Week 1

- Broad goal: Fix code.
  - ☑ Use less filtered dataset
    - Now at 30% with 39 taxa.
  - ☑ Make graphs of parameter values at each iteration
    - Did a lot of graphs, histograms and changes of betas between loops. Need to do final after changes are made.
  - ☑ Try stepwise update
    - Using .1 as a constant. Still doesnt work, so likely a more complicated approach would not be helpful.
  - ☑ Fix problem where R inverse and others not updating in beta loop
  - ☑ Change R-inv function to depend on alpha instead of X and beta since already calculated.
  - ☑ Flip order of beta and phi loops.
  - ☑ Look at residuals in each iteration. (in phi step)
  - ☐ Keep something constant through loop and/or try using identity for R.
  - ☑ Try different dataset? Maybe simulated one from previous paper.
    - Same troubles
  - ☐ Distance matrix argument to dist?
  - ☐ Check if phi is correct now, and see how is used
  - ☐ Figure out large alpha problem
  - ☐ Try a different covariate?
  - ☐ Figure out why geem code uses + instead of - on update
    - I think + is correct. At least it converges.
  - ☐ Identify which covariate is causing the trouble.
  - ☐ Try removing the single OTU that seems to be contributing to problem.
  - ☐
  - ☐ Write up algorithm for Yuan to go through? Ask to check.
  - ☐ Final run through before meeting of graphs and numbers

Data filtering

Only use day 32.

Prevalence threshold. Only include taxa with more than 1 read in at least 30% of samples. This results in 39 taxa and 68 samples. The percent of the data is 46.3.

Then calculate absolute abundance.

The current covariate being used is

Current code decisions

- X is just the normal dataframe, so work needs to be done for each β_j. Should save on space and computation time.
- Currently beta loop has 1 iteration.
- Update is beta.new = beta.old - .1update
- V inv is phi A -1/2 r inv A -1/2

Trying to locate code error

- Maybe revisit
- First loop: R inv Min. 1st Qu. Median Mean 3rd Qu. Max. -0.5101610 0.0000000 0.0000000 0.0000554 0.0000000 1.7355810
- Getting an error first go: (in update beta function)

```
  Error in h(simpleError(msg, call)) :
  error in evaluating the argument 'x' in selecting a method for function 'print': error in eva
In addition: Warning message:
In paste0("beta ", rep(ASV_id, each = q), " = ", beta.new) :
  restarting interrupted promise evaluation Havent seen before
```

FIXED. This was a problem with the ASV id argument having an old object.

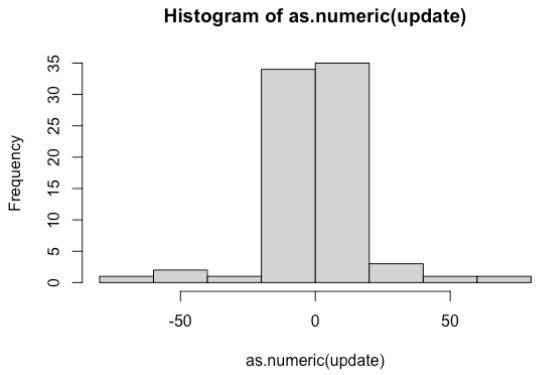


Figure 1: Histogram of update on first iteration

- Check to make sure update items match the beta items they are subtracting? Yes.
- Check to make sure update items match the beta items they are subtracting? Yes.
-
- Try with more iterations. 2nd iteration
- Third iteration. Seems to be diverging.
  It seems like the 'update' value isnt changing at all? Check this.
  So one problem is that it doesn't change within loops. Does it change after calculating phi and rho? Check.
  This is definetly some sort of problem.
  Current value for update

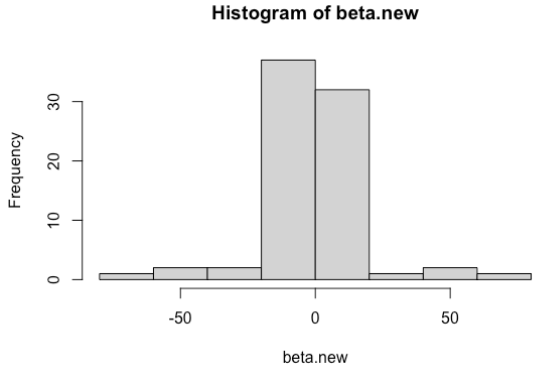


Figure 2: Histogram of first betas

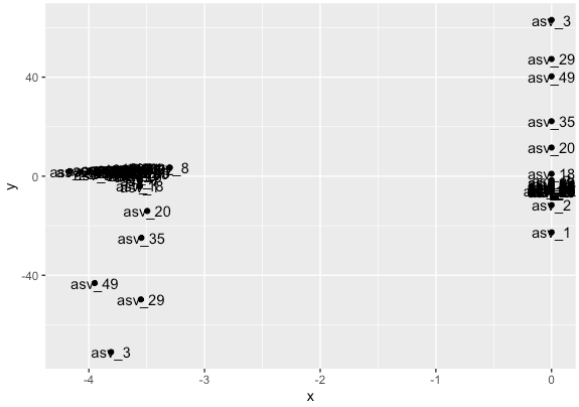


Figure 3:

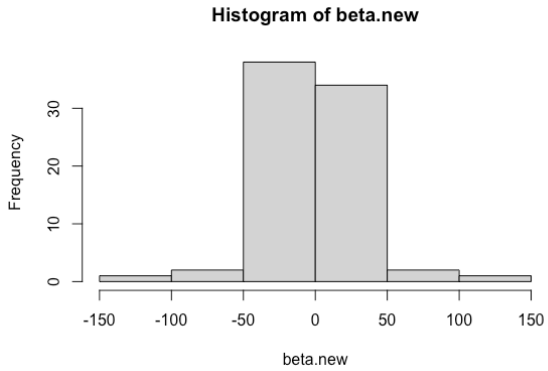


Figure 4:

```
  [1]  46.2016753 -47.3258792  -6.1901234  11.6566619  -4.7021419   3.6183032  -6.3952101
 [8]   6.3162696  -5.3106373   4.4185593  -6.6760288   5.7370180  -6.1907947   5.1419914
[15]  -6.6558117   5.5859662  -5.5437446   4.4394525  -6.7754318   5.6839888  21.3286876
[22] -22.2086941  -6.8085055   5.6762828  -5.1983832   4.4678220  -6.6312077   5.5477890
[29]  -3.3886343   2.5882506  -6.7459322   6.1195971  -4.4694171   3.4240657  -6.5218785
[36]   6.1263917  10.5371811 -11.5680454  -5.1779672   4.0250935  -6.2453704   5.1017399
[43]  -6.8097845   5.7015088  -6.1182510   4.9906303  -6.6345801   5.5203673  39.1947088
```

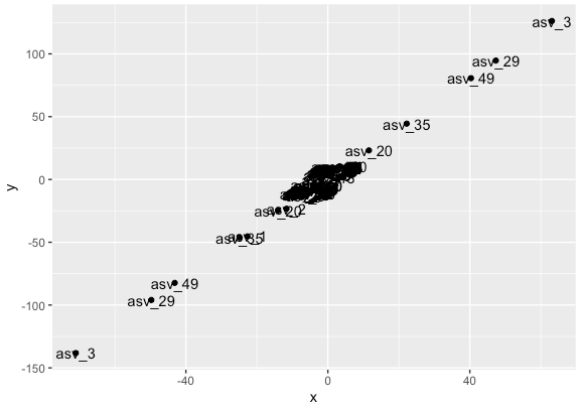


Figure 5: 2nd iteration

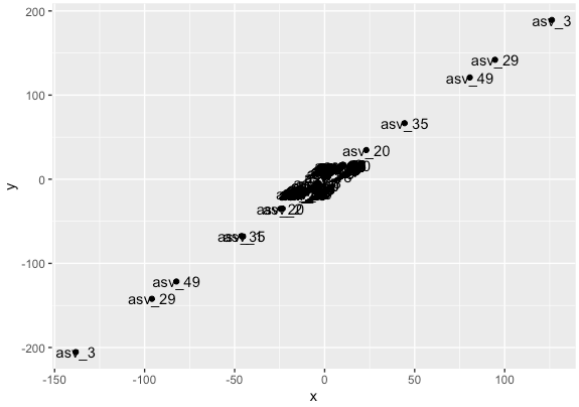
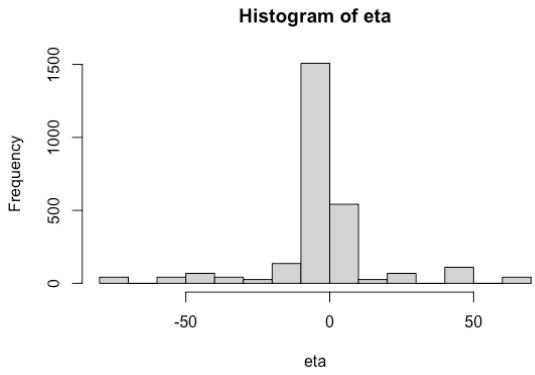


Figure 6: 3rd iteration

```
[50] -40.3184609   0.6062871  22.6626964  -3.7255341   2.6365179  -6.7033879   5.6927960
[57]  67.2184146 -63.0972211  -6.8193206   5.7064405  -4.9738631   3.8700908  -6.7519904
[64]   5.6536608  -4.7809281   3.7102062  -6.7036938   6.0152241   0.2275543  -0.9651037
[71]  -6.7608940   5.6802879  -5.8318696   4.7273785  -5.3378333   5.6281093  -1.7353577
[78]   1.6122465
```

- Now in Update phi r inv step



—

— `Browse[2]> summary(alpha)`

```
   Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
```

```
0.000e+00 0.000e+00 0.000e+00 7.977e+26 4.000e+00 5.037e+28
```

This is already a huge problem, and looks to be from only one ASV.

(check if hessian and EEs are same?)

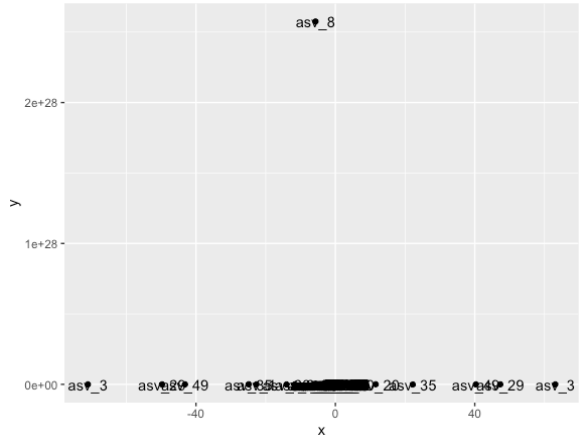
Again all the alphas are the same across samples. Why? Is this correct? Sort of. Since X is either 0 or 1.

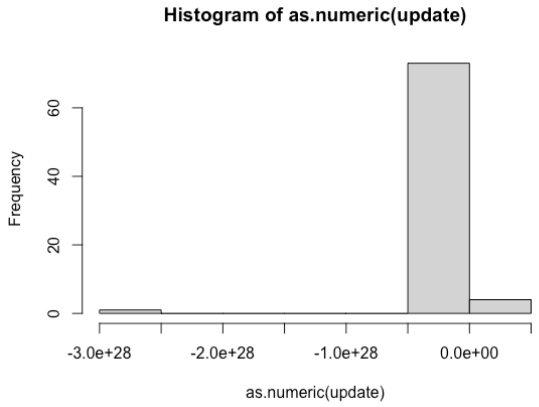
- Back to beta loop.

  Seems like a bug was found¿ get_eta step had beta, not beta.new. Try now.

  Still think like I will need to recalculate A.

  - 2nd iteration





  –

- On third loop, update is NaN. So is hessian. Probably because Vinv is now either 0 or NaN. Probably because of alpha. All partials are NaN.

  What is the cause of this? Is this because phi is just 1? should we loop back?

  Should do some checking about the partials.

  Should test the

  The gradient to find the direction towards zero of stepest decent which woudl be where zero would be? Confusion how this is the same as the estimating equations equaling zero.

  And also that the sum is equal to zero, vs the matrix form.

  Am i forgetting an X term??? in the hessian and GEE equations... ? No, this the X values are incorporated in the partials. But are they in both the partials AND the GEE equations? No. So GEE is correct?

  Is hessian a correct block matrix?

- Now try constant times update. Trying beta.new = beta.old - .1 update

  Somehow always gets a huge value? On like the second iteration. Range of beta values always goes up by a factor of 10 at least.

  First run through:

```
Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.01549 0.02411 0.02804 0.20715 0.03035 1.00000
```

  After only 1 beta iteration

```
  Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00002   0.02163   0.03603   1.85100   0.10781 113.58914
```

  After 2:

```
       Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
0.000e+00 0.000e+00 2.000e+01 1.439e+26 3.080e+03 9.087e+27
```

- test one more time if it should be +? No. even quicker huge. Actually is this correct? Geem code uses +. How is it different? Shoudl try again with loops.
- Try going back and forth. At least one loop of going back to phi and rho estimating. With only one beta iteration.
- R inv should change right? It does depend on rho and w, but it also depends on alpha. So it needs to change each iteration.

  Also change R inv function to depend on alpha and alpha0 instead of X and beta. Change R inv section of update phi R inv to call fxn.

  But this shouldnt be the problems, since we still get the problem when the beta loops just once.
- Try setting R -inv to be the identity matrix?
- Check that hessian and estimating equations are correct and solve is doing what we think it is.
- Code rearrranging. Move partials calculation to separate function. Update phi rho omega function no longer returns R inv since it is calculated in Beta step as needed depending on alpha values. DONE code runs. Still problem if multiple beta loops.
- Things seem correct except one or two ASVs.
- Going back to +. Try multiple beta loops (5) Then try (1) and back and forth with phi.
- Look at residuals. At begining very right skewed. doing resid * phi results in larger numbers as phi starts off as ¿ 1.
- Trying on simulated dataset from orig paper. 45 percent prevalence.

  Still problems. 2nd iteration already 10x9
- Try going back and forth now. One beta iteration

```
[1] "Iteration: 1"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.32868 -0.17361 -0.15113  0.07366 -0.03836 13.36048
[1] "phi = 0.939547462231508, omega  = 0.935468698041697 , rho = 3.17044241846978"
[1] "Beta iteration 1"
```

```
[1] "alpha"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.01549 0.02411 0.02804 0.20715 0.03035 1.00000
[1] "update"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-61.9698  -6.3523   0.3406   0.0000   5.5856  66.1109
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.1970 -4.2508 -1.8167 -1.8396  0.5397  2.8024
Called from: update_beta(Y = Y, X = X, beta = beta, R_inv = R_inv, phi = phi,
    n_iter = 1, n = n, p = p, q = q, ASV_id, rho, omega, D = distance_matrix)
Browse[1]> Q
> # model!
> source(here::here("R","dm_cor_gee_clean.R"))
> zebra_res <- dm_cor_gee(Y = dat$Y, X = group, sample_id = dat$sampleID,
+                     ASV_id = taxa_names(zebrafish_ps), distance_matrix = D)
[1] "Iteration: 1"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.32868 -0.17361 -0.15113  0.07366 -0.03836 13.36048
[1] "standardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.30881 -0.16312 -0.14199  0.06921 -0.03604 12.55280
[1] "phi = 0.939547462231508, omega  = 0.935468698041697 , rho = 3.17044241846978"
[1] "Beta iteration 1"
[1] "alpha"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.01549 0.02411 0.02804 0.20715 0.03035 1.00000
[1] "update"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-61.9698  -6.3523   0.3406   0.0000   5.5856  66.1109
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.1970 -4.2508 -1.8167 -1.8396  0.5397  2.8024
Called from: update_beta(Y = Y, X = X, beta = beta, R_inv = R_inv, phi = phi,
    n_iter = 1, n = n, p = p, q = q, ASV_id, rho, omega, D = distance_matrix)
Browse[1]> c
[1] "Difference = 73.1214064026175"
[1] "Iteration: 2"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
 -9.8986  -0.0543  -0.0203   1.7148   0.1129 386.2322
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-0.0293348 -0.0001610 -0.0000601  0.0050819  0.0003345  1.1446128
[1] "phi = 0.00296353515610966, omega  = 0.983583744233043 , rho = 0.308232522541486"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 0.000024  0.015260  0.024415  0.833407  0.158479 25.868966
[1] "update"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-19.0617  -2.4970  -1.3329   0.0000  -0.1486  55.5879
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.4988 -4.4549 -1.7234 -1.8396  0.3347  7.8160
```

```
Called from: update_beta(Y = Y, X = X, beta = beta, R_inv = R_inv, phi = phi,
    n_iter = 1, n = n, p = p, q = q, ASV_id, rho, omega, D = distance_matrix)
Browse[1]> c
[1] "Difference = 30.5331749772207"
[1] "Iteration: 3"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -24.2972   -0.0415   -0.0078    9.9096    0.2748 2818.1882
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.413e-03 -2.410e-06 -4.500e-07  5.762e-04  1.598e-05  1.639e-01
[1] "phi = 5.81411712568661e-05, omega  = 0.984549152947368 , rho = 0.614651231064176"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00001   0.01081   0.01766   3.53512   0.32766 157.38310
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-12.58427   0.01956   0.06204   0.00000   0.17577   7.83440
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-5.9998 -4.4254 -2.1959 -1.8396  0.3538  7.9364
Called from: update_beta(Y = Y, X = X, beta = beta, R_inv = R_inv, phi = phi,
    n_iter = 1, n = n, p = p, q = q, ASV_id, rho, omega, D = distance_matrix)
Browse[1]> c
[1] "Difference = 8.61011875874332"
[1] "Iteration: 4"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -23.9501   -0.0401   -0.0070    7.4950    0.2938 1796.3779
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-3.337e-03 -5.590e-06 -9.700e-07  1.044e-03  4.094e-05  2.503e-01
[1] "phi = 0.00013933155067034, omega  = 0.984796476225481 , rho = 0.440094621222131"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00003   0.01035   0.01816   3.84221   0.32776 168.00334
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-14.033385   0.004312   0.053323   0.000000   0.271548   7.106205
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-7.0599 -4.4007 -1.9964 -1.8396  0.3889  8.2196
Called from: update_beta(Y = Y, X = X, beta = beta, R_inv = R_inv, phi = phi,
    n_iter = 1, n = n, p = p, q = q, ASV_id, rho, omega, D = distance_matrix)
Browse[1]> c
[1] "Difference = 9.72467917960964"
[1] "Iteration: 5"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -24.1412   -0.0376   -0.0064    7.4793    0.3330 1292.1849
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-5.580e-03 -8.680e-06 -1.480e-06  1.729e-03  7.697e-05  2.987e-01
[1] "phi = 0.000231139860008589, omega  = 0.981520887502283 , rho = 0.369866079073633"
```

```
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00006   0.01129   0.01979   4.49665   0.29609 192.75334
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-18.66292  -0.03128   0.04199   0.00000   0.41205  10.10912
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-8.3170 -4.3644 -2.1857 -1.8396  0.3966  8.6902
Called from: update_beta(Y = Y, X = X, beta = beta, R_inv = R_inv, phi = phi,
    n_iter = 1, n = n, p = p, q = q, ASV_id, rho, omega, D = distance_matrix)
Browse[1]> Q
> # model!
> source(here::here("R","dm_cor_gee_clean.R"))
> zebra_res <- dm_cor_gee(Y = dat$Y, X = group, sample_id = dat$sampleID,
+                     ASV_id = taxa_names(zebrafish_ps), distance_matrix = D)
[1] "Iteration: 1"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.32868 -0.17361 -0.15113  0.07366 -0.03836 13.36048
[1] "standardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.30881 -0.16312 -0.14199  0.06921 -0.03604 12.55280
[1] "phi = 0.939547462231508, omega  = 0.935468698041697 , rho = 3.17044241846978"
[1] "Beta iteration 1"
[1] "alpha"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.01549 0.02411 0.02804 0.20715 0.03035 1.00000
[1] "update"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-61.9698  -6.3523   0.3406   0.0000   5.5856  66.1109
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.1970 -4.2508 -1.8167 -1.8396  0.5397  2.8024
[1] "Difference = 73.1214064026175"
[1] "Iteration: 2"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
 -9.8986  -0.0543  -0.0203   1.7148   0.1129 386.2322
[1] "standardized residuals"
      Min.     1st Qu.      Median       Mean    3rd Qu.       Max.
-0.0293348 -0.0001610 -0.0000601  0.0050819  0.0003345  1.1446128
[1] "phi = 0.00296353515610966, omega  = 0.983583744233043 , rho = 0.308232522541486"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 0.000024  0.015260  0.024415  0.833407  0.158479 25.868966
[1] "update"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-19.0617  -2.4970  -1.3329   0.0000  -0.1486  55.5879
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-6.4988 -4.4549 -1.7234 -1.8396  0.3347  7.8160
[1] "Difference = 30.5331749772207"
[1] "Iteration: 3"
```

```
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -24.2972   -0.0415   -0.0078    9.9096    0.2748 2818.1882
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.413e-03 -2.410e-06 -4.500e-07  5.762e-04  1.598e-05  1.639e-01
[1] "phi = 5.81411712568661e-05, omega  = 0.984549152947368 , rho = 0.614651231064176"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00001   0.01081   0.01766   3.53512   0.32766 157.38310
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-12.58427   0.01956   0.06204   0.00000   0.17577   7.83440
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-5.9998 -4.4254 -2.1959 -1.8396  0.3538  7.9364
[1] "Difference = 8.61011875874332"
[1] "Iteration: 4"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -23.9501   -0.0401   -0.0070    7.4950    0.2938 1796.3779
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-3.337e-03 -5.590e-06 -9.700e-07  1.044e-03  4.094e-05  2.503e-01
[1] "phi = 0.00013933155067034, omega  = 0.984796476225481 , rho = 0.440094621222131"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00003   0.01035   0.01816   3.84221   0.32776 168.00334
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-14.033385   0.004312   0.053323   0.000000   0.271548   7.106205
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-7.0599 -4.4007 -1.9964 -1.8396  0.3889  8.2196
[1] "Difference = 9.72467917960964"
[1] "Iteration: 5"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -24.1412   -0.0376   -0.0064    7.4793    0.3330 1292.1849
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-5.580e-03 -8.680e-06 -1.480e-06  1.729e-03  7.697e-05  2.987e-01
[1] "phi = 0.000231139860008589, omega  = 0.981520887502283 , rho = 0.369866079073633"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00006   0.01129   0.01979   4.49665   0.29609 192.75334
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-18.66292  -0.03128   0.04199   0.00000   0.41205  10.10912
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-8.3170 -4.3644 -2.1857 -1.8396  0.3966  8.6902
[1] "Difference = 12.9032787639054"
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[1] "Iteration: 6"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -24.3482   -0.0361   -0.0057   11.0754    0.3874 1013.8554
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-3.938e-03 -5.840e-06 -9.200e-07  1.791e-03  6.266e-05  1.640e-01
[1] "phi = 0.000161748619031987, omega  = 0.977301954235005 , rho = 0.426519229141335"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00011   0.01054   0.02011   5.82520   0.35510 239.40531
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-23.72076  -0.03532   0.06225   0.00000   0.88363  12.20260
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-10.0963  -4.2798  -2.0745  -1.8396   0.3993   9.0211
[1] "Difference = 17.0379943115704"
[1] "Iteration: 7"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
 -24.0014   -0.0324   -0.0046   24.7836    0.4011 2630.8079
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-6.732e-04 -9.100e-07 -1.300e-07  6.952e-04  1.125e-05  7.379e-02
[1] "phi = 2.80500340906498e-05, omega  = 0.979940749278977 , rho = 0.767286381667904"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00001   0.01153   0.02309   7.19580   0.36725 277.28483
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-20.567520   0.006673   0.049880   0.000000   0.864810  18.328470
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-12.0073  -4.2858  -1.5401  -1.8396   0.4062   9.0784
[1] "Difference = 15.8878677458046"
[1] "Iteration: 8"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
 -22.289   -0.035   -0.005   60.270    0.406 6753.782
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-9.624e-05 -1.490e-07 -2.000e-08  2.602e-04  1.753e-06  2.916e-02
[1] "phi = 4.31785512143427e-06, omega  = 0.981709982661524 , rho = 0.961916134714736"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01248   0.02315   8.25611   0.51991 286.74174
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-14.016899   0.004457   0.025964   0.000000   0.518477  14.558641
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-13.3450  -4.2257  -1.0646  -1.8396   0.4119   9.0873
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[1] "Difference = 9.80437753991997"
[1] "Iteration: 9"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  -19.672    -0.030    -0.005   101.003     0.438 11249.150
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-3.053e-05 -4.700e-08 -7.000e-09  1.568e-04  6.800e-07  1.746e-02
[1] "phi = 1.55207729785946e-06, omega  = 0.983803047522562 , rho = 0.868270247649568"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01256   0.02430   9.55604   0.65224 289.15841
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-15.37337   0.00853   0.03123   0.00000   0.46301  11.10487
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-14.8315  -4.1920  -1.0642  -1.8396   0.4288   9.0904
[1] "Difference = 7.98261948839764"
[1] "Iteration: 10"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  -18.309    -0.029    -0.004   129.332     0.434 13959.282
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.833e-05 -2.900e-08 -4.000e-09  1.295e-04  4.340e-07  1.397e-02
[1] "phi = 1.00102793904902e-06, omega  = 0.983523869706203 , rho = 0.773146920273194"
[1] "Beta iteration 1"
[1] "alpha"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
  0.0000   0.0136   0.0256  10.5181   1.0068 291.3046
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-18.19715   0.01472   0.03910   0.00000   0.50783   7.87463
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-16.6097  -4.1478  -1.0636  -1.8396   0.4337   9.0925
[1] "Difference = 7.70284144296252"
[1] "Iteration: 11"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  -17.543    -0.031    -0.004   138.071     0.431 13422.175
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.812e-05 -3.200e-08 -4.000e-09  1.426e-04  4.450e-07  1.386e-02
[1] "phi = 1.032894614361e-06, omega  = 0.97736747447489 , rho = 0.74371714175976"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01464   0.02724  11.27012   1.10443 293.65488
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-20.73626   0.01951   0.04600   0.00000   0.58505   4.40622
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
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-18.6416  -4.1024  -1.0627  -1.8396   0.4474   9.0946
[1] "Difference = 9.52078537828392"
[1] "Iteration: 12"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  -17.379    -0.036    -0.004   155.679     0.433 19057.502
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.720e-05 -3.600e-08 -4.000e-09  1.541e-04  4.280e-07  1.886e-02
[1] "phi = 9.8959962990127e-07, omega  = 0.942937105631337 , rho = 1.16337548753744"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01520   0.02992  11.77454   1.11314 296.63069
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-18.936152   0.003131   0.038862   0.000000   0.499806   4.293101
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-20.4962  -4.0756  -1.0616  -1.8396   0.4721   9.0966
[1] "Difference = 9.14039783751598"
[1] "Iteration: 13"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
  -15.77    -0.03     0.00   245.13     0.46 51778.12
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-4.615e-06 -1.000e-08 -1.000e-09  7.172e-05  1.350e-07  1.515e-02
[1] "phi = 2.92597293152538e-07, omega  = 0.87531027288368 , rho = 2.48890365167915"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01679   0.03344  13.39275   1.12181 298.59983
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-6.136997 -0.003978  0.008558  0.000000  0.149141  4.202295
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-21.0967  -4.0554  -1.0611  -1.8396   0.4762   9.0972
[1] "Difference = 3.67821574427527"
[1] "Iteration: 14"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
  -15.62    -0.03     0.00   294.70     0.47 72050.71
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-2.590e-06 -6.000e-09  0.000e+00  4.886e-05  7.800e-08  1.195e-02
[1] "phi = 1.65792585919558e-07, omega  = 0.839776237723401 , rho = 3.4180370064409"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01796   0.03444  14.00361   1.12401 298.63102
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-2.977099 -0.003386  0.003406  0.000000  0.064081  2.237480
[1] "beta"
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    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-21.3456  -4.0503  -1.0609  -1.8396   0.4774   9.0976
[1] "Difference = 1.799666661543"
[1] "Iteration: 15"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
  -15.91    -0.03     0.00   321.93     0.47 82856.93
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-2.040e-06 -4.000e-09  0.000e+00  4.129e-05  6.100e-08  1.063e-02
[1] "phi = 1.28248839357702e-07, omega  = 0.828273602668781 , rho = 3.7252933030863"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01818   0.03485  14.29110   1.12504 298.59553
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-2.350114 -0.002299  0.002545  0.000000  0.044816  1.784247
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-21.5192  -4.0463  -1.0608  -1.8396   0.4782   9.0978
[1] "Difference = 1.36297655529556"
[1] "Iteration: 16"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
  -16.13    -0.03     0.00   343.41     0.48 91301.89
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.724e-06 -4.000e-09  0.000e+00  3.671e-05  5.100e-08  9.760e-03
[1] "phi = 1.06895154366371e-07, omega  = 0.821954985685942 , rho = 3.89260965287554"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01834   0.03513  14.46801   1.12580 298.57293
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-2.009067 -0.001680  0.002094  0.000000  0.034465  1.545656
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-21.6570  -4.0429  -1.0606  -1.8396   0.4788   9.0981
[1] "Difference = 1.14164129574494"
[1] "Iteration: 17"
[1] "unstandardized residuals"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
  -16.33    -0.03     0.00   362.13     0.48 98572.87
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.509e-06 -3.000e-09  0.000e+00  3.346e-05  4.400e-08  9.109e-03
[1] "phi = 9.24101535408146e-08, omega  = 0.817752143524932 , rho = 4.001984252125"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01848   0.03537  14.59056   1.12642 298.55984
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-1.783508 -0.001677  0.001754  0.000000  0.029174  1.387214
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[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-21.7730  -4.0400  -1.0605  -1.8396   0.4793   9.0982
[1] "Difference = 1.00252084244208"
[1] "Iteration: 18"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -16.50     -0.03      0.00    379.18      0.48 105113.72
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.348e-06 -3.000e-09  0.000e+00  3.098e-05  4.000e-08  8.588e-03
[1] "phi = 8.17024565180398e-08, omega  = 0.81512168259833 , rho = 4.07040272560558"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01860   0.03557  14.68128   1.12696 298.55321
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-1.624484 -0.001357  0.001587  0.000000  0.025886  1.275652
[1] "beta"
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-21.875  -4.037  -1.060  -1.840   0.480   9.098
[1] "Difference = 0.909333461307958"
[1] "Iteration: 19"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -16.67     -0.03      0.00    395.15      0.49 111172.40
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.222e-06 -2.000e-09  0.000e+00  2.898e-05  3.600e-08  8.152e-03
[1] "phi = 7.33305412394345e-08, omega  = 0.81275529367871 , rho = 4.13181563693982"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01871   0.03574  14.75118   1.12743 298.55116
[1] "update"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-1.496403 -0.001123  0.001456  0.000000  0.023598  1.182527
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-21.9653  -4.0348  -1.0603  -1.8396   0.4807   9.0986
[1] "Difference = 0.834171847811243"
[1] "Iteration: 20"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -16.82     -0.03      0.00    410.29      0.49 116852.54
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.120e-06 -2.000e-09  0.000e+00  2.732e-05  3.300e-08  7.780e-03
[1] "phi = 6.65784120493533e-08, omega  = 0.81109333216788 , rho = 4.17480938728343"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01882   0.03671  14.80723   1.12785 298.55240
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
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-1.3961088 -0.0009499  0.0013521  0.0000000  0.0218359  1.1091146
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-22.0476  -4.0324  -1.0603  -1.8396   0.4813   9.0987
[1] "Difference = 0.775798299095333"
[1] "Iteration: 21"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -16.96     -0.03      0.00    424.84      0.49 122251.16
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.034e-06 -2.000e-09  0.000e+00  2.591e-05  3.000e-08  7.454e-03
[1] "phi = 6.09768859792844e-08, omega  = 0.809388414671349 , rho = 4.21959678375907"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01891   0.03676  14.85325   1.12823 298.55606
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.3088934 -0.0008111  0.0011964  0.0000000  0.0203318  1.0435144
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-22.1231  -4.0303  -1.0602  -1.8396   0.4818   9.0988
[1] "Difference = 0.724929256292401"
[1] "Iteration: 22"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -17.10     -0.03      0.00    438.86      0.49 127406.42
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-9.620e-07 -2.000e-09  0.000e+00  2.469e-05  2.700e-08  7.167e-03
[1] "phi = 5.6253998469363e-08, omega  = 0.808112293735121 , rho = 4.2508573317048"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01900   0.03677  14.89208   1.12858 298.56155
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.2376627 -0.0007025  0.0010839  0.0000000  0.0191143  0.9896530
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-22.1930  -4.0282  -1.0601  -1.8396   0.4823   9.0989
[1] "Difference = 0.683596353407489"
[1] "Iteration: 23"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -17.22     -0.03      0.00    452.49      0.49 132372.85
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-8.990e-07 -2.000e-09  0.000e+00  2.362e-05  2.500e-08  6.910e-03
[1] "phi = 5.21985800496743e-08, omega  = 0.807087454024426 , rho = 4.27629557449581"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01909   0.03677  14.92542   1.12890 298.56839
[1] "update"
```

```
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.1767636 -0.0006142  0.0010144  0.0000000  0.0180836  0.9431323
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-22.2583  -4.0263  -1.0600  -1.8396   0.4828   9.0990
[1] "Difference = 0.648328105483543"
[1] "Iteration: 24"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -17.35     -0.03      0.00    465.79      0.49 137182.89
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-8.440e-07 -2.000e-09  0.000e+00  2.267e-05  2.400e-08  6.677e-03
[1] "phi = 4.86706590722903e-08, omega  = 0.806196366262477 , rho = 4.29792968866025"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01909   0.03678  14.95445   1.12921 298.57626
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.1235722 -0.0005412  0.0009542  0.0000000  0.0171907  0.9020291
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-22.3197  -4.0244  -1.0600  -1.8396   0.4832   9.0991
[1] "Difference = 0.617539235770946"
[1] "Iteration: 25"
[1] "unstandardized residuals"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
   -17.46     -0.03      0.00    478.83      0.49 141859.99
[1] "standardized residuals"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-7.960e-07 -2.000e-09  0.000e+00  2.182e-05  2.200e-08  6.464e-03
[1] "phi = 4.55692681244084e-08, omega  = 0.80541706862667 , rho = 4.31647868718837"
[1] "Beta iteration 1"
[1] "alpha"
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  0.00000   0.01909   0.03678  14.98010   1.12949 298.58490
[1] "update"
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-1.0765919 -0.0004804  0.0009014  0.0000000  0.0164077  0.8653577
[1] "beta"
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-22.3777  -4.0226  -1.0599  -1.8396   0.4836   9.0992
[1] "Difference = 0.590359570128033"
```

- It looks like it is working? With +, and only 1 update each. And a small update.