

Block Modeling of Gunungsari's Rocks Electrical Property from Crossed Boreholes Rho Data

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Abstract

Block modeling of rho data could be conducted to obtain the three dimension distribution of rho value. Research was conducted on Gunungsari Hill in Magelang, Central Java Indonesia. The main purpose of this research was for proving that two dimensional rho data can be modeled into block model while they were crossed.

Rho data was obtained from ten boreholes on the peak of Gunungsari Hill. Each borehole coordinate was plotted on Rockworks software. Block model was created by interpolating rho data on boreholes within Anisotropy Inverse-Distance Algorithm.

Interpolation of two dimensional rho data from crossed boreholes lines formed block model. Crossed lines acted as planes in four directions those formed blocky shaped model. Making rho block model with crossed boreholes lines is recommended for project with limited funding.

Keywords: Block, Model, Crossed, Boreholes, Data

1. Introduction

Rho or resistivity is one of rock electrical properties. Block modeling of rho data could be conducted to obtain the three dimension distribution of rho value. Making block model needs three dimension data so this research used two boreholes lines those were crossed. The crossed lines could represent three dimensional data distribution. Research was conducted on Gunungsari Hill in Magelang, Central Java Indonesia. The main purpose of this research was for proving that two dimensional rho data can be modeled into block model while they were crossed.

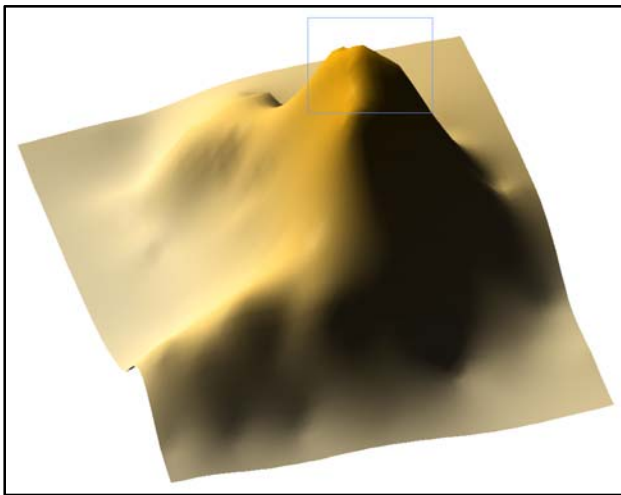


Figure 1.1 Research location (blue rectangle).

2. Methods

a. Rho Data Extraction

Rho data was obtained from ten boreholes on the peak of Gunungsari Hill. The first to fifth boreholes were lined up within azimuth N 150° E, and then the sixth to tenth boreholes were lined up within azimuth N 60° E. The first to fifth boreholes were perpendicular to bedding strike while the sixth to tenth boreholes were in line with bedding strike. Figure 2.1 shows the boreholes location around Gunungsari Hill's peak. Figure 2.2 shows rho log data from the first boreholes to the tenth boreholes.

b. Rho Data Modeling

Each borehole coordinate was plotted on Rockworks software. Then rho data were inputted to the software as point data. Block model was created by interpolating rho data on boreholes within Anisotropy Inverse-Distance Algorithm. Diagram type of block model was mid point voxels.

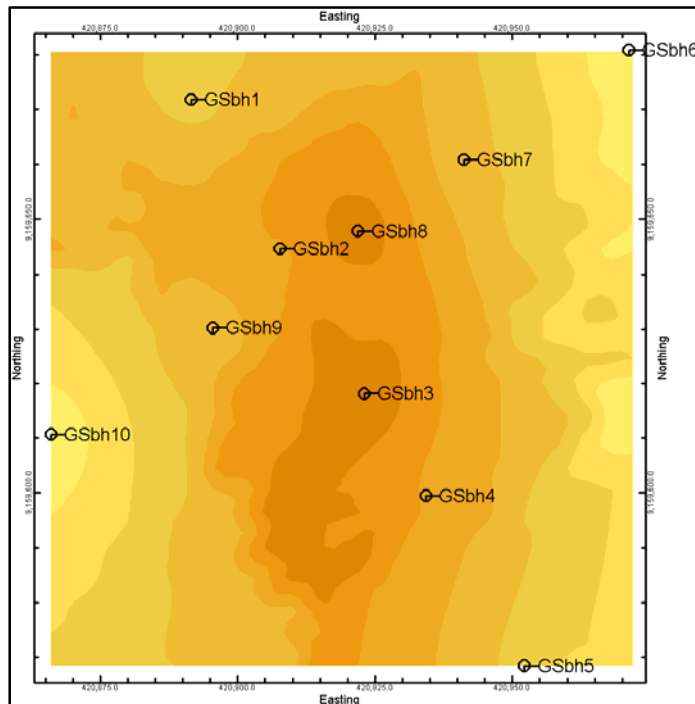


Figure 2.1 Map of boreholes location around Gunungsari Hill's peak.

c. Anisotropy Inverse-Distance Algorithm

The Inverse-Distance Anisotropic modeling method is a "flavor" of the Inverse-Distance algorithm (there are four Inverse-Distance-based solid modeling algorithms). Using Inverse-Distance in general, a voxel node value is assigned based on the weighted average of neighboring data points, and the value of each data point is weighted according to the inverse of its distance from the voxel node, taken to a power (an exponent of "2" = Inverse-Distance squared, "3" = Inverse-Distance cubed, etc). The greater the value of the exponent, the less influence distant control points will have on the assignment of the voxel node value. Using the Inverse-Distance Anisotropic method, the program will look for the closest control point in each 90-degree sector around the node. This kind of directional search can improve the interpolation of voxel values that lie between data point clusters, and can be useful for modeling drill-hole based data in stratiform deposits.

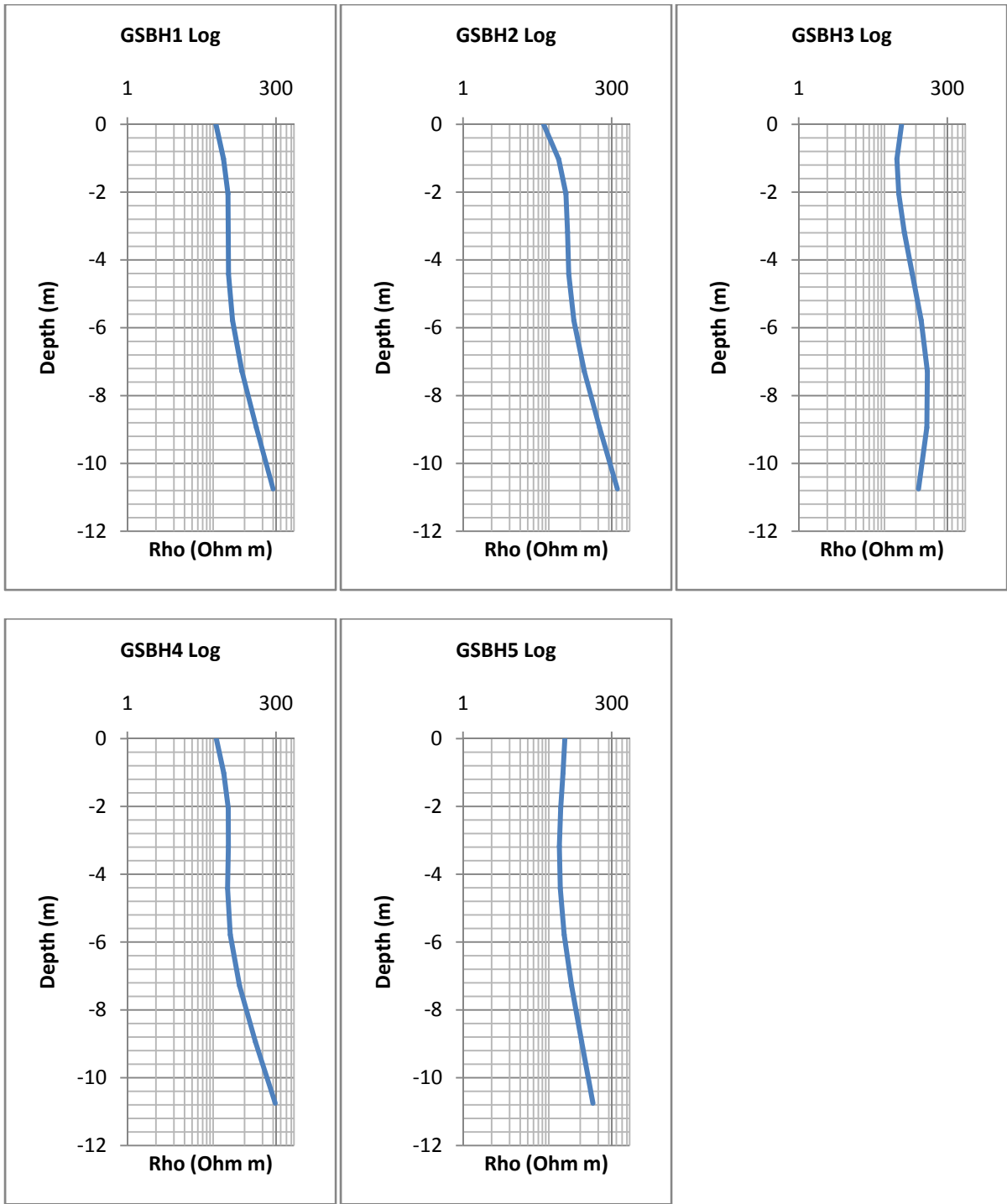


Figure 2.2.a Rho Log Data of the boreholes were lined up in N 150° E azimuth.

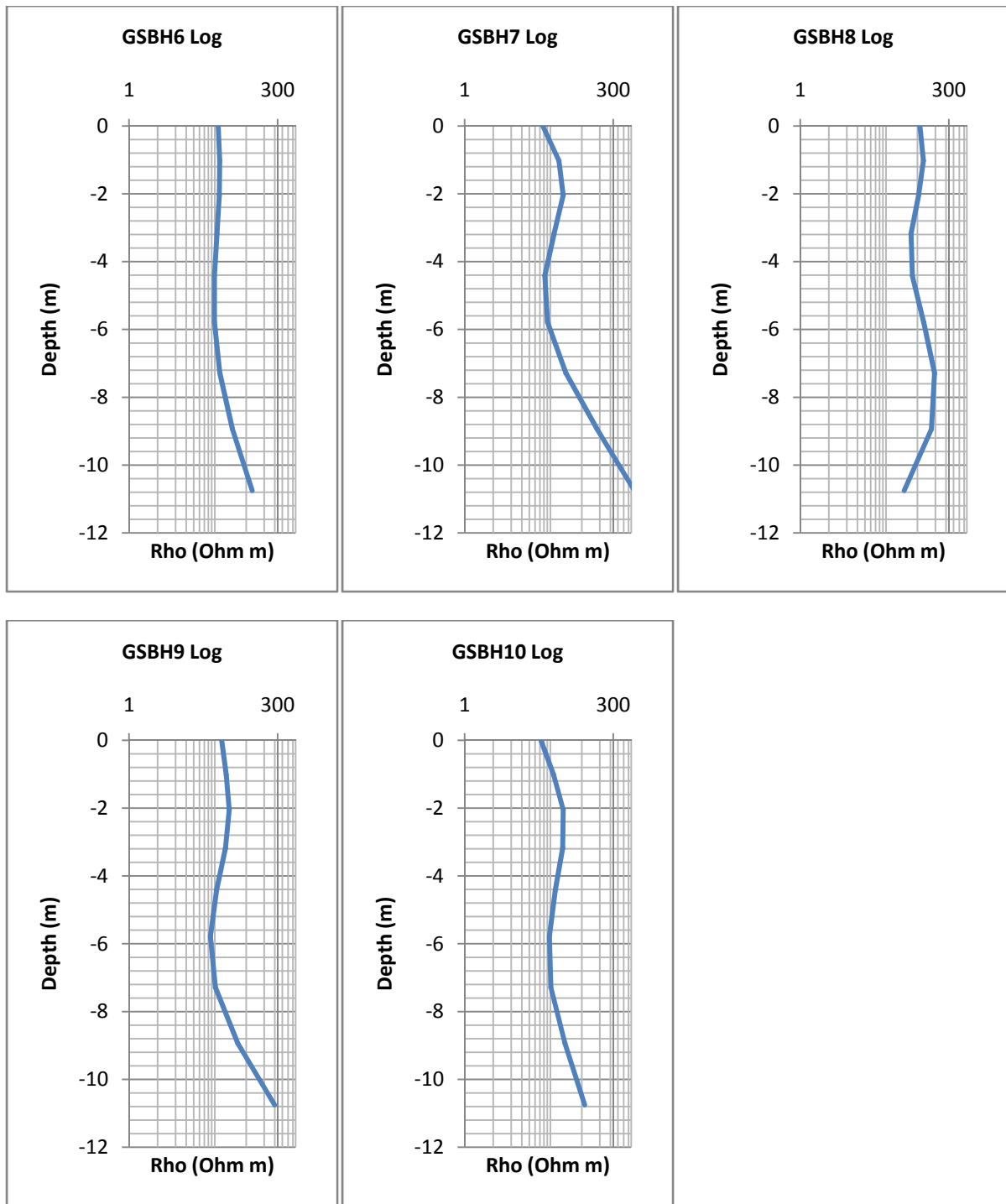


Figure 2.2.b Rho Log Data of the boreholes were lined up in N 60° E azimuth.

3. Result and Discussion

Boreholes those were lined up in two directions due to the presence of bedding structure that may influence rock's resistivity value. It also in order to get as detailed rho value distribution as possible. Boreholes in line with strike lean to have same rho value trend while boreholes perpendicular to strike lean to have different rho value. Figure 3.1 below shows rho's standard deviation in each depth of all boreholes. Based on the curve, the rho's standard deviation of boreholes those were lined up perpendicular to strike has lower value than those were lined up in line with strike direction. Based on the standard deviation value, it could be concluded that rho data on boreholes those perpendicular to strike direction have various rho value in the same depth.

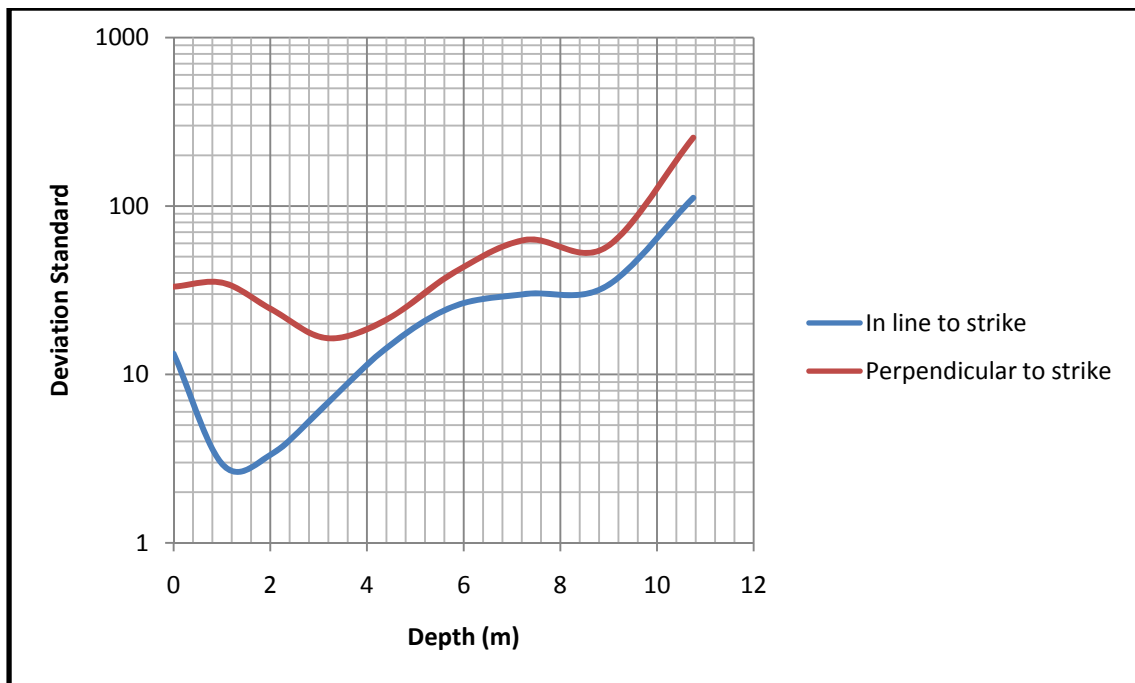


Figure 3.1 Standard deviation value comparisons between two boreholes lines

Crossed boreholes lines formed square edge of boreholes location. Crossed boreholes lines was chosen as the best way solving three dimension data problem where making a block model should use minimum four boreholes lines. Crossed boreholes lines acted as four boreholes lines although they just two lines. Interpolation of crossed lines will result in blocky model while the same number of lines uncrossed would not result in

block model. Figure 3.2 shows comparison between crossed and uncrossed borehole lines in forming block model.

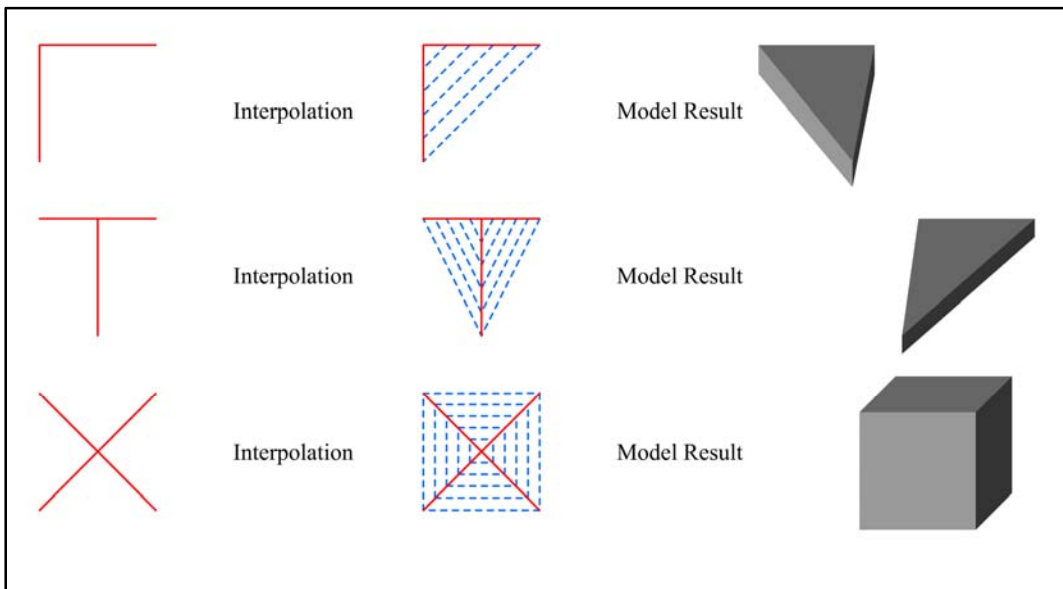
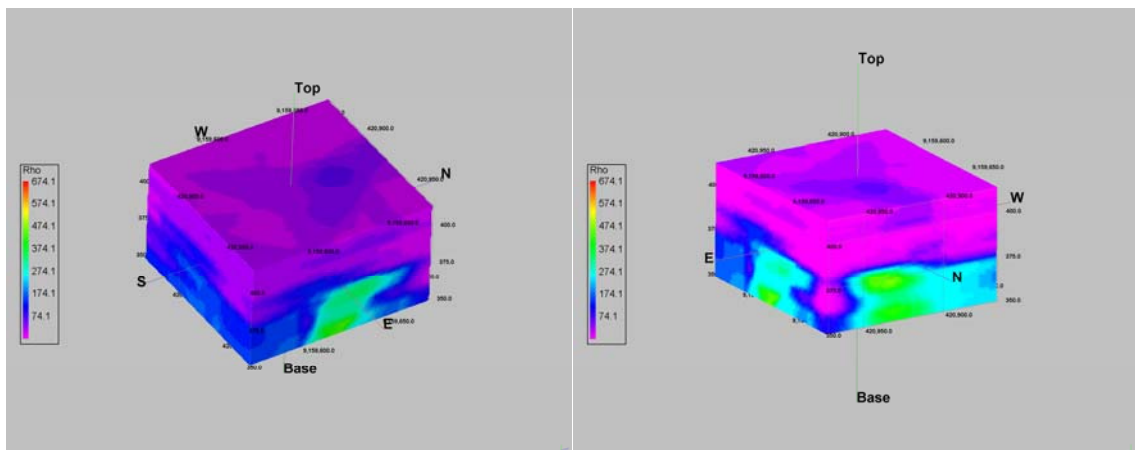


Figure 3.2 Comparisons of model results between crossed and uncrossed boreholes lines

Anisotropy Inverse-Distance algorithm was chosen to interpolate rho data. It was chosen because it could display more varying rho distribution on the model. It is also sensitive to the change of rho value in three dimension space. Voxel type diagram was chosen although the result was not as good as isosurface type diagram due to the presence of very low rho value that made the model has blank value in some section. Figure 3.3 show the block model of rho value in voxel type. Based on the last model, the resistivity distribution of Gunungsari Hill become higher as the increase of depth, then on the north and east flank the resistivity value increase dramatically.



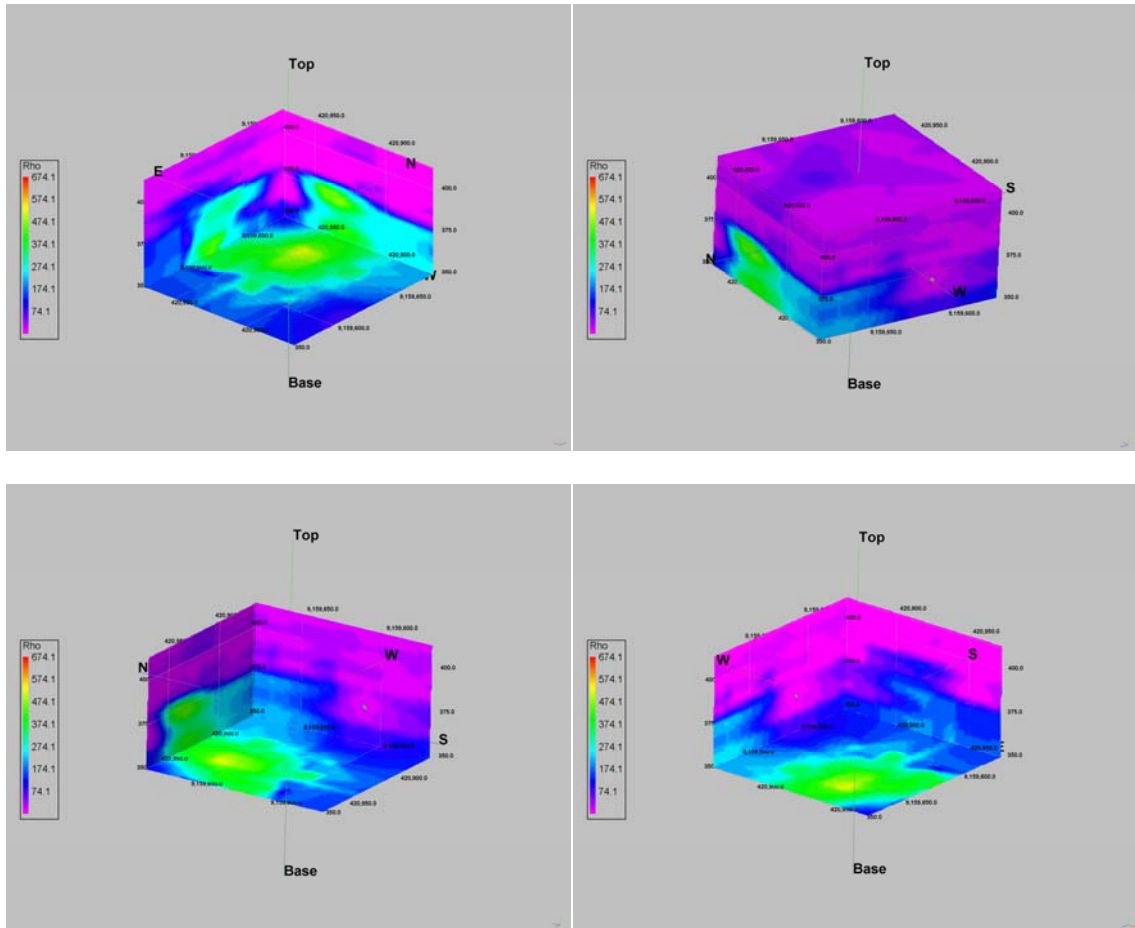


Figure 3.3 Rho block model result from crossed boreholes lines those interpolated within Anisotropy Inverse-Distance

4. Conclusion and Recommendation

Two dimensional rho data from boreholes lines can be modeled into block model while they were crossed because crossed lines acted as planes in four directions those formed blocky shaped model. Making rho block model with crossed boreholes lines will save time and money so it is recommended for project with limited funding. The structure of rock bedding need to be considered in order to get as detailed rho value distribution as possible.

5. References

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