# SELECTING OPTIMAL DATA-FITTING MODEL FOR SURVEYING AND GEODETIC APPLICATIONS

**BY**

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# Presentation Outline

- Introduction
- Spatial Interpolation Techniques
- Classification of Interpolation Method
- Surface Model Results
- Result Analysis
- Conclusion

# Introduction

- In order to make any meaningful analysis as regards risk assessment, platform stability, terrain modelling and most survey related applications; spatial continuous data are required.
- In both terrestrial and space based method for terrain modelling there is need to determine the appropriate spatial interpolation technique.
- The geodesist is faced with the task of finding the mathematical model that best fits the data-set such as to allow prediction at other points with least error residual.



# Spatial interpolation Techniques

Spatial Interpolation techniques can be generally classified into

i. Non-geostatistical Methods

ii. Geostatistical Methods (Multivariate or Univariate)

iii. Combined Method

It is usually difficult to select an appropriate spatial method for a terrain interpolation for a given dataset .

Several factor such as sample size, sampling design and data properties affect the estimations of the method

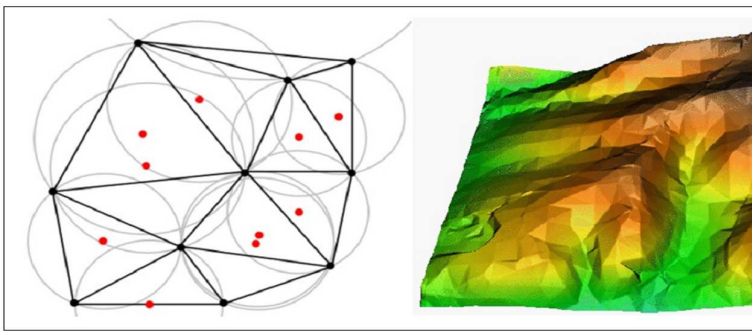
# Classification of Interpolation Methods

| S/N | INTERPOLATION METHOD | CATEGORY | SUB-CATEGORY |
|---|---|---|---|
| 1 | TIN | Non-Geostatistical | Not Applicable |
| 2 | IDW | Non-Geostatistical | Not Applicable |
| 3 | Radial Basis Function | Non-Geostatistical | Not Applicable |
| 4 | Ordinary Kriging | Geostatistical | Univariate |

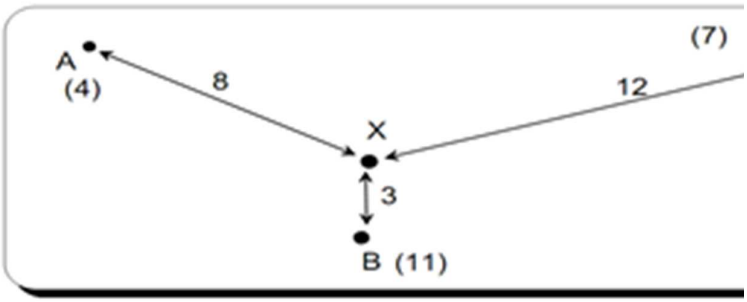


**'RIANGULATED IRREGULAR NETWORK**

lses a series of triangles based on a elauney's triangulation to join all sampled oints together (Jin and Andrew, 2008). It reates a surface formed by triangles of earest neighbour points.



**NVERSE DISTANCE WEIGHT:** This ıethod assumes that influence of the ariable entered on the map decrease with ıe increase of the distance from its sampling ite. Weights diminish as the distance ıcreases, this results in a local spatial ıterpolation. Uneven sample point istribution affects the quality of interpolation



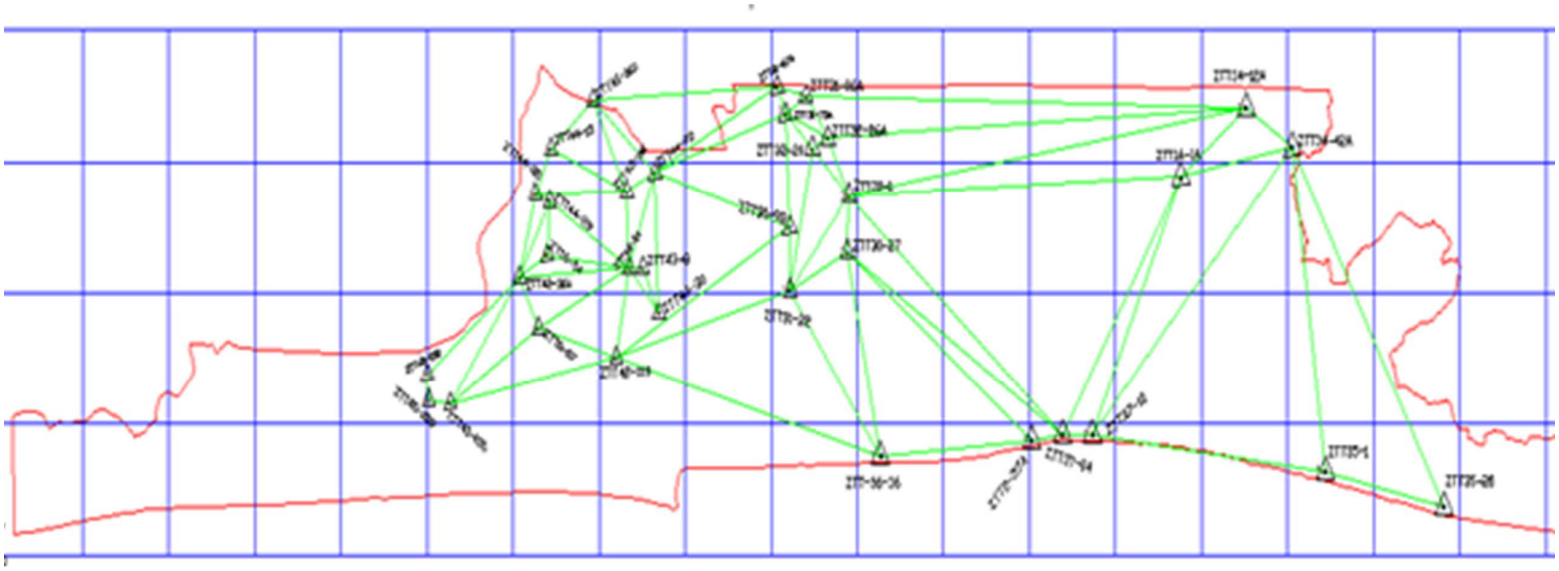
**RADIAL BASIS FUNCTIONS (RBF):** This is closest to the Kriging technique and is a flexible interpolation method. It gives the best overall interpolation of most datasets

**ORDINARY KRIGING:** Kriging involves interactive investigation of spatial behaviour of data analysed before selecting the best method of assessment for derivation of output area . A major advantage of kriging is that it can extrapolate for values beyond the "z" data range.



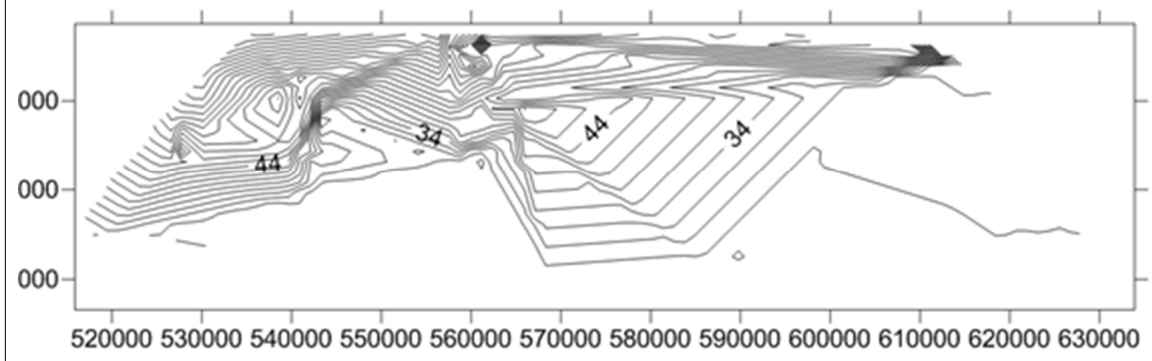
## ATA USED:

A total of 216 points being part of the Lagos State second-order control network were used in the model formulation. The control points selected being part of the ZTT 14 – 30 Series covering most parts of Lagos State has an even spatial distribution across the state.

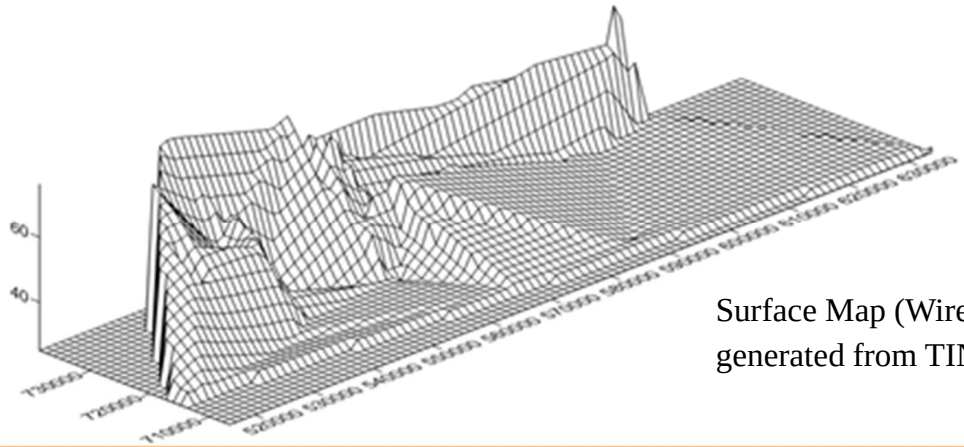


Showing Control – Network used for the Terrain – Analysis.

# SURFACE MODEL RESULTS

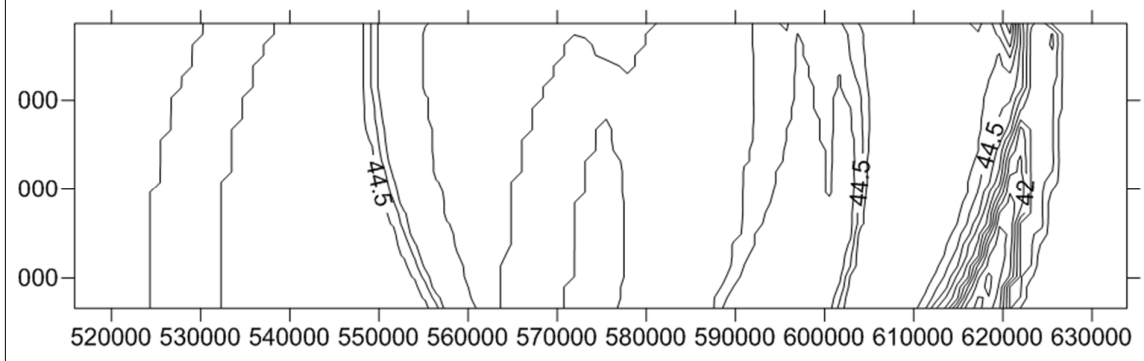



Contour Map generated from

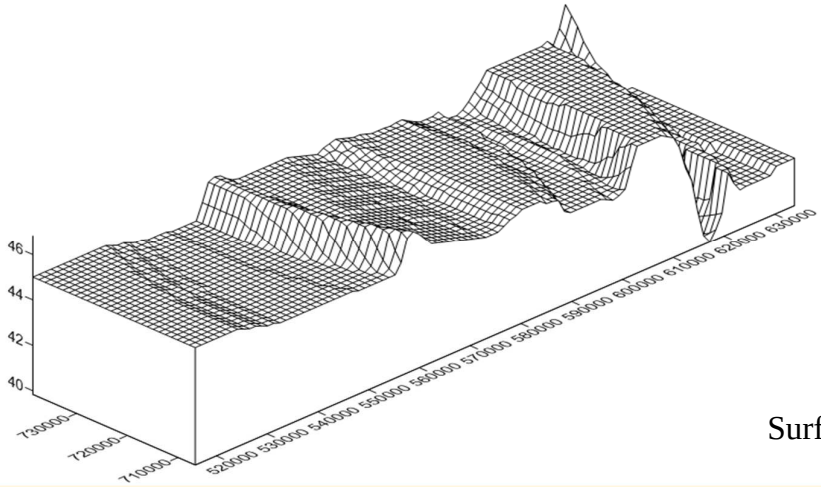



Surface Map (Wireframe) generated from TIN

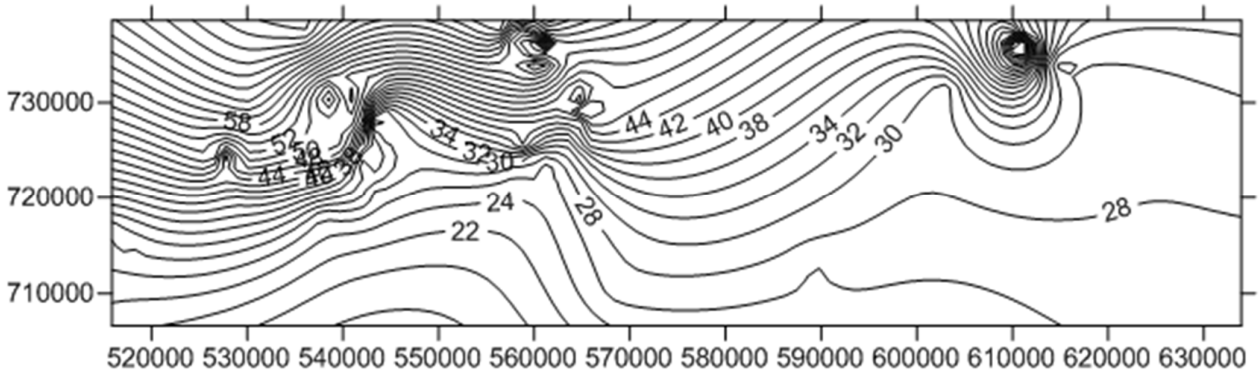




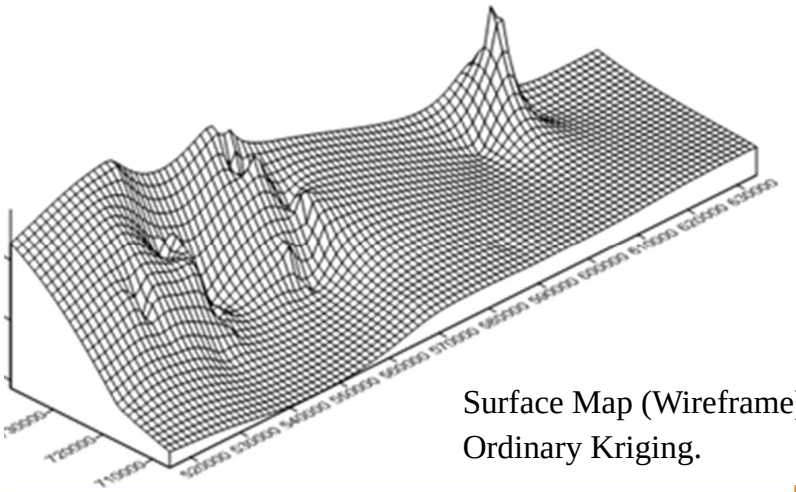

Contour Map generated from IDW




Surface Map (Wireframe) generated from IDW

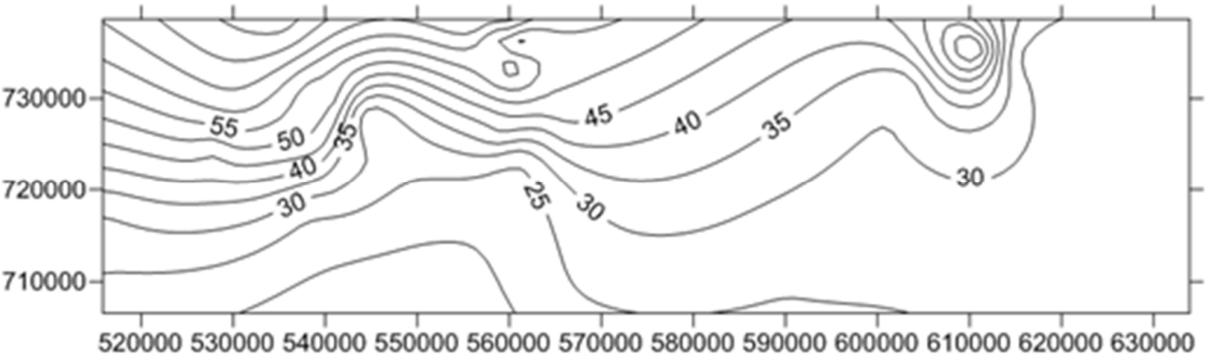



Contour Map generated from Ordinary Kriging.

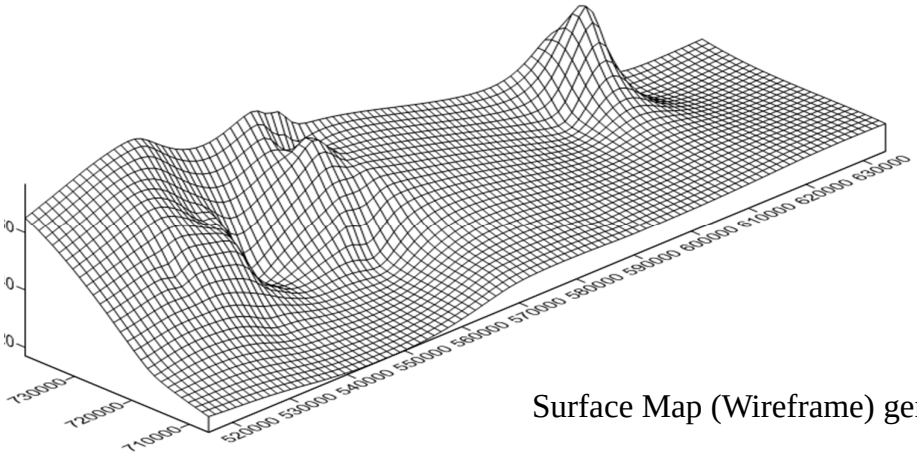


Surface Map (Wireframe) generated from Ordinary Kriging.






Contour Map generated from RBF



Surface Map (Wireframe) generated from RBF

## RESULTS ANALYSIS

| S/N | TECHNIQUE | RMSE | STD. ERROR | TIME (Secs) | APPEARANCE | REMARKS |
|---|---|---|---|---|---|---|
| 1 | TIN | 37.8935 | 0.2523 | 0.01 | Poor | Not Suitable |
| 2 | IDW | 44.4564 | 0.0208 | 0.01 | Poor | Not Suitable |
| 3 | Kriging | 37.5752 | 0.2416 | 0.09 | Very Good | Good |
| 4 | Radial Basis Function (RBF) | 37.6112 | 0.2459 | 0.07 | Good | Good |



## CONCLUSION

The Kriging and Radial Basis function are the best interpolation techniques f terrain analysis and modelling.

However, consequent upon the long time it takes to process them, it is advisable that when the available dataset exceeds 1000 points, the TIN or "minimum curvature" should be used as they both produce accuracy close t kriging when a large dataset is available.

# THANK YOU