**Question**

Figure below gives the porosity distribution in a 2D heterogeneous and possibly anisotropic reservoir.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 26 | 22 | 19 | 14 | 16 | 19 | 16 | 14 | | 23 | 20 | 17 | 20 | 14 | 23 | 21 | 17 | | 22 | 17 | 18 | 19 | 18 | 25 | 20 | 19 | | 21 | 15 | 20 | 18 | 20 | 20 | 18 | 13 | | 19 | 18 | 15 | 15 | 18 | 23 | 22 | 20 | | 18 | 16 | 10 | 16 | 14 | 18 | 20 | 18 | | 17 | 14 | 10 | 13 | 13 | 15 | 14 | 17 | | 15 | 13 | 11 | 10 | 17 | 16 | 15 | 11 | |  |  |

a. Plot the experimental variograms in the E-W, N-S, NE-SW and NW-SE directions. Perform the calculations up to and including a lag distance of 4 units. The samples are on a square grid.

b. Do the variograms show any evidence of anisotropy in the porosity data?

**Solution**

a. Variogram values in the different directions:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **E-W** | **N-S** |  |  | **NE-SW** | **NW-SE** |
|  |  |  |  |  |  |  |  |
| 1 | 56 | 6.411 | 4.982 | 1.414 | 49 | 7.459 | 7.806 |
| 2 | 48 | 9.490 | 8.750 | 2.828 | 36 | 13.194 | 13.431 |
| 3 | 40 | 10.575 | 10.675 | 4.243 | 25 | 19.280 | 10.680 |
| 4 | 32 | 10.547 | 12.953 | 5.657 | 16 | 18.406 | 12.625 |

b. Yes. There is evidence of anisotropy in the variograms in the different directions. The variograms in E-W and N-S directions are essentially the same. The variograms in the NE-SW and NW-SE directions are higher than in the other two directions at lag distances greater than 2.