Hawaii Plant METE Results Log

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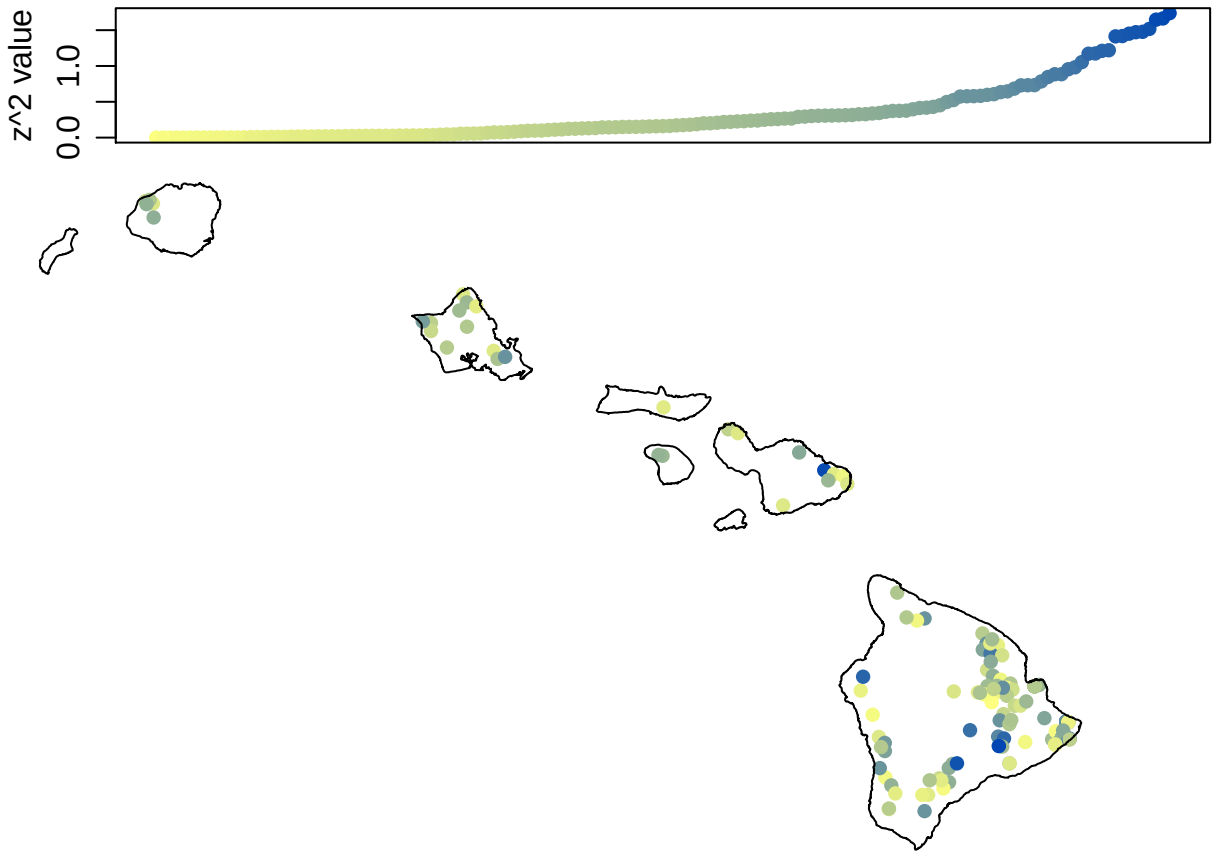
Setup workspace and load data

```
library(socorro)
library(meteR)
library(sp)
setwd('~/Dropbox/Research/hawaiiMETE_plant')

load('meteSumm.RData')
load('meteEg.RData')
load('~/Dropbox/hawaiiDimensions/kokua/data/islands.RData')
```

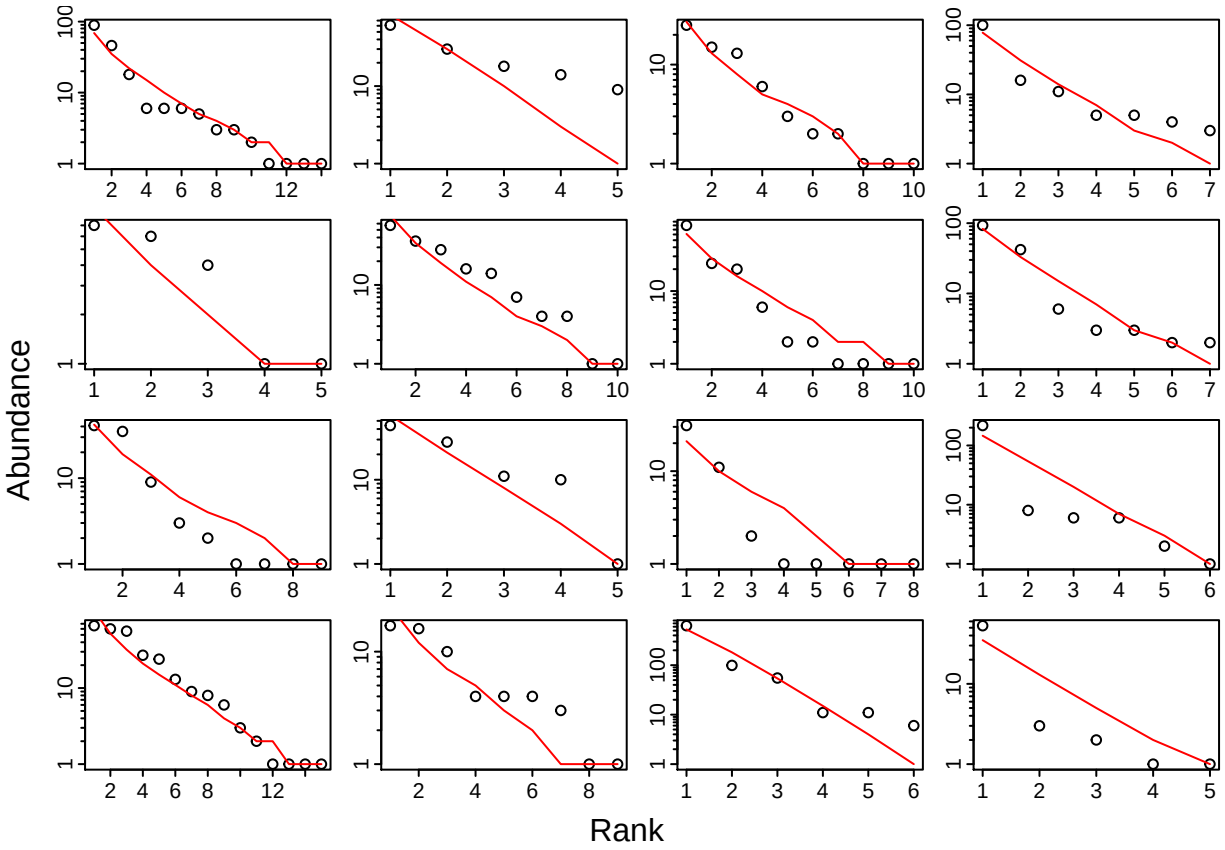
First look at how deviations from METE play out across the islands. Fit is based on z^2 values as discussed in Rominger and Merow MEE paper.

```
layout(matrix(2:1, nrow = 2), heights = c(1, 4))
par(mar = rep(0, 4))
plot(meteSumm, col = fitCol(sqrt(meteSumm@data$z2SAD)), pch = 16, cex = 1)
plot(spTransform(islands, CRS(proj4string(meteSumm))), add = TRUE)

par(mar = c(0, 3, 0, 0) + 0.5, mgp = c(2, 0.75, 0))
plot(sort(meteSumm@data$z2SAD), col = fitCol(sort(sqrt(meteSumm@data$z2SAD))),
     pch = 16, cex = 1, ylab = 'z^2 value', xaxt = 'n')
```



Overall the distribution of z^2 values tells us METE is pretty much never rejected (critical value at $\alpha = 0.05$ is $\chi^2_{1,P=0.95} = 3.841$. We can look at a few (random) example SADs:

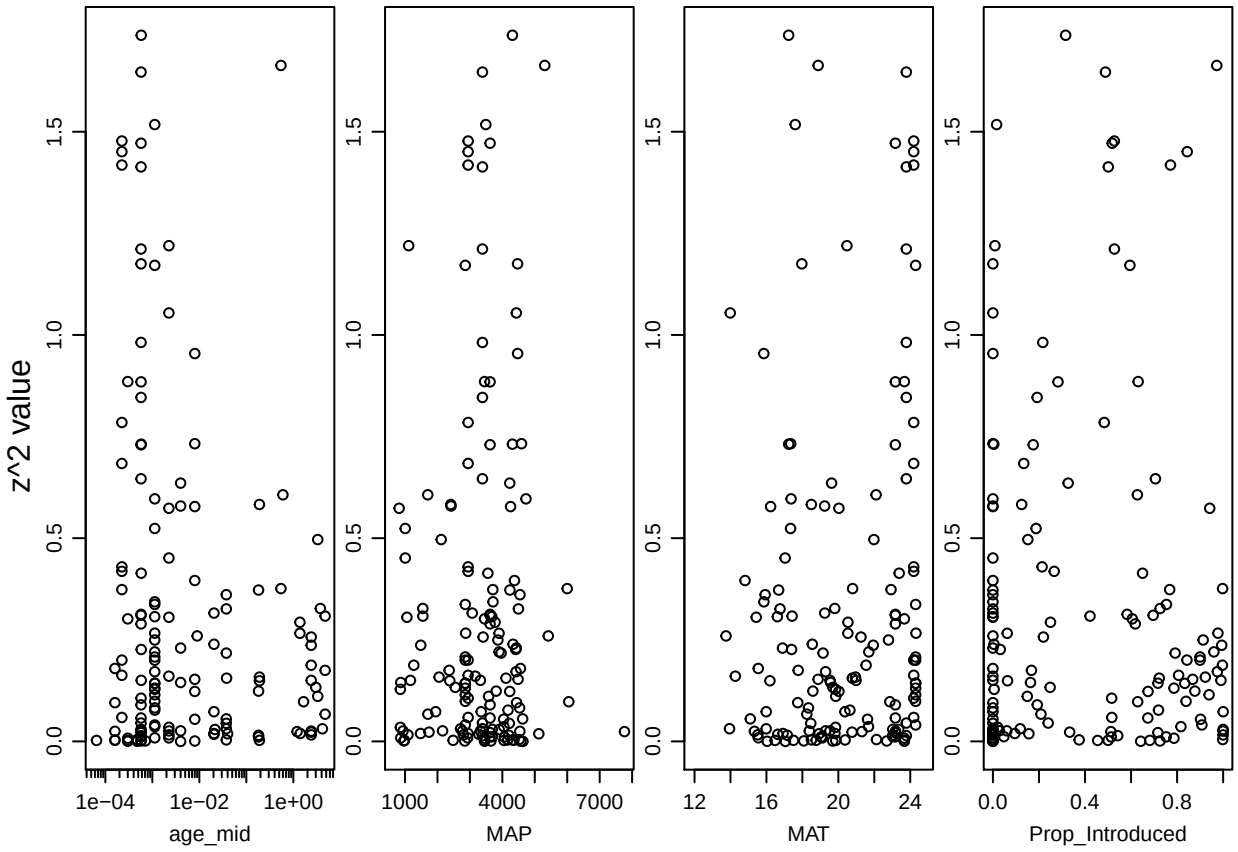
```
par(mfrow = c(4, 4), mar = c(2, 2, 0, 0), oma = c(2, 2, 0.5, 0.5),
    mgp = c(1.5, 0.3, 0), tcl = -0.25)
for(i in 1:length(meteEg)) {
    plot(meteEg[[i]]$sad, ptype = 'rad', add.legend = FALSE,
         xlab = '', ylab = '', log = 'y', ylim = c(1, max(meteEg[[i]]$sad$data)),
         yaxt = 'n')
    logAxis(2)
}
mtext('Rank', side = 1, outer = TRUE)
mtext('Abundance', side = 2, outer = TRUE)
```



When sample size is small (i.e. a few species) it's hard to make concrete conclusions about fit. The z^2 value is based on simulations that hold S_0 and N_0 fixed, so should hypothetically account for sample size.

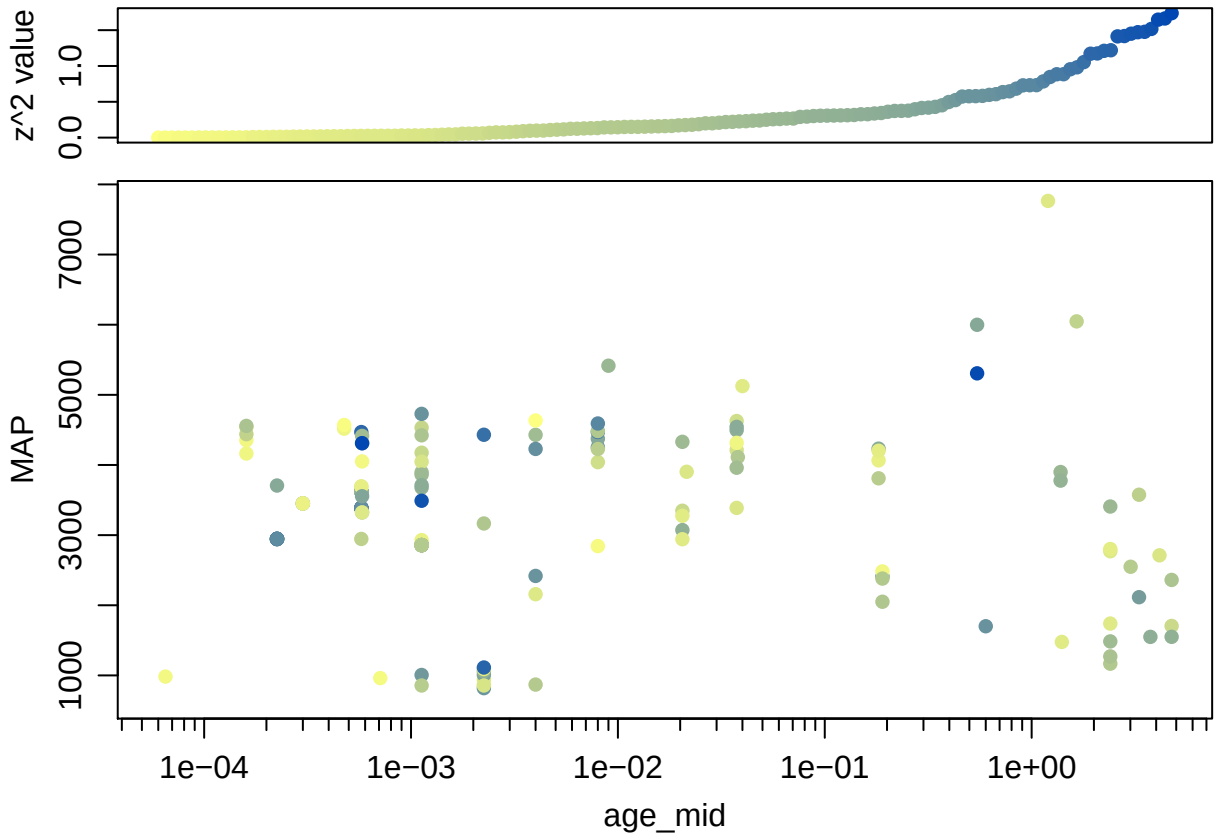
We can look explicitly at fit across variables of interest

```
par(mfrow = c(1, 4), mar = c(3, 1, 0, 0) + 0.5, oma = c(0, 2, 0, 0), mgp = c(2, 0.75, 0))
plot(meteSumm@data[, c('age_mid', 'z2SAD')], log = 'x', xaxt = 'n'); logAxis(1)
plot(meteSumm@data[, c('MAP', 'z2SAD')])
plot(meteSumm@data[, c('MAT', 'z2SAD')])
plot(meteSumm@data[, c('Prop_Introduced', 'z2SAD')])
mtext('z^2 value', side = 2, outer = TRUE, line = 0.5)
```



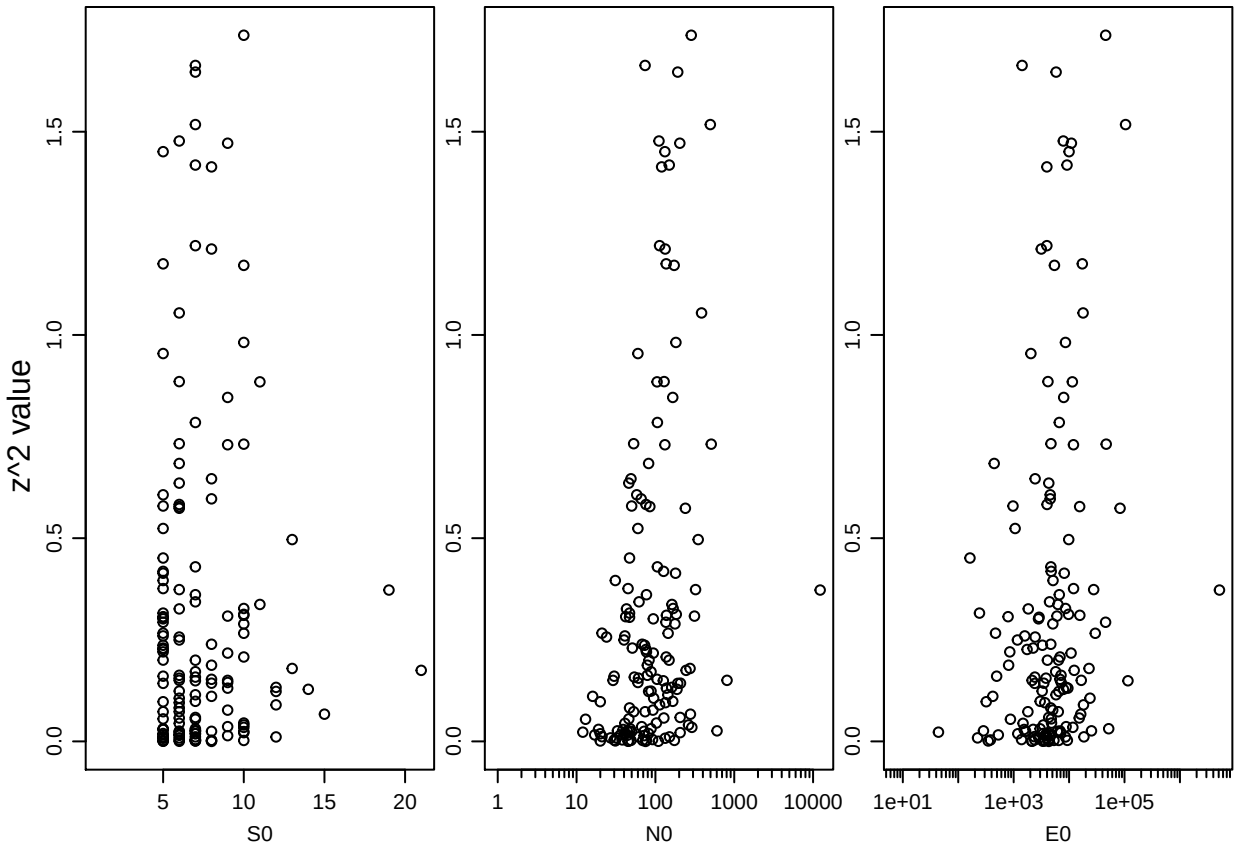
Looking now jointly at environment and age as predictors of deviation

```
layout(matrix(2:1, nrow = 2), heights = c(1, 4))
par(mar = c(3, 3, 0, 0) + 0.5, mgp = c(2, 0.75, 0))
plot(meteSumm@data[, c('age_mid', 'MAP')], log = 'x', xaxt = 'n', pch = 16, cex = 1,
     col = fitCol(sqrt(meteSumm@data$z2SAD)))
logAxis(1)
par(mar = c(0, 3, 0, 0) + 0.5, mgp = c(2, 0.75, 0))
plot(sort(meteSumm@data$z2SAD), col = fitCol(sort(sqrt(meteSumm@data$z2SAD))),
     pch = 16, cex = 1, ylab = 'z^2 value', xaxt = 'n')
```



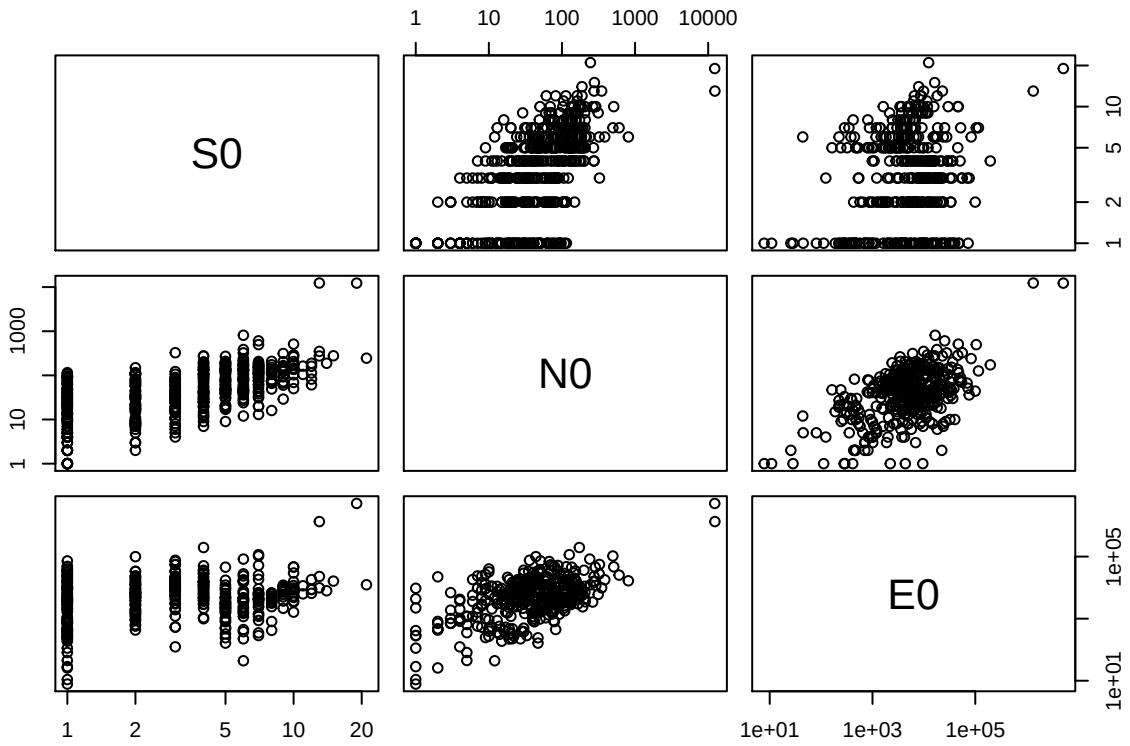
Checking if state variables influence fit, they don't

```
par(mfrow = c(1, 3), mar = c(3, 1, 0, 0) + 0.5, oma = c(0, 2, 0, 0), mgp = c(2, 0.75, 0))
plot(meteSumm@data[, c('S0', 'z2SAD')])
plot(meteSumm@data[, c('N0', 'z2SAD')], log = 'x', xaxt = 'n'); logAxis(1)
plot(meteSumm@data[, c('E0', 'z2SAD')], log = 'x', xaxt = 'n'); logAxis(1)
mtext('z^2 value', side = 2, outer = TRUE, line = 0.5)
```



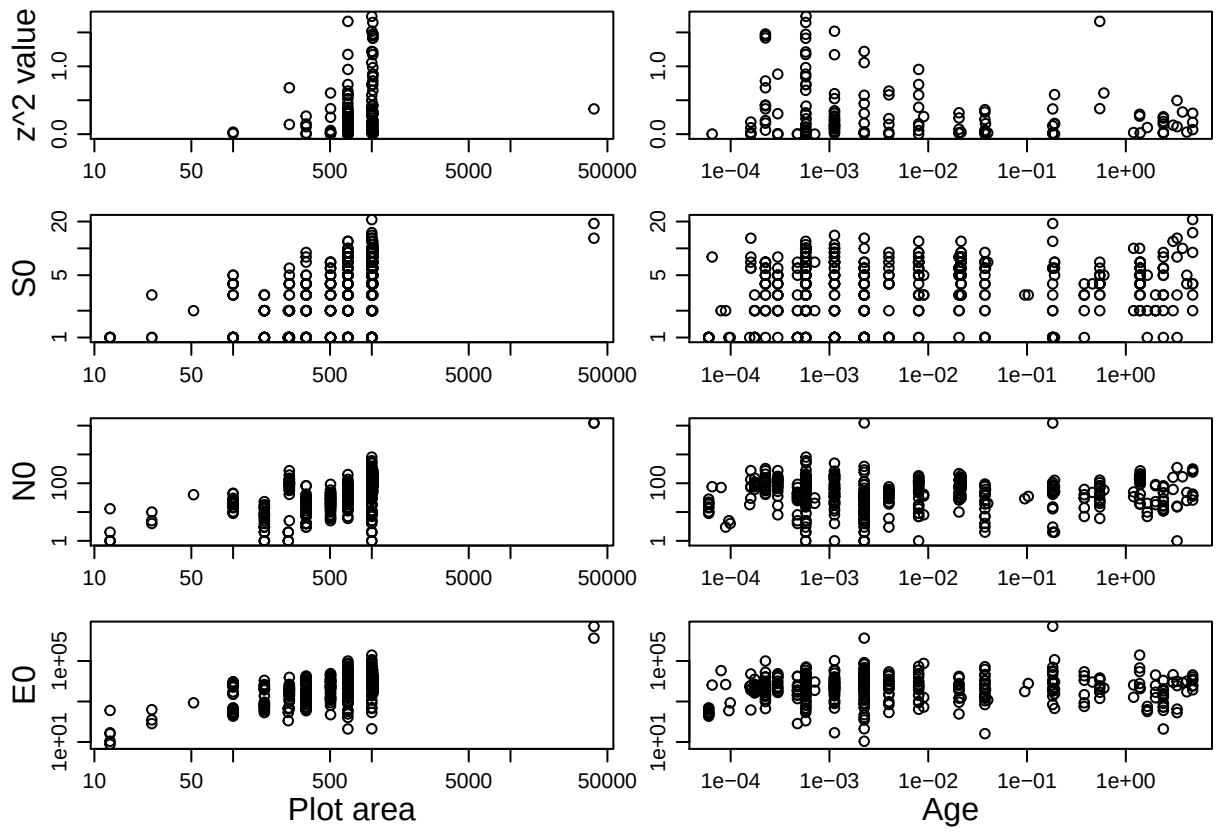
Speaking of state variables, how are they correlated?

```
pairs(meteSumm@data[, c('S0', 'N0', 'E0')], log = 'xy')
```



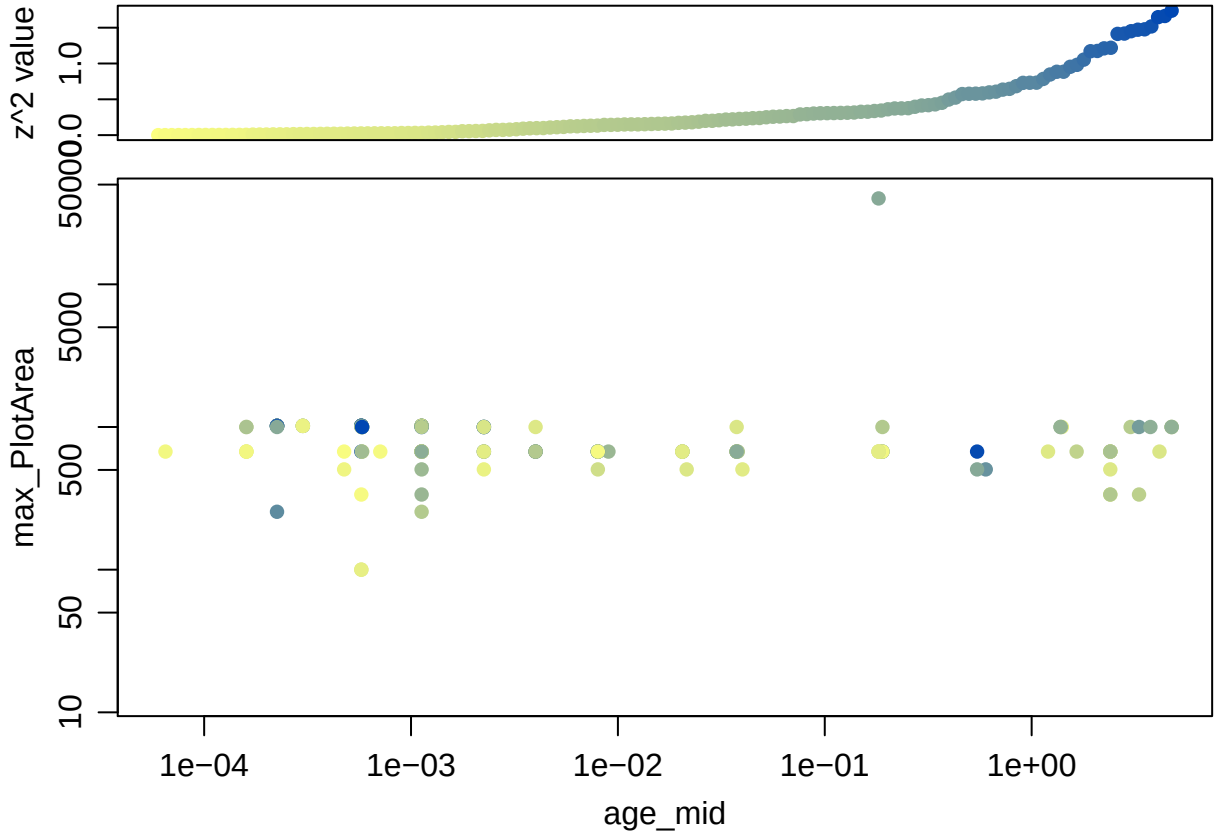
How do state variables change with age and plot area?

```
par(mfcol = c(4, 2), mar = c(2, 2, 1, 1), mgp = c(2, 0.75, 0), oma = c(1, 1, 0, 0) + 0.5)
plot(meteSumm@data[, c('max_PlotArea', 'z2SAD')], log = 'x')
mtext('z^2 value', side = 2, line = 2)

plot(meteSumm@data[, c('max_PlotArea', 'S0')], log = 'xy')
mtext('S0', side = 2, line = 2)

plot(meteSumm@data[, c('max_PlotArea', 'N0')], log = 'xy')
mtext('N0', side = 2, line = 2)

plot(meteSumm@data[, c('max_PlotArea', 'E0')], log = 'xy')
mtext('E0', side = 2, line = 2)
mtext('Plot area', side = 1, line = 2)

plot(meteSumm@data[, c('age_mid', 'z2SAD')], log = 'x')
plot(meteSumm@data[, c('age_mid', 'S0')], log = 'xy')
plot(meteSumm@data[, c('age_mid', 'N0')], log = 'xy')
plot(meteSumm@data[, c('age_mid', 'E0')], log = 'xy')
mtext('Age', side = 1, line = 2)
```



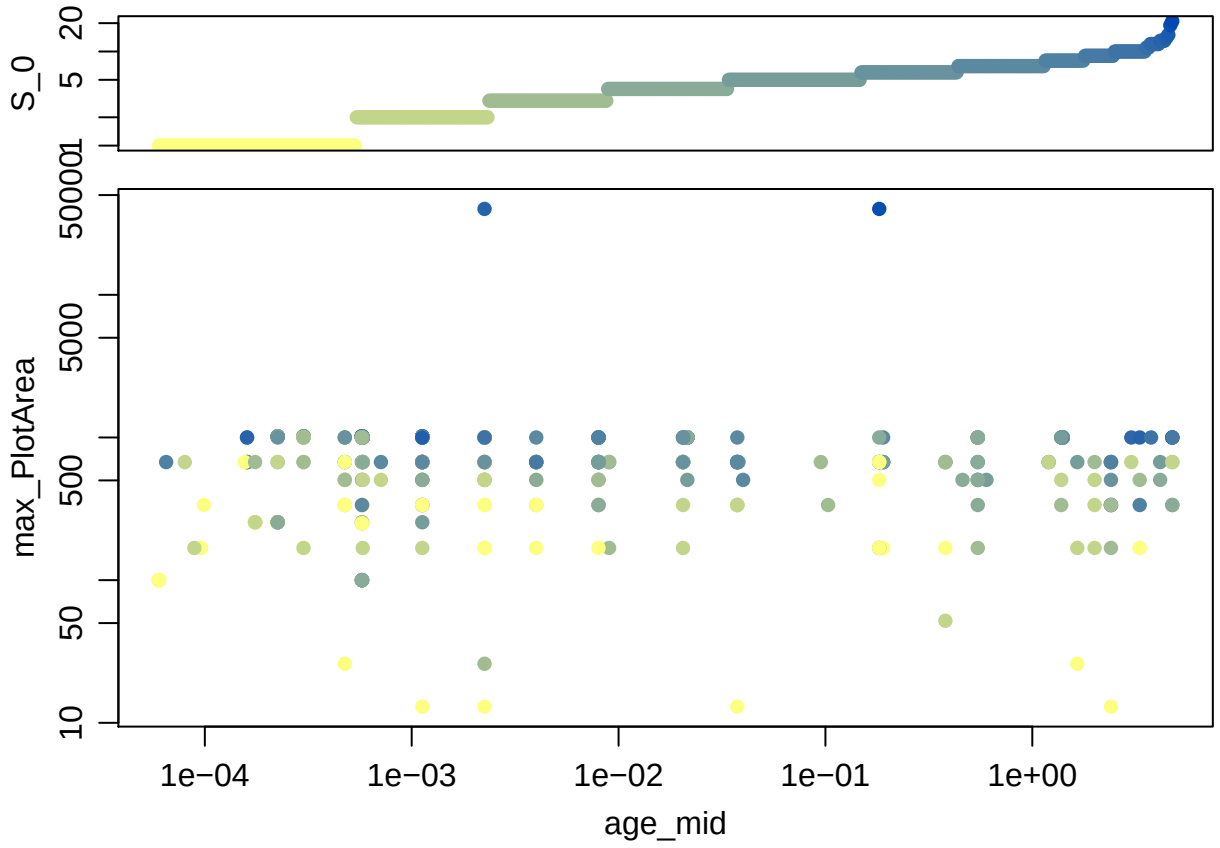

```
layout(matrix(2:1, nrow = 2), heights = c(1, 4))
par(mar = c(3, 3, 0, 0) + 0.5, mgp = c(2, 0.75, 0))
plot(meteSumm@data[, c('age_mid', 'max_PlotArea')], log = 'xy', pch = 16, cex = 1,
     col = fitCol(sqrt(meteSumm@data$z2SAD)))
par(mar = c(0, 3, 0, 0) + 0.5, mgp = c(2, 0.75, 0))
plot(sort(meteSumm@data$z2SAD), col = fitCol(sort(sqrt(meteSumm@data$z2SAD))),
```

```
     pch = 16, cex = 1, ylab = 'z^2 value', xaxt = 'n')
```



We can also look for age-specific SARs

```
layout(matrix(2:1, nrow = 2), heights = c(1, 4))
par(mar = c(3, 3, 0, 0) + 0.5, mgp = c(2, 0.75, 0))
plot(meteSumm@data[, c('age_mid', 'max_PlotArea')], log = 'xy', pch = 16, cex = 1,
     col = fitCol(log(meteSumm@data$S0)))
par(mar = c(0, 3, 0, 0) + 0.5, mgp = c(2, 0.75, 0))
plot(sort(meteSumm@data$S0), col = fitCol(sort(log(meteSumm@data$S0))),
     pch = 16, cex = 1, ylab = 'S_0', xaxt = 'n', log = 'y')
```


S_0
1
5
20
max_PlotArea
10
50
500
5000
50000
1e−04
1e−03
1e−02
1e−01
1e+00
age_mid