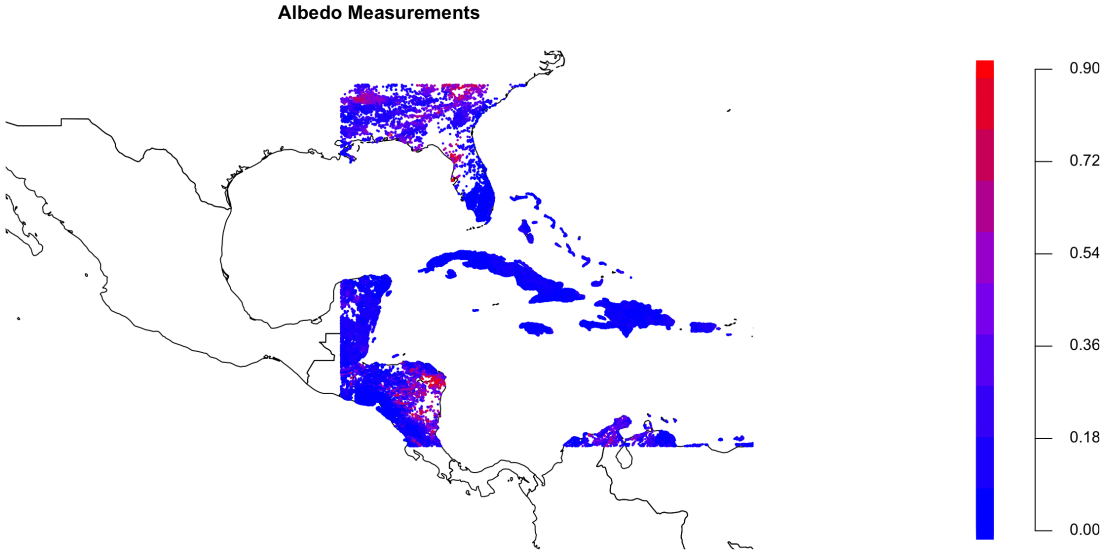
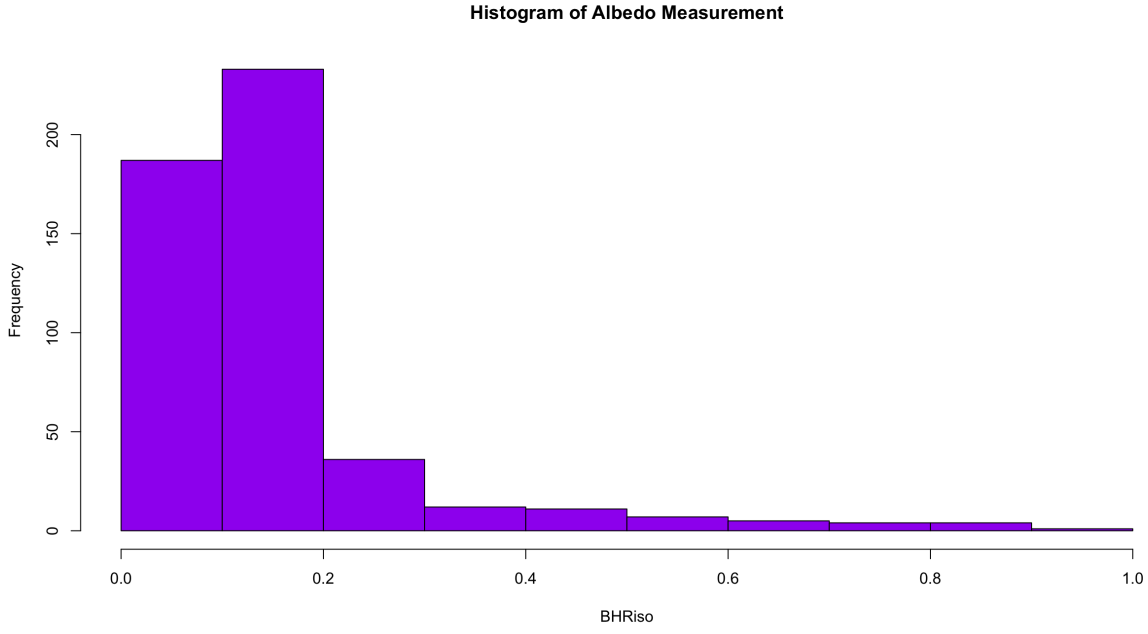
Graphical Exploration

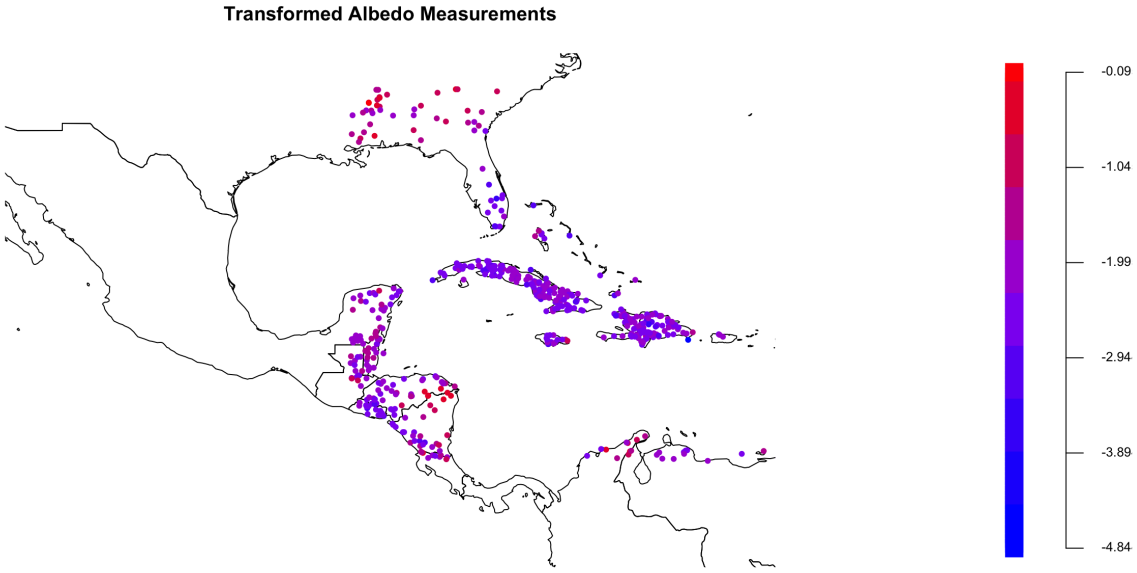
Below is a plot of albedo from the GOES75 satellite over a region in North America as well a the distribution of over 65,000 albedo measurements. We can see from both plots that the distribution is very right skewed. We randomly selected 500 points and considered a log transformation of the albedo variable.

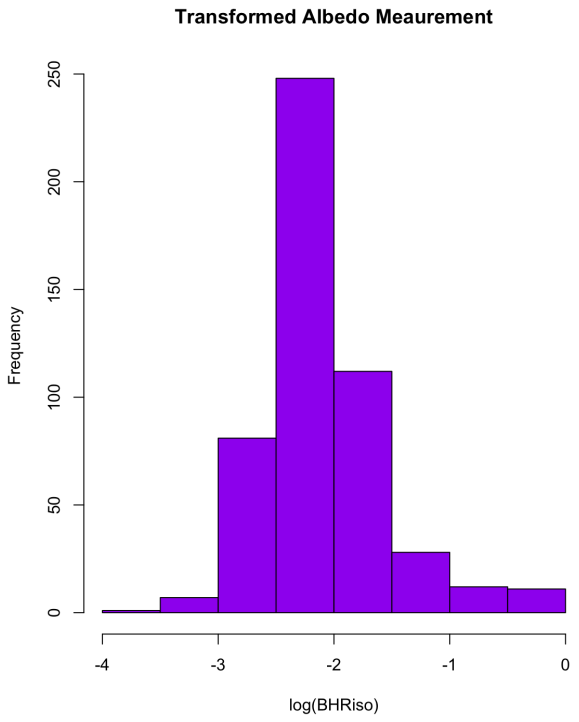


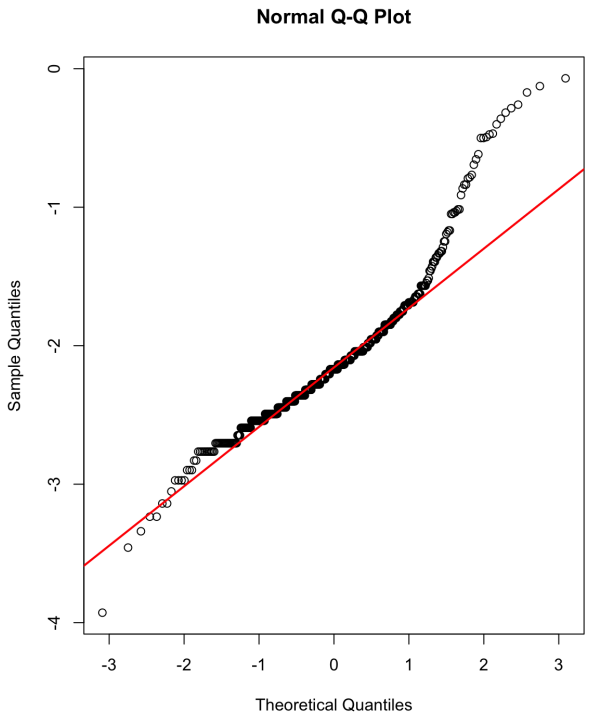


Homework 3

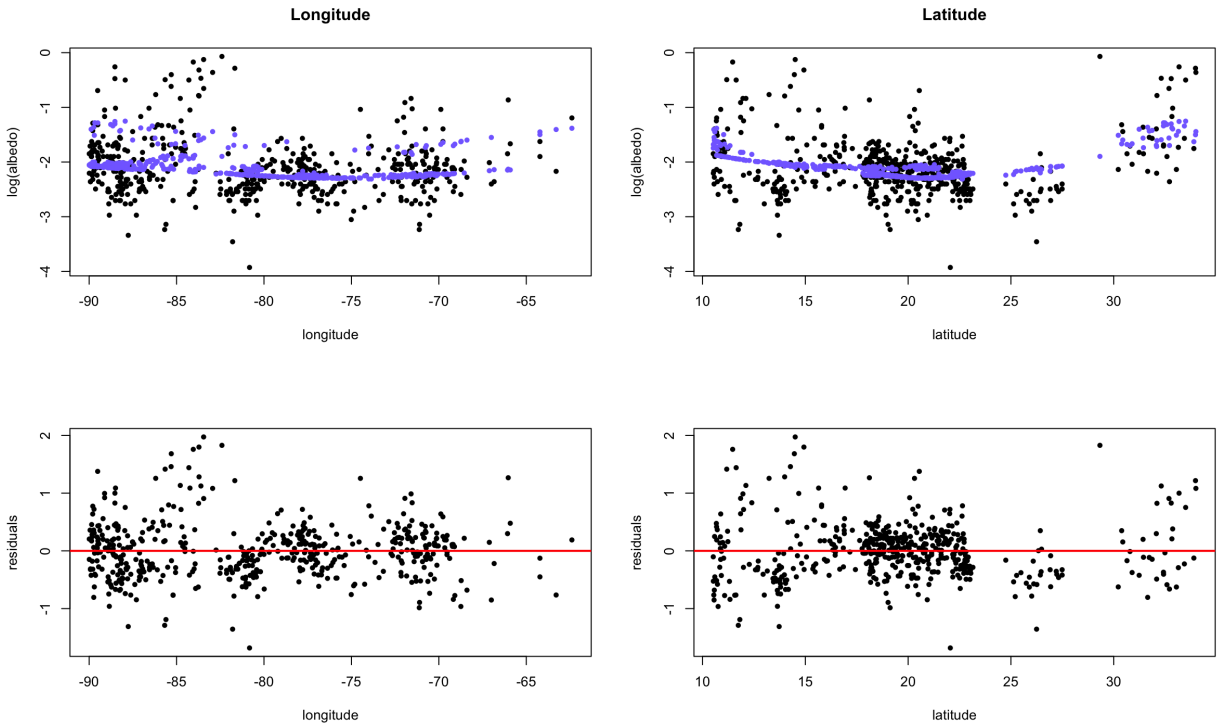
The map and distribution of the 500 log albedo points are shown below. Based on the histogram and the qqplot we can conclude that our transformation was sufficient in making the data closer to normality.







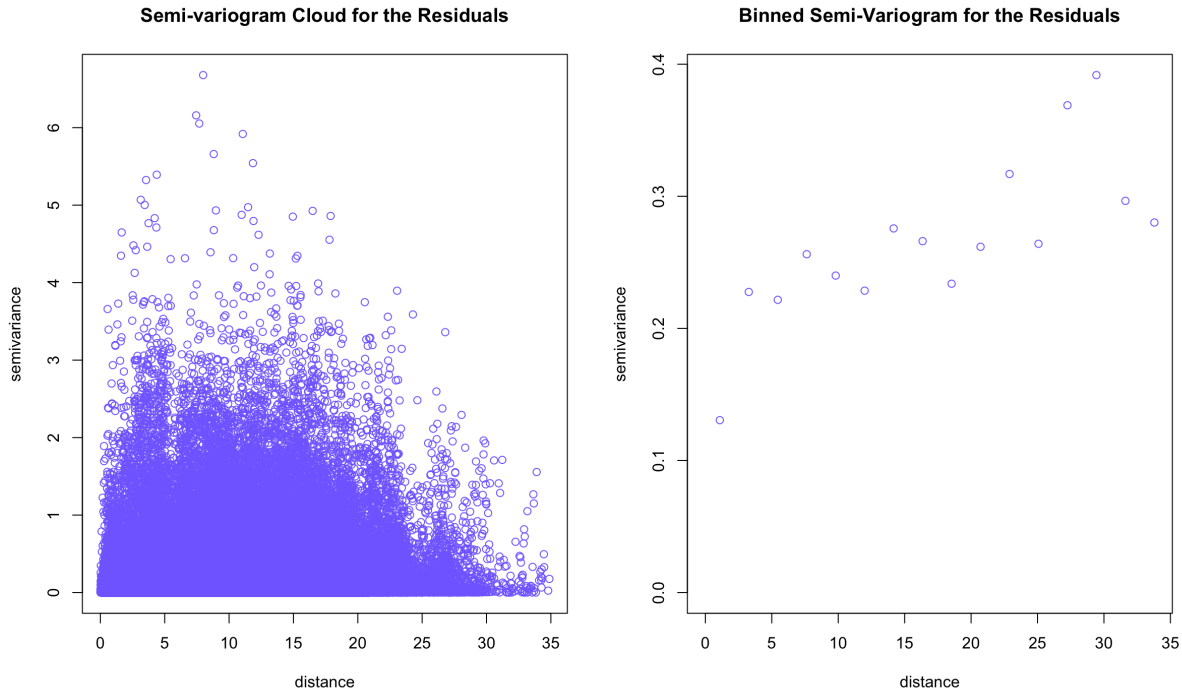
The plots below explore possible trends in the data. We have log albedo plotted against both latitude and longitude and we can see there is some evidence of a first or second order trend. We fit a quadratic regression model to the data and chose covariates based on AIC values. Both latitude and longitude were significant in predicting albedo levels and there was evidence of interaction between the two covariates. We plotted the data against the predicted values for the two directions as well as the residuals. We can see that the model follows the trend of the data and the residuals are detrended.

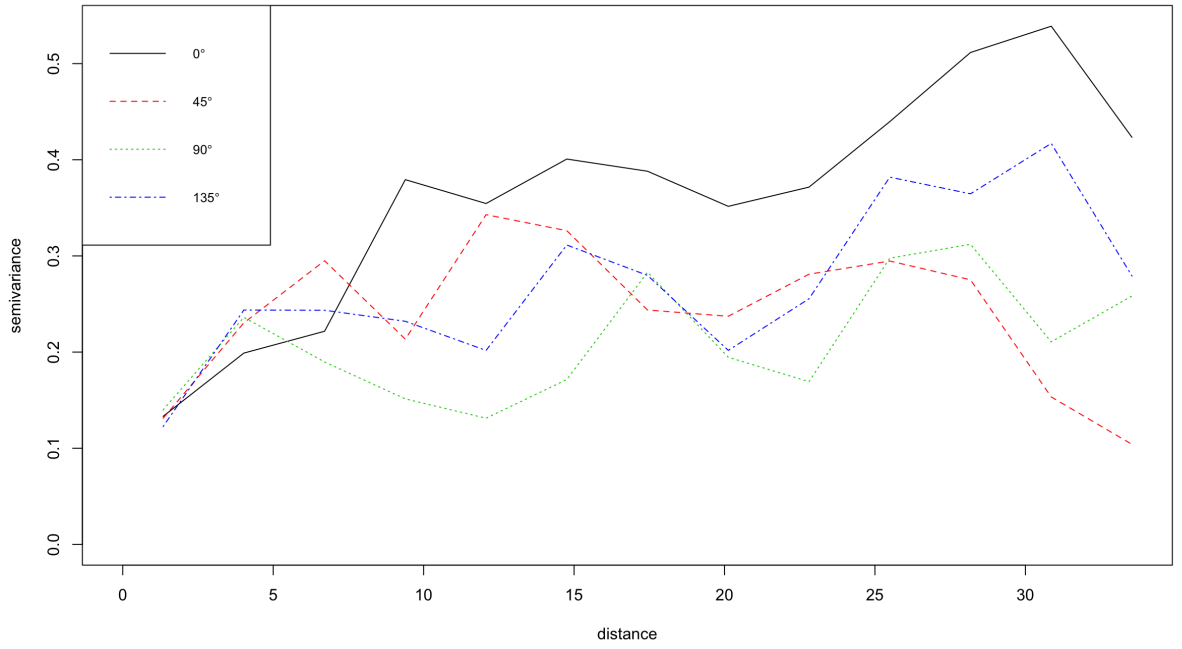


Variograms

We obtained the residuals after fitting the trend function and plotted the binned variogram and directional variogram below.

Homework 3

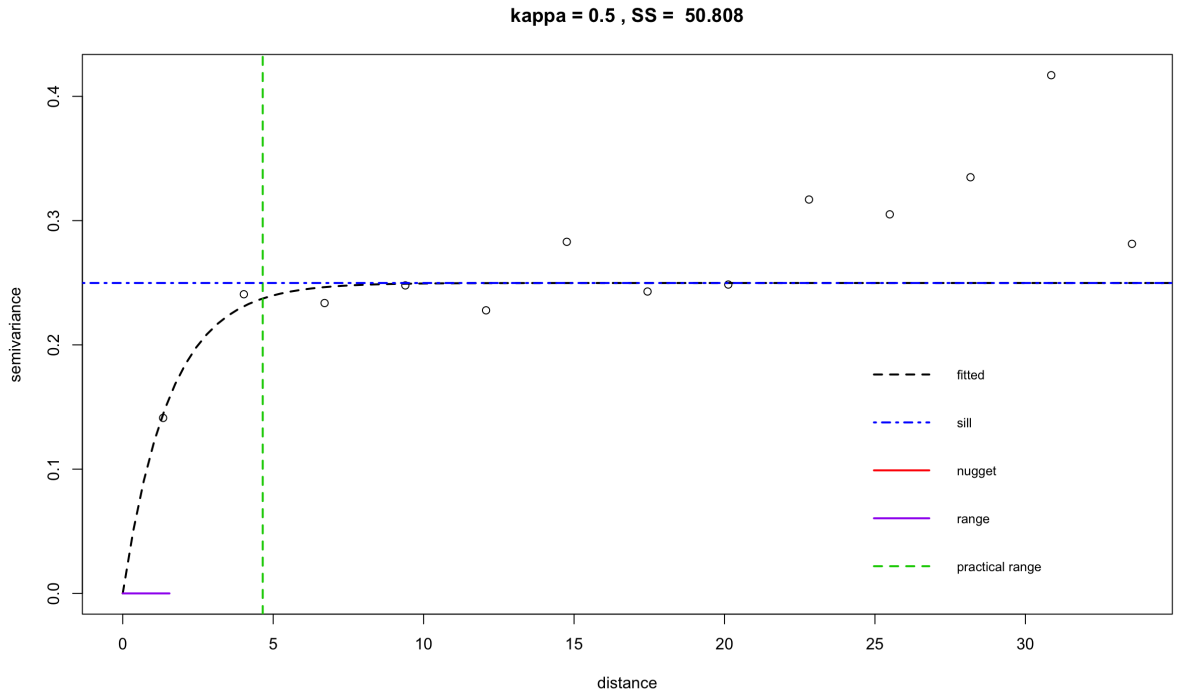


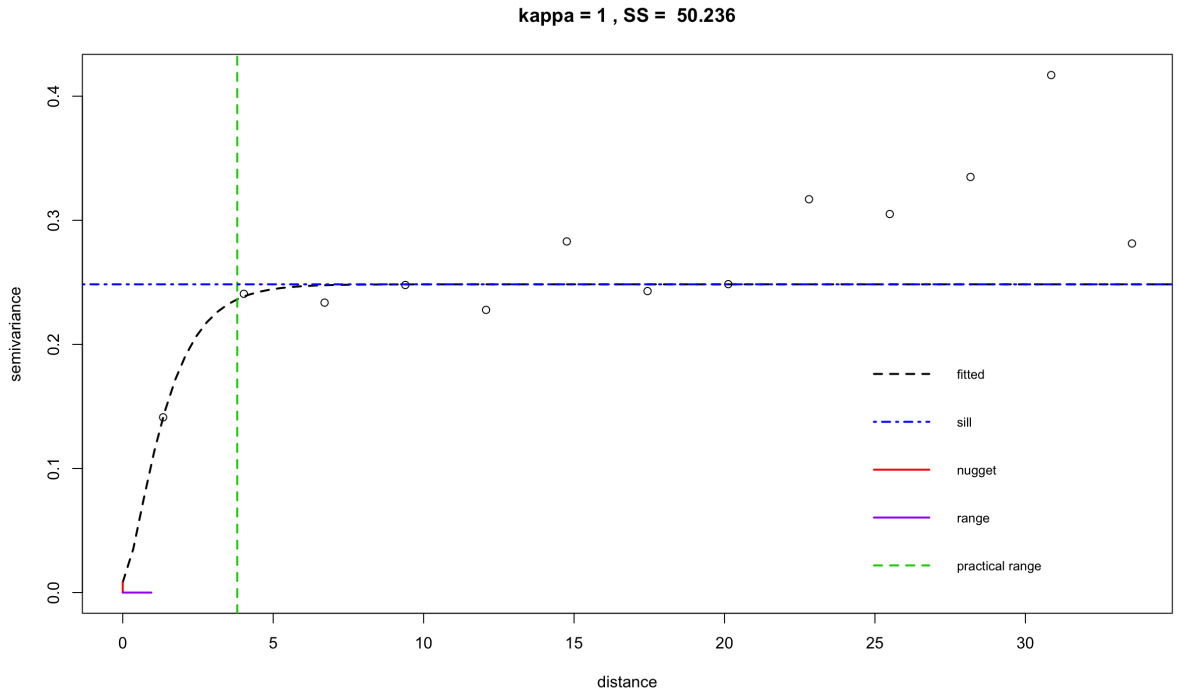


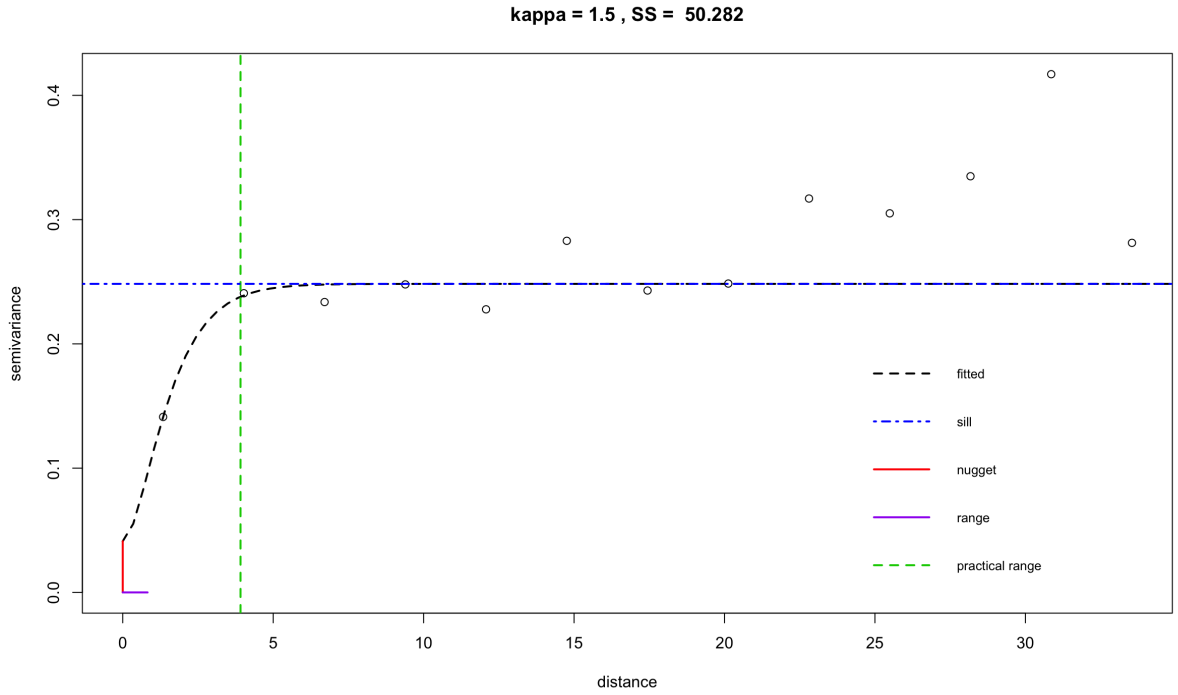
From the directional variogram we see no sufficient evidence of possible anisotropies.

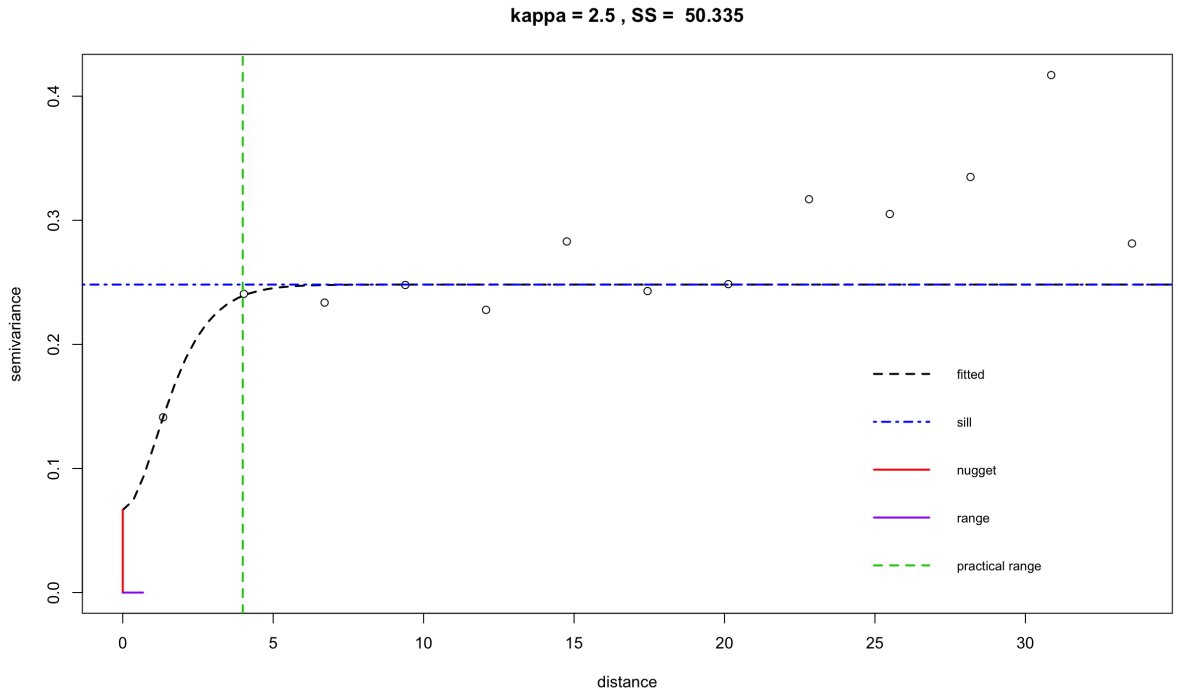
Matèrn Covariograms

We use least squares to fit the covariograms in the Matèrn family with smoothness equal to .5, 1, 1.5, and 2.5. The results are below. The best fit is the second model with $\kappa = 1$ and parameter estimates $\hat{\phi} = 0.9517$, $\hat{\tau^2} = 0.0083$, and $\hat{\sigma^2} = 0.2401$.



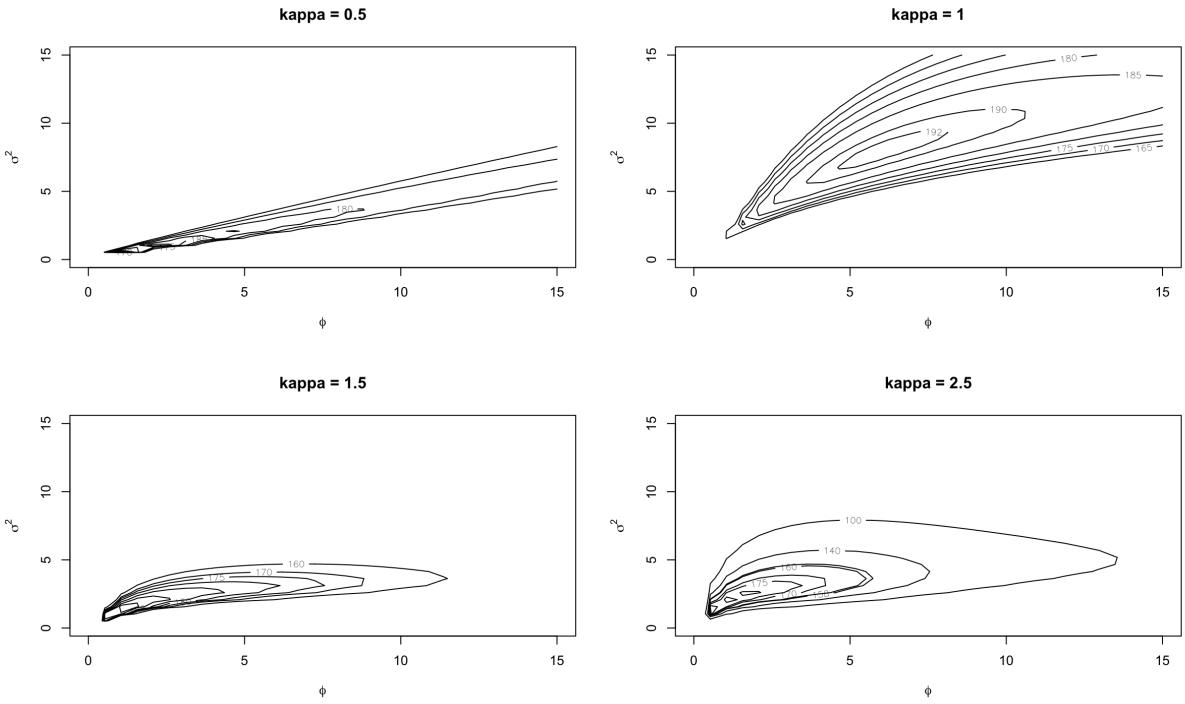

kappa = 1 , SS = 50.236
semivariance
distance
0.0
0.1
0.2
0.3
0.4
0
5
10
15
20
25
30
fitted
sill
nugget
range
practical range


kappa = 1.5 , SS = 50.282
semivariance
distance
0.0
0.1
0.2
0.3
0.4
0
5
10
15
20
25
30
fitted
sill
nugget
range
practical range



Likelihood ϕ, σ^2

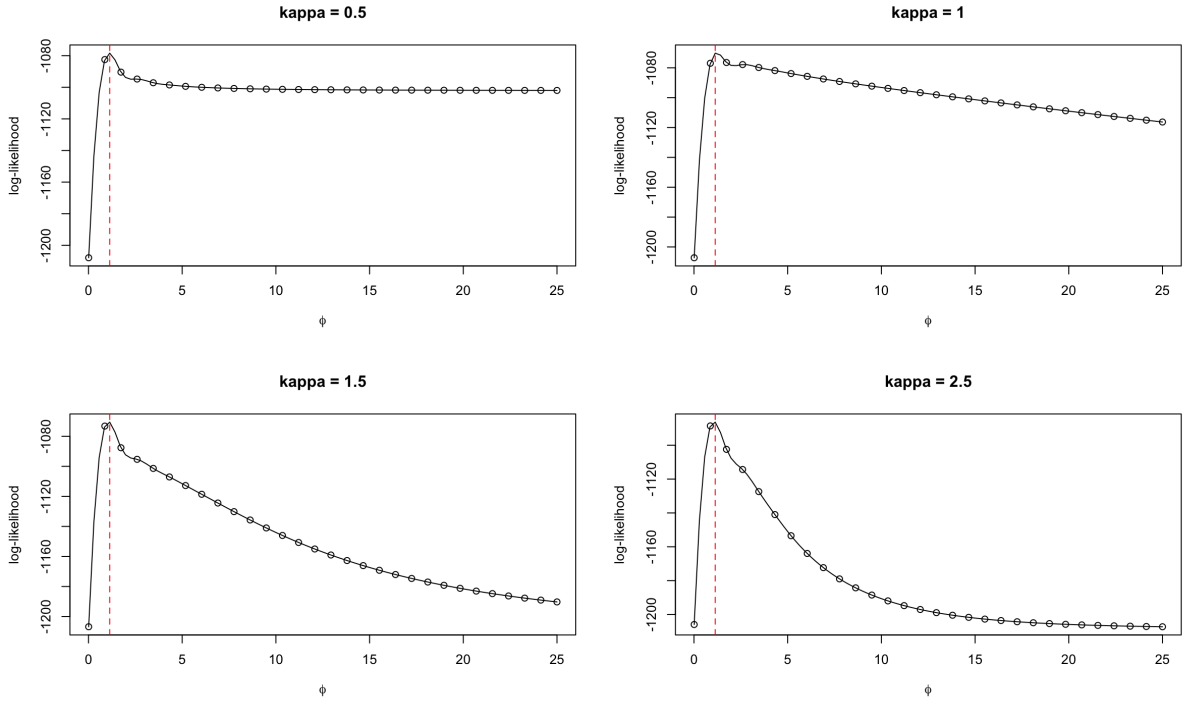
Below are the likelihood functions for the sill (σ^2) and range (ϕ) for each of the smoothness values from above. We used a nugget from each of the best fit Matèrn covariograms.



We can see that the MLE values are similar to those form the LSE method.

Marginal Likelihood ϕ

Below we have the marginal likelihood for the range parameter for each of the examples above.



Again we can see that the MLE values are similar to those in the LSE approach.