### Principal component analysis

# cleaning the data

## occations where plants die as an indicator (goes NA, if model crashes)

# for(j in 1:nrow(Store)){  
# if(is.na(Store$Pzero[j])){  
# Store\_failure <- rbind(Store\_failure, Store[j,])  
# Store<-Store[-j,]  
# }  
# }

# for(j in 1:nrow(Store)){  
# if(is.na(Store$Pzero[j])){  
# Store\_failure <- rbind(Store\_failure, Store[j,])  
# Store<-Store[-j,]  
# }  
# }  
  
# no crashes in Store! :D Store.txt in the repo is a Monte Carlo simulation with Heavy clay, 800 days and 5000 runs  
#   
# nrow(Store)  
# head(Store)  
# ncol(Store)

#### LINEAR REGRESSION

Preparing the data

mydata <- read.table("EAGELSON heavy medium clay 5000 runs 800 days.txt")  
  
head(mydata)

## Z Zr d ConcConst CM.gw c alpha  
## 1 4758.0925 357.7245 0.13576913 11.505491 9.615242 7.606346 1.0718089  
## 2 4699.0284 377.9734 0.13572194 9.867857 14.346724 9.406837 0.9543441  
## 3 1706.6431 321.3043 0.14732550 2.996419 8.626795 9.261121 1.1129852  
## 4 9848.4711 468.7371 0.15099179 5.785591 13.731347 7.674285 1.0965530  
## 5 637.4391 520.1043 0.14714997 3.135697 1.375117 6.068434 1.1517355  
## 6 7112.6880 391.0667 0.09708455 9.169175 3.812370 7.600359 1.3663670  
## lambda meanM sdM meanSmM sdSmM meanP sdP  
## 1 0.3889316 2.776285 0.0016401705 11460.004 3997.108 123.4783 0.03112101  
## 2 0.2844405 2.060344 0.3767069140 9361.824 3462.167 151.3147 14.20065013  
## 3 0.8572492 2.333379 0.0007227991 3009.174 1054.754 151.6565 0.02978008  
## 4 0.6604727 3.244274 0.0011333094 5714.123 1993.676 110.2535 0.02421482  
## 5 0.9408076 4.708444 0.0010603181 3173.963 1108.236 162.9506 0.01935202  
## 6 0.9110414 1.715964 0.0004968570 9322.210 3252.826 175.1765 0.02792751  
## meanCM sdCM minCM maxCM cum\_flux Pzero  
## 1 70.63442 24.638433 28.059207 113.17701 141.37747 0  
## 2 85.57979 86.863508 13.632040 1505.77844 145.29061 0  
## 3 22.06782 7.735847 8.705873 35.43066 1329.46367 0  
## 4 30.13882 10.516201 11.970312 48.30948 28.82843 0  
## 5 11.53504 4.027900 4.574732 18.49500 11442.83611 0  
## 6 92.96309 32.442613 36.900821 149.04486 58.71446 0

attach(mydata)

## The following objects are masked \_by\_ .GlobalEnv:  
##   
## alpha, c, CM.gw, ConcConst, d, lambda, Z, Zr

#   
# dd <-scale(mydata$c)  
# cf <- scale(mydata$cum\_flux)  
# plot(dd, cf)  
# plot(cf,dd)  
# plot(mydata$c, mydata$cum\_flux)  
# plot(mydata$cum\_flux,mydata$c)  
#   
# require(ggplot2)  
  
# lambda\_sum <- do.call(rbind,Store[][[2]])  
# lambda\_sum$time <- rep(1:time,length(lambda))  
  
#   
# data <- read.table("Sandy Clay loam 5000 runs 800 days.txt",header=T)  
# names(data)  
#   
# require(ggplot2)  
# pl <- ggplot(data,aes(x=c,y=cum\_flux, col=lambda\*alpha)) + geom\_point()  
# pl  
#   
#   
# require(dplyr)  
# mydata <- data  
#   
# newdata <- mydata %>% mutate(quantile = ntile(d, 10))  
# names(newdata)  
#   
# pl <- ggplot(newdata,aes(x=c,y=cum\_flux, col=Zr/(lambda\*alpha))) + geom\_point()  
# pl <- pl + facet\_wrap(~quantile)  
# pl  
#   
  
###  
#It is something related to larger c values, flip the > sign to < in the below code  
#   
# mydata1 <- subset(mydata,mydata$c>2.5 & mydata$Z > 2000)  
#   
# newdata1 <- mydata1 %>% mutate(quantile = ntile(d, 10))  
#   
# # names(newdata1)  
#   
# pl <- ggplot(newdata1,aes(x=c,y=cum\_flux, col=Zr/(lambda\*alpha))) + geom\_point()  
# pl <- pl + facet\_wrap(~quantile) + ggtitle("Vertical flux vs plant growth factor c, in quantiles of plant mortality d, Z > 2000 mm and c>2.5 ") + theme(plot.title = element\_text(lineheight=.8, face="bold"))   
# pl  
#   
#   
#   
#   
# plot(mydata1$c, mydata1$cum\_flux)   
#   
# zeroflux <- data.frame()  
# for (i in length(mydata)){  
# if(mydata$cum\_flux[i]<50 && mydata$cum\_flux[i]>100){  
#   
# zeroflux[i,] <- rbind(mydata[i,])  
# }  
# }  
#   
# zeroflux  
#   
# summary(mydata$cum\_flux)  
# plot(mydata$cum\_flux, ylim=c(-10000,7000))  
#   
# hist(cum\_flux)  
  
  
# pl <- ggplot(mydata,aes(x=mydata$c,y=mydata$cum\_flux, col=as.factor(mydata$lambda))) + geom\_line()  
# # pl <- pl + geom\_line(aes(x=time,y=M, colour="Moisture"))   
# pl <- pl + facet\_wrap(~mydata$alpha)   
# pl + ggtitle("Plant biomass P and soilmoisture M for varying lambdas") + geom\_line(aes(x=time, y=SmM, colour= "S (soil salt mg/L")) + theme(plot.title = element\_text(lineheight=.4))

# for(i in (9:19))  
# {   
# for(j in (1:8) )  
#   
# {   
# fit <- lm(mydata[,i] ~ mydata[,j], data=mydata) #does a regression for each column in my csv file against my independent variable 'etch'  
# rsq <- summary(fit)$r.squared  
# writelines(paste(rsq,i,"\n"))  
# }  
# }

Mean soilmoisture M

M\_all <- lm(meanM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(M\_all)

##   
## Call:  
## lm(formula = meanM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -110.118 -30.328 -8.816 19.660 171.244   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.451e+01 4.811e+00 7.173 8.41e-13 \*\*\*  
## Z -2.461e-04 1.970e-04 -1.249 0.2117   
## Zr 4.528e-02 7.637e-03 5.929 3.26e-09 \*\*\*  
## d 4.092e+02 8.568e+00 47.761 < 2e-16 \*\*\*  
## ConcConst -2.973e-01 1.243e-01 -2.392 0.0168 \*   
## CM.gw -6.886e-02 1.247e-01 -0.552 0.5809   
## c -1.323e+01 2.505e-01 -52.802 < 2e-16 \*\*\*  
## alpha -8.767e-02 2.067e+00 -0.042 0.9662   
## lambda -2.732e-01 2.095e+00 -0.130 0.8962   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 38.19 on 4991 degrees of freedom  
## Multiple R-squared: 0.5055, Adjusted R-squared: 0.5047   
## F-statistic: 637.8 on 8 and 4991 DF, p-value: < 2.2e-16

# # Scatterplot Matrices from the car Package  
# library(car)  
# scatterplot.matrix(mydata[9:19], data=mydata,  
# main="Heavy medium clay, 5000 runs, 800 days")  
  
  
# plot(mydata$Zr,mydata$meanM, main= "Root depth and mean soil moisture")  
# plot(mydata$d,mydata$meanM, main= "Root depth and mean soil moisture")  
# plot(mydata$c,mydata$meanM, main= "Plan growth factor and mean soil moisture")  
#   
# plot(mydata$Z,mydata$meanP, main= "Groundwater depth and mean plant biomass")  
# plot(mydata$d,mydata$meanP, main= "Plant mortality and mean plant biomass")  
# plot(mydata$c,mydata$meanP, main= "Plant growth factor and mean plant biomass")  
# plot(mydata$alpha,mydata$meanP, main= "Alpha and mean plant biomass")  
# plot(mydata$lambda,mydata$meanP, main= "Lambda and mean plant biomass")  
#   
# plot(mydata$Z,mydata$maxCM, main= "Groundwater depth and maximum soil salt concentration")  
# plot(mydata$d,mydata$maxCM, main= "Groundwater depth and maximum soil salt concentration")  
# plot(mydata$ConcConst,mydata$maxCM, main= "Rain salt mass and maximum soil salt concentration")  
# plot(mydata$c,mydata$maxCM, main= "Plant growth factor and maximum soil salt concentration")  
# plot(mydata$alpha,mydata$maxCM, main= "Alpha and maximum soil salt concentration")  
# plot(mydata$lambda,mydata$maxCM, main= "Lambda and maximum soil salt concentration")  
  
# write.table(summary(M\_all)$Coefficients, ""  
  
# # Groundwater depth Z  
# MZ <- lm(meanM ~ Z, data=mydata)  
# summary(MZ)  
#   
# # Root depth Zr  
# MZr <- lm(meanM ~ Zr, data=mydata)  
# summary(MZr)  
#   
# # plant mortality d  
# Md <- lm(meanM ~ d, data=mydata)  
# summary(Md)  
#   
# # salt concentration in rain  
# MConcConst <- lm(meanM ~ ConcConst, data=mydata)  
# summary(MConcConst)  
#   
# # salt concentration in groundwater  
# MCM.gw <- lm(meanM ~ CM.gw, data=mydata)  
# summary(MCM.gw)  
#   
# # plant growth factor c  
# Mc <- lm(meanM ~ c, data=mydata)  
# summary(Mc)  
#   
# # alpha  
# Malpha <- lm(meanM ~ alpha, data=mydata)  
# summary(Malpha)  
#   
# # lambda  
# Mlambda <- lm(meanM ~ lambda, data=mydata)  
# summary(Mlambda)  
#   
  
### comparing the models

### Standard deviation soilmoisture M (sdM)

sdM\_all <- lm(sdM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(sdM\_all)

##   
## Call:  
## lm(formula = sdM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -12.681 -2.433 -0.646 1.218 52.800   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 6.698e-01 5.841e-01 1.147 0.252   
## Z 1.529e-04 2.392e-05 6.393 1.77e-10 \*\*\*  
## Zr 1.375e-02 9.273e-04 14.829 < 2e-16 \*\*\*  
## d 2.783e+01 1.040e+00 26.747 < 2e-16 \*\*\*  
## ConcConst 5.028e-03 1.509e-02 0.333 0.739   
## CM.gw -8.239e-04 1.515e-02 -0.054 0.957   
## c -7.371e-01 3.042e-02 -24.230 < 2e-16 \*\*\*  
## alpha -1.859e+00 2.510e-01 -7.408 1.50e-13 \*\*\*  
## lambda -4.907e+00 2.543e-01 -19.293 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 4.637 on 4991 degrees of freedom  
## Multiple R-squared: 0.285, Adjusted R-squared: 0.2839   
## F-statistic: 248.7 on 8 and 4991 DF, p-value: < 2.2e-16

# Groundwater depth Z  
# sdMZ <- lm(sdM ~ Z, data=mydata)  
# summary(sdMZ)  
#   
# # Root depth Zr  
# sdMZr <- lm(sdM ~ Zr, data=mydata)  
# summary(sdMZr)  
#   
# # plant mortality d  
# sdMd <- lm(sdM ~ d, data=mydata)  
# summary(sdMd)  
#   
# # salt concentration in rain  
# sdMConcConst <- lm(sdM ~ ConcConst, data=mydata)  
# summary(sdMConcConst)  
#   
# # salt concentration in groundwater  
# sdMCM.gw <- lm(sdM ~ CM.gw, data=mydata)  
# summary(sdMCM.gw)  
#   
# # plant growth factor c  
# sdMc <- lm(sdM ~ c, data=mydata)  
# summary(sdMc)  
#   
# # alpha  
# sdMalpha <- lm(sdM ~ alpha, data=mydata)  
# summary(sdMalpha)  
#   
# # lambda  
# sdMlambda <- lm(sdM ~ lambda, data=mydata)  
# summary(sdMlambda)  
#   
  
### comparing the models

Mean soil SALT mass meanSmM

SM\_all <- lm(meanSmM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(SM\_all)

##   
## Call:  
## lm(formula = meanSmM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -7456.3 -696.0 399.1 1141.7 4994.3   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.154e+03 2.147e+02 -10.032 < 2e-16 \*\*\*  
## Z -1.247e-02 8.792e-03 -1.418 0.156   
## Zr 4.573e-01 3.408e-01 1.342 0.180   
## d -1.406e+04 3.824e+02 -36.778 < 2e-16 \*\*\*  
## ConcConst 8.410e+02 5.547e+00 151.601 < 2e-16 \*\*\*  
## CM.gw -2.753e+00 5.567e+00 -0.494 0.621   
## c 4.062e+02 1.118e+01 36.327 < 2e-16 \*\*\*  
## alpha 6.704e+02 9.225e+01 7.267 4.24e-13 \*\*\*  
## lambda 1.745e+03 9.348e+01 18.664 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1704 on 4991 degrees of freedom  
## Multiple R-squared: 0.8403, Adjusted R-squared: 0.84   
## F-statistic: 3281 on 8 and 4991 DF, p-value: < 2.2e-16

#   
# # Groundwater depth Z  
# SMZ <- lm(meanSmM ~ Z, data=mydata)  
# summary(SMZ)  
#   
# # Root depth Zr  
# SMZr <- lm(meanSmM ~ Zr, data=mydata)  
# summary(SMZr)  
#   
# # plant mortality d  
# SMd <- lm(meanSmM ~ d, data=mydata)  
# summary(SMd)  
#   
# # salt concentration in rain  
# SMConcConst <- lm(meanSmM ~ ConcConst, data=mydata)  
# summary(SMConcConst)  
#   
# # salt concentration in groundwater  
# SMCM.gw <- lm(meanSmM ~ CM.gw, data=mydata)  
# summary(SMCM.gw)  
#   
# # plant growth factor c  
# SMc <- lm(meanSmM ~ c, data=mydata)  
# summary(SMc)  
#   
# # alpha  
# SMalpha <- lm(meanSmM ~ alpha, data=mydata)  
# summary(SMalpha)  
#   
# # lambda  
# SMlambda <- lm(meanSmM ~ lambda, data=mydata)  
# summary(SMlambda)  
#   
#   
# ### comparing the models

Standard deviation of Soil Salt mass sdSmM (maybe not too important)

### Mean plant biomass P

meanP

P\_all <- lm(meanP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(P\_all)

##   
## Call:  
## lm(formula = meanP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -109.34 -17.96 -5.32 9.90 525.89   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 6.834e+01 4.490e+00 15.219 < 2e-16 \*\*\*  
## Z -3.206e-03 1.839e-04 -17.434 < 2e-16 \*\*\*  
## Zr 8.109e-03 7.129e-03 1.137 0.255   
## d -6.895e+02 7.998e+00 -86.207 < 2e-16 \*\*\*  
## ConcConst -7.955e-02 1.160e-01 -0.686 0.493   
## CM.gw 6.841e-02 1.164e-01 0.588 0.557   
## c 2.025e+01 2.339e-01 86.612 < 2e-16 \*\*\*  
## alpha 8.818e+00 1.929e+00 4.571 4.98e-06 \*\*\*  
## lambda 2.587e+01 1.955e+00 13.234 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 35.65 on 4991 degrees of freedom  
## Multiple R-squared: 0.7563, Adjusted R-squared: 0.7559   
## F-statistic: 1937 on 8 and 4991 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# PZ <- lm(meanP ~ Z, data=mydata)  
# summary(PZ)  
#   
# # Root depth Zr  
# PZr <- lm(meanP ~ Zr, data=mydata)  
# summary(PZr)  
#   
# # plant mortality d  
# Pd <- lm(meanP ~ d, data=mydata)  
# summary(Pd)  
#   
# # salt concentration in rain  
# PConcConst <- lm(meanP ~ ConcConst, data=mydata)  
# summary(PConcConst)  
#   
# # salt concentration in groundwater  
# PCM.gw <- lm(meanP ~ CM.gw, data=mydata)  
# summary(PCM.gw)  
#   
# # plant growth factor c  
# Pc <- lm(meanP ~ c, data=mydata)  
# summary(Pc)  
#   
# # alpha  
# Palpha <- lm(meanP ~ alpha, data=mydata)  
# summary(Palpha)  
#   
# # lambda  
# Plambda <- lm(meanP ~ lambda, data=mydata)  
# summary(Plambda)  
#   
  
### comparing the models

### Standard deviation of plant biomass P (sdP)

sdP\_all <- lm(sdP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(sdP\_all)

##   
## Call:  
## lm(formula = sdP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -17.188 -6.935 -1.730 3.772 108.743   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 2.253e+01 1.318e+00 17.089 <2e-16 \*\*\*  
## Z 6.116e-05 5.399e-05 1.133 0.2574   
## Zr 9.566e-04 2.093e-03 0.457 0.6477   
## d -1.988e+01 2.348e+00 -8.467 <2e-16 \*\*\*  
## ConcConst 6.734e-02 3.407e-02 1.977 0.0481 \*   
## CM.gw 3.095e-02 3.419e-02 0.905 0.3653   
## c 8.437e-01 6.866e-02 12.288 <2e-16 \*\*\*  
## alpha -7.785e+00 5.665e-01 -13.743 <2e-16 \*\*\*  
## lambda -2.431e+01 5.741e-01 -42.344 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 10.47 on 4991 degrees of freedom  
## Multiple R-squared: 0.3069, Adjusted R-squared: 0.3058   
## F-statistic: 276.2 on 8 and 4991 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# sdPZ <- lm(sdP ~ Z, data=mydata)  
# summary(sdPZ)  
#   
# # Root depth Zr  
# sdPZr <- lm(sdP ~ Zr, data=mydata)  
# summary(sdPZr)  
#   
# # plant mortality d  
# sdPd <- lm(sdP ~ d, data=mydata)  
# summary(sdPd)  
#   
# # salt concentration in rain  
# sdPConcConst <- lm(sdP ~ ConcConst, data=mydata)  
# summary(sdPConcConst)  
#   
# # salt concentration in groundwater  
# sdPCM.gw <- lm(sdP ~ CM.gw, data=mydata)  
# summary(sdPCM.gw)  
#   
# # plant growth factor c  
# sdPc <- lm(sdP ~ c, data=mydata)  
# summary(sdPc)  
#   
# # alpha  
# sdPalpha <- lm(sdP ~ alpha, data=mydata)  
# summary(sdPalpha)  
#   
# # lambda  
# sdPlambda <- lm(sdP ~ lambda, data=mydata)  
# summary(sdPlambda)  
#   
#   
# ### comparing the models  
#   
#   
# ```  
#   
# ### mean soil salt concentration (meanCM)  
#   
#   
#   
# ```{r}  
# CM\_all <- lm(meanCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
# summary(CM\_all)  
#   
# # Groundwater depth Z  
# CMZ <- lm(meanCM ~ Z, data=mydata)  
# summary(CMZ)  
#   
# # Root depth Zr  
# CMZr <- lm(meanCM ~ Zr, data=mydata)  
# summary(CMZr)  
#   
# # plant mortality d  
# CMd <- lm(meanCM ~ d, data=mydata)  
# summary(CMd)  
#   
# # salt concentration in rain  
# CMConcConst <- lm(meanCM ~ ConcConst, data=mydata)  
# summary(CMConcConst)  
#   
# # salt concentration in groundwater  
# CMCM.gw <- lm(meanCM ~ CM.gw, data=mydata)  
# summary(CMCM.gw)  
#   
# # plant growth factor c  
# CMc <- lm(meanCM ~ c, data=mydata)  
# summary(CMc)  
#   
# # alpha  
# CMalpha <- lm(meanCM ~ alpha, data=mydata)  
# summary(CMalpha)  
#   
# # lambda  
# CMlambda <- lm(meanCM ~ lambda, data=mydata)  
# summary(CMlambda)  
#   
#   
# ### comparing the models

Standard deviation of soil salt concentration sdCM, maybe not too important, can be added later

Neither minimum of soil salt concentration minCM?? can later be added, easily

### Maximum soil salt concentration maxCM

maxCM\_all <- lm(maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(maxCM\_all)

##   
## Call:  
## lm(formula = maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2122 -727 -258 237 40059   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 1.284e+03 2.454e+02 5.231 1.76e-07 \*\*\*  
## Z 9.406e-02 1.005e-02 9.360 < 2e-16 \*\*\*  
## Zr -4.949e-01 3.896e-01 -1.270 0.204   
## d -5.067e+03 4.371e+02 -11.592 < 2e-16 \*\*\*  
## ConcConst 5.589e+01 6.341e+00 8.814 < 2e-16 \*\*\*  
## CM.gw 9.436e+00 6.363e+00 1.483 0.138   
## c 1.161e+02 1.278e+01 9.082 < 2e-16 \*\*\*  
## alpha -4.373e+02 1.054e+02 -4.147 3.42e-05 \*\*\*  
## lambda -2.032e+03 1.069e+02 -19.018 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1948 on 4991 degrees of freedom  
## Multiple R-squared: 0.1334, Adjusted R-squared: 0.132   
## F-statistic: 96.04 on 8 and 4991 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# maxCMZ <- lm(maxCM ~ Z, data=mydata)  
# summary(maxCMZ)  
#   
# # Root depth Zr  
# maxCMZr <- lm(maxCM ~ Zr, data=mydata)  
# summary(maxCMZr)  
#   
# # plant mortality d  
# maxCMd <- lm(maxCM ~ d, data=mydata)  
# summary(maxCMd)  
#   
# # salt concentration in rain  
# maxCMConcConst <- lm(maxCM ~ ConcConst, data=mydata)  
# summary(maxCMConcConst)  
#   
# # salt concentration in groundwater  
# maxCMCM.gw <- lm(maxCM ~ CM.gw, data=mydata)  
# summary(maxCMCM.gw)  
#   
# # plant growth factor c  
# maxCMc <- lm(maxCM ~ c, data=mydata)  
# summary(maxCMc)  
#   
# # alpha  
# maxCMalpha <- lm(maxCM ~ alpha, data=mydata)  
# summary(maxCMalpha)  
#   
# # lambda  
# maxCMlambda <- lm(maxCM ~ lambda, data=mydata)  
# summary(maxCMlambda)  
#   
#   
# ### comparing the models

### Maximum soil salt concentration maxCM

maxCM\_all <- lm(maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(maxCM\_all)

##   
## Call:  
## lm(formula = maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2122 -727 -258 237 40059   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 1.284e+03 2.454e+02 5.231 1.76e-07 \*\*\*  
## Z 9.406e-02 1.005e-02 9.360 < 2e-16 \*\*\*  
## Zr -4.949e-01 3.896e-01 -1.270 0.204   
## d -5.067e+03 4.371e+02 -11.592 < 2e-16 \*\*\*  
## ConcConst 5.589e+01 6.341e+00 8.814 < 2e-16 \*\*\*  
## CM.gw 9.436e+00 6.363e+00 1.483 0.138   
## c 1.161e+02 1.278e+01 9.082 < 2e-16 \*\*\*  
## alpha -4.373e+02 1.054e+02 -4.147 3.42e-05 \*\*\*  
## lambda -2.032e+03 1.069e+02 -19.018 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1948 on 4991 degrees of freedom  
## Multiple R-squared: 0.1334, Adjusted R-squared: 0.132   
## F-statistic: 96.04 on 8 and 4991 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# maxCMZ <- lm(maxCM ~ Z, data=mydata)  
# summary(maxCMZ)  
#   
# # Root depth Zr  
# maxCMZr <- lm(maxCM ~ Zr, data=mydata)  
# summary(maxCMZr)  
#   
# # plant mortality d  
# maxCMd <- lm(maxCM ~ d, data=mydata)  
# summary(maxCMd)  
#   
# # salt concentration in rain  
# maxCMConcConst <- lm(maxCM ~ ConcConst, data=mydata)  
# summary(maxCMConcConst)  
#   
# # salt concentration in groundwater  
# maxCMCM.gw <- lm(maxCM ~ CM.gw, data=mydata)  
# summary(maxCMCM.gw)  
#   
# # plant growth factor c  
# maxCMc <- lm(maxCM ~ c, data=mydata)  
# summary(maxCMc)  
#   
# # alpha  
# maxCMalpha <- lm(maxCM ~ alpha, data=mydata)  
# summary(maxCMalpha)  
#   
# # lambda  
# maxCMlambda <- lm(maxCM ~ lambda, data=mydata)  
# summary(maxCMlambda)  
#   
#   
# ### comparing the models

### Cumulative vertical water flux, cum\_flux

cf\_all <- lm(cum\_flux ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(cf\_all)

##   
## Call:  
## lm(formula = cum\_flux ~ Z + Zr + d + ConcConst + CM.gw + c +   
## alpha + lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4577.6 -994.6 -196.0 601.2 17215.2   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 1.048e+03 2.685e+02 3.905 9.56e-05 \*\*\*  
## Z -3.623e-01 1.099e-02 -32.951 < 2e-16 \*\*\*  
## Zr 1.414e+00 4.262e-01 3.316 0.000918 \*\*\*  
## d -8.221e+03 4.782e+02 -17.191 < 2e-16 \*\*\*  
## ConcConst 6.392e+00 6.937e+00 0.921 0.356862   
## CM.gw 7.854e+00 6.961e+00 1.128 0.259266   
## c 2.976e+02 1.398e+01 21.281 < 2e-16 \*\*\*  
## alpha -8.228e+01 1.154e+02 -0.713 0.475675   
## lambda -2.515e+01 1.169e+02 -0.215 0.829675   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2131 on 4991 degrees of freedom  
## Multiple R-squared: 0.2754, Adjusted R-squared: 0.2742   
## F-statistic: 237.1 on 8 and 4991 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# cfZ <- lm(cum\_flux ~ Z, data=mydata)  
# summary(cfZ)  
#   
# # Root depth Zr  
# cfZr <- lm(cum\_flux ~ Zr, data=mydata)  
# summary(cfZr)  
#   
# # plant mortality d  
# cfd <- lm(cum\_flux ~ d, data=mydata)  
# summary(cfd)  
#   
# # salt concentration in rain  
# cfConcConst <- lm(cum\_flux ~ ConcConst, data=mydata)  
# summary(cfConcConst)  
#   
# # salt concentration in groundwater  
# cfCM.gw <- lm(cum\_flux ~ CM.gw, data=mydata)  
# summary(cfCM.gw)  
#   
# # plant growth factor c  
# cfc <- lm(cum\_flux ~ c, data=mydata)  
# summary(cfc)  
#   
# # alpha  
# cfalpha <- lm(cum\_flux ~ alpha, data=mydata)  
# summary(cfalpha)  
#   
# # lambda  
# cflambda <- lm(cum\_flux ~ lambda, data=mydata)  
# summary(cflambda)  
#   
  
### comparing the models

### Plant death, P=0, Pzero

Pzero\_all <- lm(Pzero ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(Pzero\_all)

##   
## Call:  
## lm(formula = Pzero ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## 0 0 0 0 0   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 0 0 NA NA  
## Z 0 0 NA NA  
## Zr 0 0 NA NA  
## d 0 0 NA NA  
## ConcConst 0 0 NA NA  
## CM.gw 0 0 NA NA  
## c 0 0 NA NA  
## alpha 0 0 NA NA  
## lambda 0 0 NA NA  
##   
## Residual standard error: 0 on 4991 degrees of freedom  
## Multiple R-squared: NaN, Adjusted R-squared: NaN   
## F-statistic: NaN on 8 and 4991 DF, p-value: NA

# Groundwater depth Z  
# PzeroZ <- lm(Pzero ~ Z, data=mydata)  
# summary(PzeroZ)  
#   
# # Root depth Zr  
# PzeroZr <- lm(Pzero ~ Zr, data=mydata)  
# summary(PzeroZr)  
#   
# # plant mortality d  
# Pzerod <- lm(Pzero ~ d, data=mydata)  
# summary(Pzerod)  
#   
# # salt concentration in rain  
# PzeroConcConst <- lm(Pzero ~ ConcConst, data=mydata)  
# summary(PzeroConcConst)  
#   
# # salt concentration in groundwater  
# PzeroCM.gw <- lm(Pzero ~ CM.gw, data=mydata)  
# summary(PzeroCM.gw)  
#   
# # plant growth factor c  
# Pzeroc <- lm(Pzero ~ c, data=mydata)  
# summary(Pzeroc)  
#   
# # alpha  
# Pzeroalpha <- lm(Pzero ~ alpha, data=mydata)  
# summary(Pzeroalpha)  
#   
# # lambda  
# Pzerolambda <- lm(Pzero ~ lambda, data=mydata)  
# summary(Pzerolambda)  
#   
  
### comparing the models