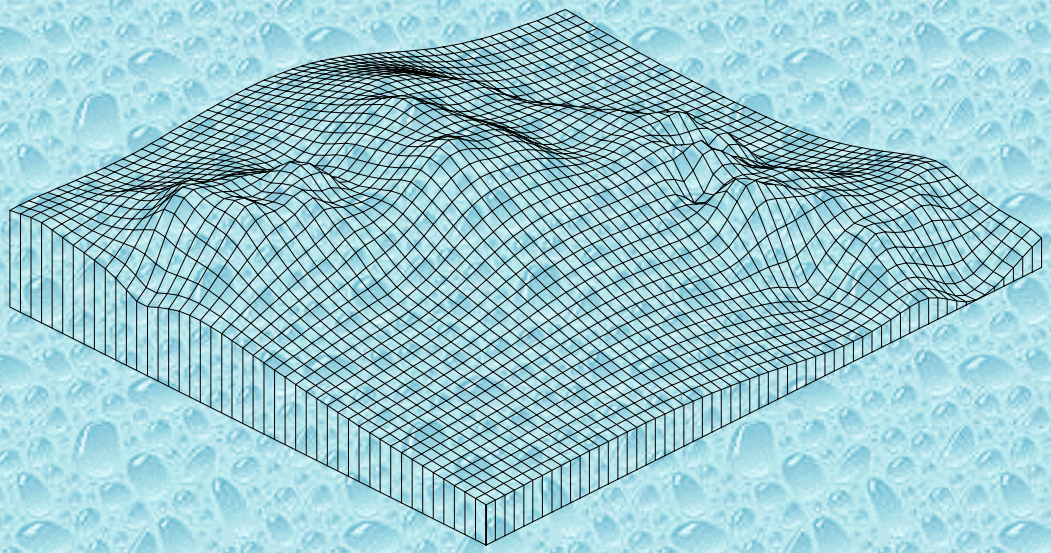


Fig.: Wireframe Map

- **Inv. Distance to power**
- **Kriging**
- **Minimum curvature**
- **Modified shepard’s**
- **Natural neighbor**
- **Nearest neighbor**
- **Polynomial regression**
- **Radial basis function**
- **Triangulation w/ linear interpolation**

Analysis of different gridding methods using “Surfer7”

Fig.: Power: 0.00001

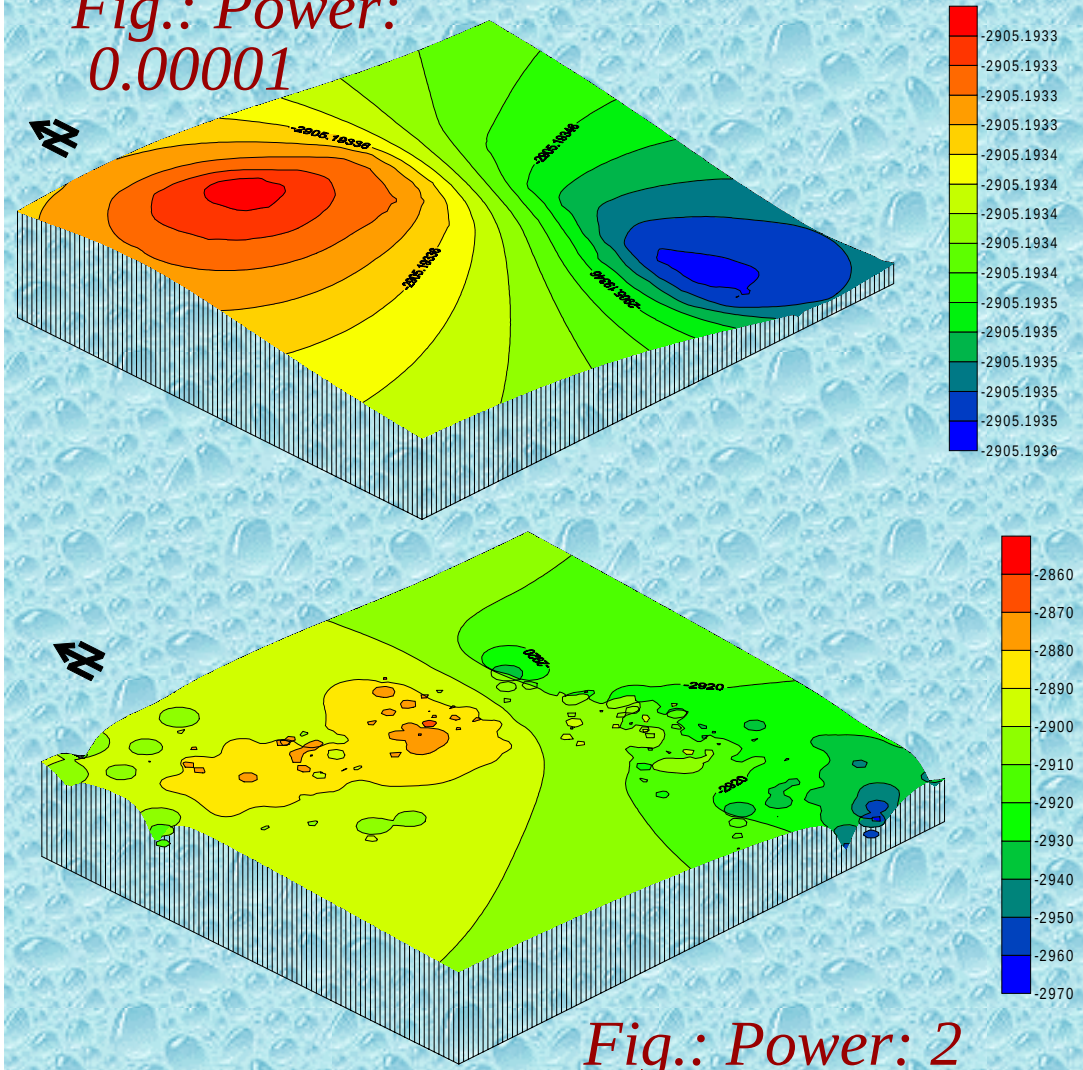


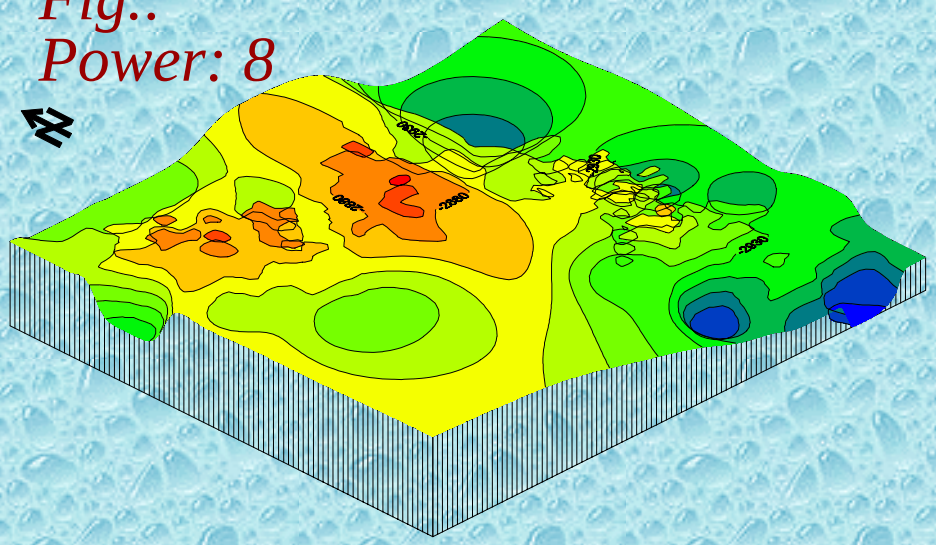
Fig.: Power: 2

Inverse Distance to a Power

- weighting average interpolator
- Power parameter between 1E-38 & 38 “0” = planar surface; great weighting power = less effect on points far from the grid node during interpolation

Analysis of different gridding methods using “Surfer7”

Fig.:
Power: 8



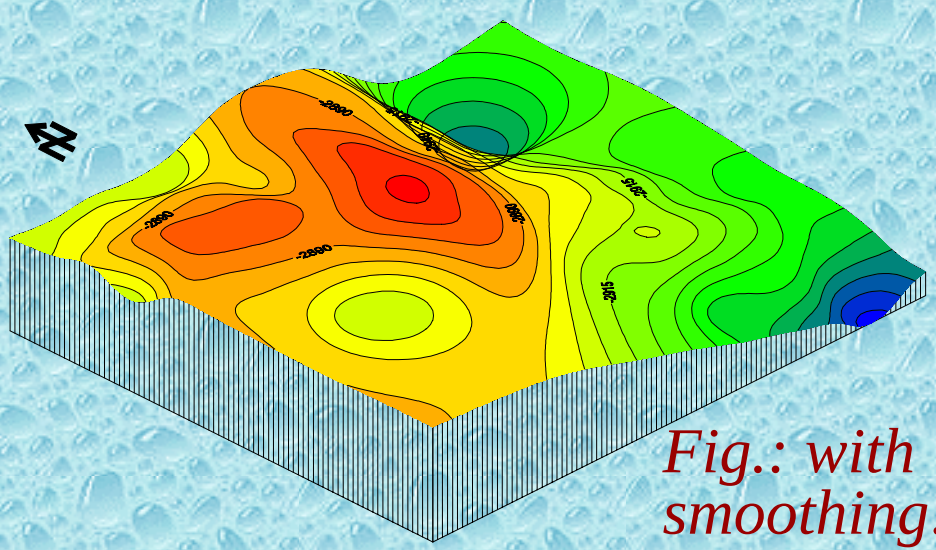


Fig.: with smoothing: 0.01

Inverse Distance to a Power

- exact or smoothing interpolator
- generate "bull's-eyes”
  -smoothing reduce this effect
- very fast method for gridding
  -till 500 Datapoints

Analysis of different gridding methods using “Surfer7”

Kriging

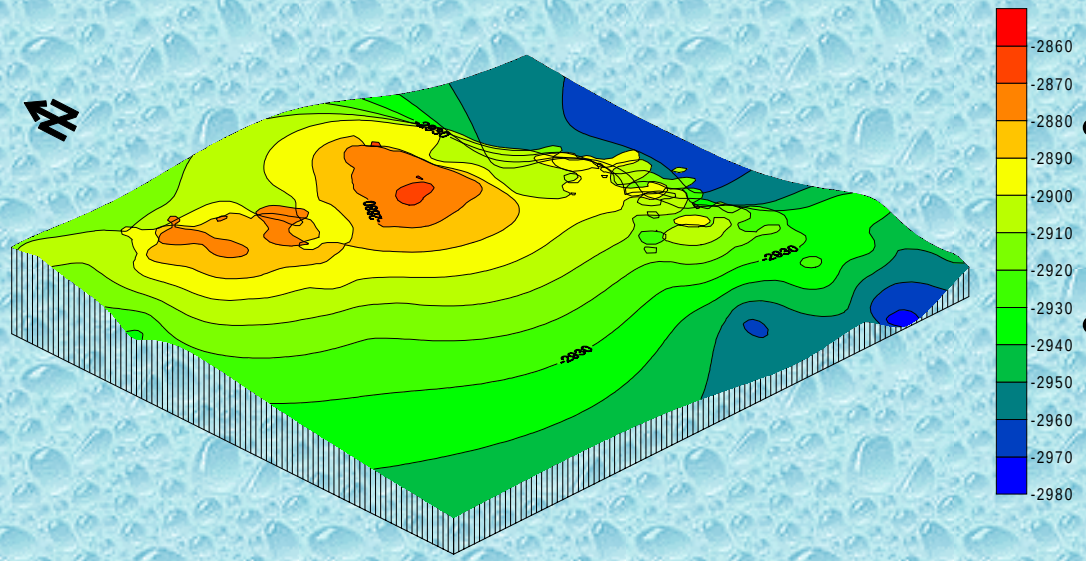


Fig.: Point Kriging

- express trends suggested in your data
- Point or Block
  -Block is using average values- smoother; not perfect
- specify & add as many variogram-components as wished

- by entering path & file name production estimated standard deviation grid

Analysis of different gridding methods using “Surfer7”

Minimum Curvature

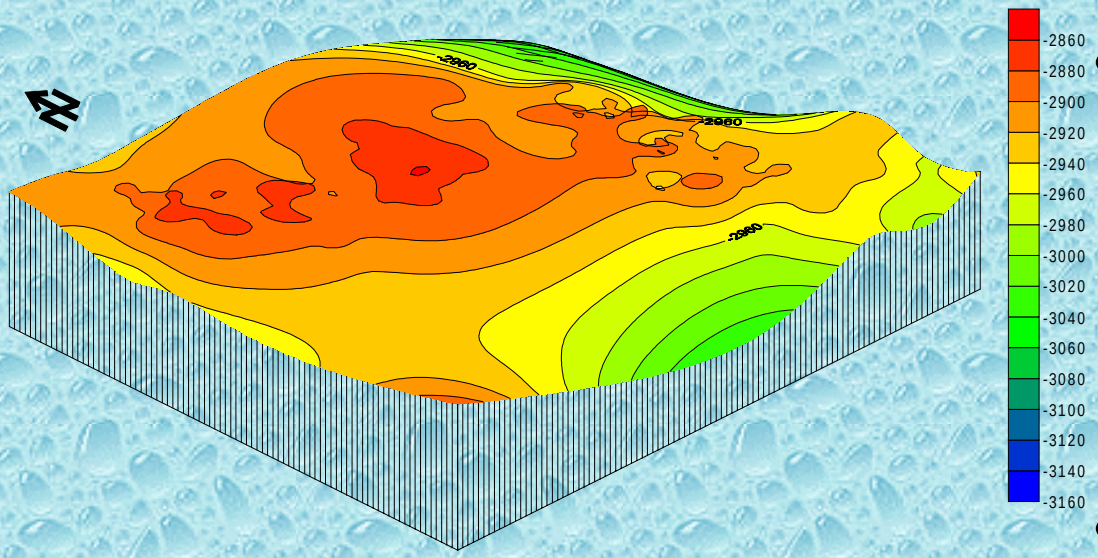
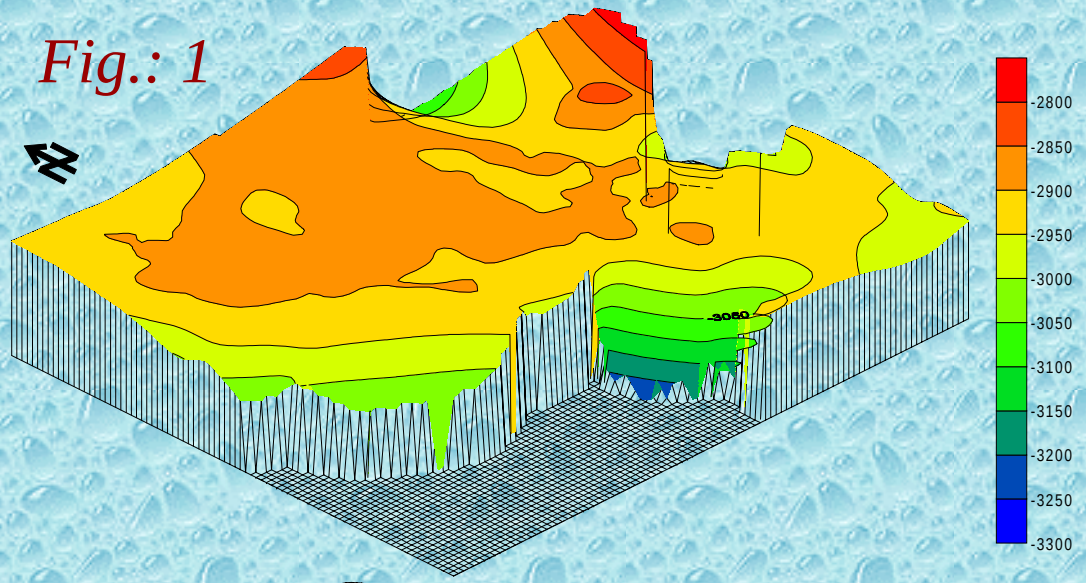


Fig.: default

- smooth but not exact
- recalculation of grid node values until reached less of max. Residual value, or max. Iteration
- Set Internal and Boundary Tension
- Relaxiation Factor

Analysis of different gridding methods using “Surfer7”

Fig.: 1



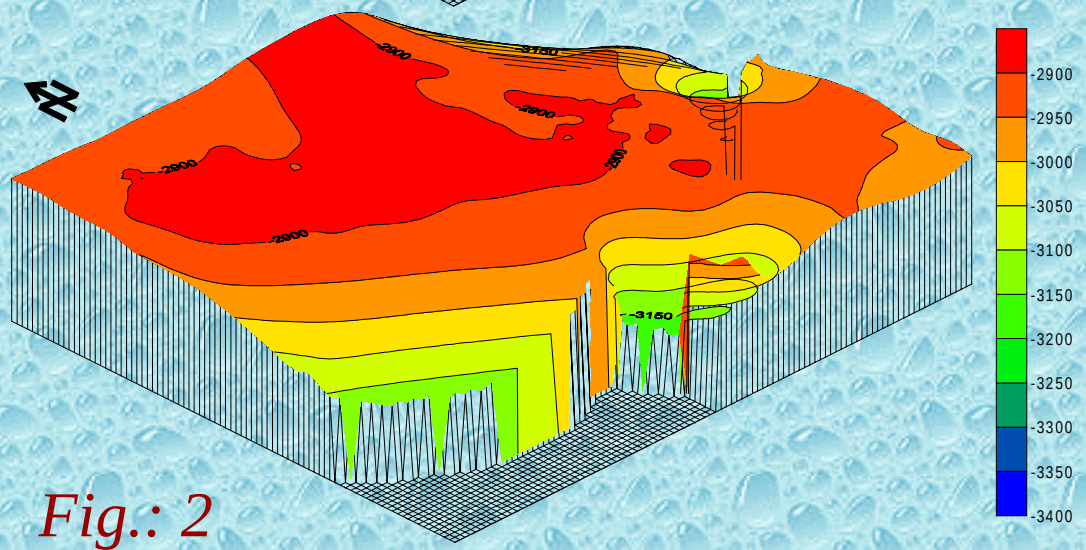


Fig.: 2

Modified Shepard’s Method

- Like IDP Method
- exact or smoothing
- Weighting and Quadratic Neighbors parameters specifies size (number) of local neighborhood
- Fig.1: Q13/W19; Fig.2: Q40/W60

Analysis of different gridding methods using “Surfer7”

Natural Neighbor

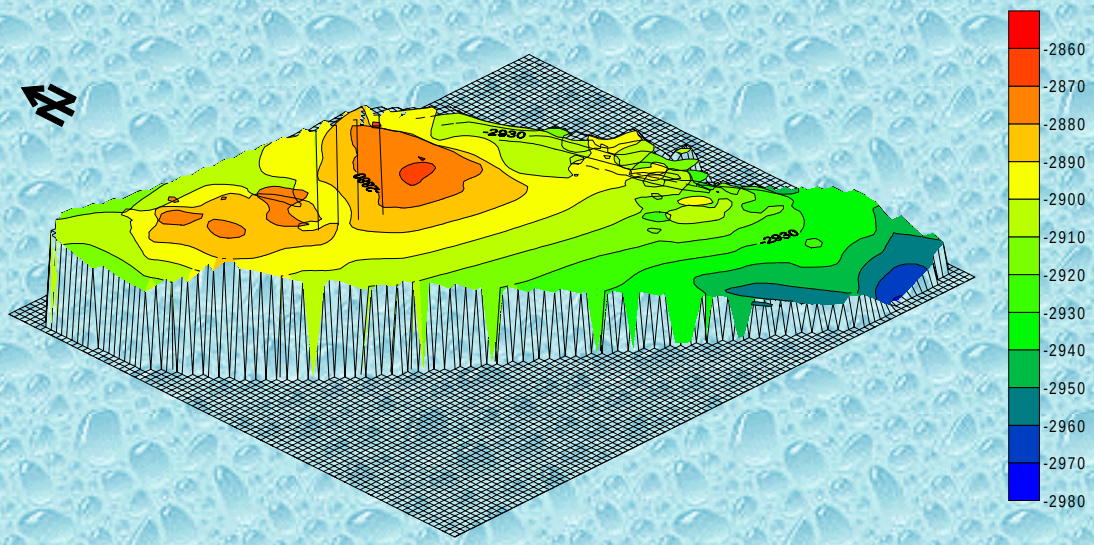


Fig.: default

- Natural Neighbor interpolation algorithm uses a weighted average of neighboring observations, where the weights are proportional to new added polygons

Analysis of different gridding methods using “Surfer7”

Nearest Neighbor

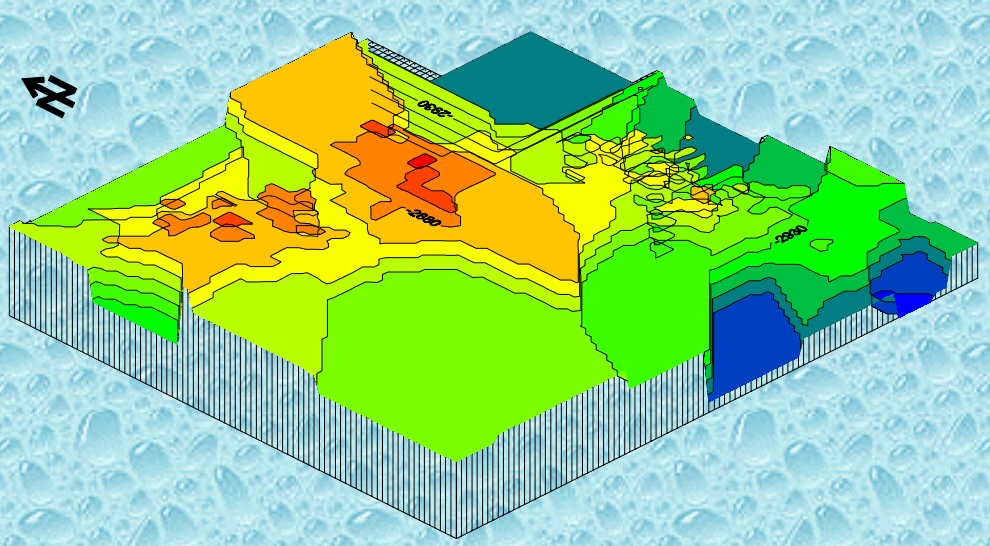
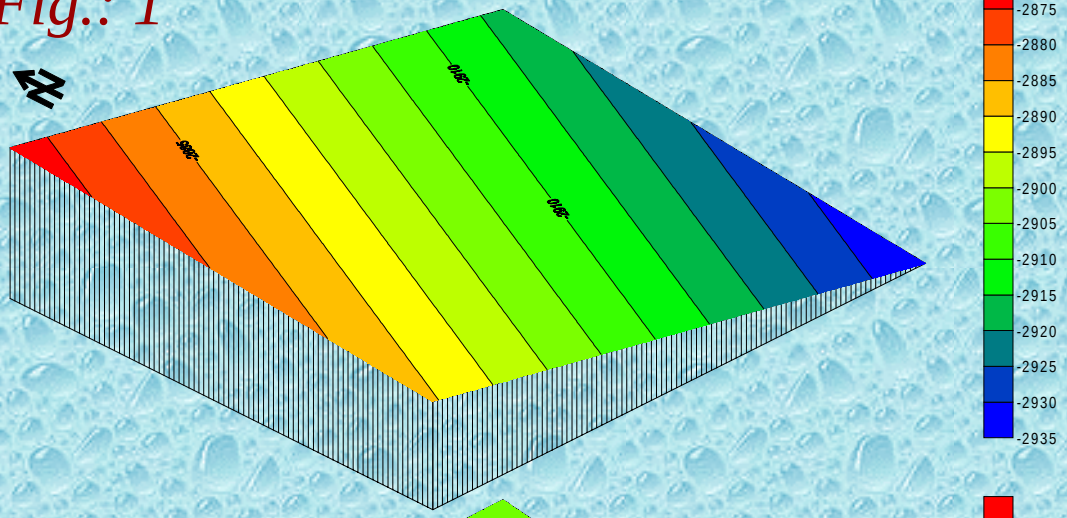


Fig.: default

- assigns value of the nearest point to each grid node
- useful when data are already evenly spaced
- this method is effective for filling missing values

Analysis of different gridding methods using “Surfer7”

Fig.: 1



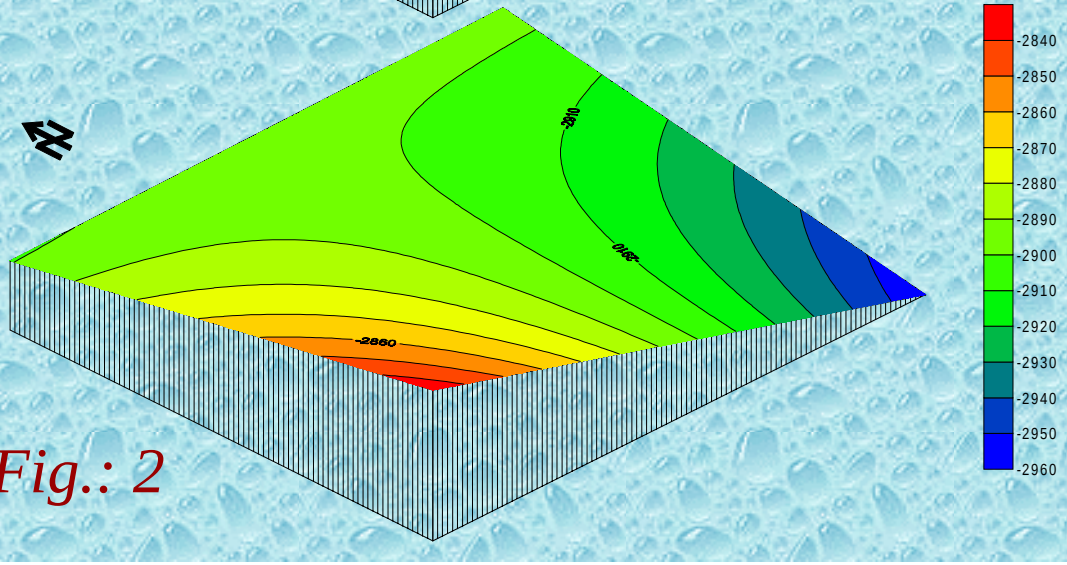


Fig.: 2

Polynomial Regression

- used to define large-scale trends & patterns
- not real interpolator (does not predict unknown Z values)
- Fig.1: Simple planar surface; Fig.2: Bi-linear saddle

Analysis of different gridding methods using “Surfer7”

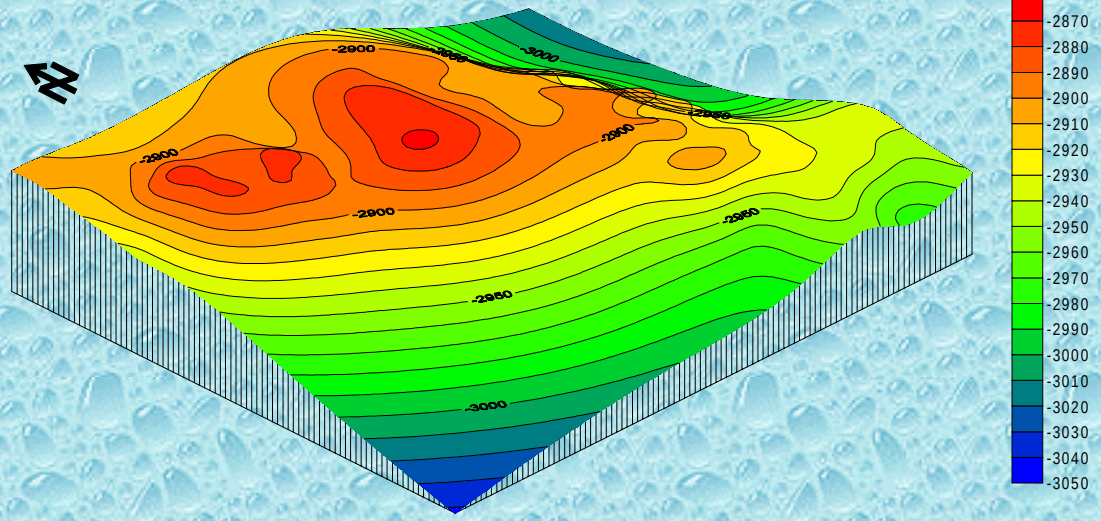


Fig.: 5. Thin plate spline

Radial Basis Function

1. Inverse Multiquadric
2. Multilog
3. Multiquadric
4. Natural Cubic Spline
5. Thin plate Spline

- 1.; 2.; 4.- error
- 5.- good; 3.- best

Analysis of different gridding methods using “Surfer7”

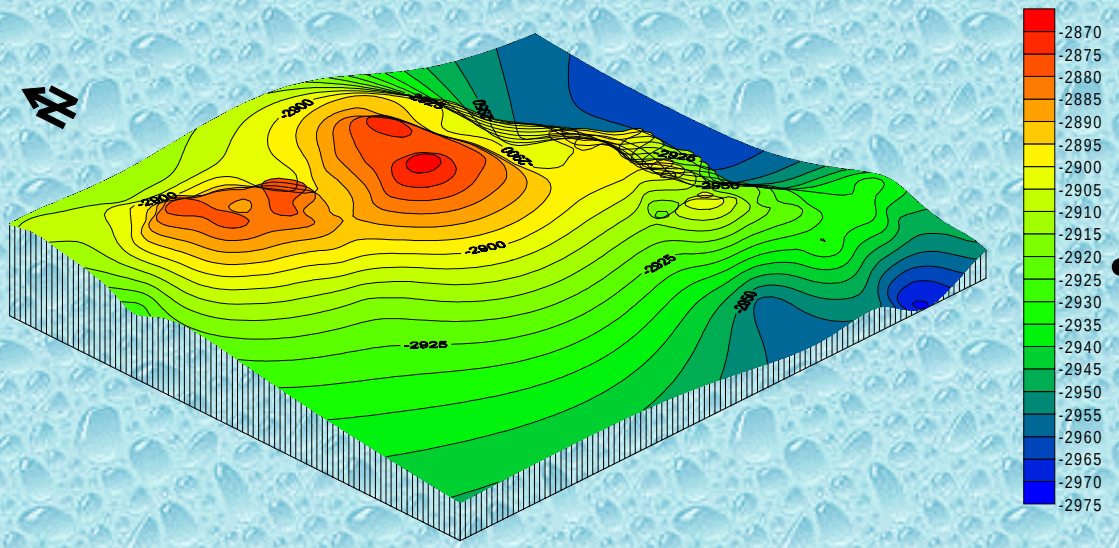


Fig.: 3. Multiquadric

Radial Basis Function

- all exact interpolators + smoothing factor
- = variogram in K. (mathematically specifies spatial variability of data set & resulting grid file

Analysis of different gridding methods using “Surfer7”

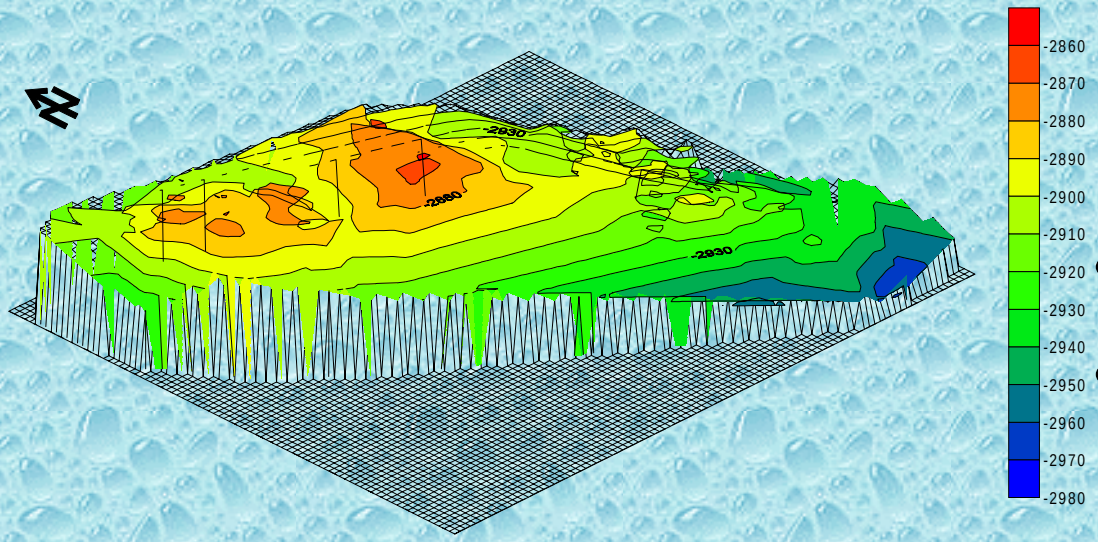


Fig.: default

Triangulation w/ linear Interpolation

- creates triangles by drawing lines between data points
- exact interpolator
- for evenly distributed data over grid area
  -sparse areas result in distinct triangular facets on map

Analysis of different gridding methods using "Surfer7"

Best Results

☆Kriging is exact, has many options & modifications, but needs knowledge

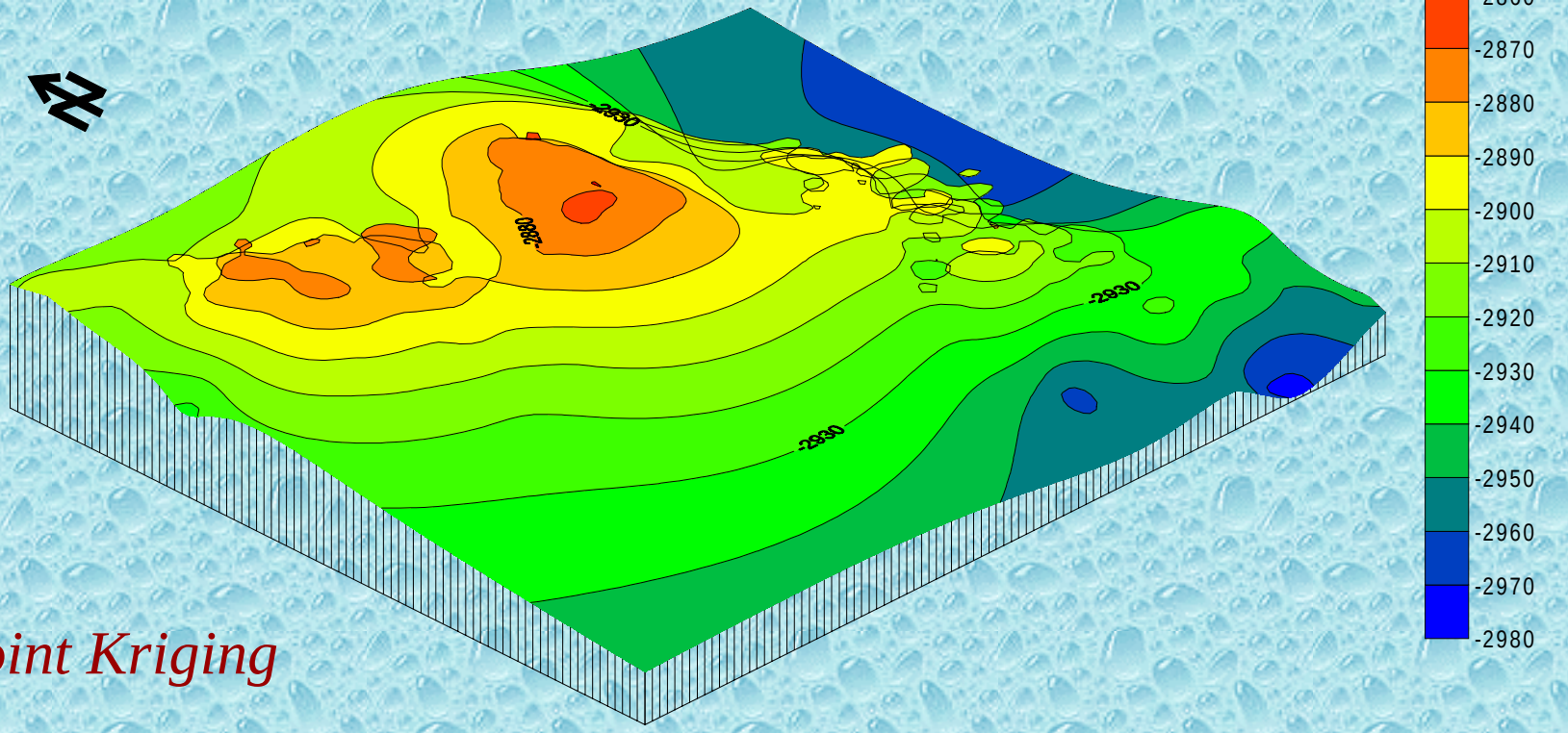


Fig.: Point Kriging

Analysis of different gridding methods using “Surfer7”

Best Results

☆Radial Basis Function is exact, shows nice views & is uncomplicated

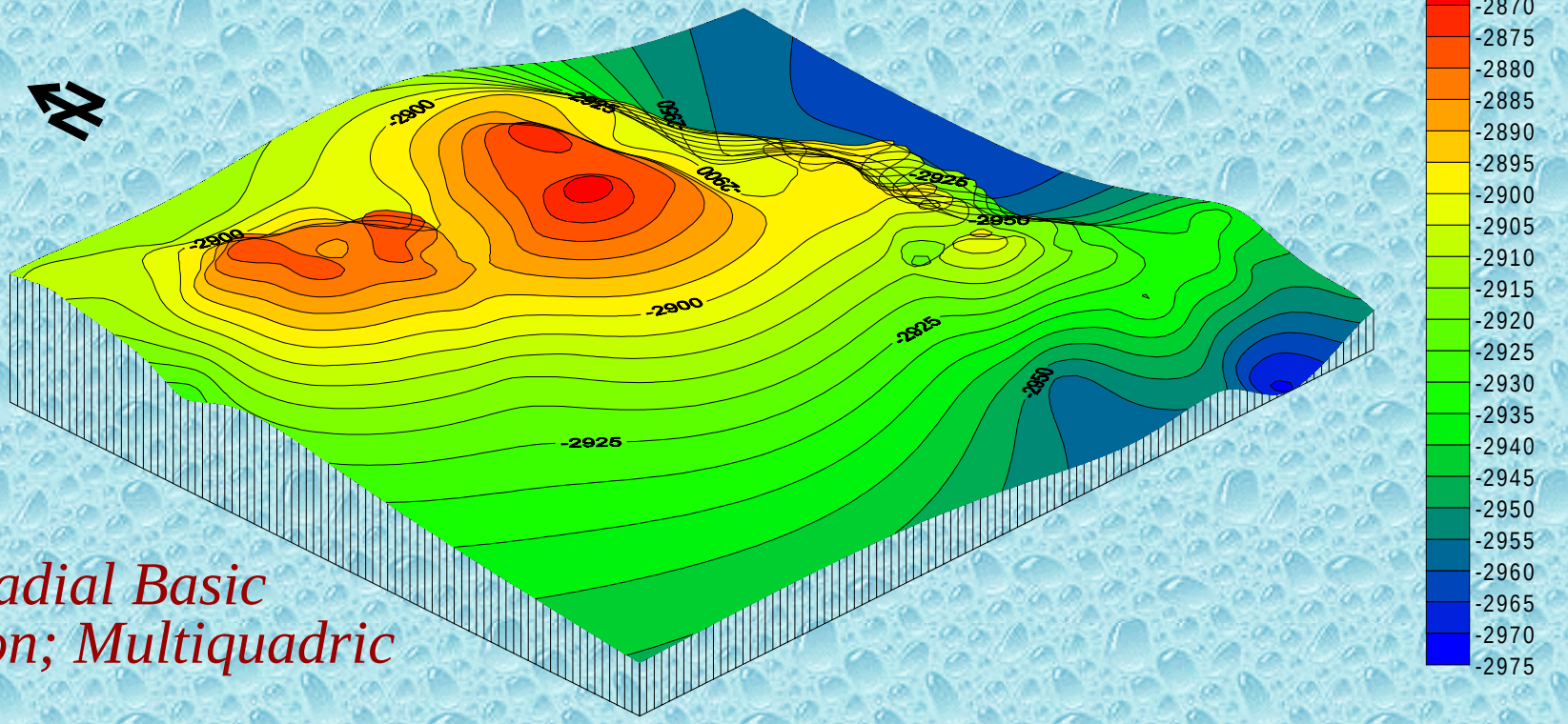


Fig.: Radial Basic Function; Multiquadric

Analysis of different gridding methods using “Surfer7”

Conclusion

- I did not consider all aspects & details
- Surfer is very powerful for the 3D-Visualization
- Surfer 7 works:
  -fast & without consuming much disk space
  -uncomplicated with Object manager
- All processes (gridding, mapping) can be automated with writing programs in Visual Basic
- Help content is very useful & describes also background information