Q1)

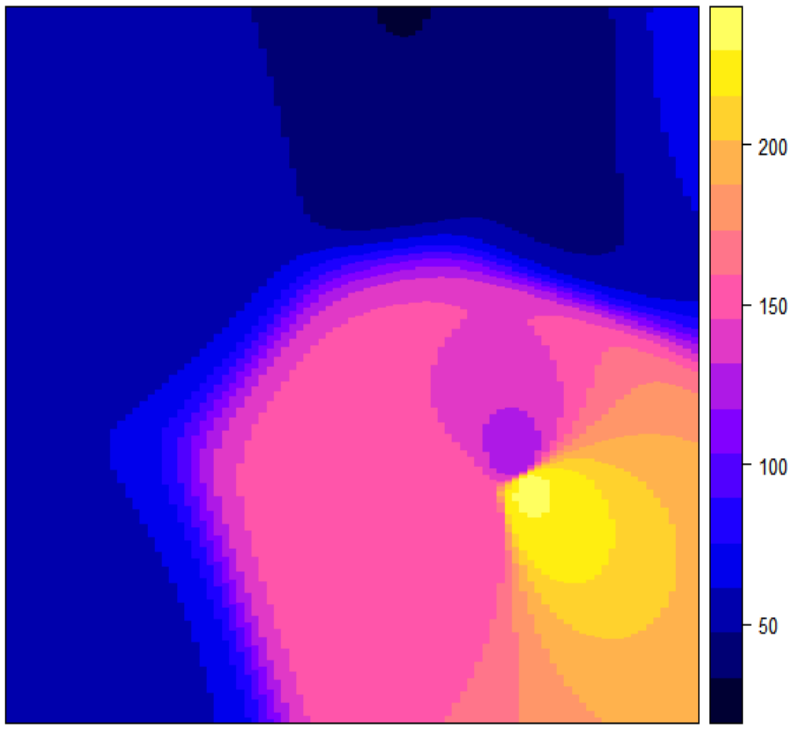
a) Use inverse distance weighting with a power of 1, 2, 5,10 to estimate:

I. Rainfall at each of the grid points. Plot showing the predicted rainfall at each grid point.

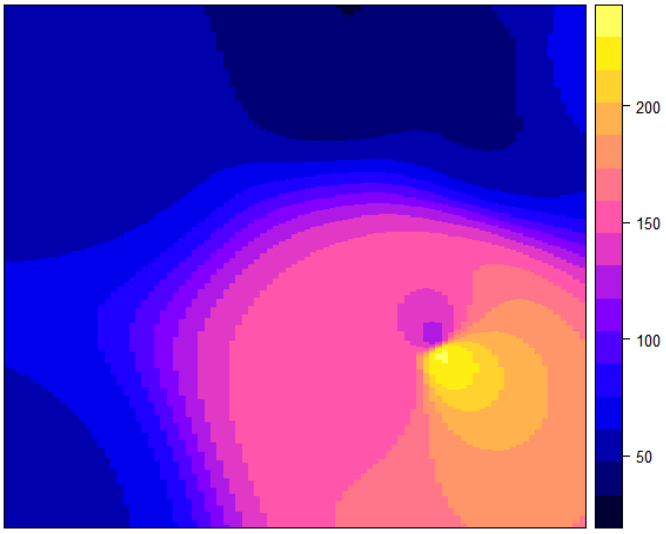
II. Lead (Pb) concentrations at each of the grid points. Plot showing the predicted lead concentration at each grid point.

Ans: A. 2) Lead (Pb)

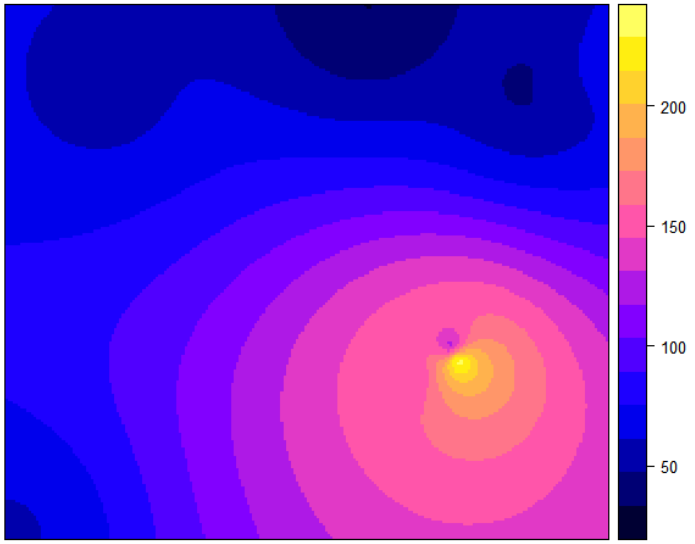
Power: 10



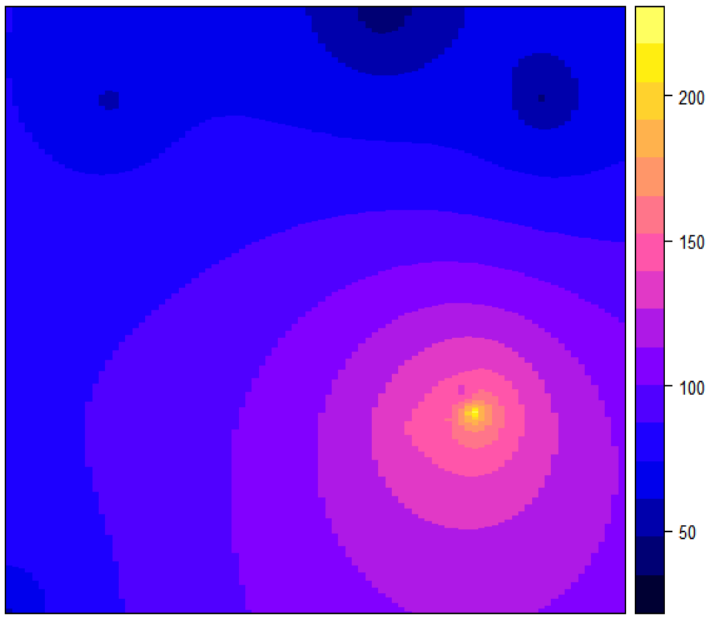
Power : 5



Power : 2

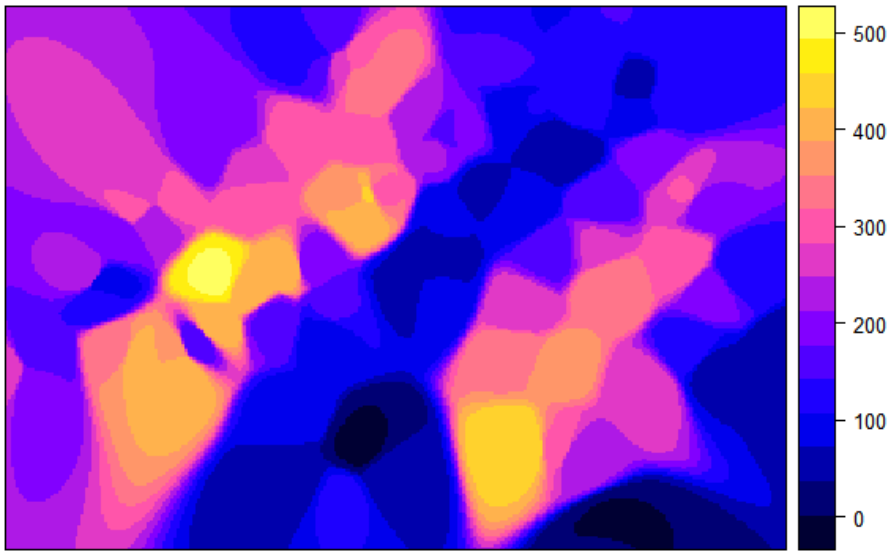


Power:1

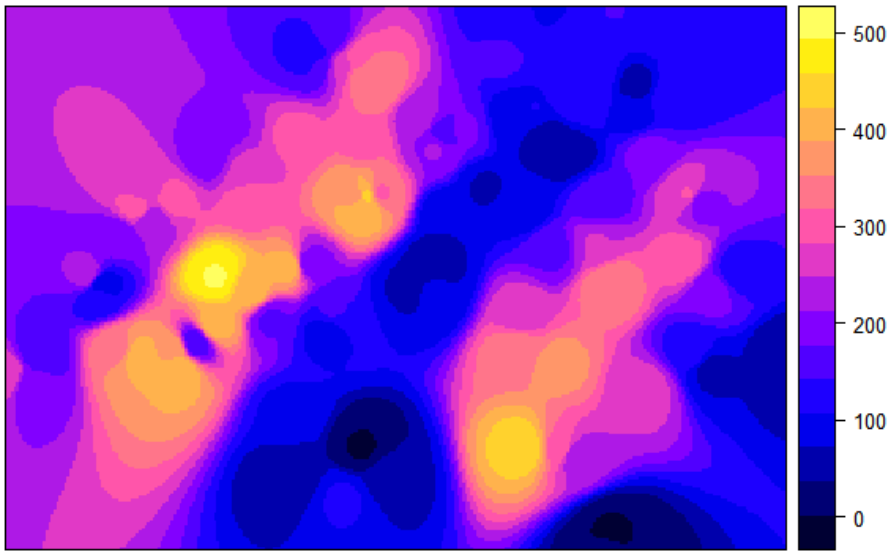


A. 1) Rainfall

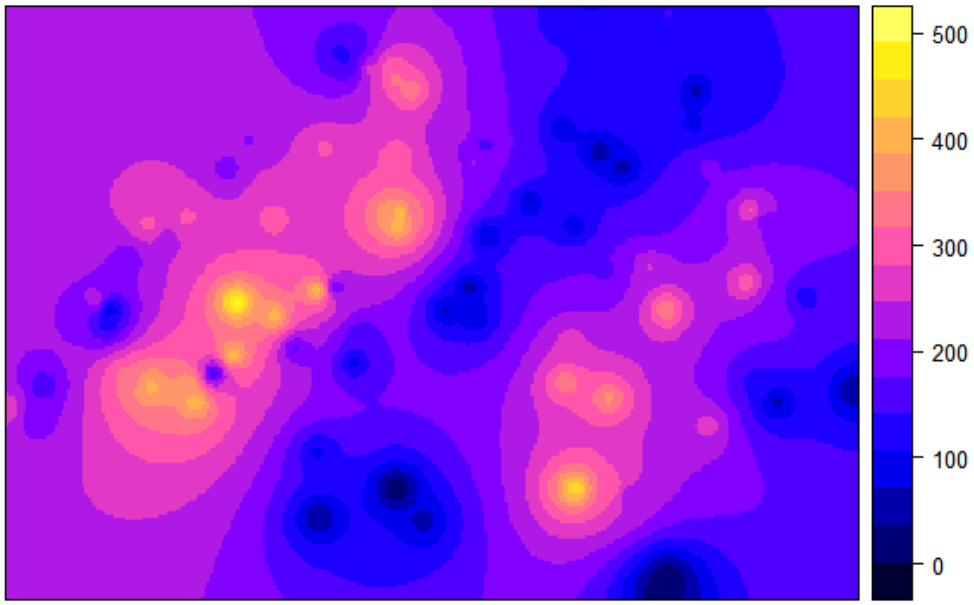
Power:10



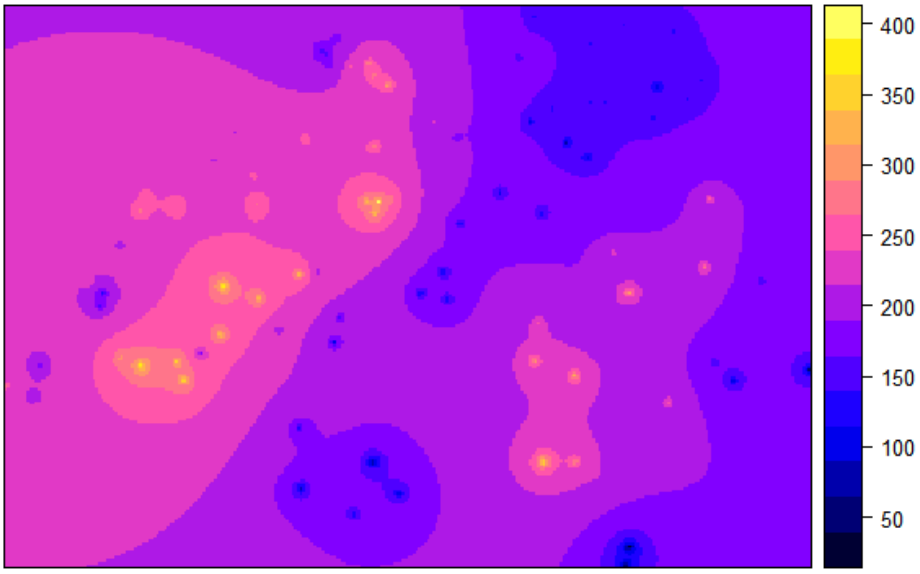
Power:5



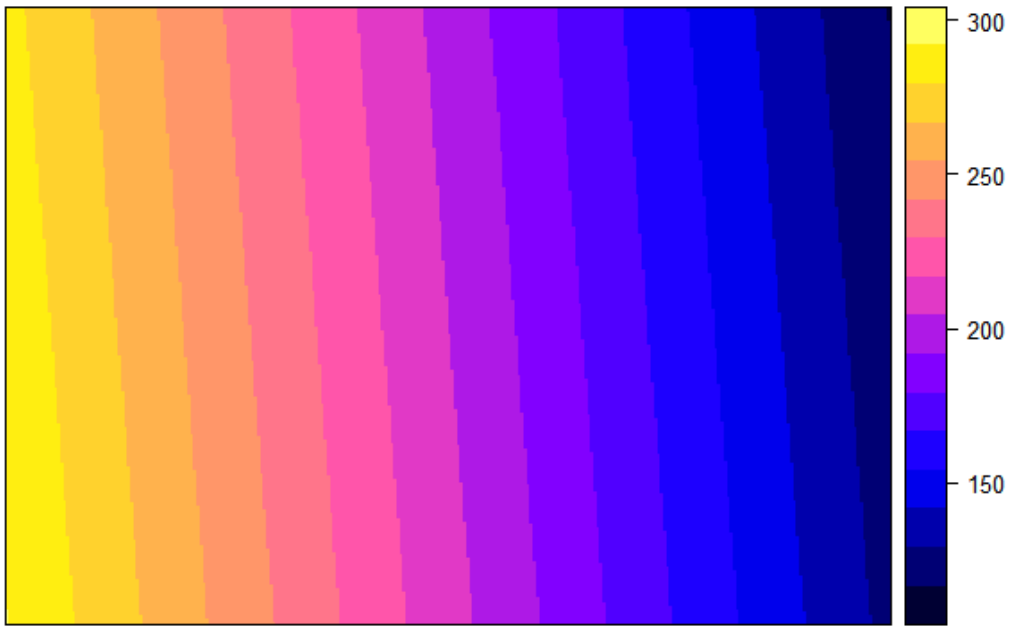
Power:2



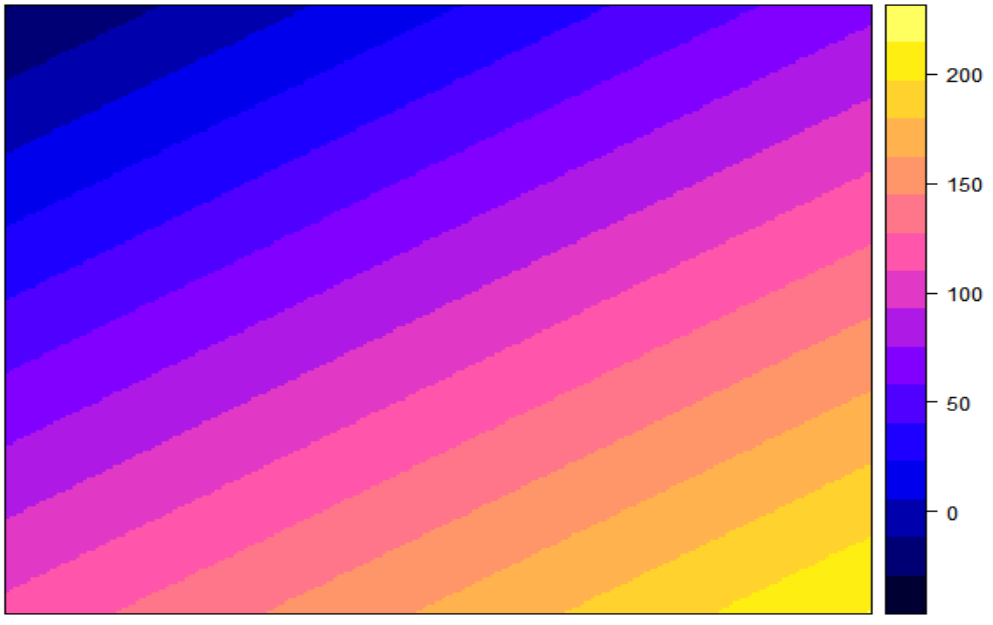
power:1



b) Rainfall



b) Lead(Pb)



c)

Trend surfaces interpolated surface rarely passes through the sample points and the trend surface is susceptible to outliers in the data. That is the reason it is used to find tendencies of the sample data, rather than to model a surface precisely.

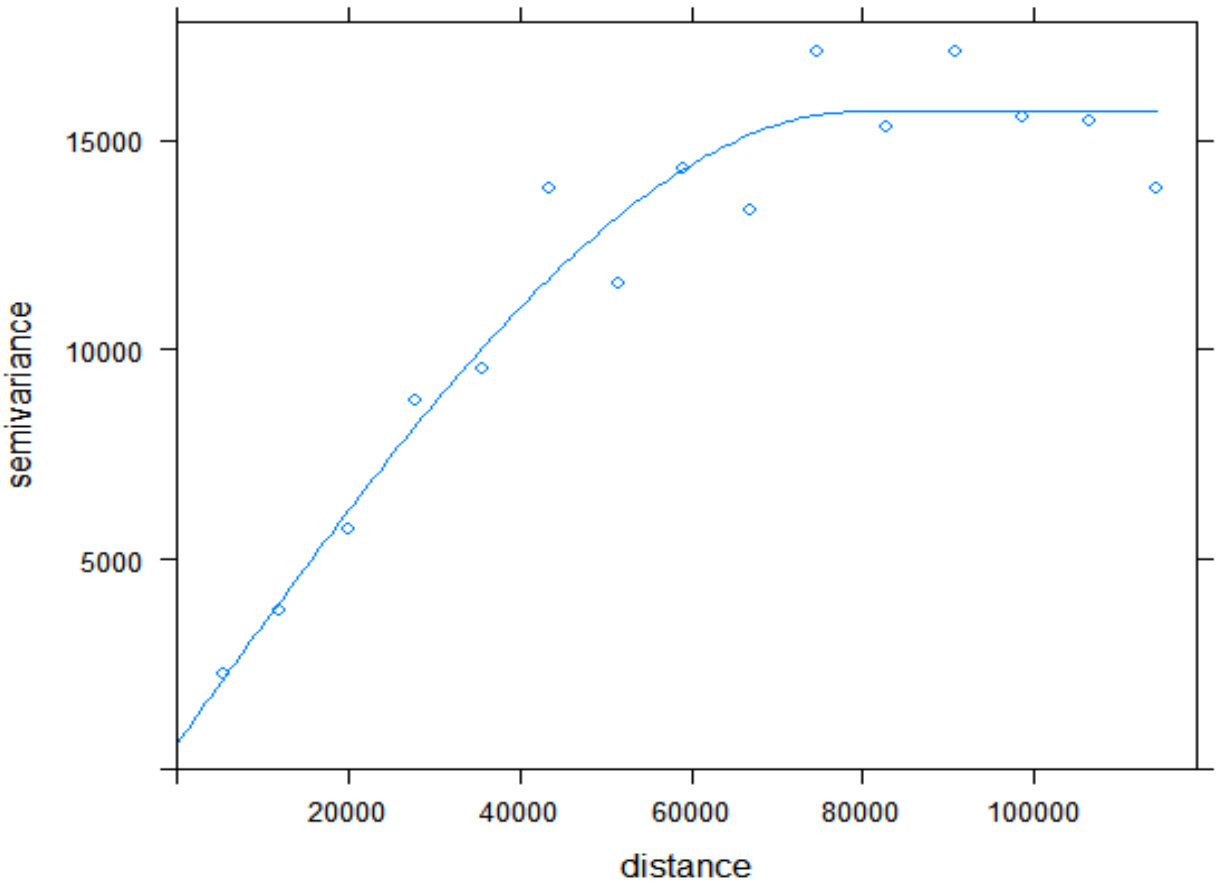
Whereas, IDW is an averaging process, all interpolated values are within the sample range.

So data should contain both upper bound and lower bound values and the samples should be more.

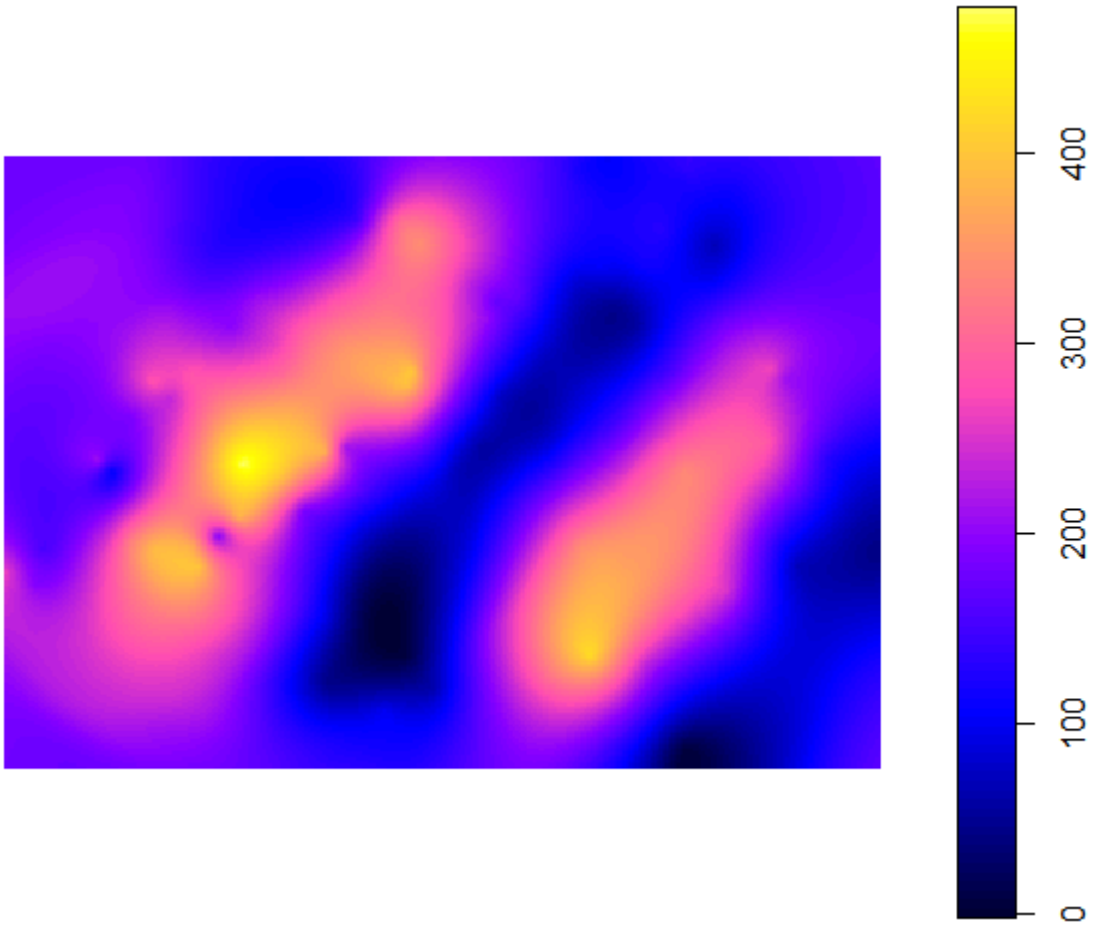
Q2)
(a) Kriging of rain data values to predict rainfall. Use a spherical model, exponential model and compare them. Show Sill, Nugget, and Range.
(b) Use the soil lead samples (Pbcon.txt) for Kriging. Use Spherical model, Exponential model, and Gaussian model. Show Sill, Nugget, and Range.
(c) Show the interpolated surface generated by Kriging.
(d) How do you validate the results of the above two (a, b) **(Bonus marks)**

Ans: Rain data

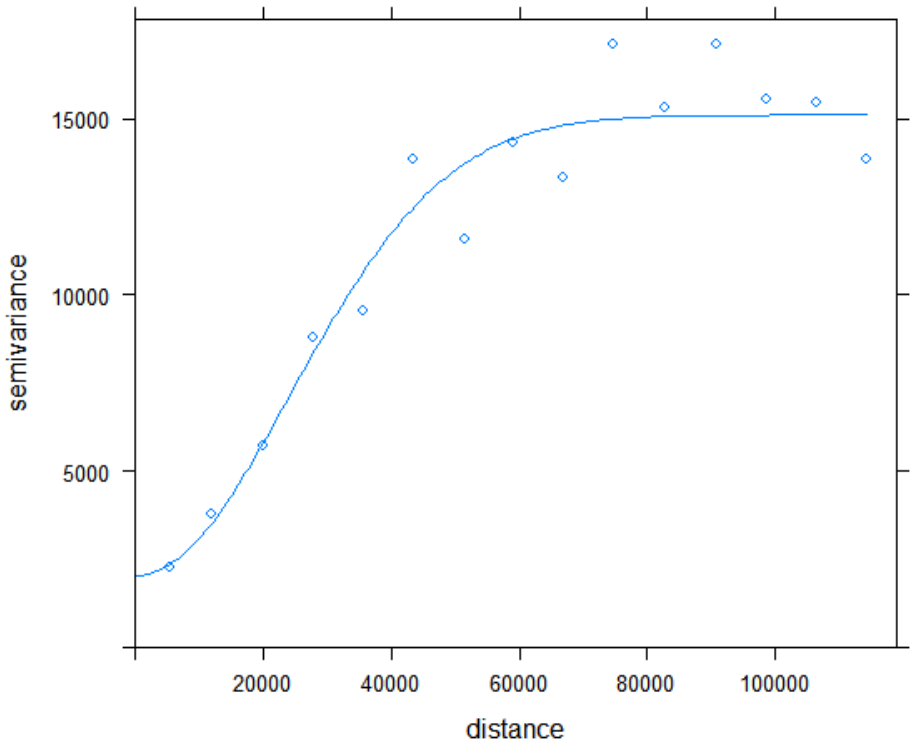
a) And c) Spherical model



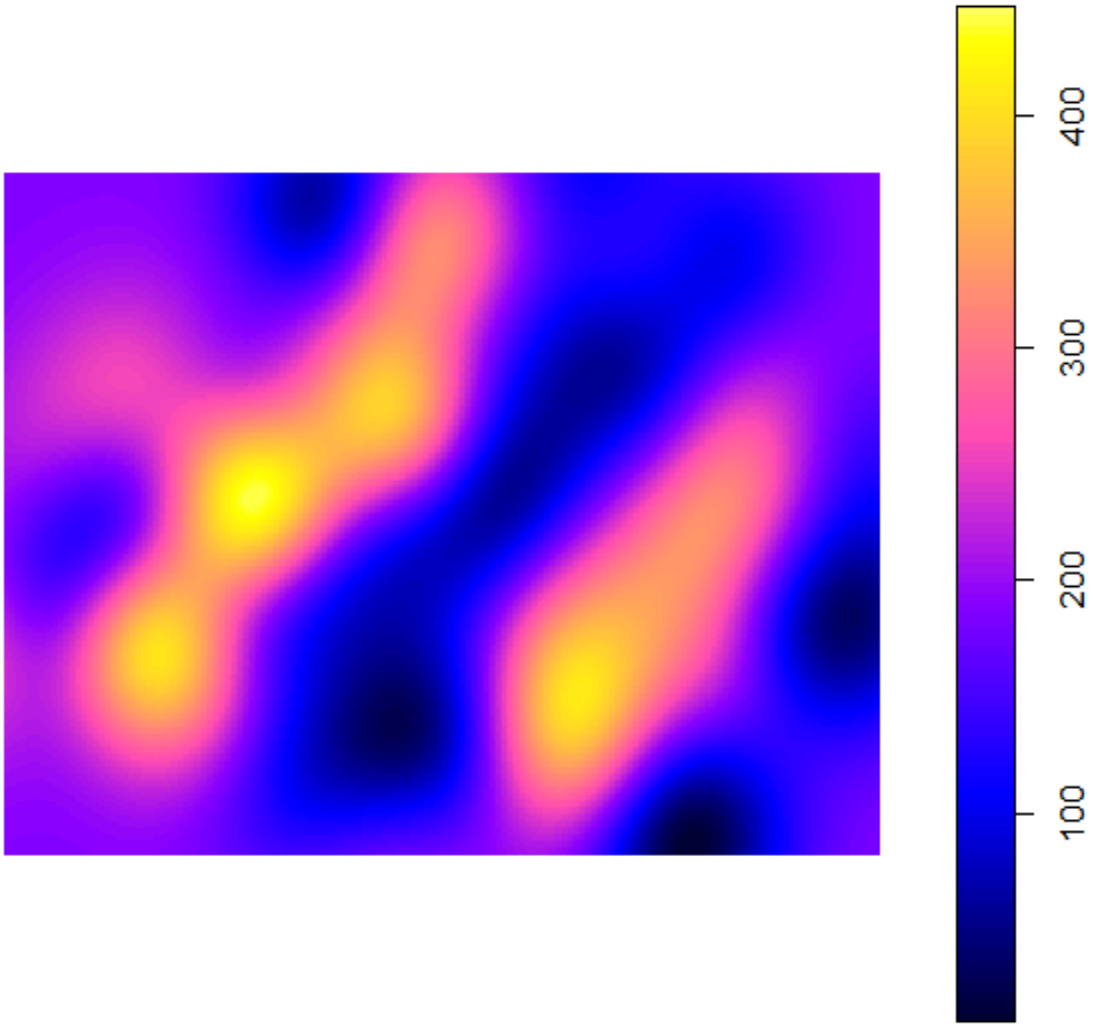

```
> fit.variog$psill[2] # sill
[1] 15074.43
> fit.variog$range[2] # range
[1] 79676.52
> fit.variog$psill[1] # nugget
[1] 604.7394
```



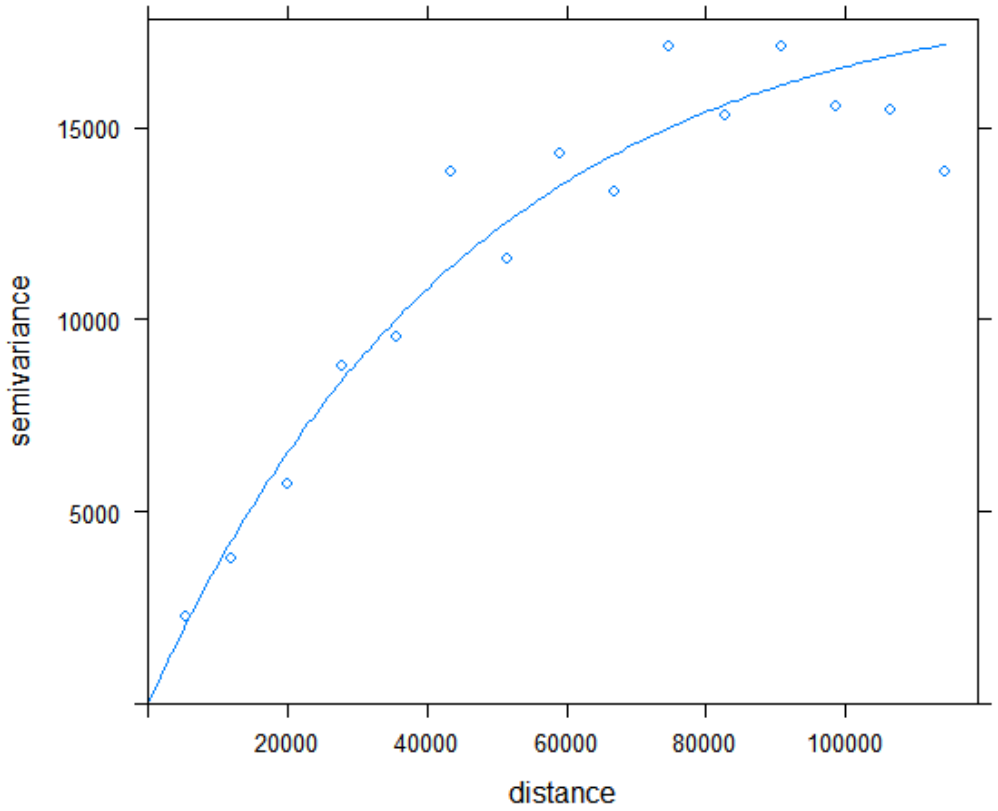
Gaussian model



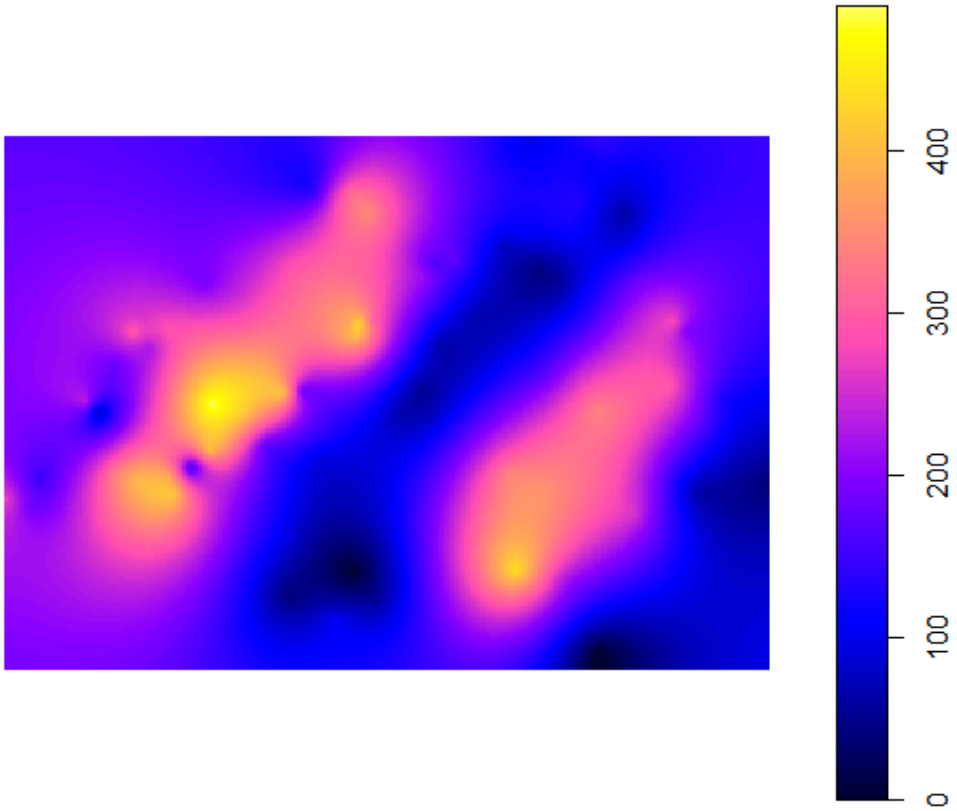
```
> fit.variog$psill[2] # sill
[1] 13075.2
> fit.variog$range[2] # range
[1] 34309.07
> fit.variog$psill[1] # nugget
[1] 2024.827
```



Exponential model

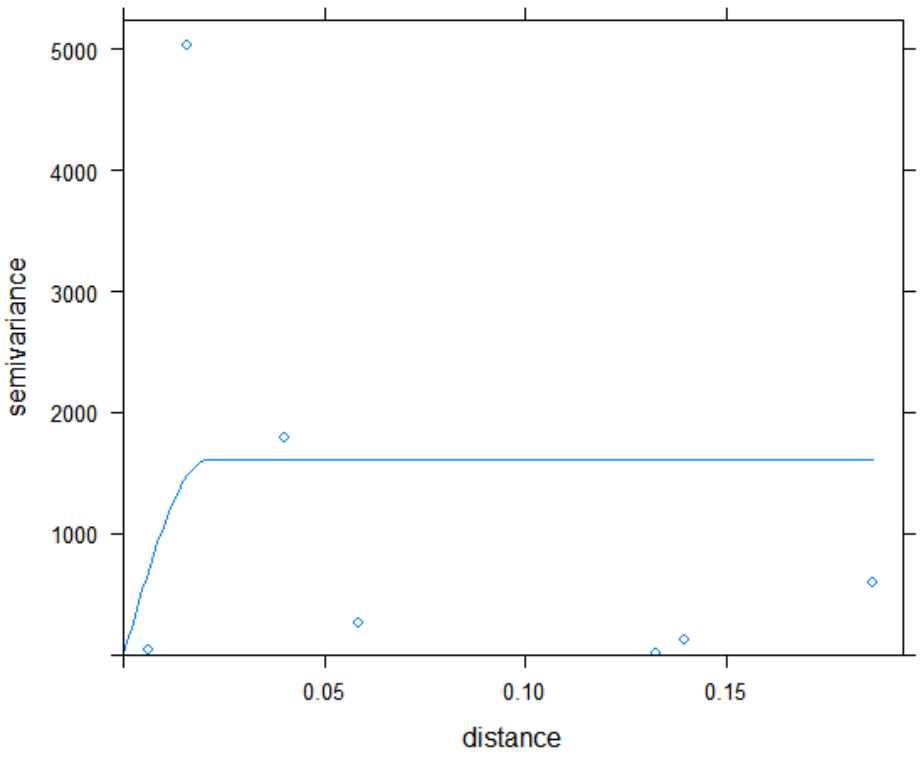



```
> fit.variog$psill[2] # sill
[1] 18792.71
> fit.variog$range[2] # range
[1] 46767.63
> fit.variog$psill[1] # nugget
[1] 0
```

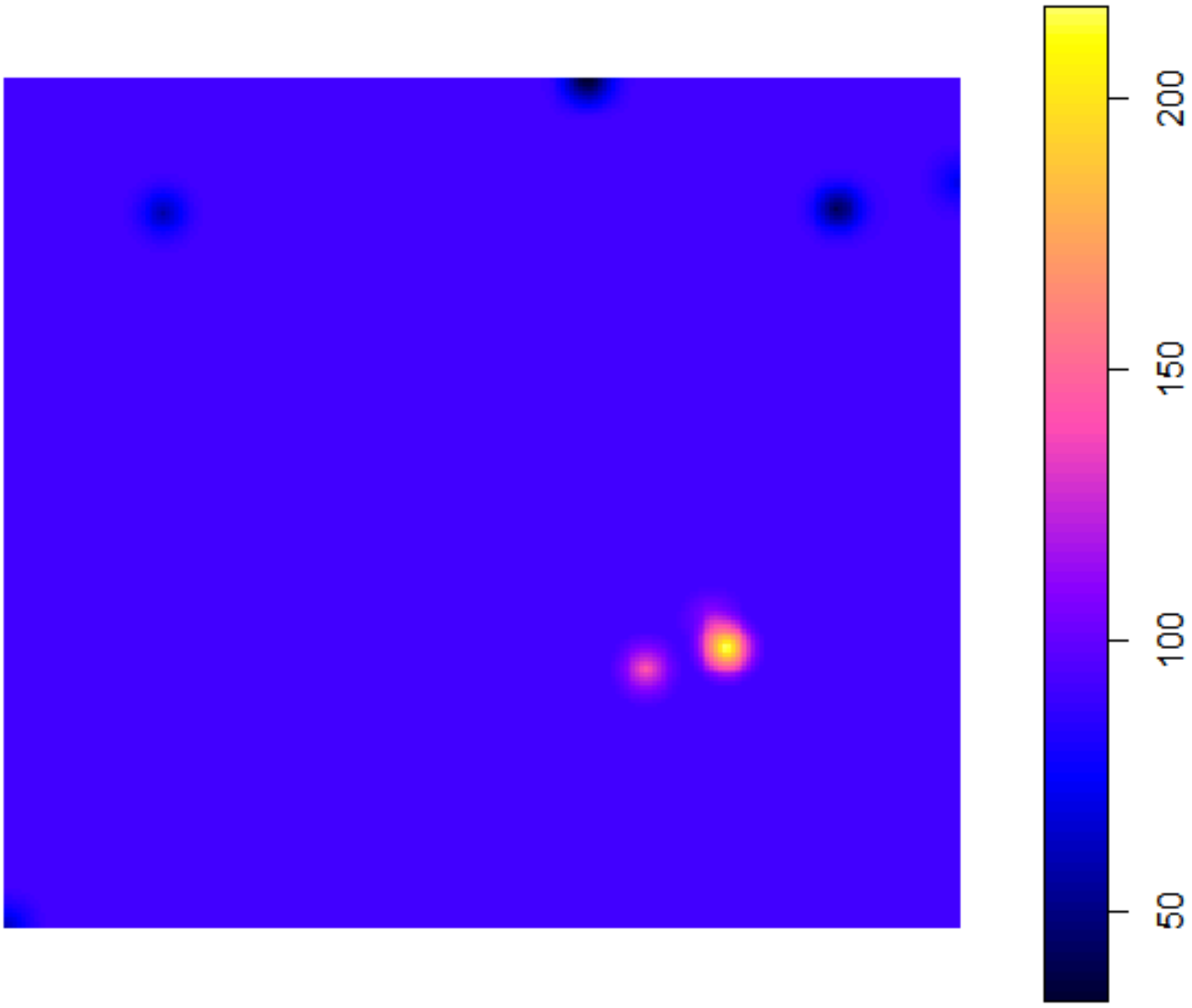


B) Soil lead samples:

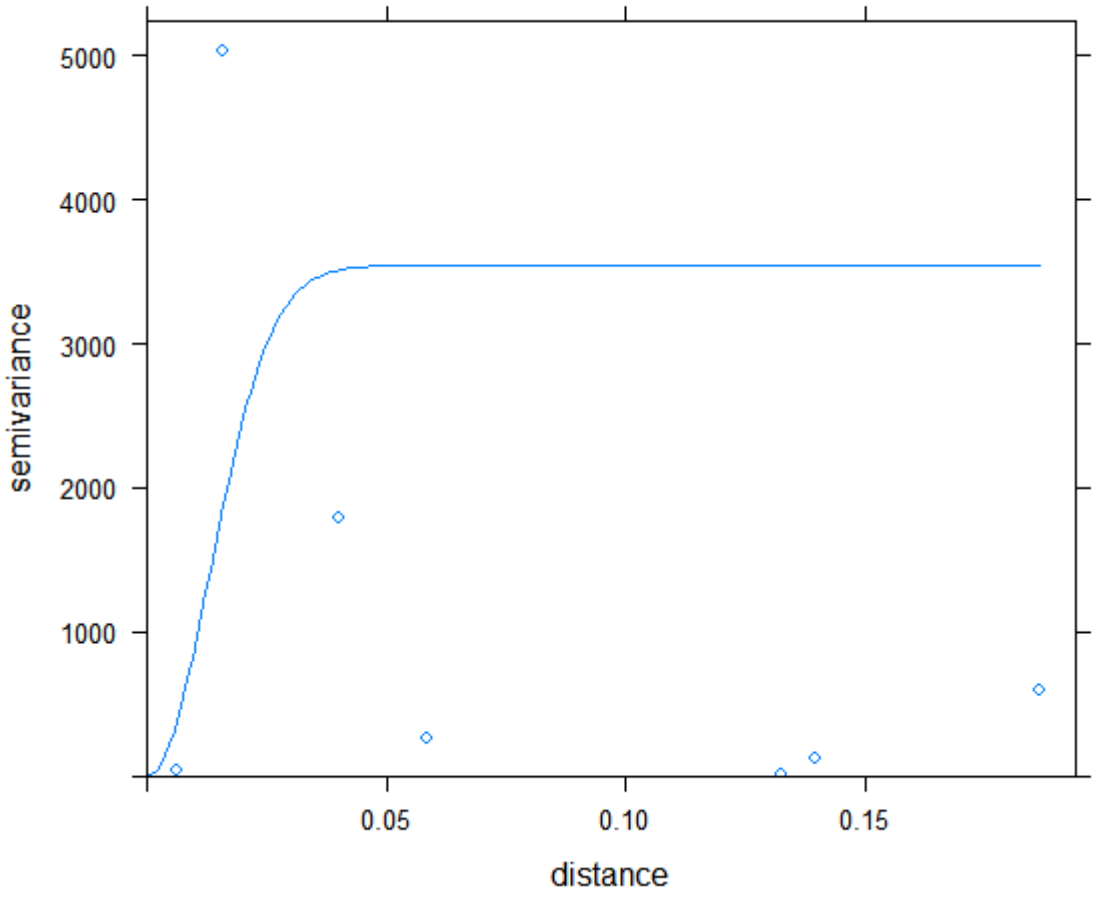
Spherical model



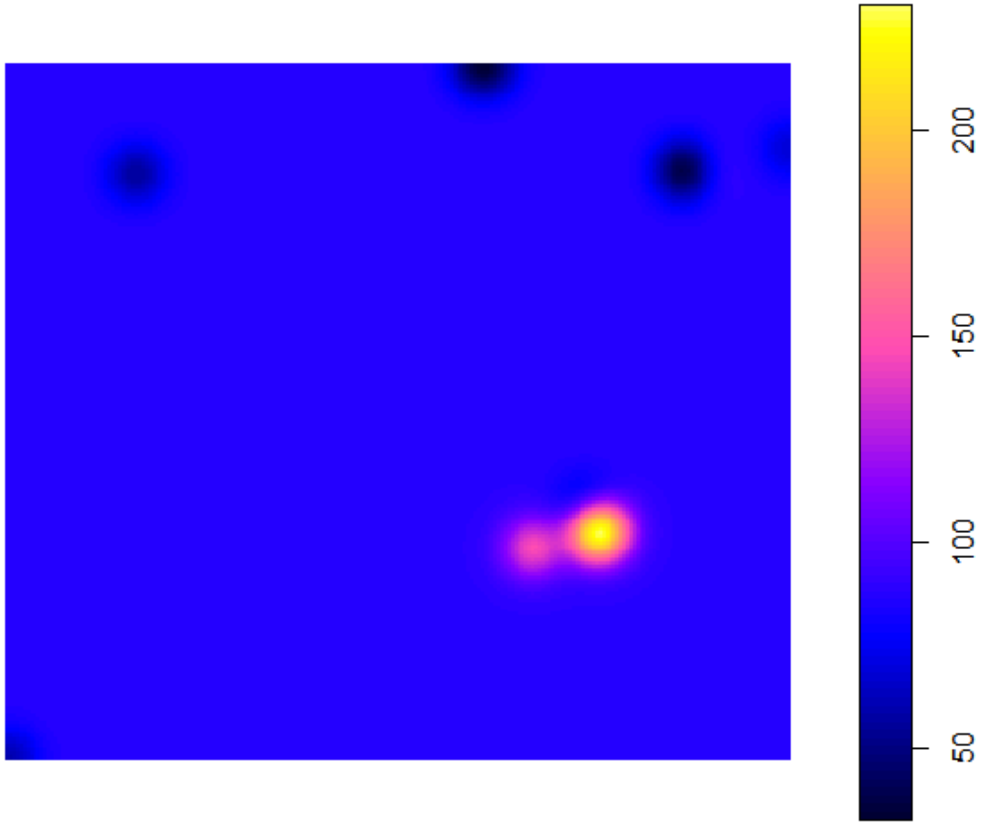
```
> fit.variog$psill[2] # sill
[1] NA
> fit.variog$range[2] # range
[1] NA
> fit.variog$psill[1] # nugget
[1] 1608.511
```



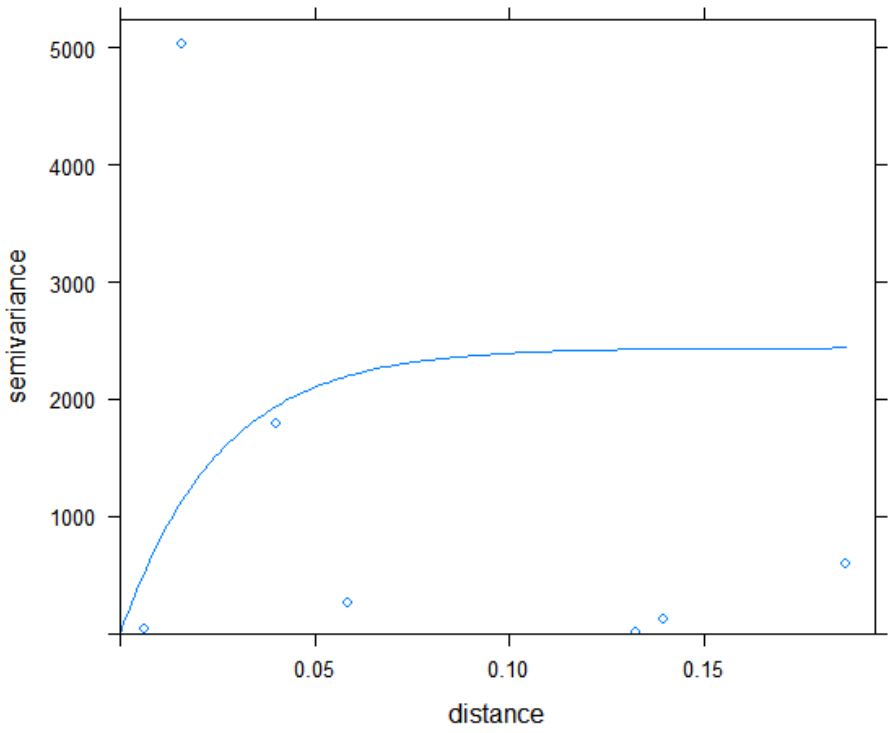
Gaussian Model



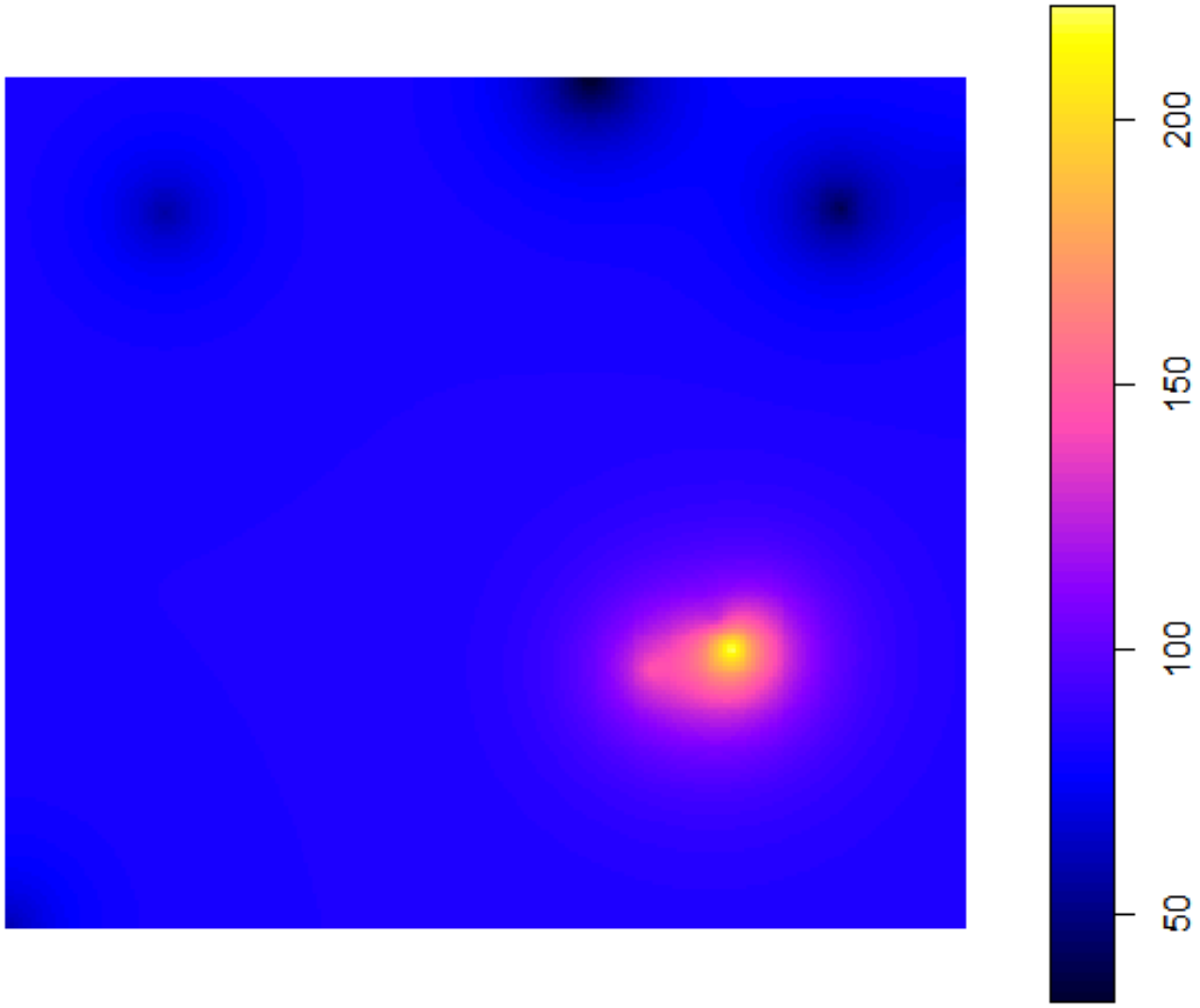

```
> fit.variog$psill[2] # sill
[1] NA
> fit.variog$range[2] # range
[1] NA
> fit.variog$psill[1] # nugget
[1] 3541.772
```



Exponential model



```
> fit.variog$psill[2] # sill
[1] NA
> fit.variog$range[2] # range
[1] NA
> fit.variog$psill[1] # nugget
[1] 2439.699
```



D)

To validate we can use: **krige.cv**

Cross validation functions for simple, ordinary or universal point (co)kriging, kriging in a local neighbourhood.

Example:

```
> #Validation of the Krige results by of Rainfall for Sphere model
> summary(krige.cv(z~1, spat.samp, spat.grid, model=fit.variog))
|==========================================================================|
 100%
var1.pred        var1.var        observed        residual
Min.   : 25.3   Min.   : 1567   Min.   :  0.0   Min.   :-239.8189
1st Qu.:117.7   1st Qu.: 3434   1st Qu.:114.5   1st Qu.: -28.8499
Median :178.1   Median : 4088   Median :172.5   Median :  -5.0064
Mean   :198.5   Mean   : 4287   Mean   :198.6   Mean   :   0.1143
3rd Qu.:278.5   3rd Qu.: 5262   3rd Qu.:291.5   3rd Qu.:  27.6223
Max.   :408.2   Max.   :11132   Max.   :493.0   Max.   : 164.1847
zscore               fold              x                 y
Min.   :-4.113902   Min.   :  1.00   Min.   :-158368   Min.   :-107871
1st Qu.:-0.420169   1st Qu.: 25.75   1st Qu.: -54019   1st Qu.: -27913
Median :-0.095826   Median : 50.50   Median :  -1632   Median :  19724
Mean   :-0.000203   Mean   : 50.50   Mean   :  -4867   Mean   :  12309
3rd Qu.: 0.436459   3rd Qu.: 75.25   3rd Qu.:  55945   3rd Qu.:  53469
Max.   : 2.466853   Max.   :100.00   Max.   : 132684   Max.   :  95408
```