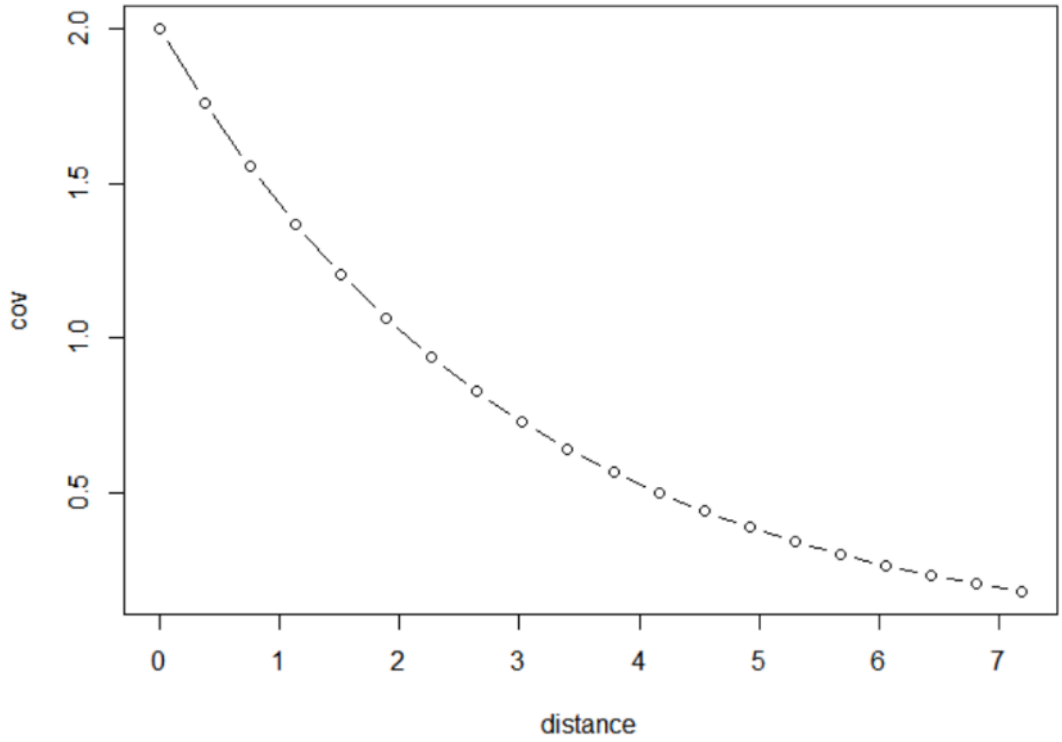
Lab5 Report

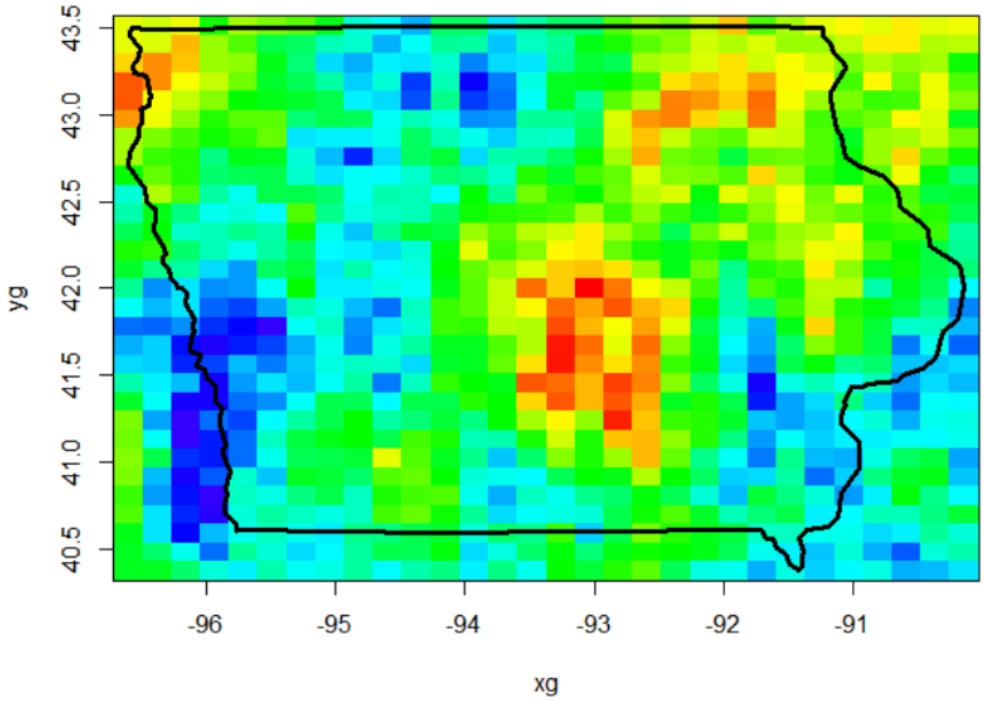
JIANG Yuhan 18106651x

Assignment1：

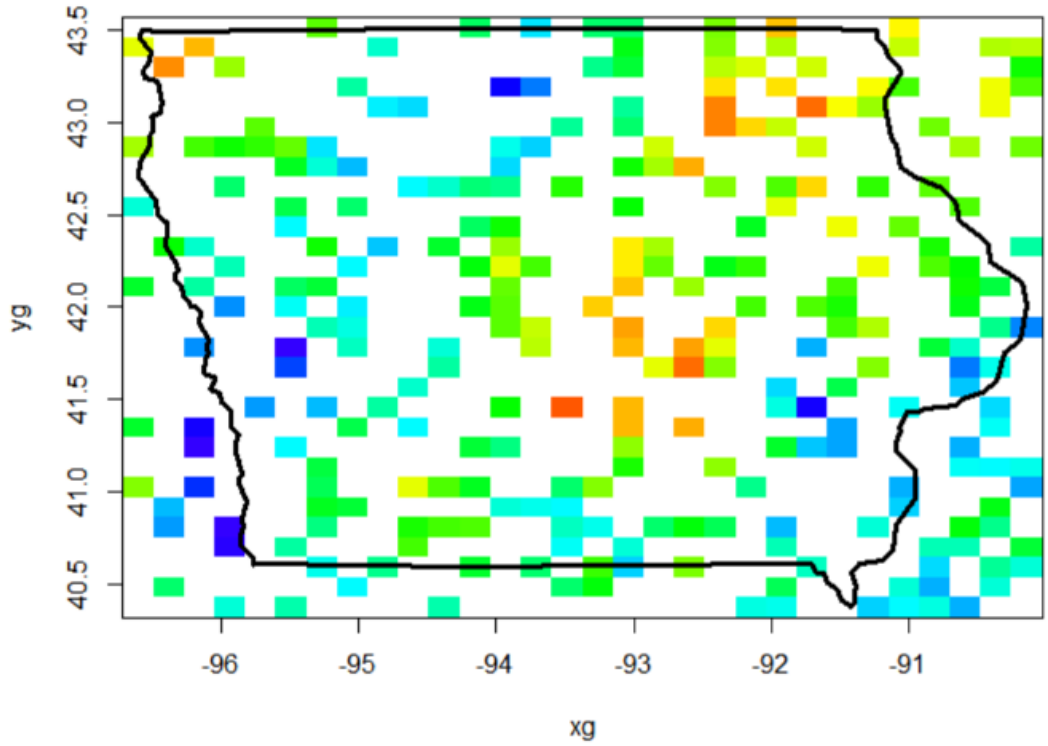
1. Provide the covariogram map



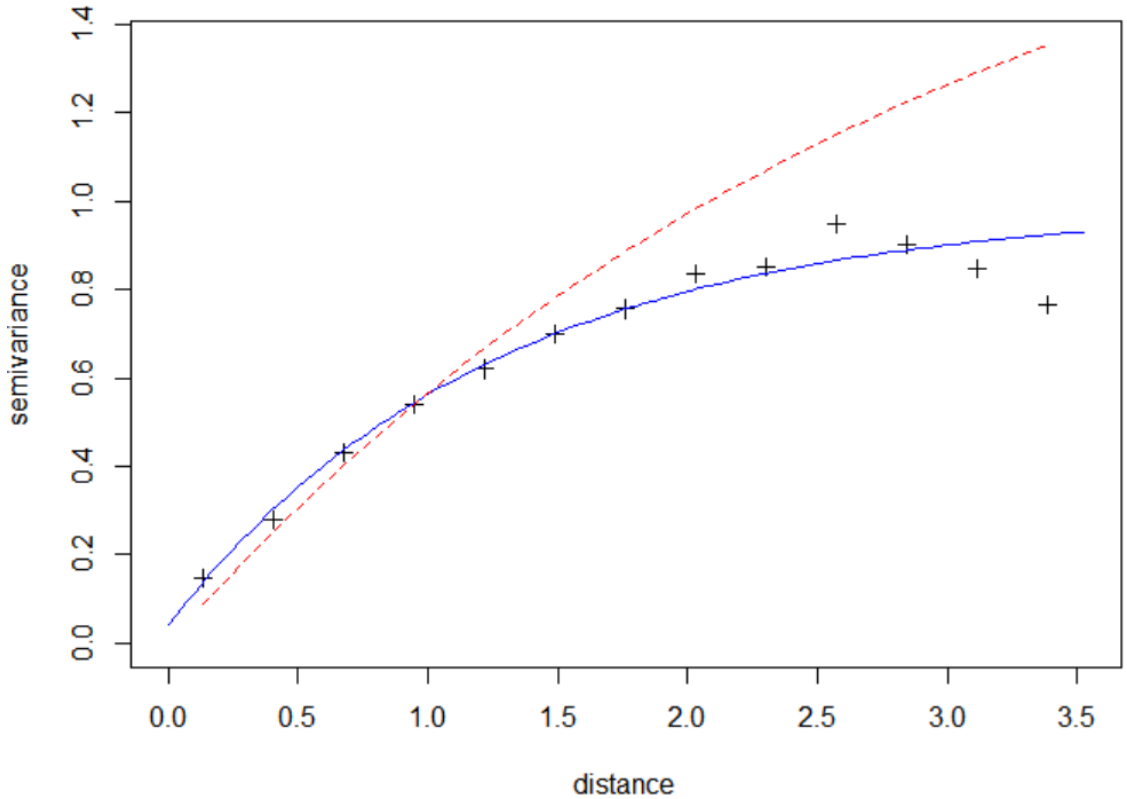
2. An image plot of the simulated spatial process with map overlay.



3. Plot the data (the reduced subset) as an image with a map overlay



4. Plot the empirical, fitted, and true semi-variograms together.



a. How does your empirical semi-variogram compare with the truth?
Firstly, the fitted line(blue) should be close to the true line(red), the closer, the

better. This shows the parameters of the empirical semi-variogram are closer to that of the truth. Secondly, the cross-shaped point should be symmetrical about the blue line, the closer be to the blue line, the better. This means the blue line fits better.

b. How do the estimated spatial parameters compare with the true values?

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variofit: model parameters estimated by WLS (weighted least squares):
covariance model is: exponential
parameter estimates:
  tausq sigmasq     phi
 0.0408  0.9460  1.2488
Practical Range with cor=0.05 for asymptotic range: 3.741174

variofit: minimised weighted sum of squares = 102.2036
```

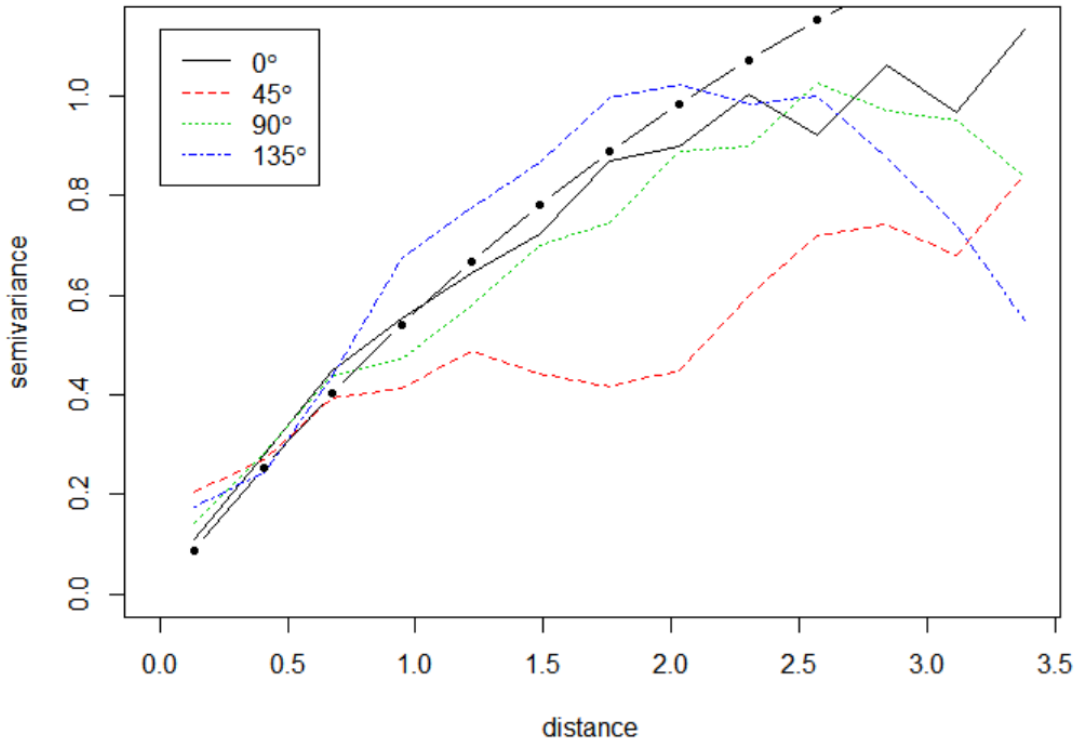
According to the picture and the data above, the empirical semi-variogram obtained is not very good.

On the one hand, in the picture the red line and blue line are obviously far away from each other. Additionally, as the distance increases, although the cross point is substantially symmetrical about the blue line, it is farther and farther away from the blue line.

On the other hand, according to the data above, the parameters of the estimated model are obviously far from the parameters of the real function. Additionally, minimized weighted sum of squares is large.

Although the blue straight line and the red straight line have the same general trend. All these reasons above, explain that the parameters of the empirical semi-variogram are not very close to that of the truth and the blue line fit is not good. So, the empirical semi-variogram obtained is not very good.

c. Is the assumption of isotropy valid here? Should it be?



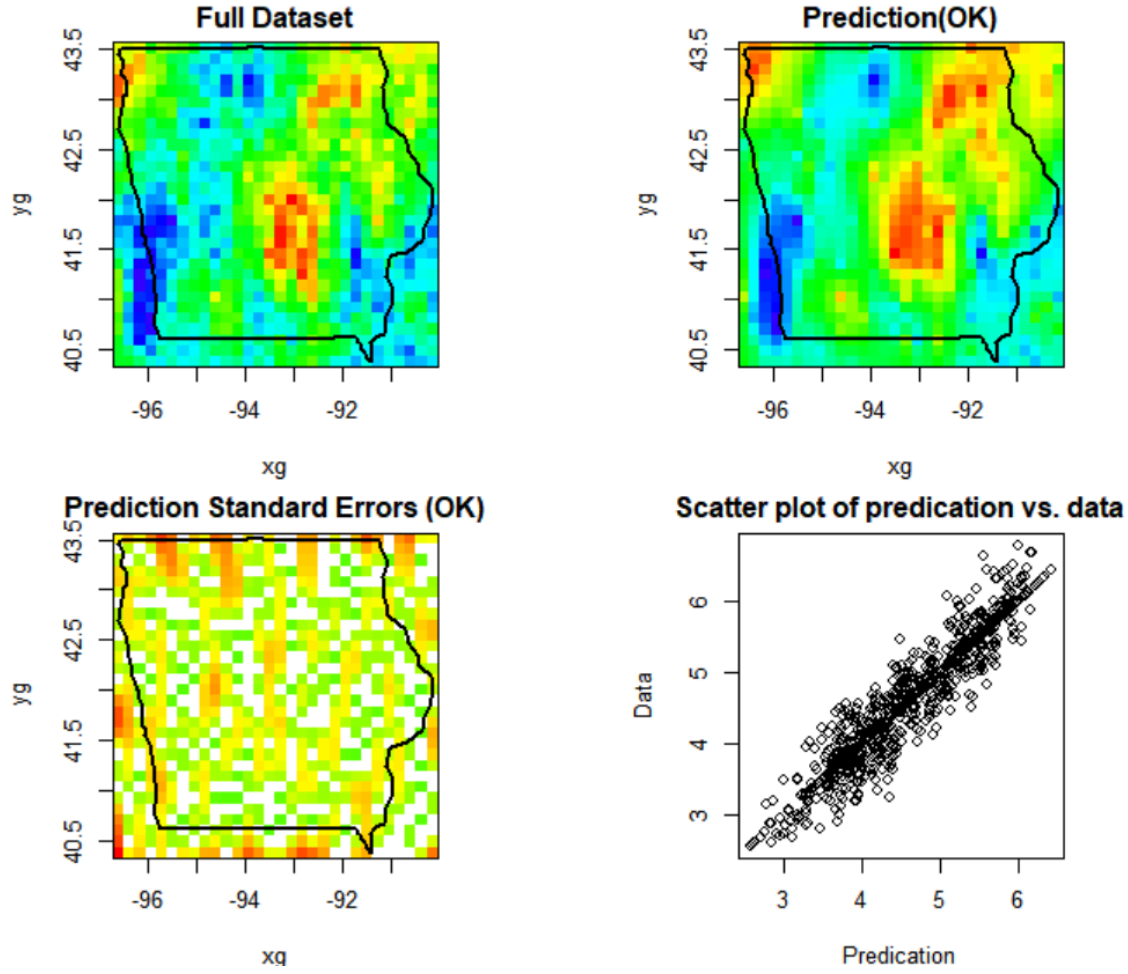
From the picture above, we could know that the assumption of isotropy is not valid here. However, it should be isotropy since our model for this process assumes stationarity and isotropy. Therefore, the interpolated data should also be isotropic, and the closer it is to the source data, the more reasonable and successful the interpolation method is.

In this plot, if they are isotropy, these four lines representing for different direction should be coincident or just have a little difference. In fact, the four lines remain basically the same in the trend at the early edge, as the distance increases, the value of semivariance increasing. Probably due to the cumulative effect, as the distance increases, the difference becomes more and more obvious, even the trend is different. Blue and green show a clear downward trend.

The four lines increase in degree to different extents. Blue grows fastest, but red grows the slowest. And the blue line and red line just represent for opposite direction, 135 degrees and 45 degrees, explaining that the data is the worst isotropic in this direction. The isotropic nature of the 0-degree direction and the 90-degree direction is relatively good, and the two lines are much closer than blue and red.

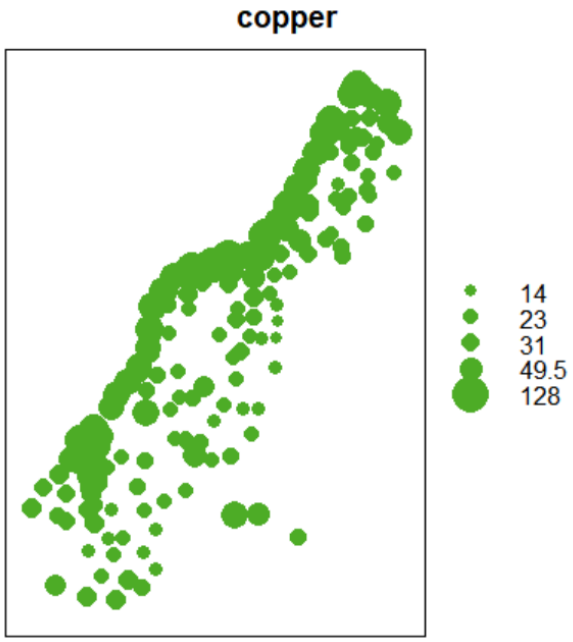
All in all, the assumption of isotropy is not valid here. But it should be.

5. Simulated map, Prediction map, Predicted standard error, The scatter plot of predication vs. data.

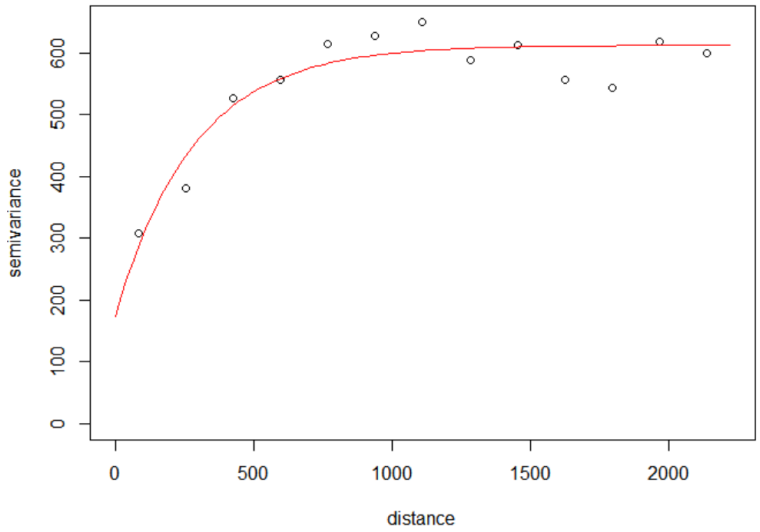


Assignment2：

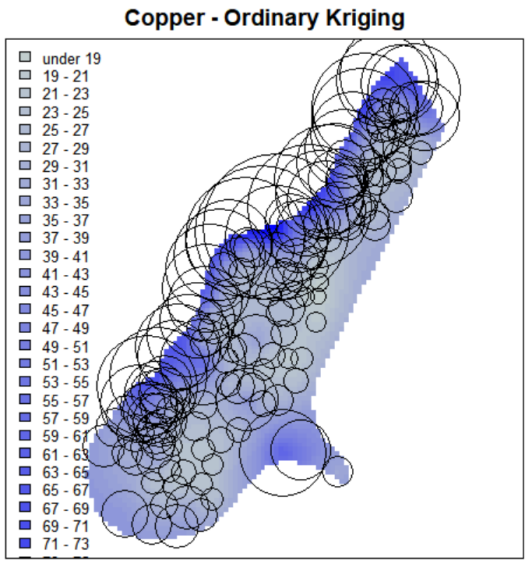
1. A bubble map of the copper heavy metal

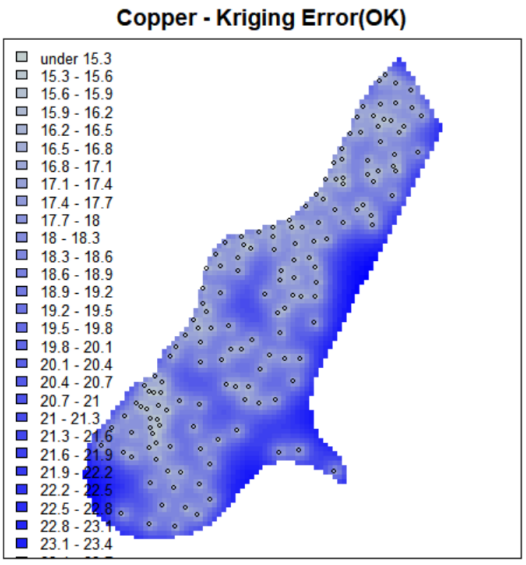


2. The empirical and fitted semi-variograms



3. The prediction map (with ordinary Kriging) and Kriging error map


Copper - Ordinary Kriging
under 19
19 - 21
21 - 23
23 - 25
25 - 27
27 - 29
29 - 31
31 - 33
33 - 35
35 - 37
37 - 39
39 - 41
41 - 43
43 - 45
45 - 47
47 - 49
49 - 51
51 - 53
53 - 55
55 - 57
57 - 59
59 - 61
61 - 63
63 - 65
65 - 67
67 - 69
69 - 71
71 - 73


Copper - Kriging Error(OK)
under 15.3
15.3 - 15.6
15.6 - 15.9
15.9 - 16.2
16.2 - 16.5
16.5 - 16.8
16.8 - 17.1
17.1 - 17.4
17.4 - 17.7
17.7 - 18
18 - 18.3
18.3 - 18.6
18.6 - 18.9
18.9 - 19.2
19.2 - 19.5
19.5 - 19.8
19.8 - 20.1
20.1 - 20.4
20.4 - 20.7
20.7 - 21
21 - 21.3
21.3 - 21.6
21.6 - 21.9
21.9 - 22.2
22.2 - 22.5
22.5 - 22.8
22.8 - 23.1
23.1 - 23.4